Chevron Richmond Long Wharf
Terminal and Port Plan

December 1, 2021

Version	Date	Approver
0	12/1/2021	Alan Davis

Certification

I certify that the information contained in the Terminal and Port Plan, and the Innovative Concept application being submitted pursuant to Control Measure for Ocean-Going Vessels At Berth (At-Berth Regulation), Title 17, Division 3, Chapter 1, Subchapter 7.5 of the California Code of Regulations (CCR) is true, accurate, and complete to the best of my knowledge, signed under penalty of perjury.

Responsible Official Signature	Printed Name	Date
Alan Davis	Alan Davis	12/1/2021

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Introduction

This Terminal and Port Plan for the Chevron Richmond Long Wharf (RLW), located in Richmond, California, is submitted to the California Air Resources Board (CARB) pursuant to **Section 93130.14** of the Control Measure for Ocean-Going Vessels At Berth (At-Berth Regulation), Title 17, Division 3, Chapter 1, Subchapter 7.5 of the California Code of Regulations (CCR), **Sections 93130** to **93130.22**. This is a combined Terminal Plan and Port Plan for the single terminal at RLW.

In accordance with the provisions of **Section 93130.14(a)(3)** of the At-Berth Regulation governing the contents of Terminal Plans, and the provisions of **Section 93130.14(b)(3)** of the At-Berth Regulation governing the contents of Port Plans, this combined Terminal and Port Plan addresses the following below:

- Identification and description of the applicable compliance strategy.
- Number of vessels expected to visit the terminal using the strategy.
- Identification and description of equipment purchases and/or construction projects necessary for compliance
- Schedule for installing equipment and/or necessary construction projects
- Identification of berths at the terminal where the equipment will be used for compliance
- Geographic boundary coordinates for the terminal and the berths at RLW
- Specific berthing restrictions
- Identification of physical and/or operational constraints at the terminal

Note that one of the requisite components of a terminal plan and a port plan—namely, the division of responsibilities between the terminal and the port—is not applicable at RLW, as Chevron is the owner and operator of both the port at RLW and the single marine terminal at the port.

As a summary of the contents of this combined Terminal and Port Plan that are set out below, Chevron is still in the process of evaluating whether a CARB Approved Emissions Control Strategy (CAECS) can be implemented in a feasible, safe and reliable manner at RLW to achieve compliance with the At-Berth Regulation. Chevron and other stakeholders presented extensive evidence during the rulemaking process showing that, as of the date of adoption of the Regulation in August 2020, there was no CAECS proven to be technologically feasible, safe, and reliable for implementation to control emissions from tanker vessels at berth. This continues to be the case in the fall of 2021, and the status of Chevron's ongoing evaluation of the potential use of one or more CAECS at RLW is described below.

At this time, given the continued significant uncertainty over whether one or more CAECS can be used in a feasible, safe and reliable manner at RLW to achieve compliance with the At-Berth Regulation, Chevron's intended compliance strategy is to use a package of Innovative Concepts to achieve emissions reductions in accordance with **Section 93130.17** of the Regulation. In order to show that the proposed package of Innovative Concepts will result in reductions of emissions of oxides of nitrogen (NOx), particulate matter with a diameter of less than 2.5 microns (PM 2.5), and reactive organic gases (ROG) that are at least equivalent to the emissions reductions that would have occurred through using one or more CAECS, Chevron first calculated the amount of emissions reductions that would need to be achieved under the Innovative Concepts by using the specific emissions rates outlined in **Section 93130.5(d)(1) and (2)** of the CARB At-Berth Regulation and then multiplying

these specified emissions rates by the expected number of vessel visits at RLW, the average visit duration and the expected fuel and power used during an average visit. Then, Chevron calculated the emissions reductions estimated to result from the implementation of each Innovative Concept, for each of the three pollutants of concern (NOx, PM2.5 and ROG). Finally, Chevron calculated the total emissions reductions estimated from all of the Innovative Concepts taken together, and then compared these totals against the required emissions reductions that were calculated using the emission rates specified in **Section 93130.5(d).**

Before addressing the contents of the Terminal and Port Plan as outlined above, a brief background is provided below.

Background

Emissions Reductions under the At-Berth Regulation

The first step in calculating the level of emissions reductions that must be achieved through use of the Innovative Concepts is to calculate the default (or baseline) emissions using the factors specified in **Section 93130.5(d)(1), and (2)** of the At-Berth Regulation and fuel totals using methodologies from CARB's 2019 At-Berth inventory[1] and auxiliary engine and boiler loads from the Port of Long Beach Inventory for 2020 (POLB 2020)[2]. The default emissions factors for auxiliary engines are 13.8 g/kW-hr for NOx, 0.17 g/kW-hr for PM 2.5, and 0.52 g/kW-hr for ROG (**Section 93130.5(d)(1)**). The default emissions factors for auxiliary boilers for tanker vessels with steam driven pumps are 2.0 g/kW-hr for NOx, 0.17 g/kW-hr for PM 2.5, and 0.11 g/kW-hr for ROG (**Section 93130.5(d)(2)**).

To calculate total emissions at the RLW, a figure of 378 vessel calls per year was used based on 2016 vessel calls. 2016 was selected as the representative year for activity levels at RLW out of a 5-year window for the following reasons: 2019 and 2020 had atypical activity due to vessel dry dock activity and then the COVID-19 pandemic. Of the 2016-2018 time period, 2016 represented slightly higher Product carrier activity levels, thus 2016 is a conservative year for estimating the emission reductions necessary to meet the regulatory compliance requirements.

Table 1 below shows the average breakdown for these 378 annual vessel visits by vessel type and the average visit duration and power for each vessel type, and then the resulting emission totals for NOx, PM-2.5 and ROG as shown in metric tons. These emissions totals are the emission levels at RLW used to determine the equivalent emissions reductions that must be attained by use of the proposed Innovative Concepts under **Section 93130.17**.

Table 2 below provides a further breakdown by showing the emissions totals from auxiliary engines and auxiliary boilers.

[1] CARB, *Appendix H: 2019 Update to Inventory for Ocean-Going Vessels At Berth: Methodology and Results*, October 2019. Available at https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/ogvatberth2019/apph.pdf

[2] Starcrest Consulting Group, *Port of Long Beach 2020 Air Emissions Inventory,* October 2021. Available at https://polb.com/download/14/emissions-inventory/12958/2020-air-emissions-inventory.pdf

Table 1: RLW Emissions - Representative Year using At-Berth Regulation Default Emission Factors

Vessel Type	Number of Vessel Visits	Average Visit Duration (hrs)	Average Visit Total Energy Used (kWh)	NOx [MT]	PM 2.5 [MT]	ROG [MT]
Aframax	25	57.37	196,621	23.46	0.85	1.02
Chemical	16	26.04	58,218	7.22	0.15	0.29
Panamax	27	62.87	217,170	25.56	1.03	1.13
Product	196	44.44	121,697	134.11	4.03	5.62
Suezmax	114	28.09	172,642	63.30	3.60	3.06
Total	**378**	**-**	**-**	**253.66**	**9.66**	**11.12**

Table 2: RLW Auxiliary Engine and Auxiliary Boiler Emissions – Representative Year using At-Berth Regulation Default Emission Factors

Vessel Type	Number of Vessel Visits	NOx Aux Engine [MT]	NOx Aux Boiler [MT]	PM 2.5 Aux Engine [MT]	PM 2.5 Aux Boiler [MT]	ROG Aux Engine [MT]	ROG Aux Boiler [MT]
Aframax	25	15.68	7.78	0.19	0.66	0.59	0.43
Chemical	16	6.45	0.78	0.08	0.07	0.24	0.04
Panamax	27	15.66	9.89	0.19	0.84	0.59	0.54
Product	196	101.43	32.68	1.25	2.78	3.82	1.80
Suezmax	114	24.47	38.83	0.30	3.30	0.92	2.14
Total	**378**	**163.69**	**89.97**	**2.02**	**7.65**	**6.17**	**4.95**

Actual Baseline Emissions at Richmond Long Wharf

Notwithstanding the use of the default emissions rates in the At-Berth Regulation for compliance demonstration purposes, it is important to explain that the actual emissions at RLW are estimated to be much lower than the assumed default emissions prescribed by the Regulation and the CARB's 2019 inventory methodology, as shown in **Table 3**. To compare actual emissions against the default emissions under the Regulation, Chevron created a secondary model that takes into account the operations (example: actual time at berth versus discharging, loading and idle time etc.) and vessel characteristics specific to RLW. The model considerations are detailed below.

Table 3: RLW Actual Emissions – Representative Year using Actual Vessel Tier Emission Factors for Auxiliary Engine and Auxiliary Boiler, and Time at Berth

Vessel Type	NOx Aux Engine [MT]	NOx Aux Boiler [MT]	PM 2.5 Aux Engine [MT]	PM 2.5 Aux Boiler [MT]	ROG Aux Engine [MT]	ROG Aux Boiler [MT]
Aframax	2.24	0.22	0.03	0.02	0.10	0.01
Chemical	92.86	5.61	1.22	0.42	3.77	0.31
Panamax	17.17	3.13	0.24	0.24	0.73	0.17
Product	13.24	3.06	0.19	0.23	0.59	0.17
Suezmax	19.26	18.19	0.86	1.38	0.95	1.00
Total	**144.78**	**30.20**	**2.54**	**2.29**	**6.14**	**1.67**

The main differences between the estimates in **Table 2** and **Table 3** are described below:

- **Vessel Engine Tiers:** Whereas the default emission rates in the At-Berth Regulation in **Table 2** assume that all vessels are Tier 0, vessels calling at RLW are not limited to Tier 0 and include Tier I and above vessels.
- **Diesel/Electric Cargo Systems:** In **Table 3**, ships were divided into diesel pumpers and steam pumpers. Diesel pumpers use diesel engines or electric motors to drive the pumps while steam pumpers use steam driven turbines to drive the pumps. Diesel pumpers have higher auxiliary loads and significantly lower boiler loads than steam pumpers. All Chemical ships, 97% of Product ships and 37% of Panamax ships were diesel pumpers. All Aframax and Suezmax ships are steam pumpers. CARB's methodology does not specify loads on diesel pumpers and as a result, the baseline model assumes all vessels are steam pumpers and this results in inaccurate fuel consumption and emissions profile. **Table 3** considers an auxiliary load for running diesel pumps which correspondingly reduces the load from the boilers compared to CARB's methodology.
- **Cargo Pumping Rates:** Pumping rates used to develop CARB's methodology discharge loads for boilers were based upon pumping rates in POLB 2020. Typically ships unloading at Port of Long Beach pump at 45% to 75% of pumping capacity while those at the RLW pump at an overall lower rate (20 to 45% of overall pumping capacity), on average.
- **At-Berth Operations and Durations:** Ships do not discharge or load the entire time at-berth as assumed by CARB and POLB 2020. While loading at RLW, cargo pumps onboard ships are not in operation. Only shore-side pumping equipment is used and auxiliary engine and auxiliary boiler onboard ships are on minimal loads. In addition, there are significant periods where the ship is idle, and not loading or discharging. These were carefully determined and used in the calculation of actual emissions, as CARB's methodology assumes that ships are either loading or discharging and does not account for the time that ships are idling.

Additionally, as a result of Chevron's strategy to lower emissions; of the 378 vessel calls to RLW in 2016, nearly 73% of vessel calls were made by vessels with greater than Tier 0 classification, or vessels with turbogenerator-powered boilers that do not produce diesel particulate matter (DPM), resulting in far lower DPM and NOx emissions than estimated when using the default emission factors for the At-Berth Regulation

Table 4 below summarizes the emissions differences between using At-Berth Regulation and POLB 2020 methodology, and when using actual RLW data.

Table 4: 2016 At-Berth Regulation Emissions Estimates Versus 2016 Actual RLW Emissions

2016 Emissions	At-Berth Regulation and POLB 2020 Method	Actual Emissions	Difference (%)	Difference (MT)
NOx (MT)	253.66	174.98	-31%	-78.68
PM2.5 (MT)	9.66	4.83	-50%	-4.83
ROG (MT)	11.12	7.81	-30%	-3.31

In conclusion, the CARB's 2019 At-Berth Emissions Inventory and the At-Berth Regulation both dramatically over-estimate at-berth emissions at RLW.

Compliance Strategy

This section addresses the following components for the Terminal and Port Plan: (a) the identification and description of the applicable compliance strategy for the marine terminal at RLW; (b) the equipment purchases, and construction projects associated with compliance; (c) the number of vessels expected to visit the terminal using the strategy; and (d) the schedule for installing equipment for compliance. (See **Section 93130.14(a)(1), (a)(3)(A), (B), and (F); Section 93130.14(b)(1), (b)(3)(A), (B), and (C)**).

As outlined above and as previously detailed to CARB as part of the rule-making process, it has not been demonstrated that there is a CAECS that can be implemented in a feasible, safe and reliable manner to control emissions from tanker vessels at berth. Chevron is continuing to evaluate potential CAECS technologies that could be implemented in a feasible, safe and reliable manner in the future at RLW, and that could be effectively applied to accommodate the approximately 140 unique vessel arrangements at RLW on an annual basis. Chevron's ongoing assessment of the potential use of one or more CAECS is discussed below.

Given the continued and significant uncertainties associated with feasible, safe and reliable implementation of one or more CAECS technologies at RLW, at this time Chevron intends to use a package of Innovative Concepts to achieve compliance with the At-Berth Regulation. As shown above in **Table 4**, Chevron's current operations at RLW result in emissions that are substantially below the default emissions using the prescribed assumed emissions rates in **Section 93130.5(d)(1) and (2)** of the Regulation. Notwithstanding this discrepancy, Chevron's package of Innovative Concepts is projected to result in emissions reductions that are sufficient to achieve compliance with the At-Berth Regulation.

Innovative Concept Summary

Based on the emissions totals in **Tables 1 and 2** above, below are the annual average emissions reductions that must be achieved through the use of Innovative Concepts in a representative year per Section **93130.17(d)(1)**. These emissions reductions reflect an ~80% reduction in emissions from the default emissions presented in **Tables 1 and 2**.

Table 5: Potential Total Emission Reductions from Innovative Concepts

	NOx [MT]	PM2.5 [MT]	ROG [MT]
Aux Engines	163.69	2.02	6.17
Aux Boilers	89.97	7.65	4.95
Total	253.66	9.66	11.12
IC Project Reduction	**202.45**	**7.96**	**9.03**

The proposed Innovative Concepts include both terminal-adjacent and ship-related projects designed to achieve the necessary emission reductions in the absence of a CAECS that can be implemented and used safely, feasibly and reliably at RLW. For more details on the emission reductions that can be achieved using Innovative Concepts, please refer to Chevron's Innovative Concepts application, which is included as an **Appendix**.

Table 6 is an overview of the level of emissions reductions that are expected from the Innovative Concepts that Chevron is proposing to implement.

Table 6: IC Project Annual Emissions Reductions

Project No	Project Description	NOx [MT]	PM2.5 [MT]	ROG [MT]
Shore-Based Innovative Concept Projects				
1	Newer Locomotive	-5.1	-0.1	-0.2
2	Boiler Replacement Project	-50.8	0	-1.6
3	Diesel Air Compressors Replacement	-27.4	-1.5	-1.3
4	FCC Ammonia Optimization	0	-103.3	0
5	Wharf ERD Replacement	-7.3	-0.8	0
6	TKN Heater Optimization	-37.5	-4.8	-3.4
7	North Ranch Diesel Engine Replacement	-0.4	-0.02	-0.02
8	Solar Electricity Project - General	-5.6	-0.3	-0.4
9	Solar Electricity Project – Shore Power	-3.2	-0.2	-0.2
	Subtotal	**-137.3**	**-111.1**	**-7.1**
Ship-Based Innovative Concept Projects				
10	Tier II or above certification on Auxiliary Engines (AE) for ships Note 1	-49	0	0
11	Tier III or above certification on Auxiliary Engines (AE) for ships Note 1	-133	0	0
12	Upgraded Combustion and Control systems for Auxiliary Boilers (AB) for ships Note 1	-48	0	0
13	Dual-Fuel Tier III Auxiliary Engines (AE) and Auxiliary Boilers (AB) Note 1	-41	0	0
14	Shore Power or Stack Capture for Barges/Tug Boats	-22	-0.2	-1.4
	Subtotal	**-97 to -185.3**	**-0.2**	**-1.4**
	Grand Total	**-234.3 to -322.6**	**-111.2**	**-8.5**

Note 1: These ship-based IC projects are not cumulative. For example, if IC project 11 is implemented, IC project 10 will be redundant.

For more information about what specific equipment, technology or other implementation strategy may be needed for each Innovative Concept and details on the implementation timeline for each Innovative Concept, please see the attached Innovative Concept application (**Appendix**).

Two points are important for purposes of this Terminal and Port Plan:

First, given the current uncertainties over whether there is a feasible, safe and reliable way to implement one or more CAECS to control emissions from vessels at berth at RLW, the package of Innovative Concepts (**Appendix**) is intended to cover compliance for all applicable vessel visits under the At-Berth Regulation.

Second, with respect to timing and schedule, Chevron is committed to actively pursuing opportunities to implement most of the Innovative Concepts on an expedited basis ahead of the 2027 compliance deadline for tanker vessels and terminals. CARB approval of the Innovative Concepts will provide for the commencement of implementation before the 2027 compliance date, and early implementation will help to achieve emissions reductions to the benefit of nearby communities in the short-term.

As stated above, a discussion follows concerning Chevron's continued evaluation of shore power and other potential CAECS under the At-Berth Regulation.

Chevron's Ongoing Evaluation of Potential CAECS

While there currently is no CAECS capable of being implemented in a feasible, safe and reliable manner to control emissions from tanker vessels at RLW within the timeline require by the CARB At-Berth Regulation, Chevron is diligently pursuing technical feasibility assessments and additional research to identify a realistic and practical implementation methodology and timelines for the following two CAECS at RLW:

1. Capture and Control (EO-AB-15-1), deployed in three methods, including:
    a. barge-based (CAEM METS-1, METS-3B),
    b. terminal-based with mobile equipment (METS-2S), and
    c. terminal-based with fixed equipment on foundations, and,
2. Shore Power

Technology, technical and operational challenges associated with implementation of the proposed CAECS for terminals with tanker vessels, within the required regulatory timeline, are also highlighted in DNV's Technology Assessment (titled "California Air Resources Board's (CARB) Ocean-going Vessels At Berth Regulation Emissions Control Technology Assessment for Tankers, Report # 2021-9470", dated November 2021).[3]

Capture and Control

Barge-based Capture and Control (EO AB-15-1*)*

Clean Air Emissions-Maritime, Inc. (CAEM) vendor representatives have repeatedly stated throughout 2019-2021 that there is neither an existing barge-based capture and control system suitable for use in Northern California meteorological conditions, sized for pumping rates of 15,000-55,000 barrels per hour (bph) tanker pumping discharge rate, nor is any such system being manufactured anywhere in the world. The METS-3B barge-based CAEC strategy to be produced in 2022, and demonstrated on POLA/POLB container ships and then tankers in late 2022, is presently not feasible for use at Richmond Long Wharf according to both the vendor and Chevron's own analyses.

Further research and development by the vendor, with specific focus on the below items is necessary to demonstrate initial feasibility of this CAECS in RLW.

1. Developing a barge that is seaworthy for the meteorological and metocean conditions prevalent in the San Francisco Bay Area and capable of mooring at water depths of greater than 50 ft into loose Bay Mud sediment
2. Technology development and capability of METS to process auxiliary engine and auxiliary boiler exhaust volumes associated with large tanker vessels pumping at rates in excess of 55,000 bbl/hr.

Specifically, CAEM has mentioned that their existing barge spud design must be modified to address low sediment shear strength, depth of Young Bay Mud, and insufficient propulsion capacity to handle current velocities in the San Francisco Bay Area and Carquinez Straits. Per CAEM, this could include lengthening the spuds to 110 ft or longer, adding supplemental anchorage capabilities to the barge, enlarging the barge footprint and/or developing a

[3] While the DNV report suggests it is possible that the barge-based system may be possible within 5 years for tankers, it has not been proven or demonstrated, therefore, the tentative finding is not applicable or reliable for RLW.

dynamically positioned (DP) barge (possibly to DP2[4] rating) to eliminate spud mooring entirely. If a DP barge is developed, however, it would need to be capable of operating continuously during vessel calls at RLW as long as 3-5 days. Further, it is imperative that the CAEM capture and control barges consistently demonstrate their ability to disconnect and move away from a moored ship in less than 30 minutes, in accordance with California Code of Regulations Title 2, Division 3, Chapter 1 Article 5 Marine Terminals, section 2340 subsection (C) 28 (A and B) ("Article 5"), under a range of sea state conditions. If a capture and control barge prevents a tanker from moving away from a terminal in an emergent situation, the consequences could be catastrophic. Though CAEM has stated its METS-3B barges are designed to retract four 90-ft spuds and be underway in 24 minutes, it has not yet been demonstrated as the first METS-3B barge is not yet in service.

Chevron has consulted with local barge operators in the Bay Area who have worked at Richmond Long Wharf, and confirmed that the time required to retract four spuds deployed in water depths to 40-50 ft and prepare the barge to move, including lowering the crane from the vessel stack, would likely exceed the 30-minute emergency departure time limit required in Article 5. This presents a significant safety risk that has been noted in prior workshops and DNV's Technology Assessment associated with the Regulation.

Summary of Outstanding Issues to Be Addressed By Barge Technology/Vendor

- Barge needs to be able to safely operate for the entire range of ships that visit RLW and the various possible ship berthing orientations (port-side or starboard-side to).
- Northern California-suitable barge design in service with sufficient propulsion to navigate safely throughout SF Bay in a range of metocean conditions, including currents of up to 3 knots, sustained winds of 30 kts (or higher wind gusts) and tidal variations of up to 7 feet. Barge must be demonstrated seaworthy in San Francisco Bay conditions, and not restrict or limit terminal operations below currently accepted wind speed limits for vessels at berth per approved Statements of Terminal Operating Limits (STOLS) pursuant to MOTEMS/CBC Chapter 31F Section 3105.
- Barge must be able to demonstrate consistently that it can disconnect and safely move away from tanker in 30-minutes or less as required by Article 5.
- Barge must be able to operate 24/7 for multi-day vessel calls (up to 3-5 days at berth). For example, a dynamically positioned barge would create substantial emissions for long-duration vessel calls that would also need to be captured and processed.
- Barge mooring risks must be understood, evaluated and mitigated, including proposed vacuum mooring, spud mooring and geotechnical constraints, or if dynamically positioned, provide sufficient safeguards for unintended power loss or mechanical failure.
- Effect of barge, if attached to vessel via mooring lines or vacuum mooring, on vessel Statements of Terminal Operating Limits (STOLs) and subsequent changes (if any) to STOLs approved by California State Lands Commission pursuant to MOTEMS (CBC Chapter 31F) requirements.
- Resolve safety and operational concerns identified in DNV's Technology Assessment.
- The barge must not create a static electricity charge and ignition threat to tankers. DNV's Technology Assessment identified short circuit/static charge risks regarding

[4] What is the difference between DP1, DP2, and DP3 vessels? (onesteppower.com)

contact between vessel stack and capture hood, where charge could build up on the barge and be discharged to the tanker, or vice versa if contact is made.

- Technology is presently not capable of processing combined stack emissions from AE and AB from a Suezmax tanker pumping at typical pumping rates of 55,000-65,000 barrels per hour.

In the event a barge-based capture and control system becomes available for use at RLW that is capable of being implemented in a feasible, safe and reliable manner, and is used at RLW for regulatory compliance, the equipment will be entirely supplied by the vendor and installed on the vendor's barge.

Until these issues are resolved with respect to the suitability of the barge design for Northern California marine environmental conditions and mooring interface with vessels at berth, the barge-based capture and control system is not feasible for use at Richmond Long Wharf.

Terminal-Based Capture and Control – Mobile Equipment

Per multiple discussions with representatives from the vendor, Clean Air Emissions-Marine, Inc. (CAEM), the METS-2S mobile at-berth capture and control equipment presently used in the Port of Long Beach for bulk carriers weighs 180,000 lbs and is not capable of processing the combined AE and AB auxiliary engine and auxiliary boiler emissions from a Suezmax tanker pumping at typical pumping rates of 55,000-65,000 barrels per hour. According to CAEM, a Suezmax -capable shore-side mobile unit would weigh 300,000 lbs. Further, the Richmond Long Wharf structure is designed to carry emergency vehicles that would be needed on the wharf, but the weight of the CAEM METS-2S equipment, as currently conceived, greatly exceeds the wharf structural capacities, and is therefore not feasible to implement at RLW. Finally, the METS-2S equipment (per CAEM, ~40 ft x 120 ft footprint combined for capture and control equipment) is so large, it would obstruct both operational and emergency vehicle access to berths while in use at RLW given the limited and narrow plot space available for equipment.

Terminal-Based Capture and Control – Fixed Equipment on Foundations

Given the structural limitations of the RLW and the weight of these units, new structures would be required to support the next generation of METS-2S system for tankers calling at the RLW. CAEM has estimated that a required platform size would be 60 ft x 130 ft. There are several significant limitations and restrictions at the RLW that would limit available locations for such platforms at each berth, including the following:

- New structures cannot be installed on the backside of Berth 3 or the south end of Berth 4 due to interferences with Berths 9 and 11, which are active barge berths. This is shown in the aerial view of the RLW in **Figure 1**, below.
- New structures cannot interfere with mooring line management. Mooring lines at Berths 1 and 4 are walked to the furthest mooring hooks on the catwalks at each end of the terminal. Any new structures with equipment cannot be located in front of catwalks that are necessary for delivering mooring lines to the hooks.
- The capture and control equipment is not currently approved for use in a Class 1, Division 2 area, as required by OSHA 1910.307 and MOTEMS Division 11 (California Building Code Section 3111F). As a minimum, these hazardous zones are located for 25 ft along the entire berth length next to the vessel cargo tanks and within a 50 ft radius in all directions of the operating envelopes of hose

manifolds and loading arms. Hazardous zones at RLW are associated with Berths 1-4, as well as overlapping hazardous zones from Berths 9 and 11, limiting the available locations of new terminal structures to support this equipment.

- Crane boom length limitations constrain locations of new terminal structures for this application. CAEM reports that the current limitation on the distance from the stack to the base of the capture unit is 225 ft, with the possibility that this might be extended by an additional 100 ft in the next generation. Because of this limitation, the capture units cannot be located on every berth in a location that can reach the stacks on all size vessels calling at each berth. For example, **Figure 2** indicates a likely platform location on the north end of Berth 4 to provide capture and control for the entire range of vessel sizes that berth port-to at Berth 4. This location would require reconfiguration of approximately 200+ feet of existing catwalks and relocation of conduits and other utilities running from the loading platform to the mooring dolphin, which would require the installation of dozens of new piles to accommodate the new catwalks, in addition to the very large new concrete pile-supported platform that would need to be installed. Combined, the work at Berth 4 alone would require more than two years to construct given in-water work windows due to threatened and endangered species and needing to maintain the berth in service during construction. In addition, there will be substantial new impacts to the marine environment due to permanent over-water shading, in-water pile driving, and new in-water fill.

  The same figure indicates the likely platform location on the south end of Berth 4. This location considers the interference with the existing pipeway to the loading platform, and the restriction from blocking Berth 11, resulting in a longer horizontal distance from the stack locations. This platform location may be restricted further due to hazardous zones from the loading platform.

  When incorporating the vertical reach required for the stack height of the largest vessel unloaded (~190 ft above MSL), it appears that the required boom reaches for both locations exceed the current technology limitations of 225 feet. However, the platforms may be feasible I the future should the technology be expanded by CAEM.

In summary, this shore-based Capture and Control technology is not feasible at Berth 3 due to interference with Berth 9. It is not currently feasible at Berth 4 due to technology limitations of the CAEM capture unit and boom crane capability. With future technology improvements by the vendor, this technology may become feasible for use at Berths 1, 2, and 4, however, the conflicts with Berth 3 cannot be mitigated.

