

## **Appendix E – Berth Analysis**

## **CARB Staff Analysis of Potential Emission Reduction Strategies by Port/Terminal/Berth**

### **For Container and Refrigerated Cargo (Reefer) Vessels**

September 2019

The berth analysis is an assessment made by California Air Resources Board (CARB) staff to characterize what additional shore power infrastructure improvements and potential emission control technologies (land- or barge-based alternative capture and control systems) may be necessary to support the new draft At Berth Regulation for container and refrigerated cargo (reefer) vessels. For the development of the analysis CARB staff relied on port maps, Google Earth maps, and vessel visit information from Wharfinger, San Francisco Marine Exchange, and California States Lands Commission data. CARB staff's assessment was based on comment letters received from industry stakeholders in response to the new draft At Berth Regulation, numerous port/terminal site visits and tours, extensive discussions with terminal operators, port staff throughout the state, and harbor pilots servicing the Northern and Southern California Ports.

The assessment assisted CARB staff in estimating the potential costs that could be incurred due to infrastructure and/or equipment upgrades as a result of the requirements of the new draft At Berth Regulation.

Legend:

C+C= Capture and control system

SP= Shore power

Prop 1B = In 2006, California voters approved Proposition 1B (Prop 1B) which authorizes \$1 billion in bond funding to CARB to reduce freight related emissions in the State's trade corridor. The program focuses on funding cleaner equipment or related infrastructure for various emission sources, including port-related equipment such as shore power and emissions capture and control systems.

Frequent vessels = Vessels that visited any California location in 2017 four or more times

Infrequent vessels = Vessels that visited any California location in 2017 three or fewer times

\* Prop 1B Funding, Performance Option 1 - Plug in requirement is a percentage of all visits to the berth by vessels regulated under the existing At-Berth Regulation

\*\* Prop 1B Funding, Performance Option 2 - Plug in requirement is a percentage of all visits to the berth by all vessels visiting the berth

\*\*\* Prop 1B Funding for these berths were an early grant prior to the Performance Options; requirement is for a percentage of all ship visits. This grant required the installation of 3 vaults at berths 60-63 (grantee chose which berths)

\*\*\*\*These 25 visits were previously under Berth 406, but Port of LA advised us Berth 406 is not in use; reassigned visits to Berth 405

Subject Headers:

- Prop 1B Berth? = Indicates which specific berth at a port/terminal was funded through Prop 1B for shore power infrastructure and plug in performance requirements

- Total # Container & Reefer Visits in 2017 = Total number of container and reefer vessel visits by berth based on 2017 visit information

(visit information includes vessel visits made by vessels subject to the existing At-Berth Regulation and unregulated vessels)

- # of Anticipated Newly Regulated Vessel Visits = Number of visits made by container and reefer vessels currently not subject to the existing At-Berth Regulation

- # of Visits from Infrequent Vessels Not Anticipated To Install SP = Number of visits staff estimate will use capture and control (or alternative technologies), instead of shore power
- # of Existing Vaults = Number of existing land-side vaults installed (to connect vessel-based shore power to land-side shore power)
- Additional SP Infrastructure Assumed? = Staff's estimates of potential infrastructure needs based on number of vessels that are currently not subject to the existing At-Berth Regulation and vessels that are currently subject to the regulation but will be required to meet vessel visit requirements once the new At Berth Regulation becomes effective
- Estimated # of Additional C+C Systems Needed = Number of emission capture and control system (land- or barge- based) that CARB staff's analysis indicates may be most feasible for use per port
- Reasoning = Basis for CARB staff analysis and assumptions



BerthLevelCARBStaffAnalysisofPotentialEmissionReductionStrategies  
August 2019

Port/Terminal/Berth	Prop 1B Berth?	Total # of Container & Reefer Visits in 2017	# of Anticipated Newly Regulated Vessel Visits	# of Visits from Infrequent Vessels Not Anticipated To Install SP	# of Existing Vaults	Additional SP Infrastructure Assumed?	Estimated # of Additional C+C Systems Needed	Reasoning
Hueneme	3	155	0	0	6	No	0	Hueneme will continue to rely on SP for compliance, as all reefer berths are SP capable. Port already owns a cable reel management system.
Wharf 1	3	155	0	0	6	No	0	Wharf 1 has SP at all three berths. Port staff advised CARB staff that they have already purchased a cable reel management system, but are unable to use it at this time due to design flaws. Due to space and navigation constraints, barge-based C+C systems are not feasible at Wharf 1. Berths are all Prop 1B berths; not assuming any additional infrastructure needed.
Berth B1	Yes, Option 1*	1			2			
Berth B2	Yes, Option 1*	117	0	0	2	No	0	All berths have SP; up to three vessels can use SP at the same time.
Berth B3	Yes, Option 1*	37			2			

One berth used 190 days of the year, two berths used at same time 67 days of the year (in 2017)

BerthLevelCARBStaffAnalysisofPotentialEmissionReductionStrategies  
August 2019

Port/Terminal/Berth	Prop 1B Berth?	Total # of Container & Reefer Visits in 2017	# of Anticipated Newly Regulated Vessel Visits	# of Visits from Infrequent Vessels Not Anticipated To Install SP	# of Existing Vaults	Additional SP Infrastructure Assumed?	Estimated # of Additional C+C Systems Needed	Reasoning
Long Beach	11	909	89	34	70	No	1 additional C+C (shared across POLB/POLA) - Terminals need access to an estimated 1 additional barge-based C+C system	POLB will continue to primarily rely on SP for compliance.
SSA - Pier A	3	225	36	14	9	No	1 (shared access across Port)	Terminal staff advised CARB staff that this terminal will continue to rely on SP for compliance. Terminal staff advised that Pier A sees limited vessel sizes due to bridge and channel restrictions; no purchase of a cable reel management system is anticipated. Vessels berth only Port side due to Pilots preference for safe navigation. Terminal may need occasional access to barge-based C+C system for vessels with SP connection only onstarboard side, but no dedicated system. Terminal staff confirmed a barge-based C+C system will fit alongside vessels if needed. No additional vaults assumed due to low frequency of all berths being used at the same time, and because all berths are Prop 1B berths; not assuming any additional infrastructure needed.
A92	Yes, Option2**	43			3	No		
A94	Yes, Option2**	104	36	14	3	No	0	All berths have SP; up to three vessels can use SP at the same time.
A96	Yes, Option 2**	78			3	No		
One berth used 176 days of the year, two berths used at same time 114 days of the year, three berths used at same time 17 days of the year (in 2017)								
SSA - Pier C	0	82	9	0	8	No	0	Pier C staff advised CARB staff this is a dedicated terminal that will continue to rely solely on SP for compliance. No purchase of additional cable reel management systems are anticipated. No additional vaults assumed as terminal staff indicates they primarily only use one berth and one vault.
C60	No	1			4	No	0	
C62	No	81	9	0	4	No	0	The terminal has two SP-capable berths, but typically uses only one; the terminal also has 8 vaults in total.
One berth used 316 days of the year, two berths used at same time 19 days of the year (in 2017) - includes both container and con-ro vessel visits								

BerthLevelCARBStaffAnalysisofPotentialEmissionReductionStrategies  
August 2019

Port/Terminal/Berth	Prop 1B Berth?	Total # of Container & Reefer Visits in 2017	# of Anticipated Newly Regulated Vessel Visits	# of Visits from Infrequent Vessels Not Anticipated To Install SP	# of Existing Vaults	Additional SP Infrastructure Assumed?	Estimated # of Additional C+C Systems Needed	Reasoning
Long Beach Container Terminal - Pier E	0	83	5	3	10	No	0	Lease with POLB already requires 100% controls (either SP or barge-based bonnet C+C system is currently used for compliance), so CARB staff not assuming any additional infrastructure needed. Per conversation with terminal staff, LBCT can plug in 2 vessels at a time - one at each berth. Terminal already owns two cable reel management systems. Third berth (E22) is currently under construction, and should be finished by early 2022 at the latest. Berth E22 will also be SP capable and terminal will have enough power for all vessels to plug in at all three berths at the same time.
E22	No	Under Construction	Under Construction	Under Construction	0	Under Construction	0	Pier E will be installing 5 SPOs as part of Phase 3 of the Middle Harbor Project at Long Beach Container Terminal. These vaults are being installed as a cost to the Existing Regulation.
E24	No	34	5	3	5	No		Both existing berths have SP. Terminal has enough power to supply SP to both berths at the same time.
E26	No	49			5			
One berth used 231 days of the year, two berths used at same time 78 days of the year (in 2017)								
International Transportation Service - Pier G	1	146	14	2	12	No	1 (shared access can across Port)	Per CARB staff information Berths G232 and G236 have SP. Have not been able to confirm with Terminal about how many vessels can plug into SP at the Terminal at the same time; assuming no additional power needed at this time. SP infrastructure, operational changes, or access to a barge-based C+C system may be needed at berth G235, but no dedicated system (to be confirmed with Terminal). No additional vaults assumed at this terminal.
G232	No	53			5	No		Berth has SP - Port of LB installed
G235	No	25	14	2	1	No	1 (shared across Port)	Berth has limited SP usage; built for a specific vessel design. Vessel must be a certain size (5500 TEU and smaller), can only use AMP box if located at aft end.
G236	Yes, Option 2**	68			6	No		Berth has SP - Port of LB installed
One berth used 117 days of the year, two berths used at same time 160 days of the year, three berths used at same time 27 days of the year (in 2017)								



BerthLevelCARBStaffAnalysisofPotentialEmissionReductionStrategies  
August 2019

Port/Terminal/Berth	Prop 1B Berth?	Total # of Container & Reefer Visits in 2017	# of Anticipated Newly Regulated Vessel Visits	# of Visits from Infrequent Vessels Not Anticipated To Install SP	# of Existing Vaults	Additional SP Infrastructure Assumed?	Estimated # of Additional C+C Systems Needed	Reasoning
Pacific Container Terminal - Pier J	4	138	18	11	20	No	1 (shared access three across Port)	Pier J staff confirmed terminal will continue to rely on SP for compliance. Terminal staff informed CARB staff that vessels berth port-side at berths J245-J247 (north berths) and starboard-side at J266-J270 (south berths) due to safety of terminal container yard operations. North berths have 1 substation, south berths have 2 substations. Can energize up to four vessels at a time, but only three vessels fit due to vessel size constraints at this time. Terminal staff advised no cable reel needed unless there is a significant change to the types of vessels calling this terminal. Terminal may need occasional access to barge-based C+C system for vessels with SP connection only on one side, but no dedicated system. No additional vaults assumed due to low frequency of all berths being used at the same time, and because berths are all Prop 1B berths; not assuming any additional infrastructure needed.
J245	Yes, Option 2**	52				No		Berth has SP; vessels calling this berth will be positioned on port-side. This is the main berth used on the north side of the terminal.
J246	No	0			9	No		Berth has SP; vessels calling this berth will be positioned on port-side. Typically only used when berth J245 is not available.
J247	Yes, Option 2**	0	18	11		No	1 (shared across Port)	Berth has SP; vessels calling this berth will be positioned on port-side. Low number of visits to this berth, as the size of the berth makes it only useable for smaller vessels.
J266	Yes, Option 2**	65			11	No		Berth has SP; vessels calling this berth will be positioned on starboard-side. This is the main berth used on the south side of the terminal.
J270	Yes, Option 2**	21				No		Berth has SP; vessels calling this berth will be positioned on starboard-side. This berth is typically used when berth J266 is not available.

One berth used 147 days of the year, two berths used at same time 153 days of the year, three berths used at same time 30 days of the year (in 2017)

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Port/Terminal/Berth	Prop 1B Berth?	Total # of Container & Reefer Visits in 2017	# of Anticipated Newly Regulated Vessel Visits	# of Visits from Infrequent Vessels Not Anticipated To Install SP	# of Existing Vaults	Additional SP Infrastructure Assumed?	Estimated # of Additional C+C Systems Needed	Reasoning
Total Terminals Inc. - Pier T	3	235	7	4	11	No	0	Pier T can energize four vessels at a time, but due to current vessel size and alignment constraints, can plug in a maximum of three vessels at a time. Terminal already owns one 100 foot cable reel management system, but can only use on vessels with aft AMP connection due to wharf space constraints. Vessels can berth port or starboard side due to location next to large turning basin. Terminal recently completed vault relocation; no additional vault installation assumed at this time.
T132	No	1						
T134	No	124			4	No		Berth has SP
T136	Yes, Option2**	55	7	4	2	No		Berth has SP
T138	Yes, Option2**	12			3	No	0	Berth has SP
T140	Yes, Option2**	43			2	No		Berth has SP
One berth used 83 days of the year, two berths used at same time 138 days of the year, three berths used at same time 117 days of the year (in 2017)								
1 Per POLB, the port has 78 total vaults; confirming location of 8 additional vaults								
Los Angeles	10	1029	123	21	70	Yes - additional 2 vaults at WBCT Berths 121 and 126	1 additional C+C (shared across POLA/POLB) - Terminals need access to an estimated 1 additional barge-based C+C system	POLA will continue to primarily rely on SP for compliance, with some use of the barge-based system for non-SP capable vessels or for situations where the terminal is unable to connect a SP-capable vessel to SP for operational reasons.
APM	5	202	10	3	20	No	0	All of APM's active berths from 2017 are SP capable; up to 6 vessels can be connected to SP at the same time. Vessels can berth port or starboard-side, with starboard-side being typical. Terminal has a large turning basin nearby that allows access for turning vessels. Terminal has a high number of existing vaults and all are Prop 1B berths; not assuming any additional infrastructure needed.
Berth 401	Yes, Option2**	1			4			Berth has SP and a low # of visits
Berth 402	Yes, Option2**	54			4			Berth has SP
Berth 403	Yes, Option2**	60	10	3	4	No	0	Berth has SP
Berth 404	Yes, Option2**	62			4			Berth has SP
Berth 405****	Yes, Option2**	25			4			Berth has SP, but no visits in 2017
One berth used 108 days of the year, two berths used at same time 148 days of the year, three berths used at same time 70 days of the year, four berths used at same time 28 days of the year (in 2017)								