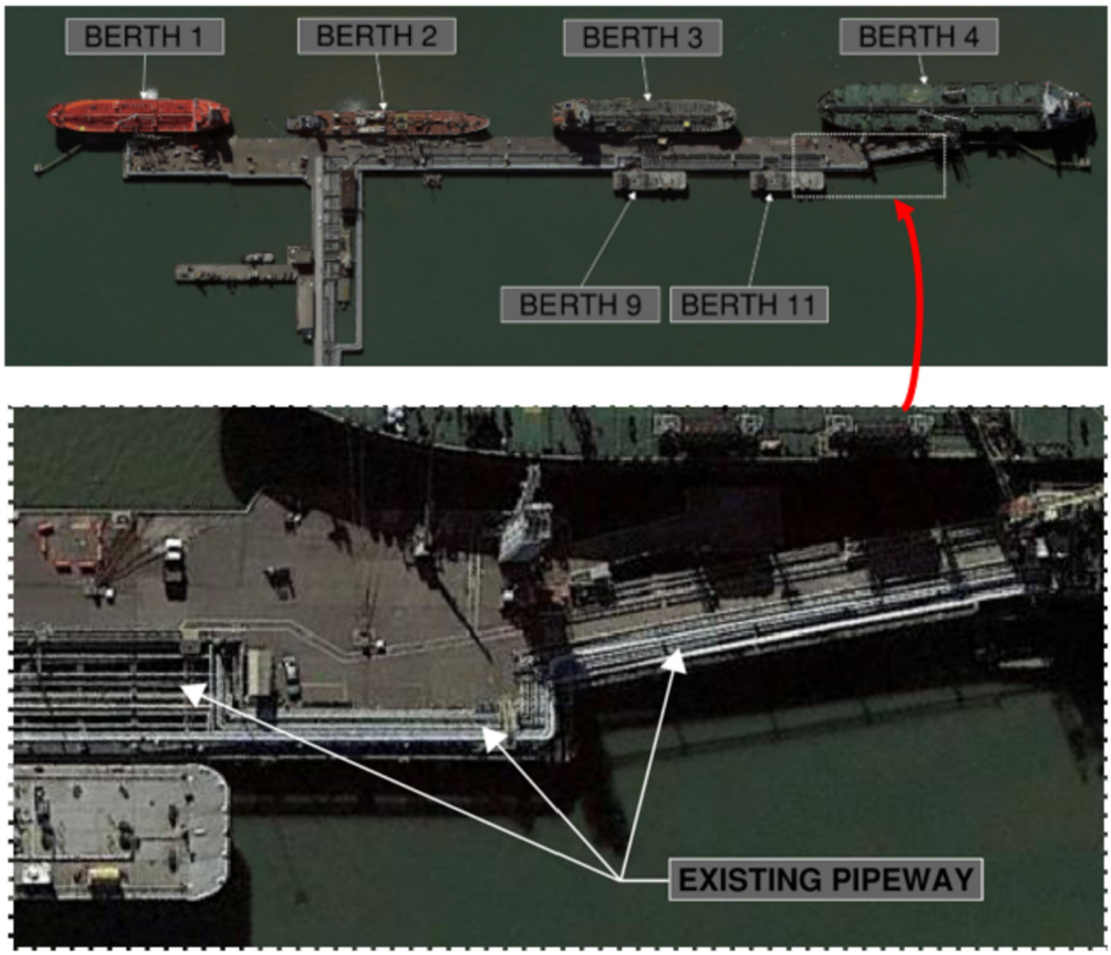


Figure 1: Richmond Long Wharf Relative Berth, Vessel and Pipeway Locations. Note: Berth 9 is an active barge berth requiring transit through Berth 11 on the shore-side of the Main Wharf.

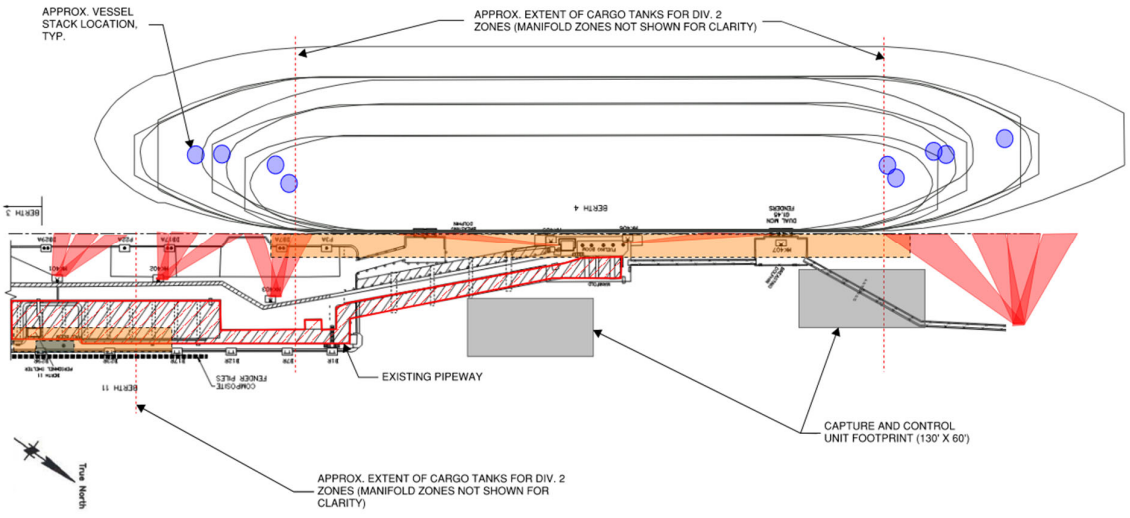


Figure 2: Potential Locations of Fixed Terminal-side Capture and Control Systems at Berth 4 with representative classes of vessels berth both starboard-to and port-to.

Until these limitations are resolved, the terminal-based capture and control using fixed equipment will not be feasible for use at the Richmond Long Wharf.

Shore Power

Chevron's marine engineering consultants, Simpson, Gumpertz and Heger (SGH), have evaluated shore power equipment layouts at the Richmond Long Wharf and determined that numerous substantial safety and functionality concerns could preclude implementation of shore power as a feasible, safe and reliable control strategy at the RLW.

The following are specific significant concerns related to the terminal infrastructure:

1. Power Available to the Terminal

Chevron has evaluated the necessary power to service four vessels simultaneously at the RLW for shore power with complete electric discharge system and determined that an additional 20 MW of service is required. Chevron's existing distribution system does not have the capacity for the additional demand from terminals at the RLW and must rely on the local utility, Pacific Gas and Electric (PG&E) to provide this.

On July 10, 2021, Gavin Newsom, governor of California, issued an Executive Order directing California ports to temporarily cease use of shore power to reduce the electrical load on the California power grid during a CAISO Flex Alert, due to an excessive heat wave and constraints in South-Central Oregon electrical transmission system due to wildfires.[5] This Executive Order was subsequently superseded on July 30th by the Governor directing CARB to offset the emission associated with the loss of shore power capability during Flex Alerts.[6] The inability of the state's electrical transmission system to serve the present 2021 shore power demand at existing ports is a significant concern, and additional power demand anticipated over the next 7-10 years due to electrification of vehicles and reduction of natural gas-based power generation is expected to exacerbate electrical supply reliability concerns within the state and western U.S. more broadly.[7,8,9,10]

To determine feasibility of supplying shore power to Berths 1-4 at Richmond Long Wharf by 2027, PG&E has directed that Chevron must commission a preliminary engineering study (PES) through PG&E's Large Load Application Process for a new or upgraded service. The purpose of the study will be A) to determine PG&E's system capacity and capability to reliably serve power to a 20 MW capacity substation simultaneously servicing four vessels of varying sizes at Berths 1, 2, 3 and 4, while pumping, and B) identify any physical constraints present in PG&E's electrical transmission system that would need to be modified to enable the expanded service to Chevron.

Chevron initiated a PES with PG&E to determine PG&E's ability to serve the additional 20 MW load either directly from PG&E's Station R in Richmond, or through Chevron Richmond Refinery's existing 115 kV electric transmission

[5] https://www.gov.ca.gov/wp-content/uploads/2021/07/EO-N-11-21-Extreme-Heat-Event-07.10.21.pdf
[6] CAP14-20210730130249
[7] Western officials reckon with reliability challenges as heat and 'wildcard' wildfire threaten grid | Utility Dive
[8] America's electric grid beset by aging equipment, congestion and failures of transparency - The Washington Post
[9] Washington State's Approaching Energy Crisis – Good Intentions Gone Wrong? (forbes.com)
[10] Western Assessment_California and Mexico Report.pdf (wecc.org)

interconnect with PG&E at the Standard Oil Switching Station (SOSS). The full assessment, including the Detailed Engineering Study, is expected to take at least 12-18 months.

Chevron also is evaluating the long-term impacts of Public Safety Power Shutoffs (PSPS) and other actions (including by the Governor) to curtail shore power electricity consumption during peak statewide demand. While CARB has provided regulatory relief during the types of curtailment events, this issue does impact the long-term viability of shore power as a safe and reliable method for alternative marine power to tankers.

2. Range of Vessels Calling at Each Berth

Vessels of different sizes visit each berth at RLW. Also, each of these vessels, could potentially berth alongside the Terminal jetty on either their port or starboard side. Depending on the size and orientation of the vessel (berthed port of starboard side), different mooring configurations are adopted using different mooring line layouts and wharf mooring points.

This entire mooring system arrangement has significant impact on design and installation of shore power equipment at the berth (switchgear, cable management system, supporting distribution, etc.). An additional complexity to resolve is to ensure that cable connections to each vessel do not interfere with mooring lines or any other terminal equipment that is installed to provide shore power to any vessel. This includes equipment used for mooring of smaller ocean-going barges that are not covered by the Regulation. Even at berths where it may be physically possible to place and install the cable management system and other supporting equipment, the specific location of such equipment at each berth will require careful consideration and evaluation for conflict with any mooring line arrangements for vessels calling at the terminal.

Figure 3 illustrates this issue for Berth 4. The figure shows a range of classes of vessels that use this berth superimposed with berthing in both directions, along with their typical mooring line arrangements, and a likely range of cable connection locations for shore power for each class of vessel. The locations of shore power connection areas on board the vessel can vary by over 200 ft between the different vessel classes.

At the south end of the berth, a cable management system could potentially be located on the wharf, based on the size of the similar unit installed at Berth 121 at the Port of Long Beach. At the north end of the berth, the cable management system would require a separate supporting structure. A separate crane would be required at each location, due to the reach required to lift and tend the cables.

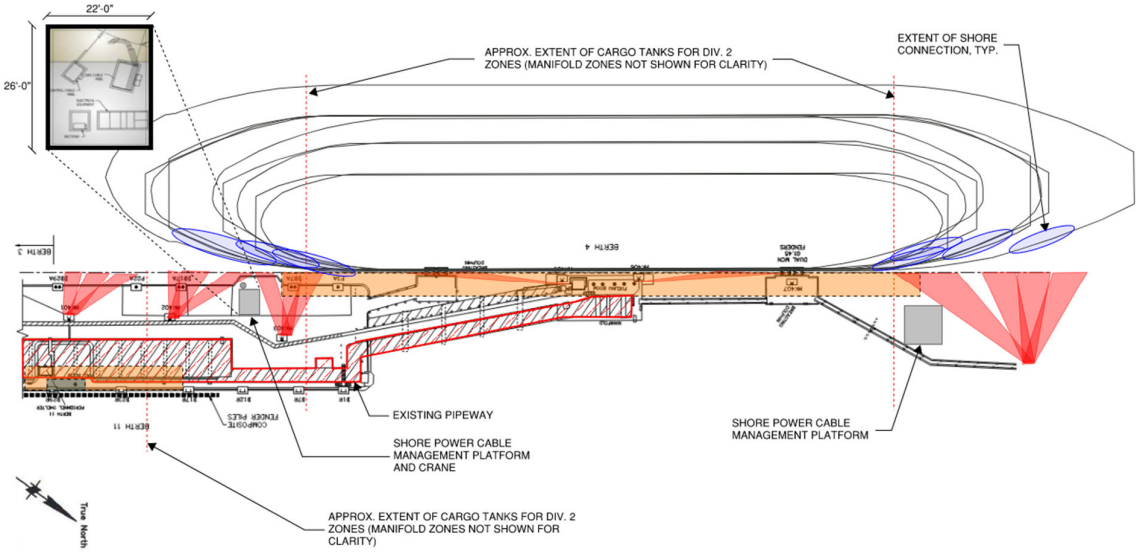


Figure 3: Possible shore power locations at Berth 4 relative to mooring line arrangements for approved vessel classes at berth.

3. *Interference with Operations at Other Berths*

The T-shaped configuration of the RLW inherently limits vehicle movement to a specified 20-ft wide lane on the Main Wharf from the tee north to Berth 4. The vehicle lane is necessary for daily operational vehicles as well as access by emergency vehicles (fire trucks) for emergency response, and is placed just east of/outside of the mooring hook locations for Berths 1-4 to avoid interfering with the mooring lines at each berth. As a consequence, there is very limited space at RLW available for new equipment, and placement of shore power equipment and power cable routing and connections cannot impede access to other berths. This is particularly restrictive for Berths 2 and 3, as an existing pipe rack on the eastern half of the wharf constrains potential equipment locations for that entire (approximately 1600-ft long) section of the RLW.

4. *Installation of Equipment in Classified Zones*

Shore power equipment, required for use at RLW, is not currently commercially available for use in Classified Areas. Because of this, the equipment must be located outside of the classified areas, which will generally require placement of the cable management system aft of the cargo tanks of the largest vessel calling at each berth, and elevated at least two feet above the deck of the RLW, and 50 feet from the loading arms or other recognized sources of potential release on the RLW. Cavotec has confirmed that currently there are no existing mobile shore power cable reel systems capable of reaching the distances necessary at to cover all berths, vessel sizes and orientations at RLW and nor are any units certified to operate in hazardous areas.

This limitation on the placement of the cable management system will result in longer cables, larger and heavier cable reels, and larger cranes with longer reach to lift the cables to the vessel and to tend the cables to account for changes in vessel draft while at berth. The resulting loads may exceed the structural capacity of the RLW. Until equipment is designed by the manufacturers that is rated for use in hazardous areas, and with the mobility necessary to handle the range of vessels calling RLW, it is not possible to proceed with detailed design that would ensure adequate structural capacity.

5. MOTEMS Conformance

In addition to identifying a location for the cable management system and crane installation that does not interfere with mooring lines, the system must be certified for use inside of classified zones or must be located outside of a classified zone. Further, the system must be able to reach the ship connection points for Chemical carriers to Panamax vessels at Berths 2 and 3, and Product Carriers to VLCCs at Berths 1 and 4. The resulting cable and crane requirements to reach those long distances (200 ft. range) will add weight and mass to the existing RLW structure and will affect the seismic loads on the wharf. The capacity of the existing structure must remain in conformance with the seismic requirements of MOTEMS (California Building Code, Section 3104F). If the wharf does not have sufficient seismic capacity for these increased loads, independent structures will be required for the cable management system. These structures will have similar limitations for placement with regards to interferences with Berths 9 and 11 as discussed for the capture and control concept.

6. Concerns regarding shipping fleet and ship/shore interface, and timing for ship retrofits:

Standard Electrical system design on all ocean-going tankers with standard cargo pumping system configurations are:

- Electrical systems designed for connection of shore power to Emergency Switchboard only.
- Cargo pumping system on VLCC's, Suezmax and Aframax tankers are steam turbine driven; powered by steam from Auxiliary Boilers (AB)

Neither the IMO nor any other maritime regulatory body:

- Mandates design of an electrical power distribution systems, that powers all hotel and cargo pumping loads, to be capable of receiving shore power.
- Mandates use of electric cargo pumps in tankers

Well below 1% of the global tanker fleet is equipped with a shore power capability to supply the auxiliary power onboard. Also, less than 0.5% of the global fleet of VLCC, Suezmax and Aframax tankers is equipped with an all-electric cargo pumping system.

Adoption of shore power capability for complete (auxiliary engines and cargo electric pumping system on shore power) or partial shore power (auxiliary engines on shore power and auxiliary boilers used to power steam turbines for cargo pumping) will require capital investment, significantly greater than DNV's Technology Assessment indicated for both shore-side and vessel-side retrofit systems.

In addition to significant machinery, equipment and control system upgrades, this could require newly designed and designated machinery space to house additional equipment beyond what is normally installed onboard. It is important to highlight that additional machinery space is often limited or even unavailable on most vessels, to accomplish such extensive modifications.

For complete shore power solution, it is also important to highlight that unless vessels are purpose built for RLW operations and designed and commercially operated only at terminals with shore power, no vessel owner will be incentivized to operate all electric vessels as there are very few tanker terminals in the world,

where these vessels will be able to operate commercially and discharge cargo on shore-power.

Full “cold-ironing” capability: “Cold-ironing” is a maritime term used to describe the ability of a vessel to connect to shore power while completing operations at berth.
Tanker vessels equipped with an all-electric cargo and ballast system and an electrical power system that is designed to connect the entire electrical distribution system to shore power (Full Cold Ironing) will be considered an approved CAECS and will comply with CARB rules for NOx, PM2.5 and ROG emissions.

As stated above, it is infeasible, impracticable and improbable to convert existing tankers with steam cargo pumping systems to complete electric cargo pumping systems.

Even if Chevron were to consider this option on select few vessels that already are capable of full cold ironing, the potential annual emissions from these vessels could reduce approximately 0.4MTPY in total NOx, 0.02 MTPY in total PM2.5, and 0.02 MTPY in total ROG.

Partial Cold Ironing capability: This term is used to describe a tanker vessel with the following capabilities:

A. Vessel equipped with electrical distribution system that is capable of being connected to shore power such that all auxiliary engines can be switched off in port, alongside the jetty, and;

B. Vessel equipped with steam cargo pumping system, that is operated using steam generated from the auxiliary boilers. Electric power, needed to run the entire steam plant is distributed from a switchboard powered from shore power.

This concept of Partial Cold Ironing will be considered an approved CAECS and will comply with CARB rules for NOx, PM2.5 and ROG emissions.

The potential, initial scope, for this concept includes: Chevron lightering vessels and a limited few other tankers calling RLW. Approximate 22MTPTY reduction in total NOx, 0.3MTPY reduction in total PM2.5, and 0.8MTPY reduction in total ROG, based on 2016 activity levels. We expect that Chevron can start retrofitting and modifying some vessels, included in the initial scope of this CAECS, as early as 2023. However, it is significant to mention that the availability of shore power, shore-side equipment development, detailed design and construction duration are presently unknown and since these are precursors to being able to begin reducing emissions from any shore-power retrofit or enabled vessels, the exact timing of implementing this CAECS is unlikely before 2027.

In the event a hazardous-area-rated mobile shore power system becomes available in the marketplace, and is capable of being implemented in a feasible, safe and reliable manner at Richmond Long Wharf, Chevron would anticipate building a structure to accommodate an approximate 20 MW 6.6 kV substation at the marine terminal, and possibly shore power dolphins at Berths 1 and 4. Cable management systems and cranes would need to be co-located at each berth or on new dolphins. Further technology development by the vendor is necessary to enable mobile medium-voltage equipment that can be located within hazardous zones, and a detailed hazard assessment would be needed before a precise location and configuration could be selected.

Port and Terminal Plan Responses

Listing of each berth at the terminal with geographical boundary coordinates

This section covers the items in Section 93130.14(a)(3)(C) (Terminal Plan) and Section 93130.14(b)(3)(E) (Port Plan) of the At-Berth Regulation.

Table 7: List of Each Berth with Geographic Boundary Coordinates

Berth	Mooring Hook	Latitude	Mooring Hook	Longitude
1	MK-101	37°55'13.07"N	MK-101	122°24'29.58"W
	MK-107	37°55'19.32"N	MK-107	122°24'35.52"W
2	MK-200	37°55'19.55"N	MK-200	122°24'35.89"W
	MK-204	37°55'24.64"N	MK-204	122°24'41.44"W
3	MK-204	37°55'24.64"N	MK-204	122°24'41.44"W
	MK-401	37°55'31.93"N	MK-401	122°24'48.18"W
4	MK-401	37°55'31.93"N	MK-401	122°24'48.18"W
	MK-408	37°55'40.39"N	MK-408	122°24'55.30"W

NOTE: Mooring hooks denote the furthest extent of the berth for vessel mooring purposes. Some hooks are shared between adjacent berths. Berths 5, 7, 9 and 11 do not receiver tankers.

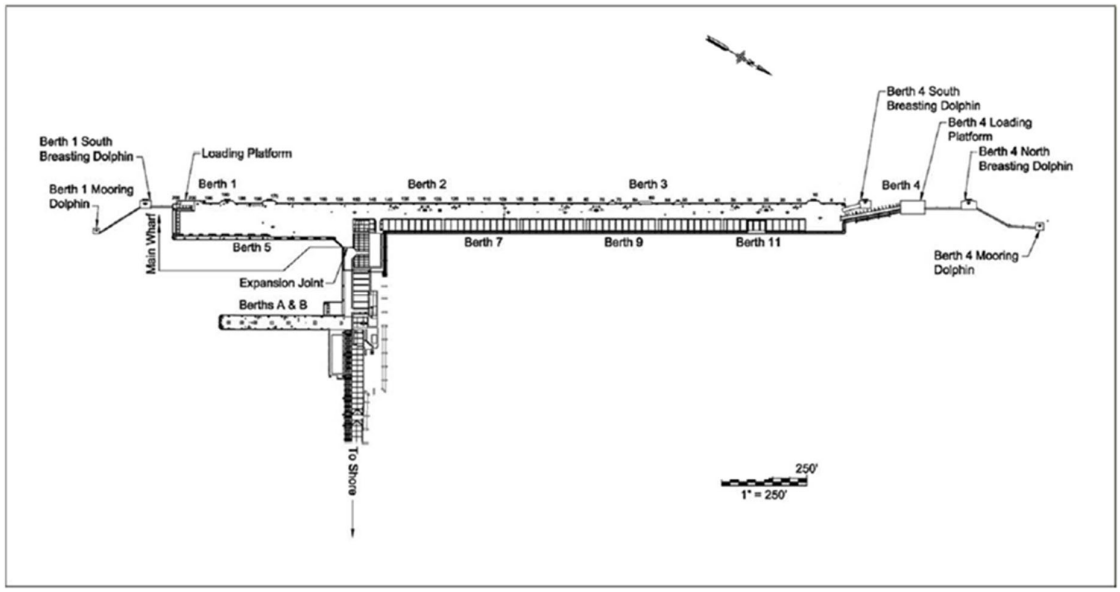


Figure 44: Main Wharf and Independent Dolphin Structures Arrangement

Identification of berths where equipment would be used

This section of the plan covers the items in Section 93130.14(a)(3)(D) (Terminal Plan) and Section 93130.14(b)(3)(D) (Port Plan) of the At-Berth Regulation.

As noted above, the proposed compliance strategy is to use a package of Innovative Concepts. Please see the attached Innovative Concepts application for a discussion of which equipment and emissions controls are associated with each Innovative Concept.

In the event a CAECS becomes available for use at RLW; is determined to be feasible, safe and reliable for implementation; and is used at RLW for compliance, the associated emission control equipment is anticipated to be used at Berths 1, 2, 3 and/or 4 as shown in **Figure 4**, since those berths accept ocean-going vessels covered by the At-Berth Regulation. Any emissions reduction equipment likely would not be used at Berths 5, 7, 9, and 11 which are not tanker berths, and/or do not support product transfers.

Terminal/port berthing restrictions

This section of the plan covers the items in Section 93130.14(a)(3)(E) (Terminal Plan) and Section 93130.14(b)(3)(F) (Port Plan) of the At-Berth Regulation.

Each vessel at each berth has specific restrictions on approach velocity, approach angle, draft, approach direction, and tidal restrictions. These are in accordance with Chapter 31F of California Building Code, Division 5, Section 3105F, as regulated by the Marine Environmental Protection Division of the California State Lands Commission.

Physical/operational constraints

This section of the plan covers the items in Section 93130.14(a)(3)(H) (Terminal Plan) of the At-Berth Regulation.

Physical and operational constraints to implementing the CAECS are as discussed above and in the technology assessment and risk assessment workshops performed by DNV, which included CARB staff participants. Throughout the rulemaking process, and in the DNV technology assessment workshops, CARB has been made aware of the numerous constraints with the technologies, and their implementation at Northern California marine terminals including the fact that suitable CAECS equipment for Northern California marine terminals does not currently exist in the marketplace. Consequently, Chevron has provided Innovative Concepts applications, including a variety of emissions reduction strategies that, subject to timely CARB approval, could be implemented prior to the initial compliance period.

Identify any equipment purchases and/or construction that are in progress or must still be completed to reduce emissions

This section of the plan covers the items in Section 93130.14(b)(3)(B) (Port Plan) of the At-Berth Regulation.

No equipment purchases or construction are presently in progress, as there does not exist CAECS equipment suitable for use in Northern California metocean conditions for EO-AB-15-1[11], Barge-Based Capture and Control, nor for 6.6 kV shore-power medium voltage equipment in hazardous areas. Further work with vendors of the EO-AB-15-1 CAECS and shore power will be necessary to develop new equipment before purchases could be specified or detailed design completed.

[11] https://ww2.arb.ca.gov/resources/documents/eo-ab-15-01

Provide schedule for installing equipment and/or any necessary construction permits

This section of the plan covers the items in Section 93130.14(b)(3)(C) (Port Plan) of the At-Berth Regulation.

A schedule for installing equipment and/or any necessary construction permits will be developed once equipment suitable for use at Richmond Long Wharf is developed by the vendors, and detailed design is completed based on the specifications for the to-be developed equipment. It is possible, should barge-based EO-AB-15-1 technology be developed that is suitable for use in Northern California metocean conditions, that no fixed equipment, and therefore no construction permits, would be necessary to be installed at berth.

For the shore power CAECS, Chevron will work with existing shore power technology suppliers (Cavotec and/or ABB), to try to develop new technology capable of operating at RLW in hazardous zones, and with the reach/mobility (in excess of 250 ft. at some berths) necessary to connect to the wide range of vessel classes calling each berth at RLW. A schedule for procurement and installation would depend upon the development and availability of suitable technology to meet the operational needs at RLW.

Appendix: Innovative Concepts Application Package

CARB At-Berth Regulation: Innovative Concept Application

Chevron Products Company
December 1, 2021

Version	Date	Approver
0	12/1/2021	Alan Davis

Contents

Tables

1. Executive Summary

The Chevron Richmond Refinery is submitting this application to the California Air Resources Board (CARB) for approval of the following Innovative Concept (IC) projects in accordance with **Section 93130.17** of the Control Measure for Ocean-Going Vessels At Berth ("At-Berth Regulation"), Title 17, Division 3, Chapter 1, Subchapter 7.5 of the California Code of Regulations (CCR), Sections 93130-93130.22. In response to the At-Berth Regulation, Chevron convened an extensive team of experts across the company to develop a robust package of Innovative Concepts for purposes of complying with the Regulation. Each Innovative Concept is listed below and then discussed in greater detail in the following sections of this application.

Table 1: Innovative Concept Projects

Project #	Project Description	Estimated Project Implementation Date(s)
1	Newer Locomotive	2022
2	Boiler Replacement Project	2024
3	Diesel Air Compressors Replacement	2023
4	FCC Ammonia Optimization	2022
5	Wharf ERD Replacement	2023
6	TKN Heater Optimization	2024
7	North Ranch Diesel Engine Replacement	2023
8	Solar Electricity Project - General	2024
9	Solar Electricity Project – Shore Power	2027-2032
10	Tier II or above certification on Auxiliary Engines (AE) for ships	2023-2027
11	Tier III or above certification on Auxiliary Engines (AE) for ships	2023-2027
12	Upgraded Combustion and Control systems for Auxiliary Boilers (AB) for ships	2023-2027
13	Dual-Fuel Tier III Auxiliary Engines (AE's) and Auxiliary Boilers (AB)	2024-2027
14	Shore Power or Stack Capture for Barges/Tug Boats	2027-2032

At the outset, it is important to emphasize that all the projects listed in **Table 1** are intended specifically to achieve compliance with the CARB At-Berth regulation. This package of IC projects was developed by a special team of Chevron experts specifically in response to the CARB At-Berth Regulation as a means of regulatory compliance. There currently are no regulatory requirements to develop, adopt, or implement any of these projects. Further, given current technological and economic trends, none of the projects would be reasonably expected to occur under a "business as usual" scenario. Rather, these IC projects will require significant capital investments, selective (incentivized) chartering/leasing strategies, and expedited adoption and implementation that would not otherwise be required or anticipated to occur in the absence of the At-Berth Regulation. As a result, the IC projects are designed to achieve emissions reductions in excess of any reductions otherwise

required by law and in excess of any reductions that would be reasonably expected under a conservative business as usual scenario.

In addition, given the uncertainties associated with future conditions as of the 2027 compliance deadline, which is more than five years away, Chevron is relying on the IC concepts as a collective package to achieve the required emissions reductions under the CARB At-Berth Regulation. Accordingly, Chevron requests that CARB approve all of the IC projects to provide for sufficient emissions reductions to achieve compliance with the At-Berth Regulation.

Chevron also requests that CARB promptly approve the IC projects as a collective package, so that Chevron can get started in implementing the projects to reduce emissions. Subject to CARB approval under the At-Berth Regulation, many of the IC projects could be implemented in the near-term, and it is anticipated that all but two of the IC projects could be implemented prior to the 2027 regulatory compliance deadline. As a result, CARB approval will provide for early emissions reductions, for the benefit of nearby communities, in advance of the 2027 regulatory compliance deadline. All of the IC projects are dependent on CARB approval for their implementation.

In addition to early adoption and implementation upon CARB approval, Chevron intends to operate all but two of the IC projects for the entirety of the duration of the first five-year compliance period (2027-2032). It also intends to continue operating the IC projects for subsequent compliance periods, subject to CARB approval of one or more extensions in accordance with the applicable provisions of the At-Berth Regulation.

As noted in **Table 1**, two of the IC projects (projects # 9 and #14) are proposed for commencement during the 2027-2032 compliance period, in the event shore power becomes available during this period as a safe, reliable and feasible way to control tanker emissions. However, as noted in DNV's Technology Assessment (titled "California Air Resources Board's (CARB) Ocean-going Vessels At Berth Regulation Emissions Control Technology Assessment for Tankers, Report # 2021-9470", dated November 2021), shore power is not projected to be available for use at tanker terminals until 2034 at the earliest. The commencement of implementation of IC projects #9 and #14 would thus be tied to the use of shore power as a feasible technology.

Each IC project is discussed individually below according to the following criteria under **Section 93130.17(b)** of the At-Berth Regulation:

- Company name, address, and contact information (**Section 93130.17(b)(1)(A)**)
- Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map (**Section 93130.17(b)(1)(B)**)
- Estimate of vessel emissions planned to be covered by the IC project for each pollutant (NOx, PM 2.5 and ROG) (**Section 93130.17(b)(1)(C)**)
- Proposed recordkeeping, reporting monitoring and testing procedures (**Section 93130.17(b)(1)(D)**)
- A Memorandum of Understanding or similar agreement between the applicant, any funding partners, owners and operators of controlled equipment for the IC that shows agreement regarding IC's scope, and requirements for using the IC project in compliance with the At-Berth Regulation (**Section 93130.17(b)(1)(E)**)
- Proposed length of time for use (**Section 93130.17(b)(1)(F)**).
- A summary of the governmental approvals needed (**Section 93130.17(b)(1)(G)**)
- A discussion of any environmental review requirements that may apply (**Section 93130.17(b)(1)(H)**)

- Any information necessary to demonstrate that the proposed IC project meets all eligibility and applicability requirements (**Section 93130.17(b)(1)(I)**).

With respect to the period of time for implementation (**Section 93130.17(b)(1)(F)**), as explained above, subject to and upon CARB approval, Chevron intends to begin implementing most of the IC projects in the near-term, and it also intends to implement the IC projects over the long-term, subject to CARB's renewed and continued approval. Given the unpredictable amount of time needed for the requisite environmental reviews, Chevron has commenced submitting requests for environmental review to several applicable government agencies to seek to ensure timely review, approval, and implementation of the IC project if it is approved as an IC project by CARB under the At-Berth Regulation. Government agencies typically do not commit to any particular timeframe for completing their reviews or approval processes, so Chevron has strived to expedite the process by submitting for agency approval before Chevron knows if the IC project will ultimately be approved by CARB for use under the At-Berth Regulation. Requesting that agencies commence and complete their environmental reviews is not a guarantee that the project will be executed in the absence of CARB approval, nor is it an indication that Chevron already has commenced project implementation.

Further, as CARB has noted in its FAQ document, an applicant may cancel an IC project for any reason. Given the uncertainty associated with future long-term conditions, Chevron reserves the right to remove or cancel an IC project for technological, safety or other reasons that may arise; if this occurs Chevron will promptly notify CARB of the cancellation and the reasons for the cancellation. Chevron understands that if one or more of the IC projects is cancelled or removed, Chevron will need to have a backup plan in place at the time of any cancellation to achieve compliance with the At-Berth Regulation.

With respect to the eligibility criteria under **Section 93130.17(a)**, the applicable criteria specific to each IC project are addressed below. For all of the proposed IC projects, no project will increase emissions at other ports or marine terminals; no public funds will be used to implement these projects; none of the projects are legally mandated by any law, rule or regulation; and none have been identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.

Lastly, it is important to emphasize that the IC projects presented in this application are in addition to numerous other environmental improvements being implemented by Chevron that are not eligible as an Innovative Concepts. Chevron aims to lower the carbon intensity of our operations, protect the environment, and invest in the communities in which we operate. Projects that accomplish these goals are prioritized, optimized and funded based upon their ability to achieve emission reductions in an economic and timely manner. While we continually work to identify such voluntary projects, the Innovative Concepts proposed below were not planned for completion at this time in the absence of the CARB At-Berth Regulation.

2. Richmond Long Wharf (RLW) Emissions

As noted in the Background section of the "Chevron Richmond Long Wharf Terminal and Port Plan" (Terminal Plan) submitted on December 1, 2021, Chevron estimated annual average emissions to be those listed below in **Table 2**. The table below also shows the annual average emissions reductions that must be achieved when using Innovative Concepts in a representative year (2016) reflecting future estimated annual vessel calls. The numbers below were calculated using the emissions factors in **Section 93130.5(d)** and the emissions calculation methodologies described in **Section 93130.17(d)(1)**.

Table 2: Annual Emissions and Emissions Reductions Needed from Innovative Concepts

	NOx [MT]	PM [MT]	ROG [MT]
Aux Engines	163.69	2.02	6.17
Aux Boilers	89.97	7.65	4.95
2016 Total	253.66	9.66	11.12
Reductions Needed from IC Projects	**202.45**	**7.96**	**9.03**

The emissions totals above apply the default emission factors in **93130.5(d)(1) and (d)(2)** that assume that all vessels are Tier 0. It should be noted that Chevron has already implemented the use of Tier I and Tier II vessels, and actual vessels emissions are much lower than what is required to be calculated per the assumed default emission rates specified in the CARB At-Berth Regulation. The Terminal and Port Plan describes in detail the true emissions from the RLW.

To ensure the emissions for NOx, PM2.5 and ROG are adequately mitigated, Chevron estimated the emissions reductions possible from the IC projects using best available data. **Table 3** below lists the annual emissions reductions that are reasonably expected from each of the IC projects, as calculated in metric tons.

Table 3: IC Project Annual Emissions Reductions

Project No	Project Description	NOx [MT]	PM2.5 [MT]	ROG [MT]
Shore-Based Innovative Concept Projects				
1	Newer Locomotive	-5.1	-0.1	-0.2
2	Boiler Replacement Project	-50.8	0	-1.6
3	Diesel Air Compressors Replacement	-27.4	-1.5	-1.3
4	FCC Ammonia Optimization	0	-103.3	0
5	Wharf ERD Replacement	-7.3	-0.8	0
6	TKN Heater Optimization	-37.5	-4.8	-3.4
7	North Ranch Diesel Engine Replacement	-0.4	-0.02	-0.02
8	Solar Electricity Project - General	-5.6	-0.3	-0.4
9	Solar Electricity Project – Shore Power	-3.2	-0.2	-0.2
	Subtotal	**-137.3**	**-111.1**	**-7.1**
Ship-Based Innovative Concept Projects				
10	Tier II or above certification on Auxiliary Engines (AE) for ships [Note 1]	-49	0	0
11	Tier III or above certification on Auxiliary Engines (AE) for ships [Note 1]	-133	0	0
12	Upgraded Combustion and Control systems for Auxiliary Boilers (AB) for ships [Note 1]	-48	0	0
13	Dual-Fuel Tier III Auxiliary Engines (AE) and Auxiliary Boilers (AB) [Note 1]	-41	0	0
14	Shore Power or Stack Capture for Barges/Tug Boats	-22	-0.2	-1.4

Project No	Project Description	NOx [MT]	PM2.5 [MT]	ROG [MT]
	Subtotal	**-97 to -185.3**	**-0.2**	**-1.4**
	Grand Total	**-234.3 to -322.6**	**-111.2**	**-8.5**

Note 1: These ship-based IC projects are not cumulative. For example, if IC project 11 is implemented, IC project 10 will be redundant.

Table 4 below summarizes the emissions reductions possible from implementation of the IC projects ahead of the 2027 compliance deadline, which would not occur without timely CARB approval of these projects. The table also highlights the benefits to the community that would occur due to the early implementation of these projects. The NOx reductions are the equivalent of eliminating approximately 155,000 cars from the roads in the local community[1] and the PM2.5 reductions are similar to eliminating 12% of diesel trucks in California[2].

Table 4: Cumulative Emissions Banking From Early Implementation of Innovative Concepts

Project No	Project Description	NOx [MT]	PM2.5 [MT]	ROG [MT]
Shore-Based Innovative Concept Projects				
1	Newer Locomotive	-25.4	-0.7	-0.8
2	Boiler Replacement Project	-152.5	0	-4.7
3	Diesel Air Compressors Replacement	-109.7	-6.1	-5.2
4	FCC Ammonia Optimization	0	-413.2	0
5	Wharf ERD Replacement	-29	-3.1	0
6	TKN Heater Optimization	-112.4	-14.3	-10.3
7	North Ranch Diesel Engine Replacement	-1.7	-0.1	-0.1
8	Solar Electricity Project - General	-16.9	-1.0	-1.1
9	Solar Electricity Project – Shore Power	0	0	0
	Subtotal	**-447.6**	**-438.5**	**-22.3**
Ship-Based Innovative Concept Projects				
10	Tier II or above certification on Auxiliary Engines (AE) for ships Note 1	-114	0	0
11	Tier III or above certification on Auxiliary Engines (AE) for ships Note 1	-248	0	0
12	Upgraded Combustion and Control systems for Auxiliary Boilers (AB) for ships Note 1	-133	0	0
13	Dual-Fuel Tier III Auxiliary Engines (AE) and Auxiliary Boilers (AB) Note 1	-51	0	0
14	Shore Power or Stack Capture for Barges/Tug Boats	0	0	0
	Subtotal	**-247 to -299**	**0**	**0**
	Grand Total	**-694.6 to -746.6**	**-438.5**	**-22.3**

Note 1: These ship-based IC projects are not cumulative. For example, if IC project 11 is implemented, IC project 10 will be redundant.

[1] Per 2020 estimate in "https://www.bts.gov/content/estimated-national-average-vehicle-emissions-rates-vehicle-vehicle-type-using-gasoline-and" and assuming 11,000 miles driven per year as noted in "Greenhouse Gas Emissions from a Typical Passenger Vehicle | US EPA"

[2] Per CARB Emissions Factor (EMFACT) model, https://arb.ca.gov/emfac/

3. Innovative Concept Projects

Project 1: Installation of Lower Emitting Locomotives

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Chevron currently operates locomotives to move railcars throughout the Chevron Richmond Refinery (see location map in **Appendix A1**). Chevron would reduce locomotive emissions by replacing 1 or more locomotives with lower emitting locomotives. Instead of operating the current locomotives for the foreseeable future because there is no regulatory requirement to stop operating them, subject to CARB approval as an IC project to reduce emissions for purposes of the At-Berth Regulation, Chevron would invest in lower emitting locomotives as early as 2022.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Chevron estimates that the emissions reductions from replacing 1 locomotive will be 5.1 metric tons per year (MTPY) for NOx, 0.1 MTPY for PM2.5, and 0.2 MTPY for ROG based on current railcar emissions. Further, the new locomotive will not increase GHGs. See **Appendix A1** for the best available NOx, PM2.5 and ROG emissions calculations for this project. Emissions were calculated using vendor provided fuel consumption data for the new locomotive, and EPA emissions factors for locomotives.

The RLW has calls from a variety of vessels that are constantly evolving and Chevron cannot predict exactly which vessels will be in operation when this regulation goes into effect in 2027, nor their exact NOx, PM2.5 and ROG emissions. **Table 2** shows the amount of NOx, PM2.5 and ROG emissions that must be reduced with IC projects when using 2016 emissions as a representative year and the emission factors from **Section 93130.5(d)(1) and (d)(2)**. **Table 3** shows how this project fits in among the Innovative Concepts as a package to ensure emissions are reduced as required by **Section 93130.17**.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Chevron will leverage current fuel consumption records collected on a monthly basis and EPA emission data for the existing locomotives, and compare them with the monthly fuel records and emissions data for the new locomotives. Emissions data will be in the form of EPA/CARB emissions certifications provided by the locomotive vendor. The emissions will

be reported to CARB on an annual basis as required by **Section 93130.17(d)(1)** of the At-Berth Regulation. See **Appendix A1** for more details.

5. A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;

Railserve is under contract to operate locomotives used at Chevron Richmond, and these locomotives are used exclusively at Chevron Richmond. This contract would be amended to account for the operation of the lower emitting locomotives exclusively at Chevron Richmond. A form of Memorandum of Understanding to amend the contract could be submitted upon request.

6. Proposed length of time during which the IC project would be used

This IC project is capable of implementation starting in 2022, as there are no governmental approvals or permits needed to commence the project. As explained above, Chevron requests timely approval so that early emissions reductions can be achieved in the near-term, well ahead of the 2027 compliance deadline. As also explained above, in addition to early implementation, Chevron proposes to implement this IC project through and including the first compliance period (2027-2032), and to continue implementation through subsequent compliance periods, subject to CARB approval of one or more extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. A summary of all governmental approvals necessary to enable development of the innovative concept;

No government approvals needed, except for a CARB approval as an IC project under the At-Berth Regulation.

8. A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and

No environmental reviews required.

9. **The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.**

The lower emitting locomotives are expected to lower NOx, PM2.5 and ROG emissions without increasing GHG emissions. Chevron will only procure a locomotive that meets this requirement. Chevron will collect all necessary data to verify emissions reductions on a yearly basis as required by **Section 93130.17(d)**. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. **The proposed innovative concept must achieve emissions reductions of NOx, PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.**

There is currently no statute, regulation or other legal requirement to install the lower emitting locomotives. While regulations have been proposed that could require lower emitting locomotives, no such requirement currently exists.

11. **The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.**

The new locomotives will be operated throughout the Chevron Richmond Refinery, and will be at the most 1-3 miles away from the Richmond Long Wharf. Emissions reductions will occur near the marine terminal and within communities that are adjacent to the refinery.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

As noted above, the project is not legally required. It also is not expected to occur under a "business as usual" scenario. Under a business as usual scenario in light of current technological and economic trends and incentives, it is likely that the existing locomotives would continue to be used as they are currently being used. Accordingly, this IC project is being proposed specifically to achieve compliance with the At-Berth Regulation, and in fact reflects one of the specific examples provided by CARB staff of a potential IC project under the Regulation. CARB approval is requested on expedited basis to afford certainty and reliability in terms of the emissions reductions that can be used to achieve compliance with the At-Berth Regulation, and also to allow for these emissions reductions to be accelerated in the near-term.

The new locomotive emissions reductions will be real, quantifiable, verifiable and enforceable: A) Real: Vendor provided emissions rates and actual fuel logs will be the basis for certifying that the emissions reductions are real. B) Quantifiable: Emissions rates will be based on EPA/CARB emissions certifications, and fuel logs will be based on metered fuel data. C) Verifiable: The EPA/CARB certifications and the fuel logs will be available for audit. D) Enforceable: CARB will be able to pursue enforcement if the requisite emissions reductions are not achieved to comply with the At-Berth Regulation and/or if there is a violation of other requirements (e.g., reporting/recordkeeping) under the Regulation.

Project 2: Boiler Replacement Project

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Chevron currently operates 5 steam boilers to meet process steam demands throughout the refinery and would replace them with two new and more fuel-efficient boilers (see location map in **Appendix A2**). Instead of operating the current boilers for the foreseeable future because there is no regulatory requirement to stop operating them, subject to CARB approval as an IC project to reduce emissions for purposes of the At-Berth Regulation, Chevron would invest in the lower emitting boilers as early as 2024.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Emissions reductions from this project are expected to be approximately 50 metric tons per year (MTPY) for NOx and 1.5 MTPY of ROG based on current boiler operations. PM2.5 emissions are not expected to change. These new boilers will not increase GHG emissions. See **Appendix A2** with the best available NOx, PM2.5 and ROG emissions calculations for this project. Emissions were calculated using vendor provided fuel consumptions and emissions data for the new boilers.

The RLW has calls from a variety of vessels that are constantly evolving and Chevron cannot predict exactly which vessels will be in operation when this regulation goes into effect in 2027, nor their exact NOx, PM2.5 and ROG emissions. **Table 2** shows the amount of NOx, PM2.5 and ROG that must be reduced with IC projects when using 2016 emissions as a representative year and the emission factors from **Section 93130.5(d)(1) and (d)(2)**. **Table 3** shows how this project fits among the Innovative Concepts as a package to ensure emissions are reduced as required by **Section 93130.17**.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Chevron will leverage the emissions reductions calculated as part of the project's New Source Review (NSR) permit evaluation that will be conducted by Bay Area Air Quality Management District (BAAQMD). This includes emissions baselines calculated using CEMS, stack testing data and process data. Emissions reductions will be demonstrated using stack monitoring data required by BAAQMD for this project. This includes CEMS, and/or stack testing data (and data collection frequencies) required by BAAQMD. The emissions will be

reported to CARB on an annual basis as required by **Section 93130.17(d)(1)** of the At-Berth Regulation. See **Appendix A2** for more details.

5. A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;

Not applicable. Chevron would be the owner and operator of the new boilers.

6. Proposed length of time during which the IC project would be used

This IC project is capable of implementation starting in 2024, assuming all government approvals are obtained in a timely manner. As explained above, Chevron requests a timely CARB approval so that early emissions reductions can be achieved ahead of the 2027 compliance deadline. As also explained above, in addition to early implementation, Chevron proposes to implement this IC project through and including the first compliance period (2027-2032), and to continue implementation through subsequent compliance periods, subject to CARB approval of one or more extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. A summary of all governmental approvals necessary to enable development of the innovative concept;

Chevron will need CARB approval as an IC project under the At-Berth Regulation, and approval from the following agencies may be required:
1) BAAQMD – Air Permit
2) City of Richmond –Project approval and CEQA Review

8. A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and

It is anticipated that the City of Richmond would serve as the CEQA lead agency for this IC project. BAAQMD would also conduct a review in accordance with its new source review rules.

9. The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.

The new boilers are expected to lower NOx and ROG emissions without increasing GHG emissions or PM2.5. Chevron will leverage the emissions calculations from New Source Review conducted by BAAQMD to demonstrate emissions reductions on a yearly basis as required by **Section 93130.17(d)**. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. The proposed innovative concept must achieve emissions reductions of NOx, PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.

There is currently no requirement to install these lower emitting boilers.

11. The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.

The new boilers will be located within the Chevron Richmond Refinery, 1-2 miles away from the Richmond Long Wharf. Emissions reductions will occur near the marine terminal and within the communities adjacent to the refinery.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

As noted above, the project is not legally required. It also is not expected to occur under a "business as usual" scenario. This project was identified for CARB At-Berth compliance. But for the regulation under a business as usual scenario in light of current technological and economic trends and incentives, it is likely that the five existing steam boilers at the refinery would have continued to be used as they are currently being used. Accordingly, this IC project is being proposed specifically as a means to achieve compliance with the At-Berth Regulation. Timely CARB approval is requested to afford certainty and reliability in terms of the emissions reductions that can be used to achieve compliance with the At-Berth Regulation, and also to allow for these emissions reductions to be achieved in the near-term.

The new boiler emissions reductions will be real, quantifiable, verifiable and enforceable: A) Real: BAAQMD NSR emissions calculations will be the basis for the emissions reductions. B) Quantifiable: BAAQMD methodologies and monitoring data will be used to estimate the reduction. C) Verifiable: The calculations and monitoring data will be available for audit. D) Enforceable: CARB will be able to pursue enforcement if the requisite emissions reductions are not achieved to comply with the At-Berth Regulation and/or if there is a violation of other requirements (e.g., reporting/recordkeeping) under the Regulation.

Project 3: Diesel Air Compressors Replacement

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Chevron currently operates diesel air compressors to support the pneumatic air system throughout the Chevron Richmond Refinery (see location map in **Appendix A3**). Instead of operating the current diesel air compressors for the foreseeable future to ensure reliable air flows, Chevron would eliminate most of these air compressors and replace them with an electric equivalent. Subject to CARB approval as an IC project to reduce emissions for purposes of the At-Berth Regulation, Chevron could implement this IC project as early as 2023. Chevron plans to conduct a study of the air system in 2022 to confirm the details of how the diesel air compressors would be replaced by 2023.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Chevron estimates that reductions from eliminating the diesel air compressor will be 27 metric tons per year (MTPY) for NOx, 1.5 MTPY for PM2.5, and 1.3 MTPY for ROG based on current air compressor emissions. The new air compressor will not increase GHG emissions. See **Appendix A3** for the best available NOx, PM2.5 and ROG emissions calculations for this project. Emissions were calculated using fuel consumptions and EPA emissions factors for the existing diesel air compressors.

The RLW has calls from a variety of vessels that are constantly evolving and Chevron cannot predict exactly which vessels will be in operation when this regulation goes into effect in 2027, nor their exact NOx, PM2.5 and ROG emissions. **Table 2** shows the amount of NOx, PM2.5 and ROG that must be reduced with IC projects when using 2016 emissions as a representative year and the emission factors from **Section 93130.5(d)(1) and (d)(2)**. **Table 3** shows how this project fits among the Innovative Concepts to ensure emissions are mitigated as required by **Section 93130.17**.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Chevron will leverage current fuel consumption records collected on a monthly basis and EPA emission data for the existing air compressors to determine emissions reductions. Emissions data will be in the form of EPA/CARB emissions certifications provided by the diesel engine vendor. The emissions will be reported to CARB on an annual basis as required by **Section 93130.17(d)(1)** of the At-Berth Regulation. See **Appendix A3** for more details.

5. **A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;**

Not applicable. Chevron would be the owner and operator of the new equipment.

6. **Proposed length of time during which the IC project would be used**

This IC project is capable of implementation starting in 2023. As explained above, Chevron requests timely approval so that early emissions reductions can be achieved in the near-term, well ahead of the 2027 compliance deadline. As also explained above, in addition to early implementation, Chevron proposes to implement this IC project through and including the first compliance period (2027-2032), and to continue implementation through subsequent compliance periods, subject to CARB approval of one or more extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. **A summary of all governmental approvals necessary to enable development of the innovative concept;**

No government approvals needed, except for a CARB approval as an IC project under the At-Berth Regulation.

8. **A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and**

No environmental reviews required.

9. **The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.**

Removal of the diesel air compressors is expected to lower NOx, PM2.5 and ROG emissions without increasing GHG emissions. Chevron will collect all necessary data to verify emissions reductions on a yearly basis as required by **Section 93130.17(d)**. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. The proposed innovative concept must achieve emissions reductions of NOx, PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.

There is currently no requirement to remove these diesel air compressors.

11. The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.

The new equipment will be operated throughout the Chevron Richmond Refinery, and will be at the most 1-2 miles away from the Richmond Long Wharf. Emissions reductions will occur near the marine terminal and within the communities adjacent to the refinery.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

As noted above, the project is not legally required. It also is not expected to occur under a "business as usual" scenario. Under a business as usual scenario in light of current technological and economic trends and incentives, it is likely that the existing diesel air compressors at the refinery would continue to be used as they are currently being used. Accordingly, this IC project is being proposed specifically as a means to achieve compliance with the At-Berth Regulation. Timely CARB approval is requested to afford certainty and reliability in terms of the emissions reductions that can be used to achieve compliance with the At-Berth Regulation, and also to allow for these emissions reductions to be achieved in the near-term.

The new air compressor emissions reductions will be real, quantifiable, verifiable and enforceable: A) Real: Emissions rates and actual fuel logs for the diesel air compressors will be the basis for certifying that the emissions reductions are real. B) Quantifiable: Emissions rates will be based on EPA/CARB emissions certifications, and fuel logs will be based on metered fuel data. C) Verifiable: The EPA/CARB certifications and the fuel logs will be available for audit. D) Enforceable: CARB will be able to pursue enforcement if the requisite emissions reductions are not achieved to comply with the At-Berth Regulation and/or if there is a violation of other requirements (e.g., reporting/recordkeeping) under the Regulation.

Project 4: FCC Ammonia Optimization

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Chevron operates a Fluidized Catalytic Cracker (FCC) to produce gasoline from long chain hydrocarbons. The process uses a fluidized catalyst, and the process of regenerating the catalyst results in some PM2.5 emissions from the FCC stack. Chevron conducted a series of FCC PM2.5 stack tests to evaluate the optimum ammonia slip conditions for controlling filterable PM2.5 emissions while controlling condensable PM2.5. Too little ammonia increases filterable PM2.5, while too much ammonia increases condensable PM2.5. By operating within the optimal ammonia slip range, significant reductions of total PM2.5 emissions are achievable.

Subject to CARB approval as an IC concept for purposes of compliance with the At-Berth Regulation, Chevron would optimize the ammonia slip to a level which is much lower than the level allowed under existing air permits. This lower ammonia slip results in a significant PM emissions reduction. There is currently no requirement to operate at this optimum ammonia slip through July 2026 when BAAQMD Regulation 6-5 goes into effect. Subject to timely CARB approval, Chevron would optimize ammonia to lower PM2.5 as a CARB At-Berth Innovative Concept (see location map in **Appendix A4**) starting in 2022, thereby resulting in earlier emissions reductions than would be achieved under the BAAQMD rule taking effect in 2026. Absent timely CARB approval as an IC concept, these emissions reductions could be delayed until the BAAQMD rule takes effect.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Chevron estimates that reductions from reducing the FCC ammonia slip will be 103 metric tons per year (MTPY) for PM2.5 based on current FCC stack emissions. No change in NOx, ROG or GHGs will occur as part of this project. See **Appendix A4** for the best available PM emissions calculations for this project. Emissions were calculated using average emissions rates measured during Chevron's prior ammonia study.

The RLW has calls from a variety of vessels that are constantly evolving and Chevron cannot predict exactly which vessels will be in operation when this regulation goes into effect in 2027, nor their exact NOx, PM2.5 and ROG emissions. **Table 2** shows the amount of NOx, PM2.5 and ROG that must be mitigated with IC projects when using 2016 emissions as an average year and the emission factors from **Section 93130.5(d)(1) and (d)(2)**. **Table 3** shows how this project fits among the Innovative Concepts to ensure emissions are mitigated as required by **Section 93130.17(d)(1)**.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Chevron will leverage stack ammonia monitoring data and PM stack testing data from Chevron's prior ammonia study to determine emissions reductions. The emissions will be reported to CARB on an annual basis as required by **Section 93130.17(d)(1)** of the At-Berth Regulation. See **Appendix A4** for more details.

5. A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;

Not applicable. Chevron is the applicant, as well as the funder and operator of the FCC plant.

6. Proposed length of time during which the IC project would be used

This IC project is capable of implementation starting in 2022, as there are no governmental approvals or permits needed to commence the project. As explained above, Chevron requests timely approval so that early emissions reductions can be achieved in the near-term, well ahead of the 2027 compliance deadline. As also explained above, in addition to early implementation, Chevron proposes to implement this IC project through July 2026 when the referenced BAAQMD regulation goes into effect.

7. A summary of all governmental approvals necessary to enable development of the innovative concept;

No government approvals needed, except for a CARB approval per this regulation.

8. A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and

No environmental reviews required.

9. **The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.**

Reducing the ammonia slip is expected to lower PM2.5 emissions without increasing NOx, ROG and GHG emissions. Chevron will collect all necessary data to verify emissions reductions on a yearly basis as required by **Section 93130.17(d)**. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. **The proposed innovative concept must achieve emissions reductions of NOx, PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.**

Through July 2026 there is no requirement to optimize ammonia slip. Chevron is proposing to implement these PM reductions in advance of these new FCC PM requirements.

11. **The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.**

The PM reductions will occur at the FCC plant, which is located 1.5 miles away from the Richmond Long Wharf.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

As noted above, there is no applicable legal requirement with respect to this IC until the BAAQMD regulation takes effect in July 2026. Similarly, given current technological and economic trends and incentives, it is not anticipated that this IC would be implemented in advance of the upcoming BAAQMD regulation under a "business as usual" scenario. Accordingly, Chevron is requesting expedited CARB approval for implementation of this project as an IC in order to reduce emissions to fulfill compliance with the At-Berth Regulation, in advance of the BAAQMD regulation taking effect in 2026 and years earlier than when the emissions reductions would otherwise occur.

The FCC PM emissions reductions will be real, quantifiable, verifiable and enforceable: A) Real: Ammonia stack monitoring and FCC PM stack testing data will be the basis for certifying that the emissions reductions are real. B) Quantifiable: Emissions rates will be based on FCC ammonia and PM stack data. C) Verifiable: The ammonia slip data and the FCC stack testing results will be available for audit. D) Enforceable: CARB will be able to pursue enforcement if the requisite emissions reductions are not achieved to comply with the At-Berth Regulation and/or if there is a violation of other requirements (e.g., reporting/recordkeeping) under the Regulation.

Project 5: Wharf ERD Replacement

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Chevron currently operates the Wharf Emissions Reduction Device (ERD) to control ROG emissions from the loading operations at the RLW. The ERD is essentially a thermal oxidizer that uses natural gas to combust the vapor streams generated at the RLW. Chevron is proposing to replace the ERD with new duplicative vapor recover units (VRU) with activated carbon adsorption technology that will eliminate the need for natural gas combustion while still controlling ROG (see location map in **Appendix A5**). Instead of operating the Wharf ERD for the foreseeable future, subject to timely CARB approval as an IC project, Chevron would implement lower emitting VOC controls as early as 2023 for compliance with the At-Berth Regulation.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Emissions reductions from this project are expected to be approximately 7.3 metric tons per year (MTPY) for NOx and 0.8 MTPY of PM2.5 based on current ERD operations. ROG emissions are not expected to change and GHG emissions are not expected to increase. See **Appendix A5** with the best available NOx, PM2.5 and ROG emissions calculations for this project. Emissions were calculated using vendor provided emissions data for the new VRU.