BerthLevelCARBStaffAnalysisofPotentialEmissionReductionStrategies  
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Port/Terminal/Berth	Prop 1B Berth?	Total # of Container & Reefer Visits in 2017	# of Anticipated Newly Regulated Vessel Visits	# of Visits from Infrequent Vessels Not Anticipated To Install SP	# of Existing Vaults	Additional SP Infrastructure Assumed?	Estimated # of Additional C+C Systems Needed	Reasoning
Everport	1	142	5	2	3	No	0	All of Terminal's active berths from 2017 are SP capable, with no visits recorded from unregulated vessels. Terminal staff confirmed they can plug in 2 vessels at the same time. Port is adding an additional 5 total vaults in the 2019-2021 timeframe. These vaults are being installed as a cost to the Existing Regulation. No cable reel considered for this terminal due to installation of new vaults occurring in 2019-2021.
Berth 227	Yes, Option2**	82	5	2	2	No	0	Berth has SP; port adding 2 additional vaults. These vaults are being installed as a cost to the Existing Regulation.
Berth 230	No	60			1			Berth has SP; port adding 3 additional vaults. These vaults are being installed as a cost to the Existing Regulation.
One berth used 143 days of the year, two berths used at same time 202 days of the year (in 2017)								
Fenix Marine	0	132	19	10	15	No	0	All of Terminal's active berths from 2017 are SP capable per CARB staff information. Confirming with Terminal about how many vessels can plug into SP at the same time.
Berth 302	No	68	19	10	4	No	0	Berth has SP
Berth 303	No	43			4			Berth has SP
Berth 304	No	19			4			Berth has SP
Berth 305	No	2			3			Berth has SP
One berth used 123 days of the year, two berths used at same time 180 days of the year, three berths used at same time 51 days of the year (in 2017)								

BerthLevel CARB Staff Analysis of Potential Emission Reduction Strategies  
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Port/Terminal/Berth	Prop 1B Berth?	Total # of Container & Reefer Visits in 2017	# of Anticipated Newly Regulated Vessel Visits	# of Visits from Infrequent Vessels Not Anticipated To Install SP	# of Existing Vaults	Additional SP Infrastructure Assumed?	Estimated # of Additional C+C Systems Needed	Reasoning
TraPac	0	99	3	1	10	No	0	Terminal only uses berths 139, 144, and 147; all three have SP and can energize three vessels at a time. No need for a cable reel management system is anticipated, as terminal staff advised CARB staff that they plan vessel berthing positions around where vessel AMP connections are located. Terminal staff advised CARB staff the terminal has an existing mitigation requirement to control 100% of emissions (SP or C+C system), so no additional infrastructure assumed at this terminal.
Berth 136	No	0			2			Berth has SP
Berth 139	No	45	3	1	2	No	0	Berth has SP
Berth 144	No	46			2			Berth has SP
Berth 147	No	8			4			Berth has SP
One berth used 247 days of the year, two berths used at same time 99 days of the year, three berths used at same time 3 days of the year (in 2017)								
WBCT - China Shipping	0	118	2	0	8	No	0	WBCT consists of the China Shipping dock and the Yang Ming dock. The terminal has four total SP capable berths, and can energize a maximum of four vessels at a time. Three vessels is maximum that will fit at the berths at any one time due to space and alignment constraints. China Shipping berths have an existing mitigation requirement to control 100% (+/- 5%) of all vessels calling berths 100 and 102, so no additional infrastructure is assumed for these berths. Per terminal staff, terminal is considering a cable reel for the China Shipping berths to increase plug ins.
China Shipping - Berth 100	No	67			4			Berth has SP
China Shipping - Berth 102	No	51	2	0	4	No	0	Berth has SP
One berth used 167 days of the year, two berths used at same time 150 days of the year (in 2017)								
WBCT - Yang Ming	2	115	78	3	4	Yes - Additional 2 vaults at Berths 121 and 126	1 (shared across of Port)	WBCT consists of the China vesseling dock and the Yang Ming dock. The terminal has four total SP capable berths, and can energize a maximum of four vessels at a time. Three vessels is maximum that will fit at the berths at any one time due to space and alignment constraints. Per Terminal staff, vessels calling Yang Ming berths can only plug in if SP connection is in the middle of the vessel (near the house), and cannot plug in if connection is at the stern. Terminal staff advised that cable reel management system will not work at Berths 121 and 126, as there is not a cable reel long enough to correct alignment issues; Berths 121 and 126 need additional vaults to plug in 100% of vessels. Normal operations are to berth port side-to; terminal can berth starboard side-to also, but ability to do so depends on alignment of vessels at the berth.
Yang Ming - Berth 121	Yes, Option 2**	74			2	Additional 1 vault	1 (shared across Port)	Berths have SP; these berths see a high number of visits from currently unregulated steam ship vessels.
Yang Ming - Berth 126	Yes, Option 2**	41	78	3	2	Additional 1 vault		
One berth used 179 days of the year, two berths used at same time 100 days of the year (in 2017)								

BerthLevelCARBStaffAnalysisofPotentialEmissionReductionStrategies  
August 2019

Port/Terminal/Berth	Prop 1B Berth?	Total # of Container & Reefer Visits in 2017	# of Anticipated Newly Regulated Vessel Visits	# of Visits from Infrequent Vessels Not Anticipated To Install SP	# of Existing Vaults	Additional SP Infrastructure Assumed?	Estimated # of Additional C+C Systems Needed	Reasoning
Yusen	2	221	6	2	10	No	0	All of Terminal's active berths from 2017 are SP capable per CARB staff information. No information received from Terminal about how many vessels can plug into SP at the same time. Terminal has a high number of existing vaults and 2 of 3 are Prop 1B berths; not assuming any additional infrastructure needed.
Berth 212	Yes, Option 2**	106			2			Berth has SP
Berth 214	No	46	6	2	4	No	0	Berth has SP
Berth 218	Yes, Option 2**	69			4			Berth has SP

One berth used 78 days of the year, two berths used at same time 205 days of the year, three berths used at same time 75 day of the year (in 2017)

**BerthLevel CARB Staff Analysis of Potential Emission Reduction Strategies  
August 2019**

Port/Terminal/Berth	Prop 1B Berth?	Total # of Container & Reefer Visits in 2017	# of Anticipated Newlv Regulated Vessel Visits	# of Visits from Infrequent Vessels Not Anticipated To Install SP	# of Existing Vaults	Additional SP Infrastructure Assumed?	Estimated # of Additional C+C Systems Needed	Reasoning
Oakland	6 berths. plus 3 vaults at Matson Terminal	1597	191	0	31	Yes - additional 3 vaults at OICT	0	Port of Oakland will continue to rely on SP for compliance with the expanded regulation. Each berth has its own substation, so no additional power is needed. Barge-based C+C looks to be an option for TraPac terminals, but not Nutter, Matson or OICT due to concerns expressed from SF Bar Pilots about wave interaction from passing vessels and channel space and navigational constraints.
Evermott (Nutter)	2	153	6	0	4	No	0	Nutter Terminal will continue to rely on SP for compliance with the regulation; both berths are SP capable and can plug two vessels in at the same time. Berths are all Prop 1B berths; not assuming any additional infrastructure needed.
Berth 35	Yes, Option 2**	99	6	0	2	No	0	Berth has SP
Berth 37	Yes, Option 2**	54	6	0	2	No	0	Berth has SP
* One berth used 260 days of the year, two berths used at same time 0 days of the year (in 2017)								
Matson	3 vaults	107	59	0	3	No	0	This terminal has SP and will continue to rely on SP for compliance with SP capable vessels. Terminal installed 3 vaults with Prop 1B funding; not assuming any additional infrastructure needed.
Berth 61	Yes***	0			3	No		This berth has SP and a low number of visits, so compliance is expected to be met with SP-capable vessels.
Berth 62	Yes***	99	59	0		No	0	This berth has SP, and receives a high number of both SP and non-SP vessels.
Berth 63	Yes***	8			0	No		This berth has SP and a low number of visits, so compliance is expected to be met with SP-capable vessels.
One berth used 240 days of the year, two berths used at same time 13 days of the year, three berths used at same time 1 day of the year (in 2017) - includes both container and con-ro vessel visits								
OICT	2	1072	113	0	18	Yes - additional 3 vaults	0	OICT will continue to rely on SP for compliance with SP capable vessels. This terminal has SP at every berth, with enough power capacity to plug in a vessel at every berth, but terminal staff has advised CARB staff that 3 additional vaults are needed. OICT has a cable reel management system, but labor has red-tagged the equipment and they are unable to use it at this time.
Berth 55	Yes, Option 2**	212			3			SP will continue to be primary pathway to compliance. Can energize five vessels at the same time, but only four vessels will fit plugged in at a time due to vessel size and positioning issues. Terminal already owns cable reel management system, but unable to use due to labor safety concerns.
Berth 56	No	255			4	3 additional vaults	0	
Berth 57	No	236	113	0	4			
Berth 58	No	224			4			
Berth 59	Yes, Option 2**	145			3			
One berth used 4 days of the year, two berths used at same time 35 days of the year, three berths were used at same time 103 days of the year, four berths were used at same time 166 times of the year, five berths								
TraPac	2	265	13	0	6	No	0	TraPac Terminal will continue to rely on SP for compliance with the regulation; both berths are SP capable and can plug two vessels in at the same time. Berths are all Prop 1B berths; not assuming any additional infrastructure needed.
Berth 30	Yes, Option 2**	101	13	0	3	No	0	Berth has SP
Berth 32	Yes, Option 2**	164	13	0	3	No	0	Berth has SP
One berth used 246 days of the year, two berths used at same time 100 days of the year (in 2017)								

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San Diego	0	52	0	0	3	No	0	Reefers visiting Port of San Diego will rely on SP for compliance. Port can plug in one reefer vessel at a time, but since only one vessel typically calls berth at a time, no additional power or infrastructure assumed necessary.
Tenth Avenue Terminal	0	52	0	0	3	No	0	Reefer terminal will continue to rely on SP for compliance with the regulation. All berths are SP capable, and only one berth typically used at a time, so no additional infrastructure assumed necessary at this terminal. Terminal has a cable management system available for use.
Berth 10-2	No	6	0	0	1	No	0	All reefer vessels calling San Diego were regulated as of 2017, with no major concerns about vessels plugging in.
Berth 10-3	No	31	0	0	1	No	0	
Berth 10-4	No	15	0	0	1	No	0	
One berth used 173 days of the year, two berths used at same time 0 days of the year (in 2017)								

Port/Terminal/Berth	# of Prop 1B Berths	Total # of Container & Reefer Visits in 2017	# of Anticipated Newly Regulated Vessel Visits	# of Visits from Infrequent Vessels Not Anticipated To Install SP	Total # of Vaults	Additional SP Infrastructure Assumed?	Estimated # of Additional C+C Systems Needed
Statewide #s	30 individual berths, plus 3 vaults at Matson - Oakland	3742	403	55	189	5 vault installations	1 additional Barge-based C+C

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This grant required the installation of 3 vaults at berths 60-63 (grantee chose which berths)

\*\*\*\*These 25 visits were previously under Berth 406, but Port of LA advised us Berth 406 is not in use; reassigned visits to Berth 405

# **CARB Staff Analysis of Potential Emission Reduction Strategies by Port/Terminal/Berth**

## **For Cruise Vessels**

September 2019

The berth analysis is an assessment made by California Air Resources Board (CARB) staff to characterize what additional shore power infrastructure improvements may be necessary for passenger (cruise) vessels to support the new Control Measure For Ocean going Vessels At Berth. For the development of the analysis CARB staff relied on port maps, Google Earth maps, and vessel visit information from Wharfinger, San Francisco Marine Exchange, and California State Lands Commission data. CARB staff's assessment was based on comment letters received from industry stakeholders in response to the new draft At Berth Regulation, numerous port/terminal site visits and tours, extensive discussions with terminal operators, Port staff throughout the state, and harbor pilots servicing the Northern and Southern California Ports.