The RLW has calls from a variety of vessels that are constantly evolving and Chevron cannot predict exactly which vessels will be in operation when this regulation goes into effect in 2027, nor their exact NOx, PM2.5 and ROG emissions. **Table 2** shows the amount of NOx, PM2.5 and ROG that must be reduced with IC projects when using 2016 emissions as a representative year and the emission factors from **Section 93130.5(d)(1) and (d)(2)**. **Table 3** shows how this project fits among the Innovative Concepts as a package to ensure emissions are reduced as required by **Section 93130.17**.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Chevron will leverage the emissions reductions calculated as part of the project's New Source Review (NSR) that will be conducted by Bay Area Air Quality Management District (BAAQMD). This includes emissions baselines calculated using GC, stack testing data and process data. Emissions reductions will be demonstrated using stack monitoring data

required by BAAQMD for this project. This includes CEMS, and/or stack testing data (and data collection frequencies) required by BAAQMD. The emissions will be reported to CARB on an annual basis as required by **Section 93130.17(d)(1)** of the At-Berth Regulation. See **Appendix A5** for more details.

5. A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;

Not applicable. Chevron is the applicant, as well as the funder and operator of the new VRU.

6. Proposed length of time during which the IC project would be used

This IC project is capable of implementation starting in 2023, assuming all government approvals are obtained in a timely manner. As explained above, Chevron requests timely CARB approval so that early emissions reductions can be achieved well ahead of the 2027 compliance deadline. As also explained above, in addition to early implementation, Chevron proposes to implement this IC project through and including the first compliance period (2027-2032), and to continue implementation through subsequent compliance periods, subject to CARB approval of one or more extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. A summary of all governmental approvals necessary to enable development of the innovative concept;

Chevron will need CARB approval per the CARB At-Berth Regulation and from the following agencies/entities:
1) BAAQMD – Air Permit

8. A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and

BAAQMD would conduct a review in accordance with its new source review rules.

9. **The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.**

The new VRU is expected to lower NOx and PM2.5 emissions without increasing GHG emissions or ROG. Chevron will leverage the emissions calculations from New Source Review conducted by BAAQMD to demonstrate emissions reductions on a yearly basis as required by **Section 93130.17(d)**. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. **The proposed innovative concept must achieve emissions reductions of NOx, PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.**

There is currently no requirement to install this lower emitting VRU.

11. **The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.**

The new VRU will be located within the Chevron Richmond Refinery, 1-2 miles away from the Richmond Long Wharf. Emissions reductions will occur near the marine terminal and within the communities adjacent to the refinery.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

As noted above, the project is not legally required. It also is not expected to occur under a "business as usual" scenario. Under a business as usual scenario in light of current technological and economic trends and incentives, it is likely that the existing ERD would continue to be used as it currently is used. Accordingly, this IC project is being proposed specifically as a means to achieve compliance with the At-Berth Regulation. Timely CARB approval is requested to afford certainty and reliability in terms of the emissions reductions that can be used to achieve compliance with the At-Berth Regulation, and also to allow for these emissions reductions to be achieved in the near-term.

The new VRU emissions reductions will be real, quantifiable, verifiable and enforceable: A) Real: BAAQMD NSR emissions calculations will be the basis for the emissions reductions. B) Quantifiable: BAAQMD methodologies and monitoring data will be used to estimate the reduction. C) Verifiable: The calculations and monitoring data will be available for audit. D) Enforceable: CARB will be able to pursue enforcement if the requisite emissions reductions are not achieved to comply with the At-Berth Regulation and/or if there is a violation of other requirements (e.g., reporting/recordkeeping) under the Regulation.

Project 6: TKN Heater Optimization

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Chevron currently operates seven process heaters to provide necessary thermal energy at the Taylor Katalytic deNitrification (TKN) plant that is essentially a hydrocracker. Chevron is proposing to install a new heat exchanger technology (such as “finned tubes”) on three of the heaters and conduct an overall thermal energy study on the plant to reduce overall firing rates (see location map in **Appendix A6**). Instead of operating the process heaters in their current form for the foreseeable future because there is no regulatory requirement to stop operating them, subject to CARB approval as an IC project for purposes of compliance with the At-Berth Regulation, Chevron would implement heater optimizations as early as 2024.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Emissions reductions from this project are expected to be approximately 37.5 metric tons per year (MTPY) for NOx, 4.8 MTPY of PM2.5 and 3.4 MTPY for ROG based on current process heater operations. This optimization will not increase GHG emissions. See **Appendix A6** with the best available NOx, PM2.5 and ROG emissions calculations for this project. Emissions were calculated using vendor provided data for the heat exchangers and project optimizations at the heaters.

The RLW has calls from a variety of vessels that are constantly evolving and Chevron cannot predict exactly which vessels will be in operation when this regulation goes into effect in 2027, nor their exact NOx, PM2.5 and ROG emissions. **Table 2** shows the amount of NOx, PM2.5 and ROG that must be reduced with IC projects when using 2016 emissions as a representative year and the emission factors from **Section 93130.5(d)(1) and (d)(2)**. **Table 3** shows how this project fits among the Innovative Concepts as a package to ensure emissions are reduced as required by **Section 93130.17**.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Chevron will leverage the emissions reductions calculated as part of the project's New Source Review (NSR) that will be conducted by Bay Area Air Quality Management District (BAAQMD) and other baseline emissions data for the heaters. This includes emissions baselines calculated using GC, stack testing data and process data. Emissions reductions will be demonstrated using stack monitoring data required by BAAQMD for this type of

project. This includes CEMS, and/or stack testing data required by BAAQMD. The emissions will be reported to CARB on an annual basis as required by **Section 93130.17(d)(1)** of the At-Berth Regulation. See **Appendix A6** for more details.

5. A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;

Not applicable. Chevron is the applicant, as well as the funder and operator of the heaters.

6. Proposed length of time during which the IC project would be used

This IC project is capable of implementation within 2024, assuming any necessary government approvals are obtained in a timely manner. As explained above, Chevron requests timely CARB approval so that early emissions reductions can be achieved ahead of the 2027 compliance deadline. As also explained above, in addition to early implementation, Chevron proposes to implement this IC project through and including the first compliance period (2027-2032), and to continue implementation through subsequent compliance periods, subject to CARB approval of one or more extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. A summary of all governmental approvals necessary to enable development of the innovative concept;

Chevron will need CARB approval as an IC project under the At-Berth Regulation, and approvals may be required from the following agencies:
1) BAAQMD – Air Permit
2) City of Richmond – Project approval and CEQA review

8. A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and

Depending on the specific approvals that may required, it is anticipated that the City of Richmond would serve as the CEQA lead agency for this IC project. If required, BAAQMD also would conduct a review in accordance with its new source review rules.

9. **The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.**

This heater optimization is expected to lower NOx, PM2.5 and ROG emissions without increasing GHG emissions. Chevron will leverage the emissions calculations conducted by BAAQMD to demonstrate emissions reductions on a yearly basis as required by **Section 93130.17(d)**. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. **The proposed innovative concept must achieve emissions reductions of NOx, PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.**

There is currently no requirement to conduct these heater optimizations.

11. **The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.**

The TKN heaters are be located within the Chevron Richmond Refinery, 1.5 miles away from the Richmond Long Wharf. Emissions reductions will occur near the marine terminal and within the communities adjacent to the refinery.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

As noted above, the project is not legally required. It also is not expected to occur under a "business as usual" scenario. Under a business as usual scenario in light of current technological and economic trends and incentives, it is likely that the existing process and technology would continue to be used as it currently is used. Accordingly, this IC project is being proposed specifically as a means to achieve compliance with the At-Berth Regulation. Timely CARB approval is requested to afford certainty and reliability in terms of the emissions reductions that can be used to achieve compliance with the At-Berth Regulation, and also to allow for these emissions reductions to be achieved in the near-term.

The process heater emissions reductions will be real, quantifiable, verifiable and enforceable: A) Real: BAAQMD emissions calculations will be the basis for the emissions reductions. B) Quantifiable: BAAQMD methodologies and monitoring data will be used to estimate the reduction. C) Verifiable: The calculations and monitoring data will be available for audit. D) Enforceable: CARB will be able to pursue enforcement if the requisite emissions reductions are not achieved to comply with the At-Berth Regulation and/or if there is a violation of other requirements (e.g., reporting/recordkeeping) under the Regulation.

Project 7: North Ranch Diesel Engine Replacement

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Chevron currently operates diesel generators to support the electric needs within the North Ranch trailers within the Chevron Refinery (see location map in **Appendix A7**). Chevron would eliminate most of these generators by installing electrical energy at the North Ranch. Subject to CARB approval as an IC for purposes of compliance with the At-Berth Regulation, instead of operating the current diesel generators for the foreseeable future to ensure reliable electricity generation, Chevron would install new electrical infrastructure as early as 2023. Chevron plans to conduct a study of the electrical needs in the North Ranch in 2022 to confirm the details of how replacement of the diesel generators would be achieved by 2023.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Chevron estimates that reductions from eliminating the diesel generators will be 0.42 metric tons per year (MTPY) for NOx, 0.02 MTPY for PM2.5, and 0.02 MTPY for ROG based on current generator emissions. The new electrical infrastructure will not increase GHG emissions. See **Appendix A7** for the best available NOx, PM2.5 and ROG emissions calculations for this project. Emissions were calculated using fuel consumptions and EPA emissions factors for the existing diesel generators.

The RLW has calls from a variety of vessels that are constantly evolving and Chevron cannot predict exactly which vessels will be in operation when this regulation goes into effect in 2027, nor their exact NOx, PM2.5 and ROG emissions. **Table 2** shows the amount of NOx, PM2.5 and ROG that must be reduced with IC projects when using 2016 emissions as a representative year and the emission factors from **Section 93130.5(d)(1) and (d)(2)**. **Table 3** shows how this project fits among the Innovative Concepts to ensure emissions are mitigated as required by **Section 93130.17**.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Chevron will leverage current fuel consumption records collected on a monthly basis and EPA emission data for the existing generators to determine emissions reductions. Emissions data will be in the form of EPA/CARB emissions certifications provided by the diesel engine vendor. The emissions will be reported to CARB on an annual basis as required by **Section 93130.17(d)(1)** of the At-Berth Regulation. See **Appendix A7** for more details.

5. **A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;**

Not applicable. Chevron is the applicant, as well as the funder and operator of the new generators.

6. **Proposed length of time during which the IC project would be used**

This IC project is capable of implementation starting in 2023. As explained above, Chevron requests timely approval so that early emissions reductions can be achieved in the near-term, well ahead of the 2027 compliance deadline. As also explained above, in addition to early implementation, Chevron proposes to implement this IC project through and including the first compliance period (2027-2032), and to continue implementation through subsequent compliance periods, subject to CARB approval of one or more extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. **A summary of all governmental approvals necessary to enable development of the innovative concept;**

No government approvals needed, except for a CARB approval as an IC project under this regulation.

8. **A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and**

No environmental reviews required.

9. **The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.**

Removal of the diesel generators is expected to lower NOx, PM2.5 and ROG emissions without increasing GHG emissions. Chevron will collect all necessary data to verify emissions reductions on a yearly basis as required by **Section 93130.17(d)**. See **Table 3** for

more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. The proposed innovative concept must achieve emissions reductions of NOx, PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.

There is currently no requirement to implement this IC project.

11. The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.

The diesel generators currently operate within Chevron Richmond Refinery, and are 1.5 miles away from the Richmond Long Wharf. Emissions reductions will occur near the marine terminal and within the communities adjacent to the refinery.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

As noted above, the project is not legally required. It also is not expected to occur under a "business as usual" scenario. Under a business as usual scenario in light of current technological and economic trends and incentives, it is likely that the existing diesel generators would continue to be used as it currently is used. Accordingly, this IC project is being proposed specifically as a means to achieve compliance with the At-Berth Regulation. Timely CARB approval is requested to afford certainty and reliability in terms of the emissions reductions that can be used to achieve compliance with the At-Berth Regulation, and also to allow for these emissions reductions to be achieved in the near-term.

The emissions reductions from replacing the diesel generators will be real, quantifiable, verifiable, and enforceable: A) Real: Emissions rates and actual fuel logs for the diesel generators will be the basis for certifying that the emissions reductions are real. B) Quantifiable: Emissions rates will be based on EPA/CARB emissions certifications, and fuel logs will be based on metered fuel data. C) Verifiable: The EPA/CARB certifications and the fuel logs will be available for audit. D) Enforceable: CARB will be able to pursue enforcement if the requisite emissions reductions are not achieved to comply with the At-Berth Regulation and/or if there is a violation of other requirements (e.g., reporting/recordkeeping) under the Regulation.

Project 8: Solar Electricity Project - General

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Chevron is currently considering a solar electricity project in the northern end of the Richmond Refinery (see location map in **Appendix A8**). This approximately 31,000 MWh project would offset consumption of electricity from the grid, and subject to CARB approval as an IC project for purposes of compliance with the At-Berth Regulation, Chevron could install solar panels as early as 2024.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Emissions reductions from this project are expected to be approximately 5.6 metric tons per year (MTPY) for NOx, 0.3 MTPY of PM2.5, and 0.4 MTPY of ROG based on projected electricity production and current California e-Grid emissions factors. These new solar panels will not increase GHG emissions. See **Appendix A8** with the best available NOx, PM2.5 and ROG emissions calculations for this project.

The RLW has calls from a variety of vessels that are constantly evolving and Chevron cannot predict exactly which vessels will be in operation when this regulation goes into effect in 2027, nor their exact NOx, PM2.5 and ROG emissions. **Table 2** shows the amount of NOx, PM2.5 and ROG that must be reduced with IC projects when using 2016 emissions as a representative year and the emission factors from **Section 93130.5(d)(1) and (d)(2)**. **Table 3** shows how this project fits among the Innovative Concepts as a package to ensure emissions are reduced as required by **Section 93130.17**.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Chevron will leverage the solar project electricity generation to determine the amount of emissions displaced from not generating electricity. This solar electricity generation along with emissions factors from e-Grid will be used to estimate emissions reductions. The emissions will be reported to CARB on an annual basis as required by **Section 93130.17(d)(1)** of the At-Berth Regulation. See **Appendix A8** for more details.

5. A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;

Not applicable. Chevron is the applicant, as well as the funder and operator of the new solar panels. Should a third-party be needed to operate the solar panels, an MOU will be developed and provided.

6. Proposed length of time during which the IC project would be used

This IC project is capable of implementation starting in 2024, assuming all government approvals are obtained in a timely manner. As explained above, Chevron requests a timely CARB approval so that early emissions reductions can be achieved well ahead of the 2027 compliance deadline. As also explained above, in addition to early implementation, Chevron proposes to implement this IC project through and including the first compliance period (2027-2032), and to continue implementation through subsequent compliance periods, subject to CARB approval of one or more extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. A summary of all governmental approvals necessary to enable development of the innovative concept;

Chevron will need CARB approval as an IC project under the At-Berth Regulation, and approvals may also be required from the following agencies depending on the project details:
1) City of Richmond
2) San Francisco Bay Conservation and Development (BCDC)
3) US Army Corps of Engineers (Section 404/Section 10)
4) California Regional Water Quality Control Board (Section 401/WDRs)

8. A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and

It is anticipated that the City of Richmond would serve as the CEQA lead agency for this IC project. BCDC may also conduct a review in accordance with its shoreline development review authority depending on the exact location of the solar panels. As noted, Corps and Regional Board environmental review also may be required.

9. **The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.**

The solar panels are expected to lower NOx, PM2.5 and ROG emissions without increasing GHG emissions. Chevron will leverage solar electricity data to demonstrate emissions reductions from displacing electricity from the grid on a yearly basis as required by **Section 93130.17(d)**. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. **The proposed innovative concept must achieve emissions reductions of NOx, PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.**

There is currently no requirement to install these solar panels.

11. **The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.**

The new solar panels will be located within the Chevron Richmond Refinery, 1-3 miles away from the Richmond Long Wharf. Emissions reductions will occur near the marine terminal and within the communities adjacent to the refinery.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

As noted above, the project is not legally required. It also is not expected to occur under a "business as usual" scenario. Under a business as usual scenario in light of current technological and economic trends and incentives, it is likely that the existing electricity consumption would continue to occur as is currently the case. Accordingly, this IC project is being proposed specifically as a means to achieve compliance with the At-Berth Regulation. Timely CARB approval is requested to afford certainty and reliability in terms of the emissions reductions that can be used to achieve compliance with the At-Berth Regulation, and also to allow for these emissions reductions to be achieved in the near-term.

The new solar panels emissions reductions will be real, quantifiable, verifiable, and enforceable: A) Real: Solar panel electricity generation will be the basis for the emissions reductions and grid emissions factors. B) Quantifiable: Solar electricity meter data will be used to estimate the reduction. C) Verifiable: The calculations and meter data will be available for audit. D) Enforceable: CARB will be able to pursue enforcement if the requisite emissions reductions are not achieved to comply with the At-Berth Regulation and/or if there is a violation of other requirements (e.g., reporting/recordkeeping) under the Regulation.

Project 9: Solar Electricity Project – Shore Power

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

In the event shore power is determined to be available for use as a safe and feasible way to reduce emissions at RLW, Chevron proposes to install a solar electricity project in or near the Richmond Refinery (see location map in **Appendix A9**) or procure electricity that is from a source with lower emissions than electricity from the grid. As noted in DNV's Technology Assessment, shore power is not expected to available until 2034 at the earliest, therefore this IC project is intended to be implemented in the event shore power becomes available as a safe and feasible technology to use at RLW within the 2027-2032 compliance period. This approximately 20 MW project would offset consumption of electricity from the grid, and subject to CARB approval as an IC project for purposes of compliance with the At-Berth Regulation and the availability of shore power as referenced above, Chevron could install solar panels as early as 2027.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Emissions reductions from this project are expected to be approximately 3.2 metric tons per year (MTPY) for NOx, 0.2 MTPY of PM2.5 and 0.2 MT for ROG based on projected electricity production/procurement and current California e-Grid emissions factors. This renewable source of electricity will displace electricity from the grid, lowering overall refinery GHG emissions. See **Appendix A9** with the best available NOx, PM2.5 and ROG emissions calculations for this project.

The RLW has calls from a variety of vessels that are constantly evolving and Chevron cannot predict exactly which vessels will be in operation when this regulation goes into effect in 2027, nor their exact NOx, PM2.5 and ROG emissions. **Table 2** shows the amount of NOx, PM2.5 and ROG that must be reduced with IC projects when using 2016 emissions as a representative year and the emission factors from **Section 93130.5(d)(1) and (d)(2)**. **Table 3** shows how this project fits among the Innovative Concepts as a package to ensure emissions are reduced as required by **Section 93130.17**.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Chevron will leverage the solar/renewable project electricity generation to determine the amount of emissions displaced from not generating electricity. This electricity generation along with emissions factors from e-Grid will be used to estimate emissions reductions. The emissions will be reported to CARB on an annual basis as required by **Section 93130.17(d)(1)** of the At-Berth Regulation. See **Appendix A9** for more details.

5. A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;

Not applicable. Chevron is the applicant, as well as the funder and operator of the new solar panels. Should a third-party be needed to operate the solar panels or provide the renewable electricity, an MOU will be developed and provided.

6. Proposed length of time during which the IC project would be used

This IC project is likely capable of being implemented as early as 2027, depending on the availability of shore power by that time as a safe and feasible technology as referenced above. Subject to this caveat and subject to CARB approval as an IC project under the At-Berth Regulation, Chevron proposes to implement this IC project through and including the first compliance period (2027-2032), and to continue implementation through subsequent compliance periods, subject to CARB approval of one or more extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. A summary of all governmental approvals necessary to enable development of the innovative concept;

Chevron will need CARB approval as an IC project under the At-Berth Regulation, and approvals may also be required from the following agencies depending on the project details:
1) City of Richmond
2) San Francisco Bay Conservation and Development (BCDC)
3) US Army Corps of Engineers (Section 404/Section 10)
4) California Regional Water Quality Control Board (Section 401/WDRs)

8. A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and

It is anticipated that the City of Richmond would serve as the CEQA lead agency for this IC project. BCDC may also conduct a review in accordance with its shoreline development review authority depending on the exact location of the solar panels. As noted, Corps and Regional Board environmental review also may be required.

9. The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.

This project is expected to lower NOx, PM2.5 and ROG emissions without increasing GHG emissions. Chevron will leverage solar/renewable electricity data to demonstrate emissions reductions from displacing electricity from the grid on a yearly basis as required by **Section 93130.17(d)**. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. The proposed innovative concept must achieve emissions reductions of NOx, PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.

There is currently no requirement to install these solar panels or procure renewable electricity.

11. The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.

The new electrical equipment will be located within the Chevron Richmond Refinery, 1-3 miles away from the Richmond Long Wharf. Emissions reductions will occur near the marine terminal and within the communities adjacent to the refinery.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

As noted above, the project is not legally required. It also is not expected to occur under a "business as usual" scenario. Under a business as usual scenario in light of current technological and economic trends and incentives, it is likely that shore power electricity demands would be met by electricality from the grid, assuming shore power is shown to be a safe and feasible technology as referenced above. Accordingly, this IC project is being proposed specifically as a means to achieve compliance with the At-Berth Regulation.

The new solar or renewable electricity emissions reductions will be real, quantifiable, verifiable, and enforceable: A) Real: Electricity generation/procurement will be the basis for the emissions reductions and grid emissions factors. B) Quantifiable: Solar electricity meter or electricity purchasing data will be used to estimate the reduction. C) Verifiable: The calculations and meter data will be available for audit. D) Enforceable: CARB will be able to pursue enforcement if the requisite emissions reductions are not achieved to comply with the At-Berth Regulation and/or if there is a violation of other requirements (e.g., reporting/recordkeeping) under the Regulation.

Project 10: Tier II or above certification for Auxiliary Engines

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Chevron proposes to replace vessels with Tier 0 and Tier I auxiliary engines (AE) with vessels with Tier II AE. We will accomplish this by 1) executing a deliberate 'Tier II AE or above' chartering strategy, or 2) implementing engineering upgrades to AE. CARB's approval of this IC will provide substantial decreases in NOx.

Tier II AE meet International Maritime Organization (IMO) limits for NOx emissions. While the IMO NOx limits are different than those for the CARB At-Berth Regulation, these lower emitting AE can provide substantial decrease in NOx.

As referenced in the 2017 San Pedro Bay Ports' Clean Air Action Plan[3] report, a significant number of calls from Tier II powered ships are not expected in California until late 2020's to early 2030's. Also, According to CARB's 2019 At-Berth inventory[4], almost 25% of time at-berth for tanker vessels visiting Richmond facility are Tier I or older.

Through this Innovative Concept, Chevron will accelerate adoption of vessels with Tier II AE or above, prior to CARB At-Berth implementation date and will significantly reduce NOx emissions not only at berth, but would also substantially reduce emissions during transit, anchorage, and maneuvering when operating within California waters.

This IC will be implemented at an excess cost for RLW. Chevron intends to develop and execute a proactive and deliberate strategy to facilitate early adoption of this IC and is seeking approval for lower emission technology beyond the "business-as-usual" case.

Until data regarding ROG and PM2.5 reductions becomes available from the engine manufacturers, Chevron will conservatively neither estimate nor take credits for reduction in PM2.5 and ROG from this innovative concept. However, any actual reductions in ROG and PM2.5 emissions resulting from the IC project that can be demonstrated after implementation, as determined under Section 93130.17(d) of the At-Berth Regulation, will be included in Chevron's annual reporting to CARB.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Subject to CARB approval, this IC would be implemented using a phased approach across the fleet of vessels that call at the RLW. For example, as early as 2023, Chevron may begin

[3] San Pedro Bay Ports, *Clean Air Action Plan 2017*, November 2017. Available at https://kentico.portoflosangeles.org/getmedia/a2820d01-54f6-4f38-a3c5-81c228288b87/2017-Final-CAAP-Update

[4] CARB, *Appendix H: 2019 Update to Inventory for Ocean-Going Vessels At Berth: Methodology and Results*, October 2019. Available at https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/ogvatberth2019/apph.pdf

implementing a 'Tier II AE or above' chartering strategy, with increasing rates of adoption through 2027. Full implementation of this IC will reduce NOx by 49 MTPY (detailed emission reduction calculations attached in **Appendix A10**). The calculations also show the annual and cumulative reductions in emissions resulting from the early, phased implementation of the IC project prior to 2027.

As stated above, Chevron is neither estimating nor requesting emission reduction credits for PM2.5 or ROG, at this time.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Technical files endorsed by the engine maker and classification societies (e.g., American Bureau of Shipping) will be primary basis for ensuring AE Tier II compliance.
The RLW Pre-Arrival Information Packet already requires vessel owners to report non-compliance or breakdown of machinery which could impact 'expected normal operations'. This information is recorded in vessel logbook and reported to Terminal and will be used for annual non-compliance reporting to CARB.

Testing of AE stack emissions will not be carried out by RLW as this is a part of the procedure that Classification Society's use to periodically endorse that AE operations are in compliance with "Technical File" requirements.

5. A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;

Not applicable for Chevron owned and operated fleet as Chevron is the applicant, as well as the funder and operator of the vessels. Compliance on other in scope vessels will be addressed through Charter Party agreements with vessel owners at the time of vessel fixture.

6. Proposed length of time during which the IC project would be used

Subject to CARB approval as an IC project under the At-Berth Regulation, Chevron is capable of beginning implementation in a phased manner, starting in 2023 and increasing adoption on vessels through 2027, at which time Chevron expects to be operating with this concept as a new minimum standard for vessels calling at Chevron RLW terminal.

Chevron proposes to implement this IC project through and including the first compliance period (2027-2032) and, continuing through subsequent compliance periods subject to CARB approval of extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. A summary of all governmental approvals necessary to enable development of the innovative concept;

Except for CARB approval as an IC project under the At-Berth Regulation, no government approval is needed for vessel modifications associated with the proposed Innovative Concept. Classification society, however, must grant approval and document as part of the vessel's Technical File (see #4 above).

8. A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and

No environmental reviews needed for vessel modifications associated with the proposed Innovative Concept.

9. The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.

The proposed Innovative Concept is expected to lower NOx emissions without increasing GHG emissions. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. The proposed innovative concept must achieve emissions reductions of NO_x , PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.

This Innovative Concept is in excess of any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a memorandum of understanding with a government entity), that is in effect, has been approved, or has been noticed.

11. The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.

This IC will reduce vessel emissions from AE at berth and will benefit communities adjacent to the refinery. It is important to note that the air quality benefits extend well beyond the RLW as the more efficient AE will be in operation during approach, at anchorage, and while transiting San Francisco Bay and California waters. Any actual emissions reductions resulting from the IC project, in addition to reductions while the ships are at berth, that occur overwater within three nautical miles of RLW (per Section 93130.17(a)(4) of the At-Berth Regulation), and that can be shown as determined under Section 93130.17(d) of the Regulation, will be included in Chevron's annual reporting to CARB.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

The proposed concept for CARB compliance will achieve emission reductions that are real, quantifiable, verifiable and enforceable. Details are provided in earlier sections of this application.

As noted above, there is no legal requirement to implement this project. In addition, the proposed Innovative Concept is in excess of a "business-as-usual" case. No current maritime protocol or policy calls for use of only Tier II vessels and the proposed IC will achieve NOx reductions that are in excess of what otherwise would be expected to occur given current economic and technological trends. Subject to CARB approval as an IC project under the At-Berth Regulation, Chevron intends to develop and execute a proactive and deliberate strategy to facilitate early adoption of this IC and to achieve emissions reductions earlier and in excess of what would take place under a business as usual scenario. Specifically, adoption of a Tier II AE vessel strategy requires a selective (incentivized)

chartering strategy whereby Chevron will limit the vessels that it elects to charter, to the extent possible, to only vessels with Tier II AE in order to promote implementation. Early adoption of this strategy, prior to the compliance date in the At-Berth Regulation, will further reduce overall at berth emissions.

Also, it is important to highlight, as indicated in Section 9 of DNV's Technology Assessment, business as usual can mean an overall increase in vessel emissions as opposed to simply steady state or decline. In contrast, implementation of this IC project would substantially reduce emissions as compared to baseline.

Project 11: Tier III or above certification for Auxiliary Engines

1. Company name, address, and contact information

Chevron Shipping Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Chevron proposes to replace vessels with Tier 0, Tier I and Tier II Auxiliary Engines (AE) with vessels installed with Tier III AE. We will accomplish this by 1) retrofitting existing vessels with Tier 0, Tier 1 and Tier II AE with technology such as Selective Catalytic Reactors (SCR) or 2) executing a deliberate 'Tier III AE or above' chartering strategy.

CARB's approval of this IC will provide substantial decreases in NOx. Also, based on preliminary discussions with engine makers and information published by the Pacific Merchant Shipping Association[5], a PM reduction should be expected when operating Tier III engines.

Tier III AE meet both the International Maritime Organization (IMO) and At-Berth Regulation for NOx emissions.

As referenced in the San Pedro Bay Ports' 2017 Clean Air Action Plan report, the "Bay Wide Ocean-Going Vessel International Maritime Organization Tier Forecast 2015-2050"[6], a significant number of calls from the cleanest Tier III powered ships are not expected in California until mid to late 2030's through mid to late 2040's. Chevron intends to develop and execute a proactive and deliberate strategy to accelerate the use by RLW of Tier III vessels much earlier and well beyond what otherwise would be expected under the "business-as-usual" scenario.

Until data regarding ROG and PM reductions becomes available from the engine manufacturers, Chevron will conservatively neither estimate nor take credits for reduction in PM2.5 and ROG from this innovative concept. However, any actual reductions in ROG and PM2.5 emissions resulting from the IC project that can be demonstrated after implementation, as determined under Section 93130.17(d) of the At-Berth Regulation, will be included in Chevron's annual reporting to CARB.

[5] South Coast Air Quality Management District, Ocean-Going Vessel Working Group (including Pacific Merchant Shipping Association), *Pacific Rim Initiative for Maritime Emission Reductions, Primer, a Multi-Regional Clean Vessel Incentive Framework,* June 2021. Available at http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/ogv-presentations-06-02-21.pdf?sfvrsn=8

[6] San Pedro Bay Ports, *Bay Wide Ocean-Going Vessel International Maritime Organization Tier Forecast 2015 – 2050*, July 2017. Available at https://kentico.portoflosangeles.org/getmedia/a23bdf8e-7df2-42f5-873f-803c36be8a57/CAAP_Vessel_Tier_Forecasts_2015-2050-Final

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Subject to CARB approval, this IC project would be implemented using a phased approach across the fleet of vessels that call at the RLW. For example, as early as 2023, Chevron may begin scheduling shipyard time for Tier III AE upgrades for vessels under Chevron's full operational control. Also, as early as 2023, a 'Tier III AE or above' chartering strategy could commence, with increasing rates of adoption through 2027. Full implementation of this IC will reduce NOx by 133 MTPY (detailed emission reduction calculations attached in **Appendix A11**). The calculations also show the annual and cumulative reductions in emissions resulting from the early, phased implementation of the IC project prior to 2027.

As stated above, Chevron is neither estimating nor requesting emission reduction credits for PM2.5 or ROG, at this time.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Technical files endorsed by the engine maker and classification societies (e.g., American Bureau of Shipping) will be primary basis for ensuring Tier III AE compliance.

The RLW Pre-Arrival Information Packet already requires vessel owners to report non-compliance or breakdown of machinery which could impact 'expected normal operations'. This information is 1) recorded in vessel logbook, 2) reported to the Terminal, and 3) will be used for annual non-compliance reporting to CARB.

Testing of AE stack emissions will not be carried out by RLW as this is a part of the procedure that Classification Societies use to periodically endorse that AE operations are in compliance with "Technical File" requirements.

5. A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;

Not applicable for Chevron owned and operated fleet as Chevron is the applicant, as well as the funder and operator of the vessels. Compliance on other in-scope vessels will be addressed through Charter Party agreements with vessel owners at the time of vessel fixture.

6. Proposed length of time during which the IC project would be used

Subject to CARB approval, Chevron is capable of beginning implementation in a phased manner, beginning in 2023. Adoption would increase on vessels through 2027, at which time Chevron expects to be operating with this concept as a new minimum standard for vessels calling at Chevron RLW.

Chevron proposes to implement this IC project through and including the first compliance period (2027-2032) and, continuing through subsequent compliance periods subject to CARB approval of extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. A summary of all governmental approvals necessary to enable development of the innovative concept;

Except for CARB approval as an IC project under the At-Berth Regulation, no government approval is needed for vessel modifications associated with the proposed Innovative Concept. Classification societies (e.g., American Bureau of Shipping), however must grant approval and document as part of the vessel's Technical File (see #4 above).

8. A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and

No environmental reviews needed for vessel modifications associated with the proposed Innovative Concept.

9. The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.

The proposed Innovative Concept is expected to lower NOx emissions without increasing GHG emissions. This IC also achieves At-Berth Regulation NOx limits. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option.

10. The proposed innovative concept must achieve emissions reductions of NO_x , PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.

This innovative concept is in excess of any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a memorandum of understanding with a government entity), that is in effect, has been approved, or has been noticed.

11. This innovative concept is in excess of any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a memorandum of understanding with a government entity), that is in effect, has been approved, or has been noticed. The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.

This IC will reduce vessel emissions from AE at berth and will benefit communities adjacent to the refinery. It is important to note that the air quality benefits extend well beyond the RLW as the more efficient AE will be in operation during approach, at anchorage, and while transiting San Francisco Bay and California waters. Any actual emissions reductions resulting from the IC project, in addition to reductions while the ships are at berth, that occur overwater within three nautical miles of RLW (per Section 93130.17(a)(4) of the At-Berth Regulation), and that can be shown as determined under Section 93130.17(d) of the Regulation, will be included in Chevron's annual reporting to CARB.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

The proposed concept for CARB compliance will achieve emission reductions that are real, quantifiable, verifiable and enforceable. Details are provided in earlier sections of this application.

As noted above, there is no legal requirement to implement this project. In addition, the proposed Innovative Concept is in excess of a "business-as-usual" case. No current maritime protocol or policy calls for use of only Tier III vessels and the proposed IC will achieve NOx reductions that are in excess of what otherwise would be expected to occur given current economic and technological trends. Subject to CARB approval as an IC project under the At-Berth Regulation, Chevron intends to develop and execute a proactive and deliberate strategy to facilitate early adoption of this IC and to achieve emissions reductions earlier and in excess of what would take place under a business as usual scenario. Specifically, adoption of a Tier III vessels strategy requires early and extensive capital investment in new technology onboard for Chevron controlled tonnage, as well as a selective (incentivized) chartering strategy whereby Chevron will limit the vessels that it elects to charter, to the extent possible, to only vessels with Tier III AE in order to promote execution of the strategy. Early adoption of this strategy, prior to implementation date of the At-Berth Regulation, will further reduce overall at berth emissions.

Also, it is important to highlight, as indicated in Section 9 of DNV's Technology Assessment, business as usual can mean an overall increase in vessel emissions as opposed to simply steady state or decline. In contrast, this IC would result in substantial emissions reductions compared to baseline.

Project 12: Upgraded Combustion and Control Systems for Auxiliary Boilers

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Chevron proposes to upgrade combustion and control systems for auxiliary boilers (AB) onboard vessels calling at RLW. We will accomplish this by 1) retrofitting existing vessels with new designed and upgraded combustion and control equipment or 2) executing a deliberate chartering strategy to secure newbuild vessels with upgraded AB systems. CARB's approval of this IC will provide substantial decreases in NOx. This IC addresses an uncommon vessel technological upgrade that is not mandated by any maritime regulation.

Until data regarding ROG and PM2.5 reductions becomes available from the boiler manufacturers, Chevron will conservatively neither estimate nor take credits for reduction in PM2.5 and ROG from this innovative concept. However, any actual reductions in ROG and PM2.5 emissions resulting from the IC project that can be demonstrated after implementation, as determined under Section 93130.17(d) of the At-Berth Regulation, will be included in Chevron's annual reporting to CARB.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Subject to CARB approval, this IC would be implemented using a phased approach across select vessels that call at the RLW and are under Chevron operational control and/or vessels with long-term supply contracts with RLW. As early as 2023, Chevron may begin scheduling shipyard time for AB upgrades, increasing rates of adoption through 2027.
Cumulatively, this would account for more than half of the annual RLW vessel calls and would reduce NOx by 48 MTPY at full implementation (detailed emission reduction calculations attached in **Appendix A12**). The calculations also show the annual and cumulative reductions in emissions resulting from the early, phased implementation of the IC project prior to 2027.

As stated above, Chevron is neither estimating nor requesting emission reduction credits for PM2.5 or ROG, at this time.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

All AB upgrades onboard vessels will be made after AB manufacturer has demonstrated compliance with CARB At-Berth Regulation emissions limits for NOx. AB Technical File and classification society certification will be used as primary basis to ensure compliance of upgraded equipment, with CARB emission limits and will be available to present to CARB, upon request.

The RLW Pre-Arrival Information Packet already requires vessel owners to report non-compliance or breakdown of machinery which could impact 'expected normal operations'. This information is recorded in vessel logbook and reported to Terminal and will be used for annual non-compliance reporting to CARB.

Additional monitoring and stack testing of AB emissions, in service, will not be required by RLW as this will be a part of the procedure that Classification Society's use to periodically endorse that AB operations are in compliance with “Technical File” requirements

5. A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept’s scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;

Not applicable for Chevron owned and operated fleet as Chevron is the applicant, as well as the funder and operator of the vessels. Compliance on other in-scope vessels will be addressed through Charter Party agreements with vessel owners at the time of vessel fixture.

6. Proposed length of time during which the IC project would be used

Subject to CARB approval, Chevron is capable of beginning implementation in a phased manner, starting in 2023 and increasing adoption on vessels through 2027, at which time Chevron expects to be operating with this concept as a new minimum standard for vessels already upgraded and calling at Chevron RLW terminal.

Chevron proposes to implement this IC project through and including the first compliance period (2027-2032) and, continuing through subsequent compliance periods subject to CARB approval of extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. A summary of all governmental approvals necessary to enable development of the innovative concept;

Except for CARB approval as an IC project under the At-Berth Regulation, no government approval is needed for vessel modifications associated with the proposed Innovative

Concept. Classification society, however, must grant approval and document as part of the vessel's auxiliary boiler upgrade (see #4 above).

8. **A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and**

No environmental reviews needed for vessel modifications associated with the proposed Innovative Concept.

9. **The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.**

The proposed Innovative Concept will lower NOx emissions without increasing GHG emissions. It will also ensure full compliance with CARB At-Berth NOx limits for AB. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. **The proposed innovative concept must achieve emissions reductions of NOx, PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.**

This Innovative Concept is in excess of any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a memorandum of understanding with a government entity), that is in effect, has been approved, or has been noticed.

11. **The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.**

This IC will reduce vessel emissions from AB at berth and will benefit communities adjacent to the refinery. It is important to note that the air quality benefits extend well beyond the RLW as the more efficient AB will be in operation during approach, at anchorage, and while transiting San Francisco Bay and California waters. Any actual emissions reductions resulting from the IC project, in addition to reductions while the ships are at berth, that occur

overwater within three nautical miles of RLW (per Section 93130.17(a)(4) of the At-Berth Regulation), and that can be shown as determined under Section 93130.17(d) of the Regulation, will be included in Chevron's annual reporting to CARB.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

The proposed Innovative Concept for CARB compliance will achieve emission reductions that are real, quantifiable, verifiable and enforceable. Details are provided in earlier sections of this application.

As noted above, there is no legal requirement to implement this project. In addition, the proposed innovative concept is in excess of a "business-as-usual" case. No current maritime protocol or policy calls for use of this innovative and uncommon technology for auxiliary boilers, and the proposed IC will achieve NOx reductions that are in excess of what otherwise would be expected to occur given current economic and technological trends. Subject to CARB approval as an IC project under the At-Berth Regulation, Chevron intends to develop and execute a proactive and deliberate strategy to facilitate early adoption of this IC and to achieve emissions reductions earlier and in excess of what would take place under a business as usual scenario. Implementing the technology upgrade under this IC requires early and extensive capital investment in new technology onboard Chevron controlled tonnage, as well as a selective (incentivized) chartering strategy whereby Chevron will limit the vessels that it elects to charter, to the extent possible, to only vessels with upgraded auxiliary boilers in order to promote execution of the strategy. Early adoption of this strategy, prior to implementation date of the At-Berth Regulation, will further reduce overall at berth emissions.

Also, it is important to highlight that as indicated in Section 9 of DNV's Technology Assessment, business as usual does not necessarily mean steady state or slight decline in emissions but in-fact leads to an overall increase in ship emissions. In contrast, implementing this IC project would substantially lower emissions as compared to baseline conditions.

Project 13: Dual-Fuel Tier III Auxiliary Engines and Auxiliary Boilers

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Chevron proposes to use vessels equipped with dual-fuel Tier III or above AE and dual fuel compatible AB's. The types of dual fuels used in the AE and AB could be LNG, Methanol, Ammonia, Hydrogen and/or other fuels beyond conventional MGO/MDO. Our proposal to achieve this IC is through 1) executing a deliberate chartering strategy to secure newbuild dual fuel vessels or 2) retrofitting existing vessels with new systems and machinery to allow them to use dual fuel for AE and AB. CARB's approval of this IC will provide substantial decreases in NOx.

Although adoption of dual-fuel AE and AB technology in tanker design is gaining popularity as a concept in the maritime industry, to date, less than 1% of global tanker fleet is dual-fuel capable. Infrastructure and availability of alternative fuels through a mature global supply chain are crucial to adoption of this innovative concept. To implement this IC project, Chevron intends to proactively seek dual-fuel vessels for use at RLW as a deliberate, early-adoption choice that is much earlier and well beyond the "business-as-usual" case, which would seek to continue using existing technology to secure more cost-efficient tonnage.

This IC provides an accelerated path for dual fuel vessels with Tier III or above AE's and dual fuel compatible AB's, which fully meet all NOx emissions criteria for the At-Berth Regulation, to carry crude/ product to and from RLW. Based on the IMO's Fourth Greenhouse Gas Study[7], a reduction in PM2.5 and ROG should also be expected when operating AE and AB's on dual fuel. However, since Maker data for PM2.5 and ROG is not available, Chevron at this time, is neither estimating nor taking credits for any decrease in PM2.5 and ROG, associated with this IC. Any actual reductions in ROG and PM2.5 emissions resulting from the IC project that can be demonstrated after implementation, as determined under Section 93130.17(d) of the At-Berth Regulation, will be included in Chevron's annual reporting to CARB.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

[7] International Maritime Organization, *Fourth IMO Greenhouse Gas Study*, 2021. Available at https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Fourth%20IMO%20GHG%20Study%202020%20-%20Full%20report%20and%20annexes.pdf

Subject to CARB approval, this IC would be implemented using a phased approach across the fleet of vessels that call at the RLW. For example, as early as 2024, Chevron may increase use of dual fuel vessels in the fleet, through implementation of a selective and deliberate chartering strategy. Also, in 2026 Chevron will try and incorporate this IC to select vessels under Chevrons operational control by making major modifications and upgrades to engines, boilers, fuel storage and delivery systems during shipyards and also increase adoption of dual fuel vessels through 2027 and beyond. Full implementation of this IC will reduce NOx by 41 MTPY (detailed emission reduction calculations attached in **Appendix A13**). The calculations also show the annual and cumulative reductions in emissions resulting from the early, phased implementation of the IC project prior to 2027.

Chevron is neither estimating nor requesting emission reduction credits for PM2.5 and ROG, at this time. However, any actual reductions in ROG and PM2.5 emissions resulting from the IC that can be shown as determined under Section 93130.17(d) of the At-Berth Regulation will be included in Chevron's annual reporting to CARB.

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Technical files endorsed by the engine maker and classification societies (e.g., American Bureau of Shipping) will be primary basis for recording and reporting AE Tier III compliance. Record keeping and reporting of change over to alternative fuel (LNG, Methanol, Ammonia, Hydrogen etc.) at berth will be in the ship's logbook and the terminal log.

The RLW Pre-Arrival Information Packet already requires vessel owners to report non-compliance or breakdown of machinery which could impact 'expected normal operations'. This information is recorded in vessel logbook and reported to Terminal and will be used for annual non-compliance reporting to CARB. Expectation on reporting non-compliance, with at berth changeover to alternative fuel, will be added to RLW Terminal Information Booklet and vessels will be made aware of the requirements through the RLW Pre-Arrival Information Packet. Vessels will be fully responsible for reporting compliance to RLW. Additional monitoring of changeover to alternative fuel will be randomly confirmed by Port State Control and RLW personnel.

Testing of AE or AB stack emissions will not be carried out by RLW as this is a part of the procedure that Classification Society's use to periodically endorse AE and AB operations in alignment with "Technical File" requirements.

5. A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;

Not applicable for Chevron owned and operated fleet as Chevron is the applicant, as well as the funder and operator of the vessels. Compliance on other in-scope vessels will be

addressed through Charter Party agreements with vessel owners at the time of vessel fixture.

6. Proposed length of time during which the IC project would be used

Subject to CARB approval, Chevron is capable of beginning implementation in a phased manner, starting in 2024 and increasing adoption on vessels through 2027 and beyond, at which time Chevron expects to be operating with this concept as a new minimum standard for vessels already upgraded and calling at Chevron RLW terminal.

Chevron proposes to implement this IC project through and including the first compliance period (2027-2032) and, continuing through subsequent compliance periods subject to CARB approval of extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. A summary of all governmental approvals necessary to enable development of the innovative concept;

Except for CARB approval as an IC project under the At-Berth Regulation, no government approval is needed for vessel modifications associated with the proposed Innovative Concept. Classification society, however, must grant approval and document as part of the vessel's auxiliary boiler upgrade (see #4 above).

8. A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and

No environmental reviews needed for ship modifications associated with the proposed Innovative Concept.

9. The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.

The proposed Innovative Concept will lower NOx, PM2.5 and ROG emissions without increasing GHG emissions. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. The proposed innovative concept must achieve emissions reductions of NOx, PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.

This Innovative Concept is in excess of any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a memorandum of understanding with a government entity), that is in effect, has been approved, or has been noticed.

11. The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.

This IC will reduce vessel emissions from AE and AB at berth and will benefit communities adjacent to the refinery. It is important to note that the air quality benefits extend well beyond the RLW as the more efficient AE and AB will be in operation during approach, at anchorage, and while transiting San Francisco Bay and California waters. Any actual emissions reductions resulting from the IC project, in addition to reductions while the ships are at berth, that occur overwater within three nautical miles of RLW (per Section 93130.17(a)(4) of the At-Berth Regulation), and that can be shown as determined under Section 93130.17(d) of the Regulation, will be included in Chevron's annual reporting to CARB.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

The proposed concept for CARB compliance will achieve emission reductions that are real, quantifiable, verifiable and enforceable. Details are provided in earlier sections of this application.

As noted above, there is no legal requirement to implement this IC project. In addition, this IC project is excess of a "business as usual" case. Today, less than 1% of global tanker fleet is dual-fuel capable and there currently is no maritime protocol or policy calling for use of dual-fueled vessels in California. Also, as with the other IC projects included in this application, there are not sufficient economic incentives or a technological impetus at this time to implement this IC concept in the absence of the CARB At-Berth Regulation. Rather, execution of this IC project requires early and extensive capital investment in new technology onboard, selective (incentivized) chartering strategies and assurance of mature dual fuel bunkering infrastructure to enable adoption of the IC. Through this IC, Chevron intends to proactively identify opportunities to charter dual-fuel vessels for use at RLW, which would reflect a deliberate, early-adoption choice beyond the "business-as-usual" case, which would seek to rely on existing technology to secure more efficient dual-fuel tonnage. Early adoption of this strategy, prior to implementation date of At-Berth Regulation, will further reduce overall at berth emissions.

Also, it is important to highlight that as indicated in Section 9 of DNV's Technology Assessment, business as usual does not necessarily mean steady state or slight decline in emissions but in-fact leads to an overall increase in ship emissions. In contrast, this IC would lead to substantially reduced emissions as compared to baseline.

Early adoption of this strategy, prior to implementation date of CARB-at-berth regulation, will further reduce overall at berth emissions.

Project 14: Shore Power or Stack Capture for Barges and Tug Boats

1. Company name, address, and contact information

Chevron Products Company, a subsidiary of Chevron U.S.A. Inc.
P.O Box 1272
Richmond, CA 94802 – 0272

2. Description of proposal including an overview of the source and scope of emission reductions, and a project site plan and location map.

Should shore power and/or stack capture and control be shown to be a safe and feasible option at the RLW, subject to CARB approval as an IC project, Chevron intends to also use either or both of these technologies on barges and tugboat that make calls at RLW (see location map in **Appendix A14**). As noted in the DNV's Technology Assessment, shore power is not expected to be available until 2034 at the earliest, therefore this IC project is intended to be implemented should shore power be available at RLW within the years 2027-2032. Chevron would reduce barge and tugboat emissions by controlling engine emissions as would occur on a tanker vessel. Instead of operating the barges and tug boats with no emissions controls for the foreseeable future because there is no requirement to do so, subject to CARB approval as an IC project to reduce emissions for purposes of the At-Berth Regulation, Chevron would control these emissions as early as 2027. This IC project is in excess of the emissions reductions that will be achieved as part of the Commercial Harbor Craft Regulation.

3. Estimate of the vessel emissions planned to be covered under the innovative concept for each pollutant NOx, PM 2.5, and ROG by multiplying the emission factor for a pollutant found in section 93130.5(d) of this Control Measure by the expected number of vessel visits, average visit duration, and expected power used during an average visit;

Chevron estimates that the emissions reductions from controlling the barge and tug boat emissions will be 22 metric tons per year (MTPY) for NOx, 0.2 MTPY for PM2.5, and 1.4 MTPY. GHG emissions will not increase. See **Appendix A14** for the best available NOx, PM2.5 and ROG emissions calculations for this project. Emissions were calculated using RLW data from the "2021 Update to the Emissions Inventory for Commercial Harbor Craft: Methodology and Results"[8] and anticipated reductions from controlling these emissions.

The RLW has calls from a variety of vessels that are constantly evolving and Chevron cannot predict exactly which vessels will be in operation when this regulation goes into effect in 2027, nor their exact NOx, PM2.5 and ROG emissions. **Table 2** shows the amount of NOx, PM2.5 and ROG emissions that must be reduced with IC projects when using 2016 emissions as a representative year and the emission factors from **Section 93130.5(d)(1) and (d)(2)**. **Table 3** shows how this project fits in among the Innovative Concepts as a package to ensure emissions are reduced as required by **Section 93130.17**.

[8] https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2021/chc2021/apph.pdf

4. The proposed recordkeeping, reporting, monitoring, and testing procedures that the applicant plans to use to demonstrate reductions;

Chevron will leverage annual barge and tug boat emissions calculations, as well the emissions control rates for shore power and stack capture. Stack capture emissions control information will be obtained from the vendor, while shore power emissions controls will assume 100% control in most cases. The emissions will be reported to CARB on an annual basis as required by **Section 93130.17(d)(1)** of the At-Berth Regulation. See **Appendix A14** for more details.

5. A Memorandum of Understanding or similar agreement between the applicant, any funding partners (if more than one entity is providing funding), owners and operators of controlled equipment for the innovative concept that shows agreement regarding the innovative concept's scope and requirements for using the innovative concept in compliance with this Control Measure. The Memorandum of Understanding or similar agreement must be approved by the Executive Officer and must be in place prior to the start date of the innovative concept compliance period;

Chevron will address compliance on vessels, included in scope of this Innovative Concept, through Charter Party agreements with vessel owners at the time of vessel fixture.

6. Proposed length of time during which the IC project would be used

Subject to CARB approval, this IC project would be capable of implementation as early as 2027 should shore power become available. Chevron proposes to implement this IC project through and including the first compliance period (2027-2032), and to continue implementation through subsequent compliance periods, subject to CARB approval of one or more extensions. Chevron understands that an IC project may not be extended beyond any compliance period during which the project becomes legally required by law or regulation.

7. A summary of all governmental approvals necessary to enable development of the innovative concept;

No government approvals needed, except for a CARB approval as an IC project under the At-Berth Regulation.

8. A discussion regarding any environmental review requirements that may apply to the proposed innovative concept, including identification of which agency would serve as the lead agency for environmental review purposes; and

No environmental reviews required.

9. **The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure.**

Controlling the barge and tug boat emissions is expected to lower NOx, PM2.5 and ROG emissions without increasing GHG emissions. Chevron will collect all necessary data to verify emissions reductions on a yearly basis as required by **Section 93130.17(d)**. See **Table 3** for more details on how this project helps shape the Innovative Concept compliance option within the At-Berth Regulation.

10. **The proposed innovative concept must achieve emissions reductions of NOx, PM 2.5, and ROG that, as of the date the compliance period begins, are early or in excess of: (1) any other state, federal or international rule, regulation, statute, or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity), that is in effect, has been approved, or has been noticed; or (2) of an emission reduction strategy identified in an AB 617 Community Emissions Reduction Program that has been approved by CARB's Governing Board.**

There is currently no statute, regulation or other legal requirement to control barge and tug boat emissions as proposed in this IC project. While CARB is updating the emissions regulation that applies to barges and tug boats (Proposed Amendments to Commercial Harbor Craft Regulation), this IC accounts for the emissions reductions that would be achieved as part of the modified CARB regulation. This IC project is in excess of the emissions reductions that will be achieved as part of the Commercial Harbor Craft Regulation.

11. **The proposed innovative concept must achieve reductions in and around the California port or marine terminal at which the vessel visits take place for which the innovative concept is used. The reductions must be at the same port or marine terminal, within adjacent communities, or overwater within three nautical miles of the port or marine terminal.**

The barge and tug boat emissions will be controlled at the Richmond Long Wharf.

12. The proposed innovative concept must achieve emissions reductions that exceed any reductions otherwise required by law, regulation, or legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario. For purposes of this section, "business as usual" means the set of conditions reasonably expected to occur within the relevant area in the absence of the incentive provided by the innovative concept provisions of this Control Measure, taking into account all current laws and regulations, as well as current economic and technological trends. The proposed innovative concept must achieve reductions that are real, quantifiable, verifiable, and enforceable where: (A) "Real" means that reductions result from a demonstrable action or set of actions, and are quantified using appropriate, accurate, and conservative methodologies that account for all emissions within the innovative concept; (B) "Quantifiable" means the ability to accurately measure and calculate reductions relative to a project baseline in a reliable and replicable manner for all emissions within the innovative concept; (C) "Verifiable" means that any emission assertions are well documented and transparent such that it lends itself to an objective review; and (D) "Enforceable" means the authority for CARB to hold a particular party or parties liable and to take appropriate action if any of the provisions of this article are violated.

As noted above, the project is not legally required. It also is not expected to occur under a "business as usual" scenario. Under a business as usual scenario in light of current technological and economic trends and incentives, it is likely that the that barge and tug boat emissions would not be controlled via shore power or stack capture and control. Accordingly, this IC project is being proposed specifically as a means to achieve compliance with the At-Berth Regulation, and in fact reflects one of the specific examples provided by CARB staff of a potential IC project under the Regulation.

The barge and tug boat reductions will be real, quantifiable, verifiable and enforceable: A) Real: Vendor provided emissions control rates, and estimated barge and tug boat emissions will be the basis for certifying that the emissions reductions are real. B) Quantifiable: Emissions rates will be based on vendor emissions certifications for stack capture and 100% control for shore power. C) Verifiable: The EPA/CARB certifications and estimated barge and tug boat emissions will be available for audit. D) Enforceable: CARB will be able to pursue enforcement if the requisite emissions reductions are not achieved to comply with the At-Berth Regulation and/or if there is a violation of other requirements (e.g., reporting/recordkeeping) under the Regulation.

Appendix A: Emissions Calculations and Site Maps for Innovative Concept Projects

Appendix A1: Newer Locomotive

Appendix A1: Site Map for New Locomotives

Appendix A1: New Locomotive Project Emissions

Estimation of emission reduction from replacing each locomotive (i.e. only 1 locomotive replaced).

	Annual Diesel Consumption (Gal/yr)	
		Use EPA factor of 15.2 BHP-hr/gallon of diesel burned
Current Locomotive	20000	Annual Average for current operations
New Locomotive	10000	Provided by vendor

	NOx gms/BHP-hr	PM2.5 gm/BHP-hr	ROG gm/BHP-hr	per CARB certificate for Engine converted gm/KW-hr to Gms/BHP-hr by dividing by 1.341
Current Locomotive	17.40	0.44	1.01	
New Locomotive	1.34	0.007	1.01	

Note: ROG emissions factor is still being determined for new locomotive. Will request ROG test data from vendor when the locomotive is procured.

	NOx Reduction			PM2.5 Reduction			ROG Reduction		
	gms/yr	lbs/yr	Metric tons/yr	gms/yr	lbs/yr	Metric tons/yr	gms/yr	lbs/yr	Metric tons/yr
Current Locomotive	5289600	11651	5.28	133760	295	0.13	307040	676	0.31
New Locomotive	203680	449	0.20	1064	2	0.00	153520	338	0.15
Annual Reduction	**5085920**	**11202**	**5.1**	**132696**	**292**	**0.13**	**153520**	**338**	**0.15**

Note: The net reduction in fuel consumption means a net reduction in GHGs.