The assessment assisted CARB staff in estimating the potential cost impacts that could be incurred due to infrastructure and/or equipment upgrades as a result of the requirements of the new Control Measure For Ocean going Vessels At Berth.



Legend:

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- Reasoning = Basis for CARB staff analysis and assumptions

## Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies September 2019

Port/Terminal/Berth	Total # of Cruise Visits in 2017	# of Anticipated Newly Regulated Vessel Visits	# of Existing Vaults	Additional SP Infrastructure Needed?	Reasoning
Long Beach	256	0	1	No	Port of LB has one cruise berth and it is already SP capable.
Cruise Terminal	256	0	1	No	Terminal has one berth, with SP already installed.
Berth H4	256	0	1	No	Berth has SP
Los Angeles	101	22	6	No	Port of LA cruise terminal can plug vessels into SP at both berths at the same time.
World Cruise Terminal	101	22	6	No	Terminal has two active berths, with SP already installed at both berths. Can plug two vessels in at the same time.
Berth 92	27	22	4	No	Berth has two 11 kV AMP vault connections and two 6.6 kV vault connections.
Berth 93A	74		2	No	Berth has two 11 kV AMP vault connections.
One berth used 83 days of the year, two berths used at same time 15 days of the year (in 2017)					
San Diego	89	16	3	No	Port of San Diego can plug in one cruise vessel at a time. Assumption is that Port of San Diego will not install additional power to plug in multiple vessels simultaneously, but that assumption may change if updated information is recieved from the Port.
B Street Pier	81	16	2	No	Port has two terminals B Street (5 berths, with two SP connection points) and Broadway (2 berths, with one SP connection point). The port only has enough power to plug in one vessel at a time, either B-Street OR Broadway, but not at both simultaneously.
North Berth (B-1 and B-2)	14		1		B Street Pier has five berths located on the North, South and West sides of the pier, The North and South side each have one shore power connection point (services both berths). Only one cruise vessel is capable of plugging in at the port at a time.
South Berth (B-4 and B-5)	45	16		No	
	22		1		
Broadway Pier	8	0	1	No	This pier already has SP and limited vessel activity.
Broadway Berth	8	0	1	No	Broadway Terminal has one connection point, with limited activity in 2017. Only one cruise vessel is capable of plugging in at the port at a time.
One berth used 71 days of the year, two berths used at same time 11 days of the year, three berths used at same time 2 days of the year (in 2017)					

## Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies September 2019

Port/Terminal/Berth	Total # of Cruise Visits in 2017	# of Anticipated Newly Regulated Vessel Visits	# of Existing Vaults	Additional SP Infrastructure Needed?	Reasoning
San Francisco	81	18	1	Potentially one additional shore power berth	Port of San Francisco operates cruise terminals at two Piers - Pier 27 and Pier 35. Pier 27 has SP infrastructure, but Pier 35 does not have SP infrastructure. Staff assumes that the currently unregulated vessels will be outfitted with SP to comply, and that the number of vessels calling multiple berths on the same day will likely increase, which will result in the port needing an additional shore power berth.
Cruise Terminal	81	18	1	Potentially one additional shore power berth	The cruise terminal has one SP berth currently and staff assumes they will need one additional SP berth at their terminal.
Pier 27	66		1	No	Pier 27 has one berth, with a SP vault already installed.
Pier 35 (North and South Berths)	15	18	None	Potentially one additional shore power berth	Pier 35 has two berths (north and south), and is typically used as an overflow berth. Pier 35 does not have any SP infrastructure.
One berth used 78 days of the year, two berths used at same time 14 days of the year (in 2017)					

	Total # of Cruise Visits in 2017	# of Anticipated Newly Regulated Vessel Visits	# of Existing Vaults	Additional SP Infrastructure Needed?
Statewide #'s	527	56	11	1 potential new shore power installation

1 CARB staff assume SP will be control technology pathway for each cruise terminal. No C+C assumed for cruise vessels.

2 Pier 35 is only cruise berth at a currently regulated Port without any SP infrastructure installed.

## **CARB Staff Analysis of Potential Emission Reduction Strategies by Port/Terminal/Berth**

### **For Roll On-Roll Off (Ro-Ro) Vessels**

September 2019

The berth analysis is an assessment made by California Air Resources Board (CARB) staff to characterize what additional shore power infrastructure improvements and potential emission control technologies (land- or barge-based alternative capture and control systems) may be necessary to support the new draft At Berth Regulation for auto carrier and roll on- roll off (ro-ro) vessels. For the development of the analysis CARB staff relied on port maps, Google Earth maps, and vessel visit information from Wharfinger, San Francisco Marine Exchange, and California State Lands Commission data. CARB staff's assessment was based on comment letters received from industry stakeholders in response to the new draft At Berth Regulation, numerous port/terminal site visits and tours, extensive discussions with terminal operators, Port staff throughout the state, and harbor pilots servicing the Northern and Southern California Ports.

The assessment assisted CARB staff in estimating the potential cost impacts that could be incurred due to infrastructure and/or equipment upgrades as a result of the requirements of the new Control Measure For Ocean going Vessels At Berth.

Legend:

C+C= Capture and control system

SP= Shore power

Subject Headers:

- # of Ro-Ro Visits in 2017 = Total number of auto/Ro-Ro vessel visits by berth based on 2017 visit information
- # of Frequent Ro-Ro Vessels Visiting Terminals in 2017 = Number of frequent (vessel that visits the same berth in California at least 4 times in a year) auto/Ro-Ro vessels by port
- # of Visits by Frequent Auto & Ro-Ro Vessels in 2017 = Number of visits made by frequent auto/ro-ro vessels
- Estimated # of C+C Systems Needed = Number of emission capture and control system (land- or barge-based) that CARB staff estimates will be necessary per port
- Assumed Control Technology = Type of emissions control technology that CARB staff's analysis indicates may be most feasible for use
- Improvements to Existing Infrastructure Needed? = Additional landside infrastructure improvements needed to support the emission control technology assumption for a given port/marine terminal complex (in some situations infrastructure upgrades, such as wharf improvements may be necessary to support a land-based emission control strategy)
- Reasoning = Basis for CARB staff analysis and assumptions

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Port/Terminal/Berth	# of Ro-Ro Visits in 2017	# of Frequent Ro-Ro Vessels Visiting Terminals in 2017	# of Visits by Frequent Ro-Ro Vessels in 2017	Estimated # of C+C Systems Needed	Assumed Control Technology	Improvements to Existing Infrastructure Needed?	Reasoning
Carquinez	122	5	24	1	1 Barge-based C+C (shared)	No	Barge-based C+C seems most feasible option for Benicia terminal considering minimal space on wharf and implementation date of 2025. CARB staff anticipate terminal being able to share one C+C system, with some operational adjustments.
Benicia - AM Ports	122	5	24	1			Barge-based C+C seems most cost effective option.
Berth 2	115	5	24	1	Barge-based C+C	No	Comment letter from Benicia Port Terminal Company expressed concern that a land-side C+C system would restrict cargo movement and a barge-based system may not be feasible due to strong currents and navigational hazards. SF Bar Pilots commented they have no significant concerns about a barge-based C+C system being used here, as long as the system is designed with the strong currents in mind.
Berth 3	7	0	0		Barge-based C+C	No	This berth seems primarily used for overflow ro-ro visits.
One berth used 105 days of the year, two berths used at same time 3 days of the year (in 2017)							

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Hueneme	240	5	21	1	SP already installed, 1 Land-based C+C	No	Hueneme already has three SP berths at Wharf 1 for plugging in regulated reefer vessels. Land-based C+C at main ro-ro berth with operational changes at overflow berths may be most cost effective option considering visit activity.
Wharf 1	19	0	0	0		No	SP already installed at this terminal.
Berth 1	4	0	0	0	SP already installed	No	These berth are primarily used for reefer vessels and overflow ro-ro visits, and already have SP installed.
Berth 2	15	0	0		SP already installed	No	
Wharf 2	212	4	16	1	Land-based C+C	No	This berth is the primary ro-ro berth. Port staff advised there is no room for a barge-based C+C system due to space constraints. Port has expressed concerns with using a capture and control bonnet connection due to diurnal windy conditions that run perpendicular to the bonnet sock.
Berth 4	212	4	16	1	Land-based C+C	No	This berth is the primary ro-ro berth. Port staff advised there is no room for a barge-based C+C system due to space constraints. Port has expressed concerns with using a capture and control bonnet connection due to diurnal windy conditions that run perpendicular to the bonnet sock.
Wharf 3	9	1	5	0		No	Berth 6 is used for overflow ro-ro visits. It does not have the space constraints of berths 1,2, and 4, but is operated by Hueneme through a joint-use agreement with the Navy. CARB staff would like to discuss if operational changes can be made to absorb visits at another berth with controls.
Berth 6 (Navy Joint-Use)	9	1	5	0	Operational changes may be most cost effective?	No	Berth 6 is used for overflow ro-ro visits. It does not have the space constraints of berths 1,2, and 4, but is operated by Hueneme through a joint-use agreement with the Navy. CARB staff would like to discuss if operational changes can be made to absorb visits at another berth with controls.
One berth used 213 days of the year, two berths used at same time 31 days of the year, three berths used at same time 2 days of the year (in 2017)							

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Long Beach	211	7	36	2	1 Barge-based C+C (shared), 1 Land-based C+C	No	Barge-based C+C systems with minor operational changes; Jacobson Pilots at POLB expressed concern about using a barge-based C+C at Berth 83.
Cooper T. Smith	47	0	0	1 (shared with Crescent Terminal)	Barge-based C+C	No	Jacobson Pilots at POLB did not express any significant concern about using a barge-based C+C system at this berth. Assuming shared barge-based C+C most feasible for flexibility and cost effectiveness.
Berth F204	3	0	0	1 (shared)	Barge-based C+C	No	Jacobson Pilots at POLB did not express any significant concern about using a barge-based C+C system at this berth.
Berth F205	44	0	0	1 (shared)	Barge-based C+C	No	Jacobson Pilots at POLB did not express any significant concern about using a barge-based C+C system at this berth.
Crescent Terminal	60	0	0	1 (shared with Cooper Terminal)	Barge-based C+C	No	Jacobson Pilots at POLB did not express any significant concern about using a barge-based C+C system at this berth. Assuming shared barge-based C+C most feasible for flexibility and cost effectiveness.
Berth F207	60	0	0	1 (shared)	Barge-based C+C	No	Jacobson Pilots at POLB did not express any significant concern about using a barge-based C+C system at this berth.
One berth used at F205 and F207 at same time 98 days of the year, two berths used at same time 15 days of the year							
Toyota Logistics	104	7	36	1	Land-based C+C	No	Jacobson Pilots at POLB stated a barge-based C+C system here would block navigational access to the back of the channel for other vessels. A land-based C+C system appears to fit on the berth basis visual maps; port or terminal staff have not advised any wharf infrastructure improvements would be necessary to support weight of land-based C+C system.
Berth B83	104	7	36	1	Land-based C+C	No	Jacobson Pilots at POLB stated a barge-based C+C system here would block navigational access to the back of the channel for other vessels. A land-based C+C system appears to fit on the berth basis visual maps; port or terminal staff have not advised any wharf infrastructure improvements would be necessary to support weight of land-based C+C system.



Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Los Angeles	94	7	54	1	1 Barge-based C+C (shared)	No	No significant concern from Los Angeles Pilots about use of a barge-based C+C system. Assuming shared barge-based C+C most feasible for flexibility and cost effectiveness. Multiple berths only used a few times a year on any given day, anticipate terminal to be able to address this overlap with operational changes.
WWL	94	7	54	1	Barge-based C+C	No	No significant concern from Los Angeles Pilots about use of a barge-based C+C system at this terminal.
Berth 196	1	0	0		Barge-based C+C		
Berth 197	8	1	7		Barge-based C+C		
Berth 198	69	5	32	1 (shared)	Barge-based C+C	No	No significant concern from Los Angeles Pilots about use of a barge-based C+C system here.
Berth 199	16	1	15		Barge-based C+C		
One berth used 128 days of the year, two berths used at same time 2 days of the year (in 2017)							
Richmond	71	1	5	1	1 Barge-based C+C (shared)	No	Conversation with SF Bar Pilots did not raise any significant concerns about a barge-based C+C system being used for ro-ro terminal at Richmond. Assuming shared barge-based C+C most feasible for flexibility and cost effectiveness.
Auto Warehouse Co.	71	1	5	1	Barge-based C+C	No	Conversation with SF Bar Pilots did not raise any significant concerns about a barge-based C+C system being used at this terminal.
Berth RCH8	71	1	5	1	Barge-based C+C	No	Conversation with SF Bar Pilots did not raise any significant concerns about a barge-based C+C system being used at this berth.