Appendix A2: Boiler Replacement Project

Appendix A2: Site Map for Boiler Replacement Project

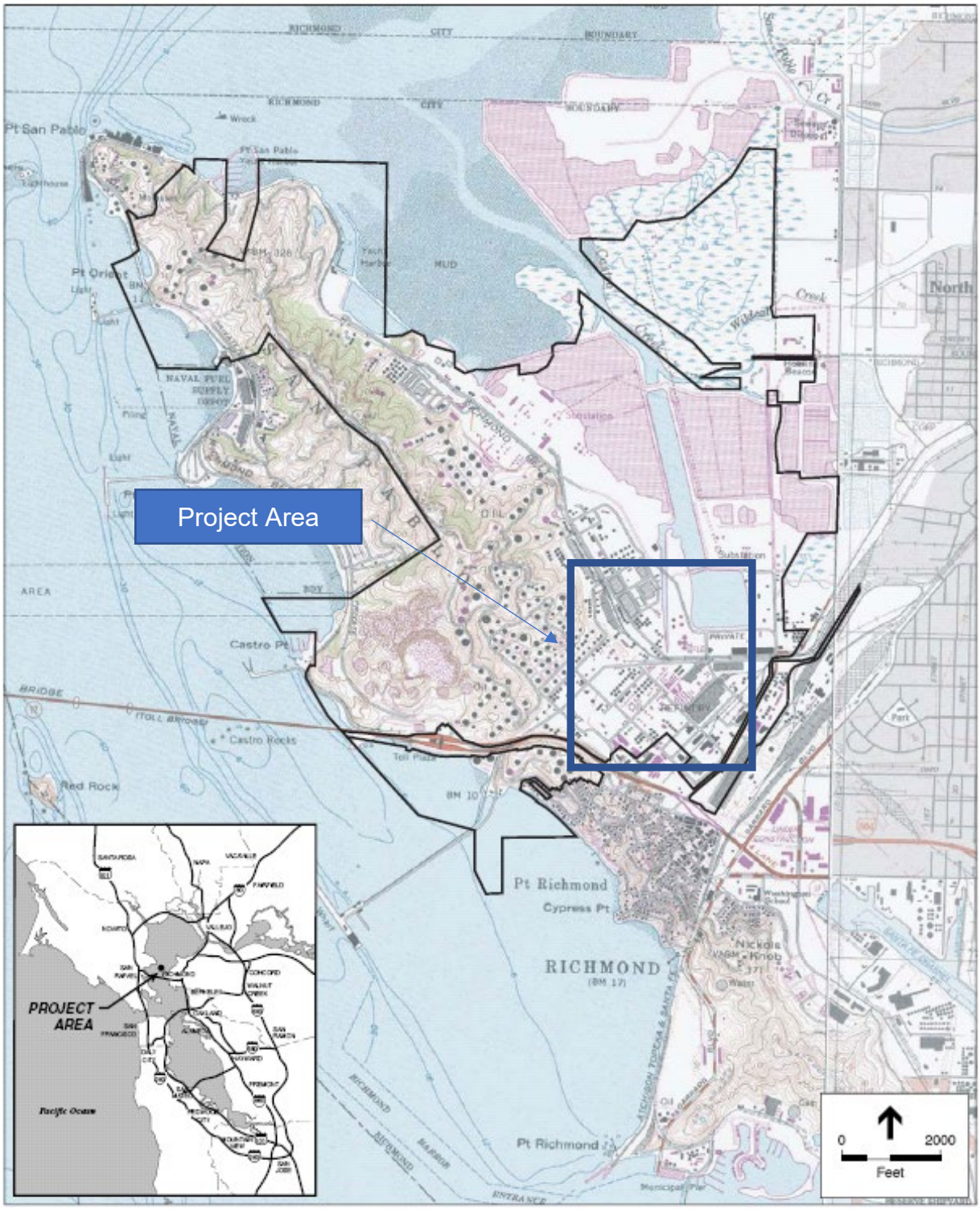
Appendix A2: Boiler Replacement Project

Parameter	Value	Units	Source
Average 2018-2020 V701 Boiler Fuel Consumption	4411.11	MMscf/yr	Average of 2018-2020
2018-2020 Avg NOx Emissions	61.02	tn/yr	Average of 2018-2020
Baseline VOC EF	0.0048	lb/MMBtu	Source tests
Projected NOx Emissions	5.0	ton/yr	
Expected Actual Emission Reduction - NOx	50.8	Metric/yr	
Expected Actual Emission Reduction - VOC	1.6	Metric/yr	

Note: PM reductions also possible, but assumed to be zero for now. The net reduction in fuel consumption means a net reduction in GHGs.

Appendix A3: Diesel Air Compressors Replacement

Appendix A3: Richmond Refinery Site Map
Diesel Air Compressor Replacement



Appendix A3: Diesel Air Compressors Replacement

- These calculations look at the emissions that would be eliminated by removing these diesel air compressors

EPA Tier 3-4 Engine Emissions Factors [g/(HP*hr)]					
Tier	**Horsepower Range**		**NOx**	**PM2.5**	**ROG**
3	300	600	2.85	0.15	0.15
4I	50	75<	0.30	0.22	0.016
4F	175	750 <	0.30	0.015	0.016

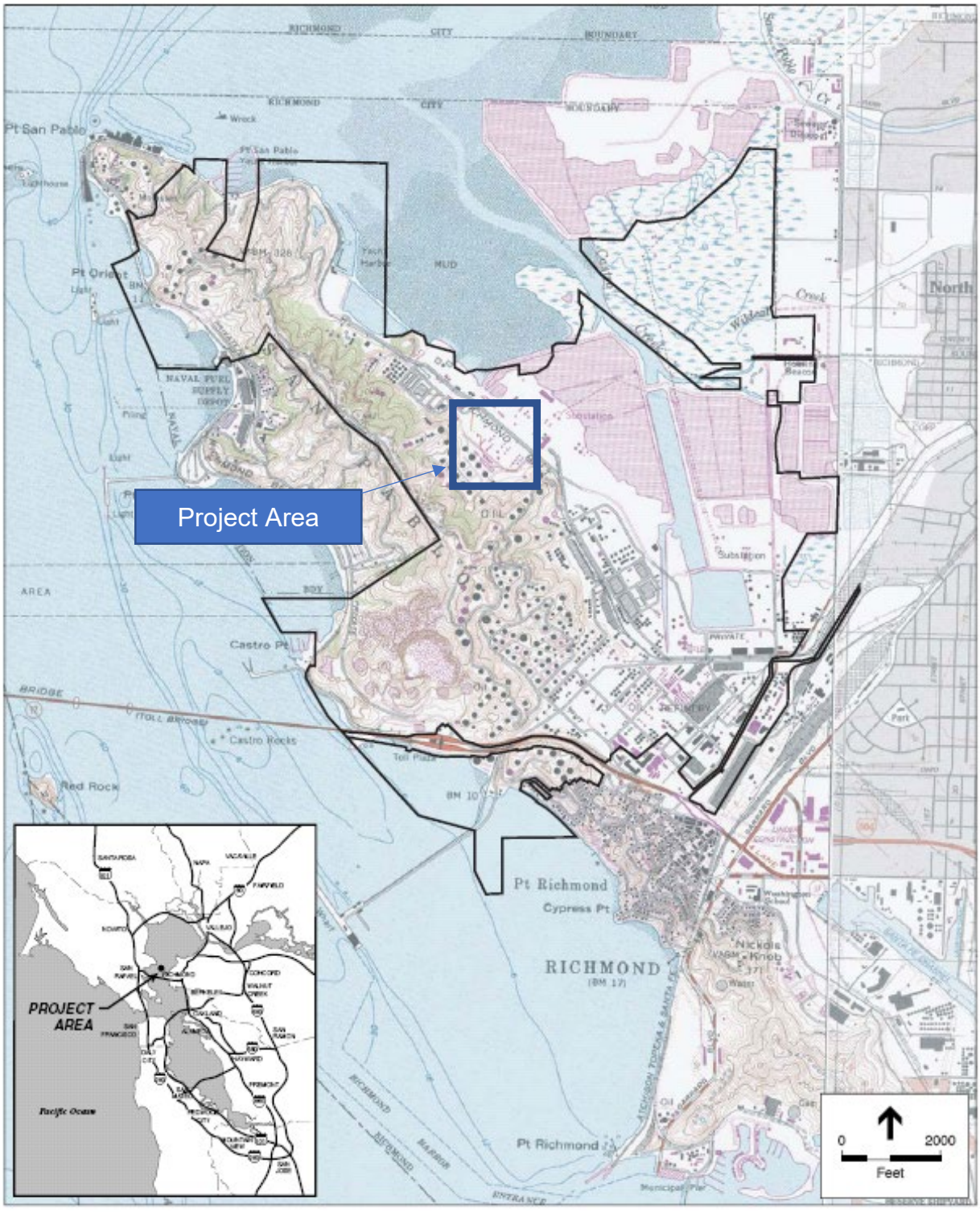
Note: Per BAAQMD guidance, NOx and ROG emissions factor derived from NMHC + NOx factor that assumes 95% NOx.

Engine Description	Average Hours of Operation	NOx [Metric Tons]	PM2.5 [Metric Tons]	ROG [Metric Tons]
Engine 1	666	0.104	0.005	0.005
Engine 2	171	0.027	0.001	0.001
Engine 3	171	0.027	0.001	0.001
Engine 4	627	0.938	0.049	0.045
Engine 5	738	0.116	0.085	0.006
Engine 6	8760	13.107	0.690	0.626
Engine 7	8760	13.107	0.690	0.626
	Total	**27.43**	**1.52**	**1.31**

Note: The net reduction in diesel engine usage means a net reduction in GHGs.

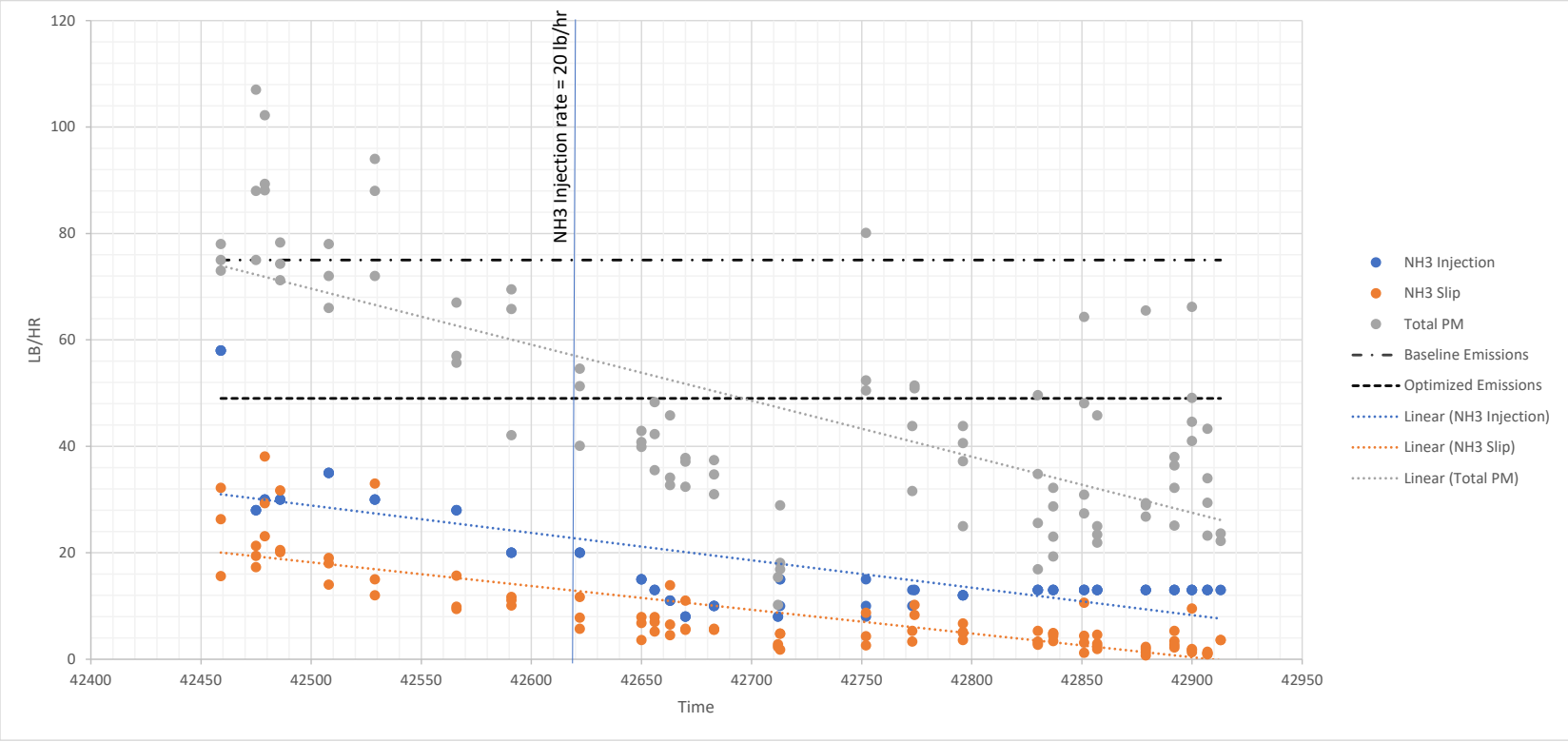
Appendix A4: FCC Ammonia Optimization

Appendix A4: Richmond Refinery Site Map
FCC Ammonia Optimization



Appendix A4: FCC Ammonia Optimization

- Chevron operates a Fluidized Catalytic Cracker (FCC) to produce gasoline from long chain hydrocarbons. The process uses a fluidized catalyst, and the process of regenerating the catalyst results in some PM2.5 emissions from the FCC stack. Chevron conducted a series of FCC PM2.5 stack tests to evaluate the optimum ammonia slip conditions for controlling filterable PM2.5 emissions while controlling condensable PM2.5. Too little ammonia increases filterable PM2.5, while too much ammonia increases condensable PM2.5. By operating within the optimal ammonia slip range, significant reductions of total PM2.5 emissions are achievable.



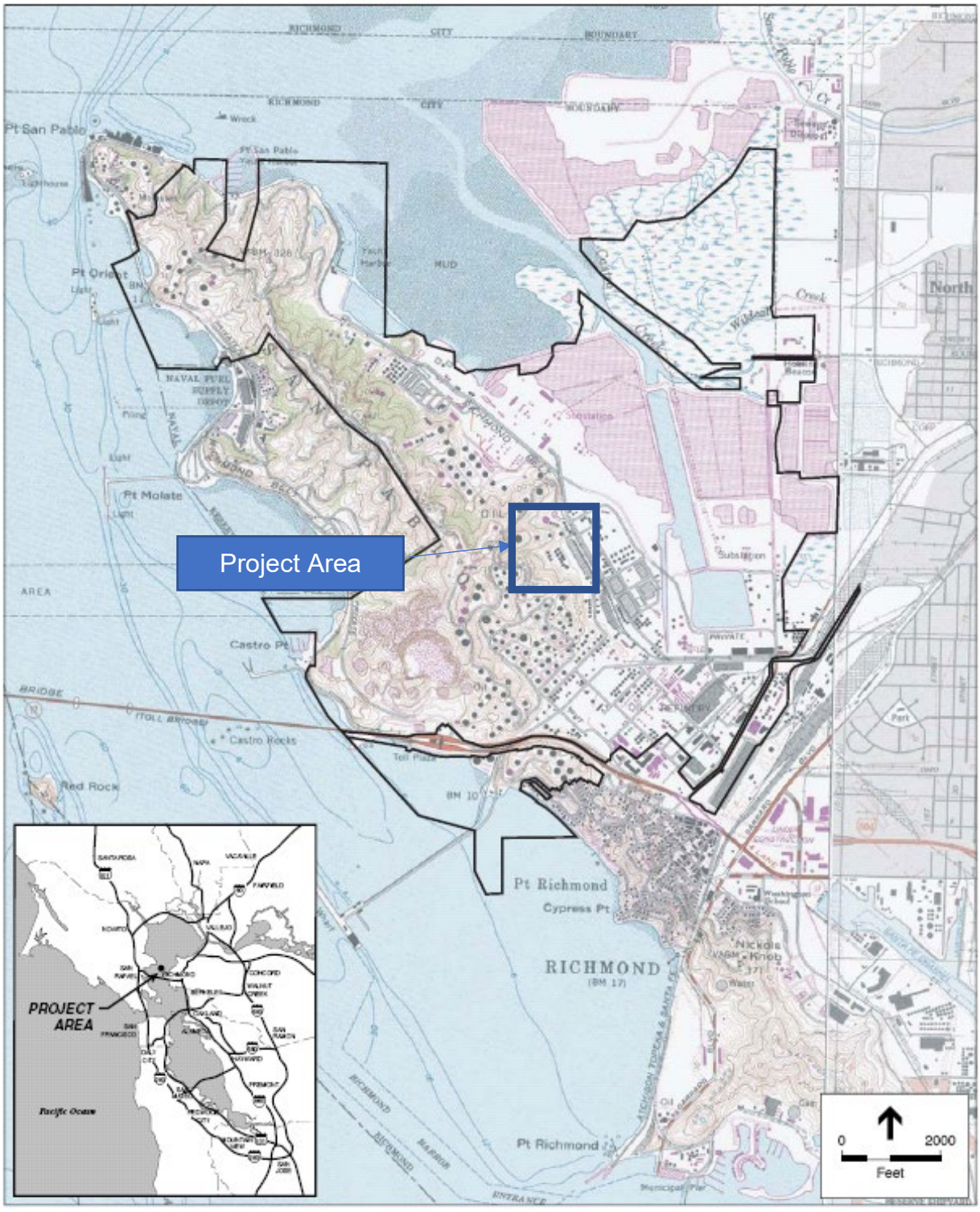
	PM2.5 Emissions Reduction		
	lbs/hr	**Metric Tons per Year**	Note on Ammonia Slip
Current Emissions	75	298	at varying ammonia slips
Innovative Concepts Emissions Proposal	49	195	with ammonia optimization
Net Reduction	**26**	**103**	

- Actual annual emissions reductions could be lower, but the calculations above show how high they can be in a given year.

Note: No net change in NOx, ROG or GHGs will occur.

Appendix A5: Wharf ERD replacement

Appendix A5: Richmond Refinery Site Map
Wharf ERD Replacement



Appendix A5: Wharf Emissions Reduction Device (ERD) Replacement

- These calculations look at the emissions that would be eliminated by replacing the Wharf ERD with a noncombustion abatement system.

Emissions Factors			
		Units of Measure	**Source**
NOx	1.17	lb/1000 bbls loaded	Source Testing
PM2.5	0.00559	lb/MMBtu fired	AP 42
ROG	0	-	Will assume zero

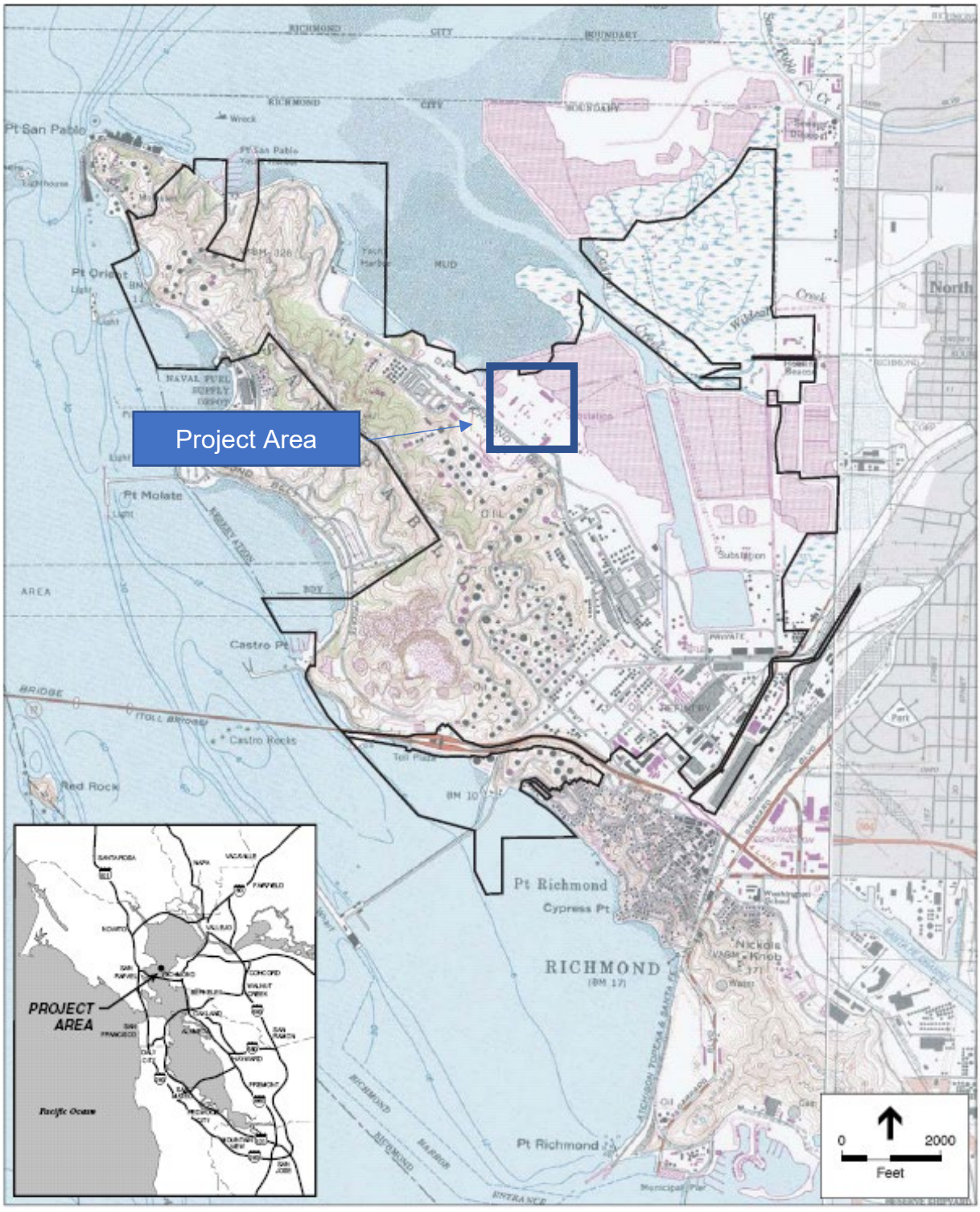
*** Average for 2018-2020**

Project	NOx [Metric Tons]	PM2.5 [Metric Tons]	ROG [Metric Tons]
Wharf ERD Replacement	7.3	0.78	0

Note: The elimination of fuels combusted at the Wharf ERD means a net reduction in GHGs.

Appendix A6: TKN Heater Optimization

Appendix A6: Richmond Refinery Site Map
TKN Heater Optimization



Appendix A6: TKN Heater Optimization

Estimation of emission reduction from installing improved heat exchangers at TKN Unit heaters, and optimizing operation of the heaters.

Chevron is evaluating installing improved heat exchangers technologies that could result in a 10-20% reduction in fuel consumption at furnaces F-510, F-520, and F-530, and further process improvements that would reduce fuel consumption by another 30% at all 7 furnaces in the plant.
- A reduction in fuel will result in an equivalent reduction in exhaust volumetric flow rate from the furnaces.
- NOx is calculated as function of exhaust flow rate, while PM and ROG are calculated as a function of fuel gas flows
- Therefore it is expected that a reduction in fuel consumption will have an equivalent reduction in NOx, PM and ROG will occur from this project. See below.

		NOx Metric Tons	PM2.5 Metric Tons	ROG Metric Tons	
1	**2020 Emissions For F-510, F-520, F-530**	61.8	3.7	2.7	Pulled from BAAQMD Certified Emissions (see below). Calculated using CEMS, stack testing and fuel flow data. Used methods from BAAQMD Refinery Emissions Inventory Guidelines. 2020 served as an average year because it had lower emissions than other years. Ensures conservative emissions estimates.
	Reduction from New Heat Exchangers (10% of F-510, F-520, F-530)	6.2	0.37	0.27	10% of 2020 Emissions for F-510, F-520, F-530
2	**2020 Emissions For a All TKN Heaters (See list Below)**	104.3	14.7	10.6	Pulled from BAAQMD Certified Emissions (see below). Calculated using CEMS, stack testing and fuel flow data. Used methods from BAAQMD Refinery Emissions Inventory Guidelines. 2020 served as an average year because it had lower emissions than other years. Ensures conservative emissions estimates.
	30% reduction from Optimizing Operations	31.3	4.40	3.18	30% of 2020 Emissions for all furnaces
	Total Reductions	**37.5**	**4.8**	**3.4**	Reductions for Innovative Concept

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

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ANNUAL PERMIT RENEWAL INVOICE

Invoice for Renewal Term 12/1/2021 to 12/1/2022

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BAAQMD regulations are available at www.baaqmd.gov or by calling (415) 749-4900.

Reported Source Emissions

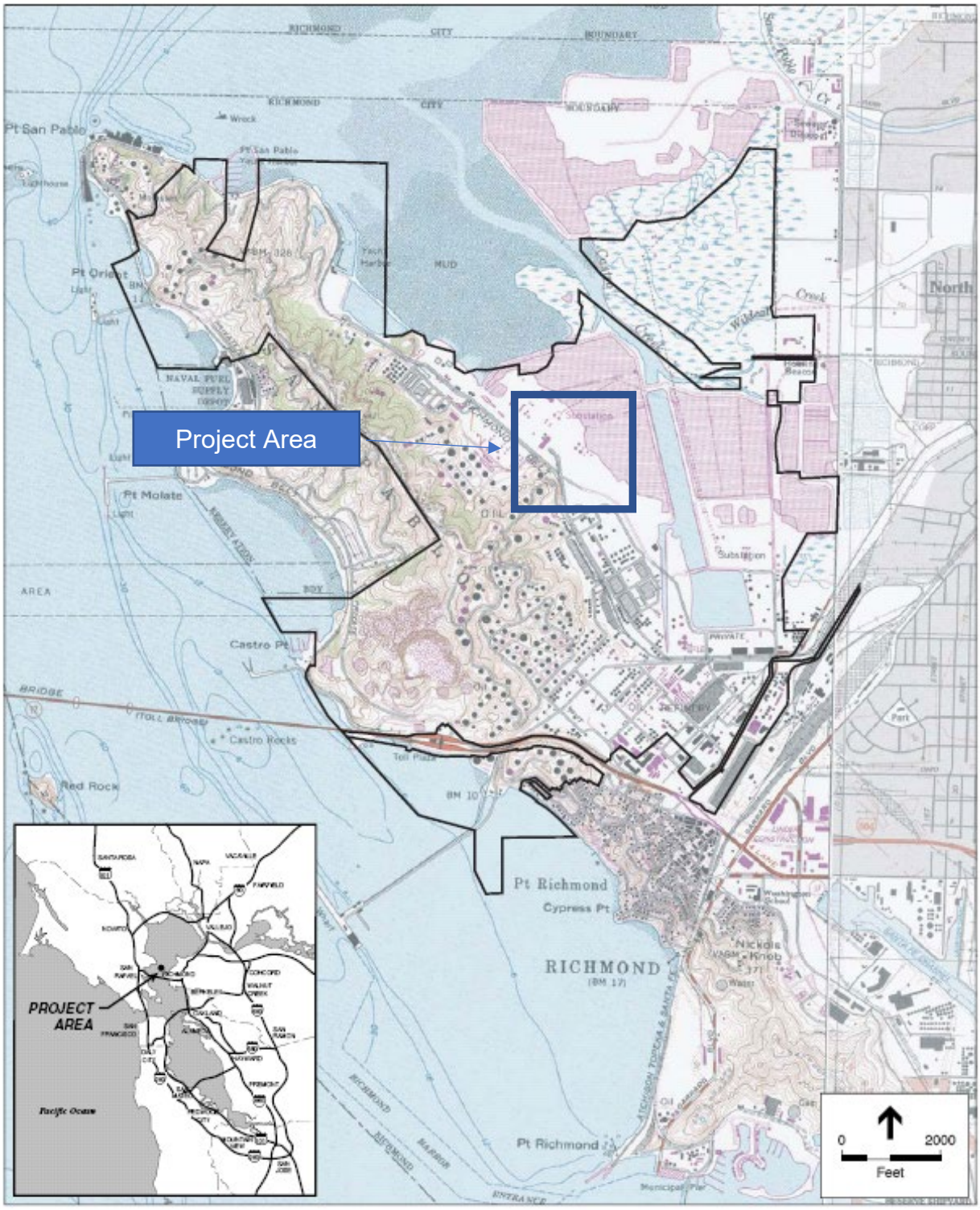
For Renewal Period 12/1/2021 to 12/1/2022

		Annual Average lbs/day				
Source	Facility Source Description	PM	Org	NOx	SO2	CO
S4161	F-510 TKN Feed Furnace/Low NOx Burners	7.56	5.48	126.58	2.88	0.90
S4162	F-520 TKN Furnace/Low-NOx Burners	7.15	5.18	119.73	2.71	0.85
S4163	F-530 TKN Feed Furnace/Low NOx Burners	7.59	5.48	127.12	2.88	0.90
S4164	F-630 ISOCRACKER FEED FURNACE ISOMAX w/Ultra Low NOX Burners	4.30	3.10	19.95	1.62	0.36
S4165	F620 ISOCRACKER FEED FURNACE ISOMAX w/Ultra Low NOX Burners	4.25	3.07	19.75	1.61	0.36
S4166	F-610 ISOCRACKER FEED FURNACE ISOMAX w/Ultra Low NOX Burners	5.18	3.75	24.08	1.96	0.43
S4168	F-730 ISOCRACKER SPLITTER FEED FURNACE ISOMAX w/Ultra Low NOX Burners	22.44	16.22	75.89	8.49	6.66
S4169	F-731 ISOCRACKER REBOILER ISOMAX w/Ultra Low NOX Burners	30.14	21.75	116.71	11.40	2.21

Note: The net reduction in fuel consumption means a net reduction in GHGs.