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

San Diego	253	4	36	2	1 Barge-based C+C (shared), 1 Land-based C+C	No	Based on port maps, a barge-based C+C system looks to fit at berths 24-2, 24-4, and 24-5 with no navigational concerns. Port staff advised that due to channel restrictions, barge-based C+C was not feasible for berths 24-10 and 24-11. Land-based C+C looks feasible at these berths. Unknown if any wharf infrastructure improvements would be necessary to support weight of C+C system.
National City Marine	253	4	36	2	1 Barge-based C+C (shared), 1 Land-based C+C	No	Based on port maps, a barge-based C+C system looks to fit at berths 24-2, 24-4, and 24-5 with no navigational concerns. Port staff advised that due to channel restrictions, barge-based C+C was not feasible for berths 24-10 and 24-11. Land-based C+C looks feasible at these berths. CARB staff have not received any information suggesting wharf improvements are needed to support the weight of land-based system at this time.
Berth 24-2	26	1	23		Barge-based C+C		Based on port maps and conversation with Port staff, a land-based system seems most feasible due to narrow channel causing possible navigational concerns for a barge-based C+C system.
Berth 24-4	19	0	0	1 (shared)	Barge-based C+C		
Berth 24-5	156	3	13		Barge-based C+C	No	
Berth 24-10	23	0	0	1 (shared mobile)	Land-based C+C		
Berth 24-11	29	0	0		Land-based C+C		
One berth used 177 days of the year, two berths used at same time 73 days of the year, three berths used at same time 7 days of the year (in 2017)							
San Francisco	26	0	0	1	1 Barge-based C+C (shared)	No	Per Port staff, barge or land-based C+C system seems feasible, but port is confirming with SF Bar Pilots and engineering staff.
Pasha Terminal	26	0	0	1	1 Barge-based C+C (shared)	No	Growth to 50-70 vessel visits is expected in 2019, so have included this terminal in our updated berth analysis. Per Port staff, barge or land-based C+C system seems feasible, but port is confirming with SF Bar Pilots.
Pier 80*	26	0	0	1	Barge-based C+C	No	Per Port staff, barge or land-based C+C system seems feasible, but port is confirming with SF Bar Pilots.

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Port/Terminal/Berth	# of Ro-Ro Visits in 2017	Estimated # of C+C Systems Needed	Assumed Control Technology	Additional Infrastructure Improvements Needed?
Statewide #s	1017	9	6 Barge-based C+C, 3 Land-based C+C	No Infrastructure Improvements Assumed

\*Port staff advise vessel activity expected to exceed threshold in 2019

## **CARB Staff Analysis of Potential Emission Reduction Strategies by Port/Terminal/Berth**

### **For Crude and Product Tanker**

Vessels September 2019

The berth analysis is an assessment made by California Air Resources Board (CARB) staff to characterize what additional shore power infrastructure improvements and potential emission control technologies (land- or barge-based alternative capture and control systems) may be necessary to support the new draft At Berth Regulation for tanker vessels. For the development of the analysis CARB staff relied on port maps, Google Earth maps, and vessel visit information from Wharfinger, San Francisco Marine Exchange, and California State Lands Commission data. CARB staff's assessment was based on comment letters received from industry stakeholders in response to the new draft At Berth Regulation, numerous port/terminal site visits and tours, extensive discussions with terminal operators, Port staff throughout the state, and harbor pilots servicing the Northern and Southern California Ports.

The assessment assisted CARB staff in estimating the potential cost impacts that could be incurred due to infrastructure and/or equipment upgrades as a result of the requirements of the new Control Measure For Ocean going Vessels At Berth.

Legend:

C+C= capture and control system

SP= shore power

Spud barge = is a type of barge that is moored by using through-deck pilings or steel shafts

Subject Headers:

- # of Tanker Visits in 2017 = Total number of tanker vessel visits by berth based on 2017 visit information

- # of Frequent Tanker Vessels Visiting Terminals in 2017 = Number of frequent (vessel that visits the same berth in California at least 4 times in a year) tanker vessels by port/marine terminal complex

- # of Visits by Frequent Tanker Vessels in 2017 = Number of visits made by frequent tanker vessels by port/marine terminal complex

- Assumed Control Technology & Estimated # of C+C Systems Needed = Type of emissions control technology that CARB staff's analysis indicates may be most feasible for use and estimated number of emission capture and control system (land- or barge-based) that CARB staff estimates will be necessary per port/marine terminal complex

- Additional Infrastructure Improvements Needed? = Additional landside infrastructure improvements needed to support the emission control technology assumption for a given port/marine terminal complex (in some situations infrastructure upgrades, such as wharf improvements may be necessary to support a land-based emission control strategy)

- Reasoning = Basis for CARB staff analysis and assumptions

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Port/Terminal/Berth	# of Tanker Visits in 2017	# of Frequent Tanker Vessels Visiting Terminal in 2017	# of Visits by Frequent Tanker Vessels in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed	Additional Infrastructure Improvements Needed?	Reasoning
Carquinez	277	7	58	5 Land-based C+C, 12 cranes	Yes	
Pacific Atlantic	41	3	24	1 Land-based C+C, 2 cranes	Yes	
Berth MRZ 6	41	3	24	2 cranes	Yes	Per SF Bar pilots, a barge-based C+C system would present navigational concerns at this location due to interaction with vessels passing close by under the nearby UPRR bridge. CARB staff analysis of satellite imagery indicates there may be available space for an land-based C+C system in the facility's parking lot. If unable to place system on land, wharf improvements may be necessary to support the weight of a C+C system and piping. Adapting a land-based C+C system and crane will have to account for the wetlands surrounding the pipelines on all sides as it extends from the berth to the treatment facility further inland.
Shell	89	0	0	1 Land-based C+C, 4 cranes	Yes	
Berth MRZ2	26	0	0	2 cranes	Yes	Although SF Bar Pilots did not have any significant navigational concerns about using a barge-based C+C system at these berths, Shell terminal staff have voiced concerns about using the barge due to mooring line interference. Staff assumes that the berths will likely require structural wharf reinforcements to be able to accommodate piping for transferring exhaust gas. CARB staff saw during a field visit to this terminal that a thermal oxidizer facility used for treating VOC emissions is located onshore (off the berth) and assumes a land-based emissions treatment facility could potentially be located near this thermal oxidizer, and that onshore pipings connecting to each capture bonnet can be both routed to the same treatment destination.
Berth MRZ3	63	0	0	2 cranes	Yes	
One berth used 128 days of the year, two berths used at same time 15 days of the year (in 2017)						

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Port/Terminal/Berth	# of Tanker Visits in 2017	# of Frequent Tanker Vessels Visiting Terminal in 2017	# of Visits by Frequent Tanker Vessels in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed	Additional Infrastructure Improvements Needed?	Reasoning
Tesoro - Avon	53	1	4	1 Land-based C+C, 2 cranes	Yes	
Berth MRZ 5	53	1	4	2 cranes	Yes	Per SF Bar pilots, a barge-based C+C system would present navigational concerns at this location due to interaction with vessels passing close by under the nearby UPRR bridge. CARB staff analysis indicates a potential need for berth reinforcement if a land-based C+C system is used, in order to run additional piping onshore. CARB staff analysis also indicates there may be room for the emissions treatment facility on the western side of the facility.