Appendix A7: North Ranch Diesel Engine Replacement

Appendix A7: Richmond Refinery Site Map
North Ranch Diesel Engine Replacement



Appendix A7: North Ranch Diesel Engine Replacement

- These calculations look at the emissions that would be eliminated when installing electricity in this area and eliminate diesel generators currently used.

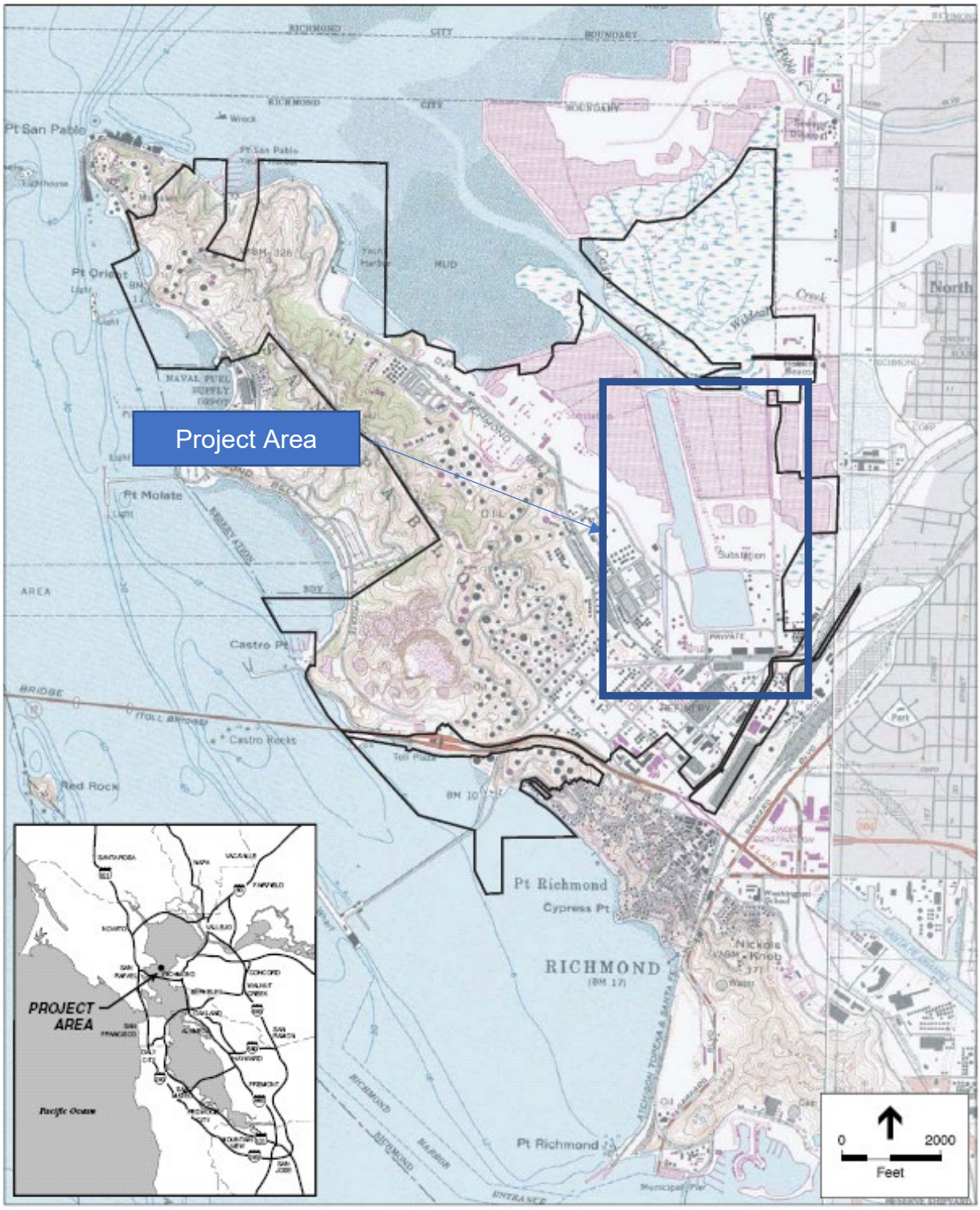
Engine Permitted Emissions Factors [lb/(HP*hr)]			
Engine	**NOx**	**PM2.5**	**ROG**
Engine 1	3.11E-04	9.87E-06	1.64E-05
Engine 2	6.49E-04	3.24E-05	3.41E-05

Engine	**NOx [Metric Tons]**	**PM2.5 [Metric Tons]**	**ROG [Metric Tons]**
Engine 1	0.221	0.007	0.011
Engine 2	0.200	0.010	0.010
Total	**0.42**	**0.02**	**0.02**

Note: The net reduction in diesel engine usage means a net reduction in GHGs.

Appendix A8: Solar Electricity Project - General

Appendix A8: Richmond Refinery Site Map
Solar Electricity Project - General



Appendix A8: Solar Electricity Project - General

- These calculations look at the emissions that would be eliminated by displacing PG&E electricity with solar assuming a 31,000 MWh project.

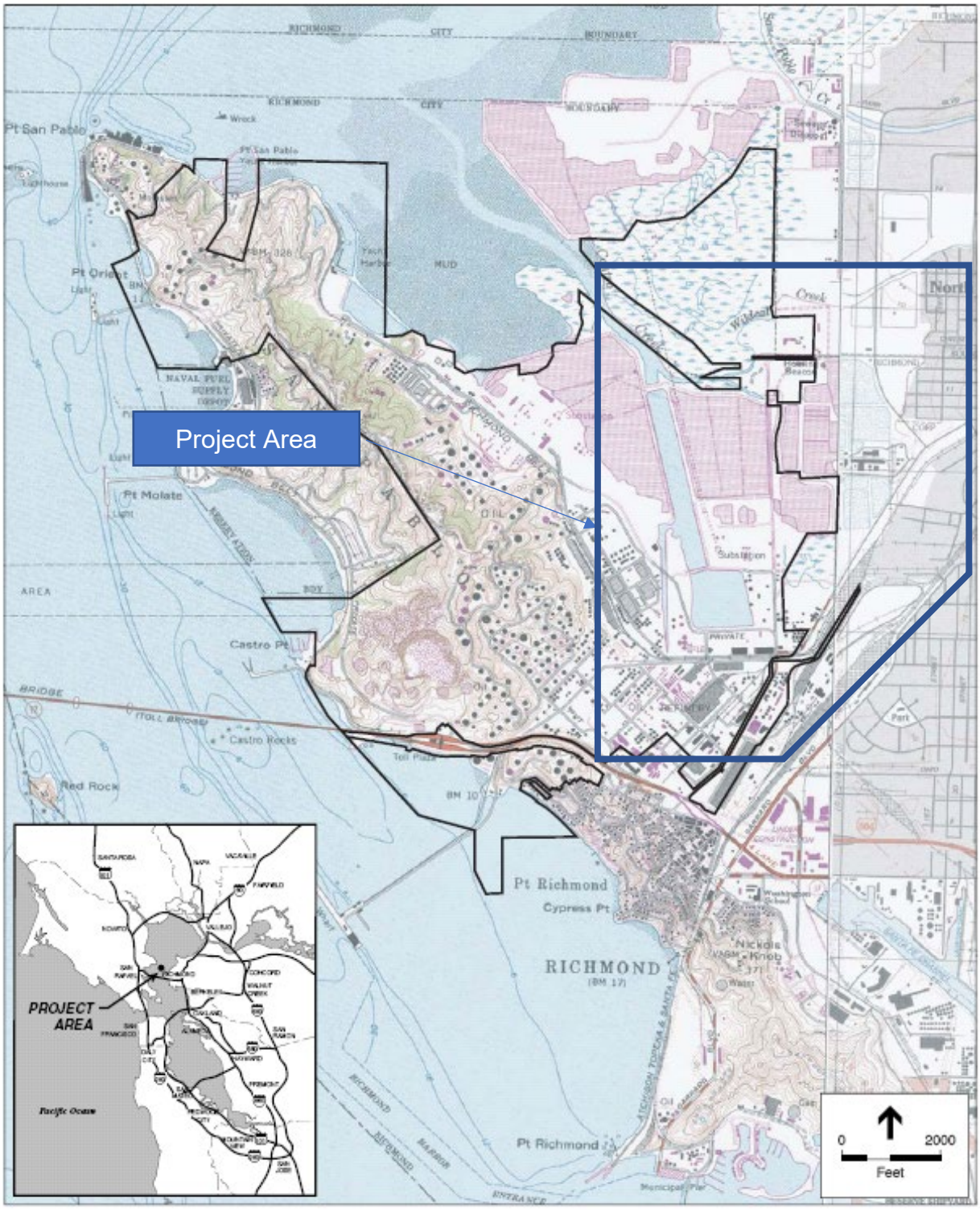
Electricity Engine Emissions Factors [lb/MWh]		
		Source
NOx	0.4	2019 e-Grid for California
PM2.5	0.024	2018 e-Grid for California
ROG	0.027	2019 e-Grid for California (CH4)

Project	**MWh/year**	**NOx [Metric Tons]**	**PM2.5 [Metric Tons]**	**ROG [Metric Tons]**
Solar Project	31000	5.6	0.3	0.4

Note: The net reduction in PG&E electricity usage means a net reduction in GHGs.

Appendix A9: Solar Electricity Project – Shore Power

Appendix A9: Richmond Refinery Site Map
Solar Electricity Project – Shore Power



Appendix A9: Solar Shore Power

- These calculations look at the emissions that would be eliminated by displacing PG&E electricity with solar assuming a 20 MW shore power project or another renewable project.
- Assumes that shore power provided 20% of the time, during 50% of the day (day time).

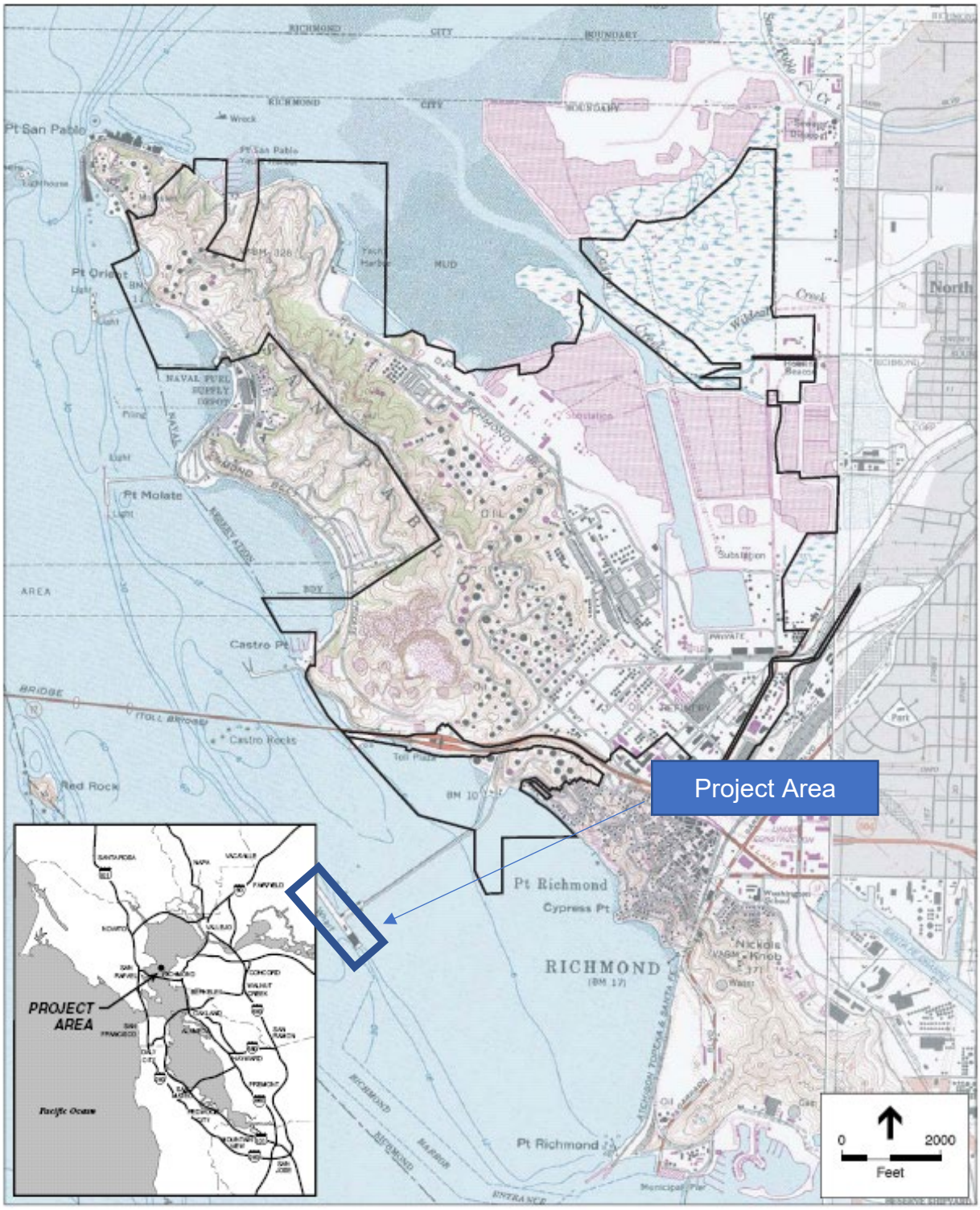
Electricity Engine Emissions Factors [lb/MWh]		
		Source
NOx	0.4	2019 e-Grid for California
PM	0.024	2018 e-Grid for California
ROG	0.027	2019 e-Grid for California (CH4)

Project	**MWh/year**	**NOx [Metric Tons]**	**PM [Metric Tons]**	**ROG [Metric Tons]**
Solar Project	17520	3.2	0.2	0.2

Note: The net reduction in PG&E electricity usage means a net reduction in GHGs.

Appendix A10: Tier II or above certification on Auxiliary Engines (AE's) for ships

Appendix A10: Richmond Refinery Site Map
Tier II or above certification on Auxiliary Engines (AE's) for ships



Appendix A10 -A13: Inputs for Appendices A10 through A13

	Master List	NOX [g/kWhr]	PM [g/kWhr]	ROG [g/kWhr]	Source:
Aux	Cold Ironing	0.00	0.00	0.00	
	Tier II	10.5	0.17	0.52	CARB Inventory
	Tier III	2.6	0.17	0.52	CARB Inventory
	Dual Fuel - LNG	1.3	0.03	0.52	IMO 4th GHG Study (NOX) + EPA Study (PM) + CARB Default (ROG)
	Aux - No Change	13.8	0.17	0.52	CARB-at-Berth default values
Boiler	Burner Upgrade	0.27	0.17	0.11	Alborg (NOX) + CARB Default (PM and ROG)
	Burner - LNG	0.13	0.17	0.11	IMO 4th GHG Study (NOX) + EPA Study (PM) + CARB Default (ROG)
	Boiler - No Change	2.00	0.17	0.11	CARB-at-Berth default values

1 2 3 4 5 6 7

2016 Class Breakdown	Total Vsls	Total Calls	Avg Hotel Time [hrs]	Total Hotel Time [hrs]	Aux Power / Call [kW]	Boiler Power / Call [kW]
SUEZMAX - SUB CLASS 1	1	1	24	24	768	3,583
SUEZMAX - SUB CLASS 2	2	69	34	2,344	554	6,300
SUEZMAX - SUB CLASS 3	5	32	16	528	554	5,230
AFRAMAX - SUB CLASS 1	2	7	65	452	792	1,821
PRODUCT - SUB CLASS 1	4	89	46	4,105	844	2,225
VARIOUS - SUB CLASS 1	3	3	26	77	1,121	766
VARIOUS - SUB CLASS 2	28	65	34	2,223	769	2,819
VARIOUS - SUB CLASS 3	67	95	51	4,798	807	2,046
VARIOUS - SUB CLASS 4	5	17	54	910	844	1,402
Grand Total	**117**	**378**		**15,460**		

^ Auto Calculated ^

GENERAL NOTE: CALCULATIONS AND PERCENT REDUCTIONS ARE BASED ON RLW's 2016 ACTUAL VESSEL CALL DURATIONS, THE 2020 PORT OF LONG BEACH INVENTORY METHODOLOGY FOR EQUIPMENT LOAD DURING VARIOUS OPERATIONS TO CALCULATE FUEL CONSUMPTIONS, CARB'S 2019 UPDATE TO INVENTORY FOR OCEAN-GOING VESSELS METHODOLOGY FOR EMISSION FACTORS ON VARIOUS ENGINE TIERS FOR POTENTIAL REDUCTIONS, AND THE CARB-AT-BERTH FINAL REGULATION ORDER FOR DEFAULT EMISSION FACTORS (BASELINE).

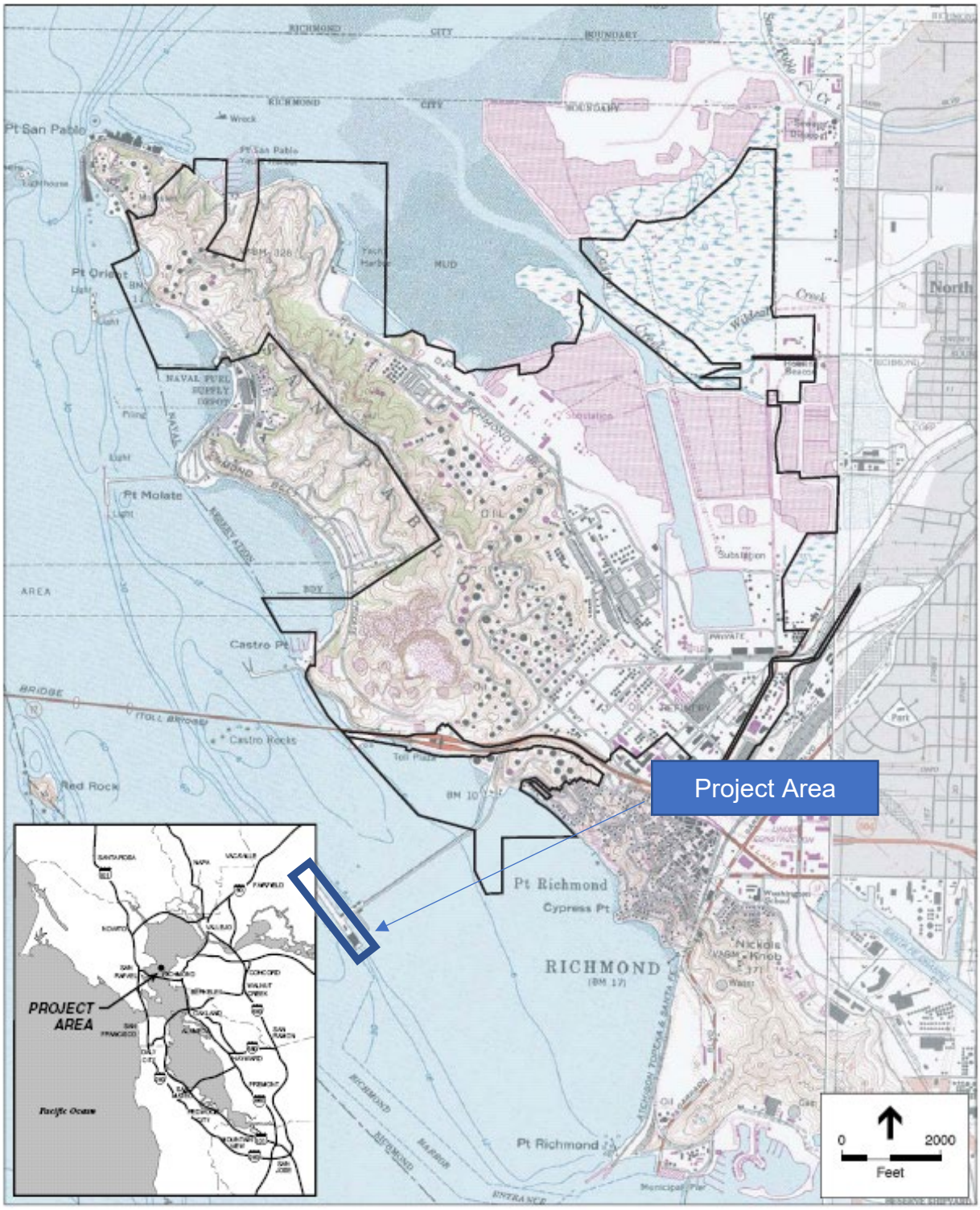
Appendix A10: Tier II or above Certification on Auxiliary Engines (AEs) for Ships

Group	Concept	Scope	% Applicable	Total Vessels	Total Calls	Avg Hotel Time [hrs]	Avg Call Pwr [kW]	Total Pwr [kW]	CARB SFC [kg/kWhr]	CARB Default Values (Baseline)			Estimated w/ Innovative Concept (New)			Total Estimated Annual Reductions		
										NOX [g/kWhr]	PM [g/kWhr]	ROG [g/kWhr]	NOX [g/kWhr]	PM [g/kWhr]	ROG [g/kWhr]	NOX [MT]	PM [MT]	ROG [MT]
Auxilaries	Tier III	SUEZMAX - SUB CLASS 2	100%	2	69	34	554	1,297,856	0.27	13.80	0.17	0.52	2.60	0.17	0.52	14.54	0.00	0.00
	Tier II	SUEZMAX - SUB CLASS 1	100%	1	1	24	768	18,499	0.27	13.80	0.17	0.52	10.50	0.17	0.52	0.06	0.00	0.00
	Tier II	SUEZMAX - SUB CLASS 3	100%	5	32	16	554	292,141	0.27	13.80	0.17	0.52	10.50	0.17	0.52	0.96	0.00	0.00
	Tier II	PRODUCT - SUB CLASS 1	100%	4	89	46	844	3,463,840	0.27	13.80	0.17	0.52	10.50	0.17	0.52	11.43	0.00	0.00
	Tier II	AFRAMAX - SUB CLASS 1	100%	2	7	65	792	358,241	0.27	13.80	0.17	0.52	10.50	0.17	0.52	1.18	0.00	0.00
	Tier II	VARIOUS - SUB CLASS 3	100%	67	95	51	807	3,872,579	0.27	13.80	0.17	0.52	10.50	0.17	0.52	12.78	0.00	0.00
	Tier II	VARIOUS - SUB CLASS 4	100%	5	17	54	844	767,728	0.27	13.80	0.17	0.52	10.50	0.17	0.52	2.53	0.00	0.00
	Tier II	VARIOUS - SUB CLASS 1	100%	3	3	26	1,121	86,292	0.27	13.80	0.17	0.52	10.50	0.17	0.52	0.28	0.00	0.00
	Tier II	VARIOUS - SUB CLASS 2	100%	28	65	34	769	1,709,862	0.27	13.80	0.17	0.52	10.50	0.17	0.52	5.64	0.00	0.00
Boilers	Boiler - No Change	SUEZMAX - SUB CLASS 2	100%	2	69	34	6,300	14,766,606	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	SUEZMAX - SUB CLASS 1	100%	1	1	24	3,583	86,356	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	SUEZMAX - SUB CLASS 3	100%	5	32	16	5,230	2,758,957	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	PRODUCT - SUB CLASS 1	100%	4	89	46	2,225	9,131,932	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	AFRAMAX - SUB CLASS 1	100%	2	7	65	1,821	823,014	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 3	100%	67	95	51	2,046	9,814,711	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 4	100%	5	17	54	1,402	1,275,825	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 1	100%	3	3	26	766	58,981	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 2	100%	28	65	34	2,819	6,268,117	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
												TOTAL				49.4	0.0	0.0

NOx reductions through early implementation of IC	2023	2024	2025	2026	Total reductions prior to 2027
IC10 - Tier II or above certification for Auxiliary Engines	27	28	28	31	114

Appendix A11: Tier III or above certification on Auxiliary Engines (AE's) for ships

Appendix A11: Richmond Refinery Site Map
Tier III or above certification on Auxiliary Engines (AE's) for ships



Appendix A10 -A13: Inputs for Appendices A10 through A13

	Master List	NOX [g/kWhr]	PM [g/kWhr]	ROG [g/kWhr]	Source:
Aux	Cold Ironing	0.00	0.00	0.00	
	Tier II	10.5	0.17	0.52	CARB Inventory
	Tier III	2.6	0.17	0.52	CARB Inventory
	Dual Fuel - LNG	1.3	0.03	0.52	IMO 4th GHG Study (NOX) + EPA Study (PM) + CARB Default (ROG)
	Aux - No Change	13.8	0.17	0.52	CARB-at-Berth default values
Boiler	Burner Upgrade	0.27	0.17	0.11	Alborg (NOX) + CARB Default (PM and ROG)
	Burner - LNG	0.13	0.17	0.11	IMO 4th GHG Study (NOX) + EPA Study (PM) + CARB Default (ROG)
	Boiler - No Change	2.00	0.17	0.11	CARB-at-Berth default values

1 2 3 4 5 6 7

2016 Class Breakdown	Total Vsls	Total Calls	Avg Hotel Time [hrs]	Total Hotel Time [hrs]	Aux Power / Call [kW]	Boiler Power / Call [kW]
SUEZMAX - SUB CLASS 1	1	1	24	24	768	3,583
SUEZMAX - SUB CLASS 2	2	69	34	2,344	554	6,300
SUEZMAX - SUB CLASS 3	5	32	16	528	554	5,230
AFRAMAX - SUB CLASS 1	2	7	65	452	792	1,821
PRODUCT - SUB CLASS 1	4	89	46	4,105	844	2,225
VARIOUS - SUB CLASS 1	3	3	26	77	1,121	766
VARIOUS - SUB CLASS 2	28	65	34	2,223	769	2,819
VARIOUS - SUB CLASS 3	67	95	51	4,798	807	2,046
VARIOUS - SUB CLASS 4	5	17	54	910	844	1,402
Grand Total	**117**	**378**		**15,460**		

^ Auto Calculated ^

GENERAL NOTE: CALCULATIONS AND PERCENT REDUCTIONS ARE BASED ON RLW's 2016 ACTUAL VESSEL CALL DURATIONS, THE 2020 PORT OF LONG BEACH INVENTORY METHODOLOGY FOR EQUIPMENT LOAD DURING VARIOUS OPERATIONS TO CALCULATE FUEL CONSUMPTIONS, CARB'S 2019 UPDATE TO INVENTORY FOR OCEAN-GOING VESSELS METHODOLOGY FOR EMISSION FACTORS ON VARIOUS ENGINE TIERS FOR POTENTIAL REDUCTIONS, AND THE CARB-AT-BERTH FINAL REGULATION ORDER FOR DEFAULT EMISSION FACTORS (BASELINE).

Appendix A11: Tier III or above Certification on Auxiliary Engines (AEs) for Ships

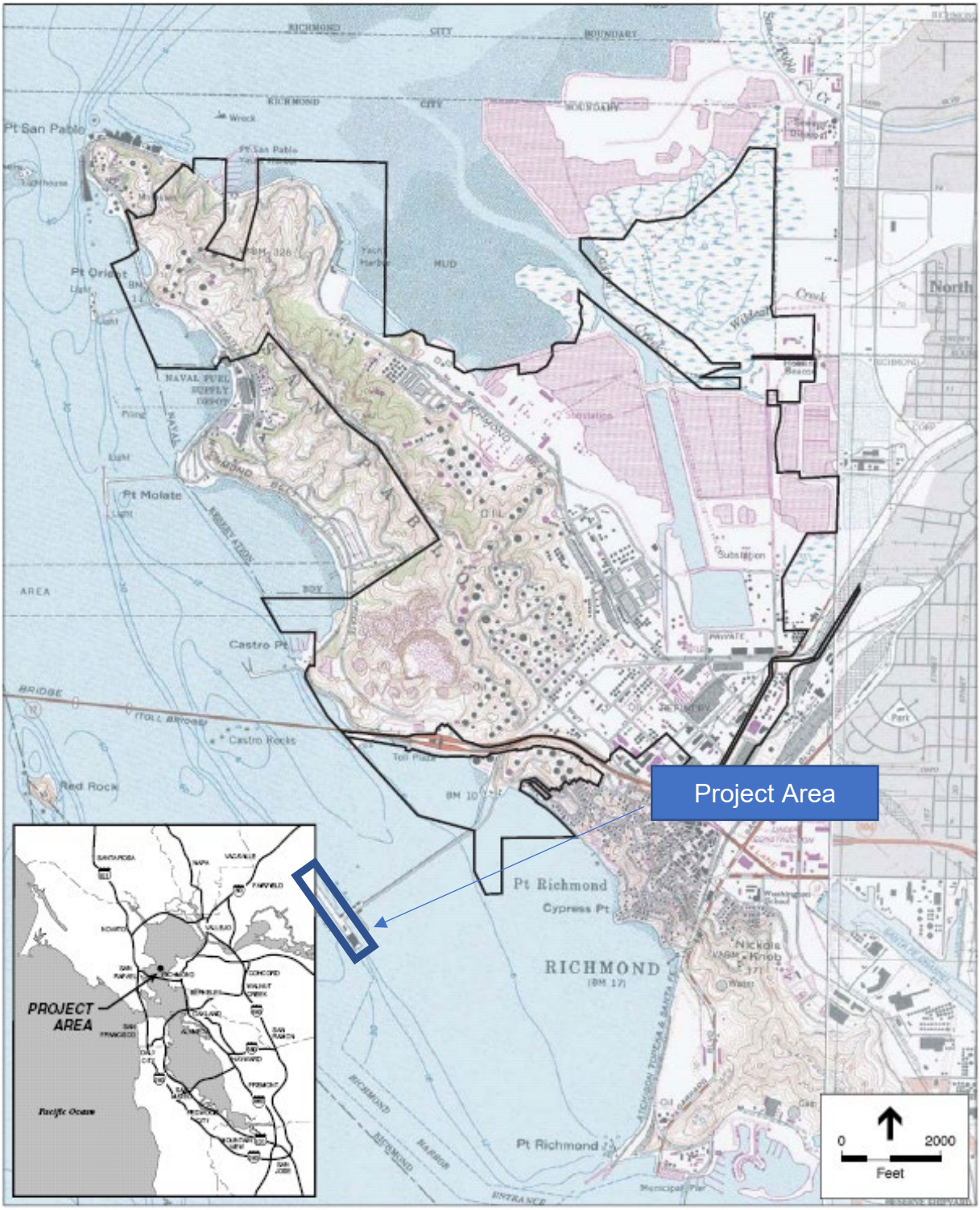
Group	Concept	Scope	% Applicable	Total Vessels	Total Calls	Avg Hotel Time [hrs]	Avg Call Pwr [kW]	Total Pwr [kW]	CARB SFC [kg/kWhr]	CARB Default Values (Baseline)			Estimated w/ Innovative Concept (New)			Total Estimated Annual Reductions		
										NOX [g/kWhr]	PM [g/kWhr]	ROG [g/kWhr]	NOX [g/kWhr]	PM [g/kWhr]	ROG [g/kWhr]	NOX [MT]	PM [MT]	ROG [MT]
Auxilaries	Tier III	SUEZMAX - SUB CLASS 2	100%	2	69	34	554	1,297,856	0.27	13.80	0.17	0.52	2.60	0.17	0.52	14.54	0.00	0.00
	Tier III	SUEZMAX - SUB CLASS 1	100%	1	1	24	768	18,499	0.27	13.80	0.17	0.52	2.60	0.17	0.52	0.21	0.00	0.00
	Tier III	SUEZMAX - SUB CLASS 3	100%	5	32	16	554	292,141	0.27	13.80	0.17	0.52	2.60	0.17	0.52	3.27	0.00	0.00
	Tier III	PRODUCT - SUB CLASS 1	100%	4	89	46	844	3,463,840	0.27	13.80	0.17	0.52	2.60	0.17	0.52	38.80	0.00	0.00
	Tier III	AFRAMAX - SUB CLASS 1	100%	2	7	65	792	358,241	0.27	13.80	0.17	0.52	2.60	0.17	0.52	4.01	0.00	0.00
	Tier III	VARIOUS - SUB CLASS 3	100%	67	95	51	807	3,872,579	0.27	13.80	0.17	0.52	2.60	0.17	0.52	43.37	0.00	0.00
	Tier III	VARIOUS - SUB CLASS 4	100%	5	17	54	844	767,728	0.27	13.80	0.17	0.52	2.60	0.17	0.52	8.60	0.00	0.00
	Tier III	VARIOUS - SUB CLASS 1	100%	3	3	26	1,121	86,292	0.27	13.80	0.17	0.52	2.60	0.17	0.52	0.97	0.00	0.00
	Tier III	VARIOUS - SUB CLASS 2	100%	28	65	34	769	1,709,862	0.27	13.80	0.17	0.52	2.60	0.17	0.52	19.15	0.00	0.00
Boilers	Boiler - No Change	SUEZMAX - SUB CLASS 2	100%	2	69	34	6,300	14,766,606	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	SUEZMAX - SUB CLASS 1	100%	1	1	24	3,583	86,356	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	SUEZMAX - SUB CLASS 3	100%	5	32	16	5,230	2,758,957	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	PRODUCT - SUB CLASS 1	100%	4	89	46	2,225	9,131,932	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	AFRAMAX - SUB CLASS 1	100%	2	7	65	1,821	823,014	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 3	100%	67	95	51	2,046	9,814,711	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 4	100%	5	17	54	1,402	1,275,825	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 1	100%	3	3	26	766	58,981	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 2	100%	28	65	34	2,819	6,268,117	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
												TOTAL				132.9	0.0	0.0

NOx reductions through early implementation of IC	2023	2024	2025	2026	Total reductions prior to 2027
IC11 - Tier III or above certification for Auxiliary Engines	57	61	61	69	248

Appendix A12: Upgraded Combustion and Control systems for Auxiliary Boilers (AB's) for ships

Appendix A12: Richmond Refinery Site Map

Upgraded Combustion and Control systems for Auxiliary Boilers (AB's) for Ships



Appendix A10 -A13: Inputs for Appendices A10 through A13

	Master List	NOX [g/kWhr]	PM [g/kWhr]	ROG [g/kWhr]	Source:
Aux	Cold Ironing	0.00	0.00	0.00	
	Tier II	10.5	0.17	0.52	CARB Inventory
	Tier III	2.6	0.17	0.52	CARB Inventory
	Dual Fuel - LNG	1.3	0.03	0.52	IMO 4th GHG Study (NOX) + EPA Study (PM) + CARB Default (ROG)
	Aux - No Change	13.8	0.17	0.52	CARB-at-Berth default values
Boiler	Burner Upgrade	0.27	0.17	0.11	Alborg (NOX) + CARB Default (PM and ROG)
	Burner - LNG	0.13	0.17	0.11	IMO 4th GHG Study (NOX) + EPA Study (PM) + CARB Default (ROG)
	Boiler - No Change	2.00	0.17	0.11	CARB-at-Berth default values

1 2 3 4 5 6 7

2016 Class Breakdown	Total Vsls	Total Calls	Avg Hotel Time [hrs]	Total Hotel Time [hrs]	Aux Power / Call [kW]	Boiler Power / Call [kW]
SUEZMAX - SUB CLASS 1	1	1	24	24	768	3,583
SUEZMAX - SUB CLASS 2	2	69	34	2,344	554	6,300
SUEZMAX - SUB CLASS 3	5	32	16	528	554	5,230
AFRAMAX - SUB CLASS 1	2	7	65	452	792	1,821
PRODUCT - SUB CLASS 1	4	89	46	4,105	844	2,225
VARIOUS - SUB CLASS 1	3	3	26	77	1,121	766
VARIOUS - SUB CLASS 2	28	65	34	2,223	769	2,819
VARIOUS - SUB CLASS 3	67	95	51	4,798	807	2,046
VARIOUS - SUB CLASS 4	5	17	54	910	844	1,402
Grand Total	**117**	**378**		**15,460**		

^ Auto Calculated ^

GENERAL NOTE: CALCULATIONS AND PERCENT REDUCTIONS ARE BASED ON RLW's 2016 ACTUAL VESSEL CALL DURATIONS, THE 2020 PORT OF LONG BEACH INVENTORY METHODOLOGY FOR EQUIPMENT LOAD DURING VARIOUS OPERATIONS TO CALCULATE FUEL CONSUMPTIONS, CARB'S 2019 UPDATE TO INVENTORY FOR OCEAN-GOING VESSELS METHODOLOGY FOR EMISSION FACTORS ON VARIOUS ENGINE TIERS FOR POTENTIAL REDUCTIONS, AND THE CARB-AT-BERTH FINAL REGULATION ORDER FOR DEFAULT EMISSION FACTORS (BASELINE).

Appendix A12: Upgraded Combustion and Control Systems for Auxiliary Boilers (ABs) for Ships

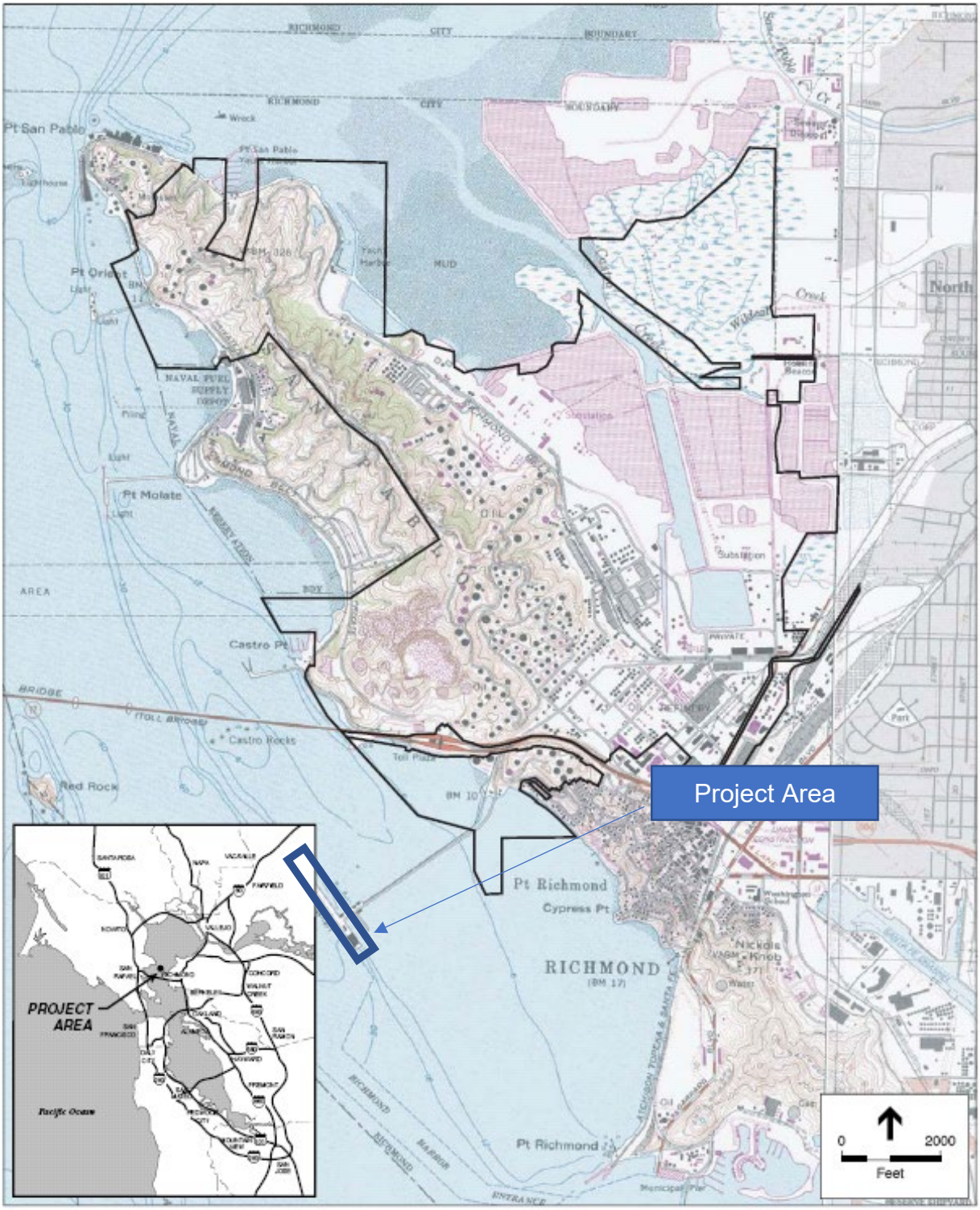
Group	Concept	Scope	% Applicable	Total Vessels	Total Calls	Avg Hotel Time [hrs]	Avg Call Pwr [kW]	Total Pwr [kW]	CARB SFC [kg/kWhr]	CARB Default Values (Baseline)			Estimated w/ Innovative Concept (New)			Total Estimated Annual Reductions		
										NOX [g/kWhr]	PM [g/kWhr]	ROG [g/kWhr]	NOX [g/kWhr]	PM [g/kWhr]	ROG [g/kWhr]	NOX [MT]	PM [MT]	ROG [MT]
Auxilaries	Aux - No Change	SUEZMAX - SUB CLASS 2	100%	2	69	34	554	1,297,856	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Aux - No Change	SUEZMAX - SUB CLASS 1	100%	1	1	24	768	18,499	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Aux - No Change	SUEZMAX - SUB CLASS 3	100%	5	32	16	554	292,141	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Aux - No Change	PRODUCT - SUB CLASS 1	100%	4	89	46	844	3,463,840	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Aux - No Change	AFRAMAX - SUB CLASS 1	100%	2	7	65	792	358,241	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Aux - No Change	VARIOUS - SUB CLASS 3	100%	67	95	51	807	3,872,579	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Aux - No Change	VARIOUS - SUB CLASS 4	100%	5	17	54	844	767,728	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Aux - No Change	VARIOUS - SUB CLASS 1	100%	3	3	26	1,121	86,292	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Aux - No Change	VARIOUS - SUB CLASS 2	100%	28	65	34	769	1,709,862	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
Boilers	Burner Upgrade	SUEZMAX - SUB CLASS 2	100%	2	69	34	6,300	14,766,606	0.27	2.00	0.17	0.11	0.27	0.17	0.11	25.55	0.00	0.00
	Boiler - No Change	SUEZMAX - SUB CLASS 1	100%	1	1	24	3,583	86,356	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Burner Upgrade	SUEZMAX - SUB CLASS 3	100%	5	32	16	5,230	2,758,957	0.27	2.00	0.17	0.11	0.27	0.17	0.11	4.77	0.00	0.00
	Burner Upgrade	PRODUCT - SUB CLASS 1	100%	4	89	46	2,225	9,131,932	0.27	2.00	0.17	0.11	0.27	0.17	0.11	15.80	0.00	0.00
	Burner Upgrade	AFRAMAX - SUB CLASS 1	100%	2	7	65	1,821	823,014	0.27	2.00	0.17	0.11	0.27	0.17	0.11	1.42	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 3	100%	67	95	51	2,046	9,814,711	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 4	100%	5	17	54	1,402	1,275,825	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 1	100%	3	3	26	766	58,981	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 2	100%	28	65	34	2,819	6,268,117	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
												TOTAL				47.5	0.0	0.0

NOx reductions through early implementation of IC	2023	2024	2025	2026	Total reductions prior to 2027
IC12 - Upgrade combustion and control systems for Auxiliary Boilers	15	22	48	48	133

Appendix A13: Dual-Fuel Tier III Auxiliary Engines (AE's) and Auxiliary Boilers (AB's)

Appendix A13: Richmond Refinery Site Map

Dual-Fuel Tier III Auxiliary Engines (AE's) and Auxiliary Boilers (AB's)



Appendix A10 -A13: Inputs for Appendices A10 through A13

	Master List	NOX [g/kWhr]	PM [g/kWhr]	ROG [g/kWhr]	Source:
Aux	Cold Ironing	0.00	0.00	0.00	
	Tier II	10.5	0.17	0.52	CARB Inventory
	Tier III	2.6	0.17	0.52	CARB Inventory
	Dual Fuel - LNG	1.3	0.03	0.52	IMO 4th GHG Study (NOX) + EPA Study (PM) + CARB Default (ROG)
	Aux - No Change	13.8	0.17	0.52	CARB-at-Berth default values
Boiler	Burner Upgrade	0.27	0.17	0.11	Alborg (NOX) + CARB Default (PM and ROG)
	Burner - LNG	0.13	0.17	0.11	IMO 4th GHG Study (NOX) + EPA Study (PM) + CARB Default (ROG)
	Boiler - No Change	2.00	0.17	0.11	CARB-at-Berth default values

1 2 3 4 5 6 7

2016 Class Breakdown	Total Vsls	Total Calls	Avg Hotel Time [hrs]	Total Hotel Time [hrs]	Aux Power / Call [kW]	Boiler Power / Call [kW]
SUEZMAX - SUB CLASS 1	1	1	24	24	768	3,583
SUEZMAX - SUB CLASS 2	2	69	34	2,344	554	6,300
SUEZMAX - SUB CLASS 3	5	32	16	528	554	5,230
AFRAMAX - SUB CLASS 1	2	7	65	452	792	1,821
PRODUCT - SUB CLASS 1	4	89	46	4,105	844	2,225
VARIOUS - SUB CLASS 1	3	3	26	77	1,121	766
VARIOUS - SUB CLASS 2	28	65	34	2,223	769	2,819
VARIOUS - SUB CLASS 3	67	95	51	4,798	807	2,046
VARIOUS - SUB CLASS 4	5	17	54	910	844	1,402
Grand Total	**117**	**378**		**15,460**		

^ Auto Calculated ^

GENERAL NOTE: CALCULATIONS AND PERCENT REDUCTIONS ARE BASED ON RLW's 2016 ACTUAL VESSEL CALL DURATIONS, THE 2020 PORT OF LONG BEACH INVENTORY METHODOLOGY FOR EQUIPMENT LOAD DURING VARIOUS OPERATIONS TO CALCULATE FUEL CONSUMPTIONS, CARB'S 2019 UPDATE TO INVENTORY FOR OCEAN-GOING VESSELS METHODOLOGY FOR EMISSION FACTORS ON VARIOUS ENGINE TIERS FOR POTENTIAL REDUCTIONS, AND THE CARB-AT-BERTH FINAL REGULATION ORDER FOR DEFAULT EMISSION FACTORS (BASELINE).

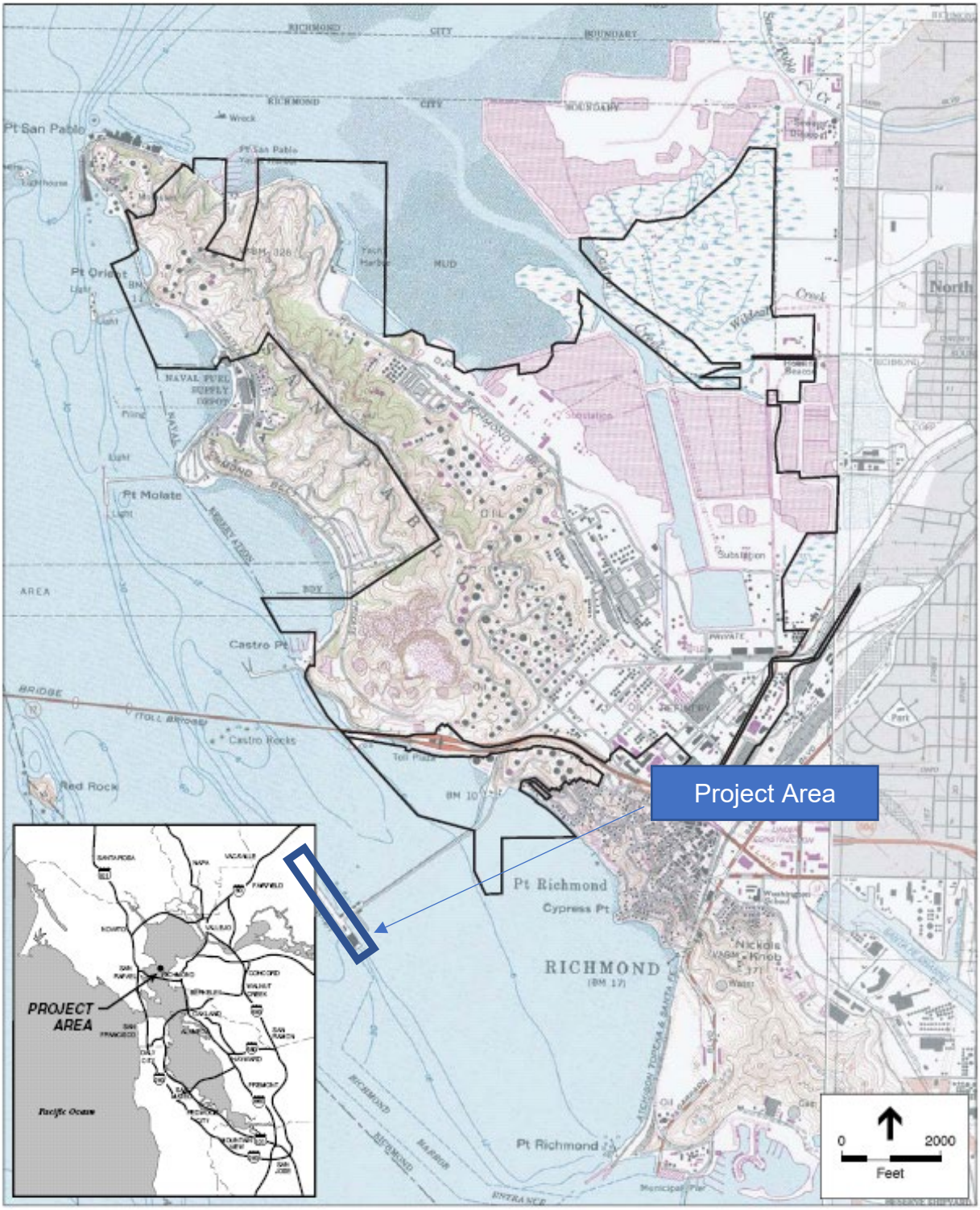
Appendix A13: Dual-Fire Tier III Auxiliary Engines (AEs) and Auxiliary Boilers (ABs)

Group	Concept	Scope	% Applicable	Total Vessels	Total Calls	Avg Hotel Time [hrs]	Avg Call Pwr [kW]	Total Pwr [kW]	CARB SFC [kg/kWhr]	CARB Default Values (Baseline)			Estimated w/ Innovative Concept (New)			Total Estimated Annual Reductions		
										NOX [g/kWhr]	PM [g/kWhr]	ROG [g/kWhr]	NOX [g/kWhr]	PM [g/kWhr]	ROG [g/kWhr]	NOX [MT]	PM [MT]	ROG [MT]
Auxilaries	Aux - No Change	SUEZMAX - SUB CLASS 2	100%	2	69	34	554	1,297,856	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Aux - No Change	SUEZMAX - SUB CLASS 1	100%	1	1	24	768	18,499	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Aux - No Change	SUEZMAX - SUB CLASS 3	100%	5	32	16	554	292,141	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Dual Fuel - LNG	PRODUCT - SUB CLASS 1	50%	2	45	46	844	1,731,920	0.27	13.80	0.17	0.52	1.30	0.03	0.52	21.65	0.24	0.00
	Aux - No Change	PRODUCT - SUB CLASS 1	50%	2	45	46	844	1,731,920	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Dual Fuel - LNG	AFRAMAX - SUB CLASS 1	100%	2	7	65	792	358,241	0.27	13.80	0.17	0.52	1.30	0.03	0.52	4.48	0.05	0.00
	Aux - No Change	VARIOUS - SUB CLASS 3	100%	67	95	51	807	3,872,579	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Dual Fuel - LNG	VARIOUS - SUB CLASS 4	40%	2	7	54	844	307,091	0.27	13.80	0.17	0.52	1.30	0.03	0.52	3.84	0.04	0.00
	Aux - No Change	VARIOUS - SUB CLASS 4	60%	3	10	54	844	460,637	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Aux - No Change	VARIOUS - SUB CLASS 1	100%	3	3	26	1,121	86,292	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
	Aux - No Change	VARIOUS - SUB CLASS 2	100%	28	65	34	769	1,709,862	0.27	13.80	0.17	0.52	13.80	0.17	0.52	0.00	0.00	0.00
Boilers	Boiler - No Change	SUEZMAX - SUB CLASS 2	100%	2	69	34	6,300	14,766,606	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	SUEZMAX - SUB CLASS 1	100%	1	1	24	3,583	86,356	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	SUEZMAX - SUB CLASS 3	100%	5	32	16	5,230	2,758,957	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Burner - LNG	PRODUCT - SUB CLASS 1	50%	2	45	46	2,225	4,565,966	0.27	2.00	0.17	0.11	0.13	0.17	0.11	8.54	0.00	0.00
	Boiler - No Change	PRODUCT - SUB CLASS 1	50%	2	45	46	2,225	4,565,966	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Burner - LNG	AFRAMAX - SUB CLASS 1	100%	2	7	65	1,821	823,014	0.27	2.00	0.17	0.11	0.13	0.17	0.11	1.54	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 3	100%	67	95	51	2,046	9,814,711	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Burner - LNG	VARIOUS - SUB CLASS 4	40%	2	7	54	1,402	510,330	0.27	2.00	0.17	0.11	0.13	0.17	0.11	0.95	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 4	60%	3	10	54	1,402	765,495	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 1	100%	3	3	26	766	58,981	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
	Boiler - No Change	VARIOUS - SUB CLASS 2	100%	28	65	34	2,819	6,268,117	0.27	2.00	0.17	0.11	2.00	0.17	0.11	0.00	0.00	0.00
												TOTAL				41.0	0.3	0.0

NOx reductions through early implementation of IC	2023	2024	2025	2026	Total reductions prior to 2027
IC13 - Dual-Fuel Tier III Auxiliary Engines and Auxiliary Boilers	0	0	10	41	51

Appendix A14: Shore Power or Stack Capture for Barges and Tug Boats

Appendix A14: Richmond Refinery Site Map
Shore Power or Stack Capture for Barges and Tug Boats

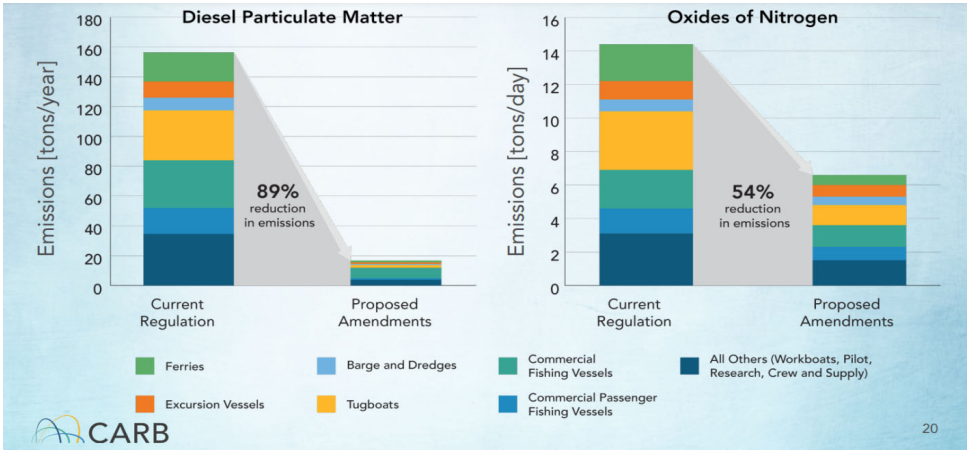


Appendix A14: Shore Power or Stack Capture for Barges and Tug Boats

- As a baselines for this IC project, RLW emissions calculated as part of the "2021 Update to the Emissions Inventory for Commercial Harbor Craft: Methodology and Results" by CARB are used.
- Assumes that the CARB Commercial Harbor Craft rule will reduce NOx by 54%, PM by 89% and ROG by 54% (same as NOx) percent. See below.
- Assumes that stack capture and/or shore power will further reduce emissions by 50%. True reduction will be higher but this is a conservative estimate.

Baseline Emissions			
Year	NOX (MTPY)	PM (MTPY)	HC (MTPY)
2027	95.34	3.21	6.06
2028	95.13	3.19	6.02
2029	94.85	3.18	5.96
2030	94.40	3.15	5.89
2031	93.73	3.12	5.81
2032	93.03	3.08	5.71
2033	92.31	3.04	5.62
2034	91.56	3.00	5.53
2035	90.81	2.96	5.44
2036	90.02	2.91	5.34
2037	89.14	2.86	5.24
2038	88.25	2.81	5.14
2039	87.37	2.76	5.04
2040	86.51	2.72	4.94
2041	85.65	2.67	4.85
2042	84.81	2.62	4.75
2043	83.99	2.58	4.66
2044	83.19	2.53	4.57
2045	82.33	2.49	4.48
2046	81.43	2.45	4.39
2047	80.53	2.41	4.30
2048	79.64	2.36	4.21
2049	78.71	2.32	4.12
2050	77.78	2.28	4.03

IC Project Reduction			
Year	NOX (MTPY)	PM (MTPY)	HC (MTPY)
2027	21.93	0.18	1.39
2028	21.88	0.18	1.38
2029	21.81	0.17	1.37
2030	21.71	0.17	1.36
2031	21.56	0.17	1.34
2032	21.40	0.17	1.31
2033	21.23	0.17	1.29
2034	21.06	0.16	1.27
2035	20.89	0.16	1.25
2036	20.70	0.16	1.23
2037	20.50	0.16	1.21
2038	20.30	0.15	1.18
2039	20.10	0.15	1.16
2040	19.90	0.15	1.14
2041	19.70	0.15	1.11
2042	19.51	0.14	1.09
2043	19.32	0.14	1.07
2044	19.13	0.14	1.05
2045	18.94	0.14	1.03
2046	18.73	0.13	1.01
2047	18.52	0.13	0.99
2048	18.32	0.13	0.97
2049	18.10	0.13	0.95
2050	17.89	0.13	0.93



Note: The net reduction in PG&E electricity usage means a net reduction in GHGs.