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Port/Terminal/Berth	# of Tanker Visits in 2017	# of Frequent Tanker Vessels Visiting Terminal in 2017	# of Visits by Frequent Tanker Vessels in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed	Additional Infrastructure Improvements Needed?	Reasoning
Tesoro - Amorco	41	2	11	1 Land-based C+C, 2 cranes	Yes	
Berth MRZ 8	41	2	11	2 cranes	Yes	Per SF Bar pilots, a barge-based C+C system would present navigational concerns at this location due to the proximity to the Federal Channel. CARB staff analysis of satellite imagery indicates a potential need for berth reinforcement if a land-based C+C system is used, in order to run additional piping onshore. CARB staff analysis also indicates possible space for the emissions treatment facility to be located on a concrete inland wharf at the edge of a lagoon near the berth; pipelines at this berth cross over a long stretch of wetlands, similar to MRZ6.
Valero	53	1	19	1 Land-based C+C, 2 cranes	Yes	
Berth BNC 4	53	1	19	2 cranes	Yes	SF Bar Pilots did not have any significant navigational concerns about using a barge-based C+C system at this BNC 4 given the distance from the Federal Channel. However, terminal staff have raised express safety concerns for using a barge due to weather and strong currents typically affecting vessels tied to this berth. CARB staff analysis of satellite imagery indicates a potential need for berth reinforcement if a land-based C+C system is used to accommodate the additional piping. The piping lines are routed over a set of adjacent railway tracks running parallel to the shore, the exhaust piping will have to travel the same path. CARB staff analysis also indicates possible locations for the onshore emissions treatment facility may be the parking lot adjacent to the Carquinez bridge.



Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Port/Terminal/Berth	# of Tanker Visits in 2017	# of Frequent Tanker Vessels Visiting Terminal in 2017	# of Visits by Frequent Tanker Vessels in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed	Additional Infrastructure Improvements Needed?	Reasoning
Long Beach	359	16	115	4 Land-based C+C, 7 cranes	Yes	CARB staff assuming land-based C+C due to safety concerns about barge tying up to a tanker vessel. Jacobson Pilots expressed navigation concern about using a barge-based C+C at Tesoro - Pier B and Tesoro - Pier T; no navigational concerns expressed by harbor pilots at Chemoil or Vopak.
Chemoil	43	1	7	1 Land-based C+C, 1 crane	Yes	Jacobson Pilots advised there is room for a barge-based system navigationally at this location, however, CARB staff assuming land-based C+C due to industry preference considering safety concerns about barge tying up to a tanker vessel.
Berth F209	43	1	7	1 crane	Yes	Jacobson Pilots advised there is room for a barge-based system navigationally at this location, however, CARB staff assuming land-based C+C due to industry preference considering safety concerns about barge tying up to a tanker vessel.
Tesoro - Pier B	155	6	44	2 Land-based C+C, 5 cranes	Yes	Jacobson Pilots at POLB stated using a barge-based C+C system at any berth at Pier B would block navigational access to the channel. Per POLA staff, Pier B is not one a contiguous reinforced structure. Two land-based C+C would likely be needed to cover all berths, as they are not in the same physical location (one at berths B77-B78, one at Berths B84-B86)
Berth B77	14	1	4	1 crane	Yes	Jacobson Pilots at POLB stated using a barge-based C+C system at any berth at Pier B would block navigational access to the channel. Per POLA staff, Pier B is not one a contiguous reinforced structure. Two land-based C+C would likely be needed to cover all berths, as they are not in the same physical location (one at berths B77-B78, one at Berths B84-B86)
Berth B78	46	3	16	1 crane	Yes	
Berth B84	10	0	0	1 crane	Yes	
Berth B84A	54	1	18	1 crane	Yes	
Berth B86	31	1	6	1 crane	Yes	
One berth used 185 days of the year, two berths used at same time 97 days of the year, three berths used at same time 20 days of the year (in 2017)						

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Port/Terminal/Berth	# of Tanker Visits in 2017	# of Frequent Tanker Vessels Visiting Terminal in 2017	# of Visits by Frequent Tanker Vessels in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed	Additional Infrastructure Improvements Needed?	Reasoning
Tesoro - Pier T	161	9	64	1 Land-based C+C, 1 crane	Yes	
Berth T121	161	9	64	1 crane	Yes	Berth already has SP, but likely to need a C+C system for majority of visits from non-SP capable vessels, as industry has expressed a lack of desire for installing SP connections on tanker vessels. Jacobson Pilots stated using a barge-based C+C system at Pier T would block navigational access to the channel. Therefore, staff assumed a land-based C+C system and a crane would be best suited for this terminal.

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Port/Terminal/Berth	# of Tanker Visits in 2017	# of Frequent Tanker Vessels Visiting Terminal in 2017	# of Visits by Frequent Tanker Vessels in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed	Additional Infrastructure Improvements Needed?	Reasoning
Los Angeles	187	3	18	5 Land-based C+C, 6 cranes	Yes	CARB staff assuming land-based C+C due to safety concerns about barge tying up to a tanker vessel. LA Pilots expressed navigation concern about using a barge-based C+C at PBF Energy and Phillips 66 terminals; no navigational concerns at Shell, Valero, or Vopak.
PBF Energy	20	2	14	1 Land-based C+C, 1 crane	N/A	N/A - Berth will be demolished
Berth 238 (To Be Upgraded)	20	2	14	1 crane	N/A	Per LA Pilots, there are wave interaction concerns with using a barge-based C+C system at this berth. Staff assumed a land-based C+C system and crane would be best suited for the terminal.
Phillips 66	32	1	4	1 Land-based C+C, 2 cranes	o (already upgrading)	
Berth 149 (To Be Demolished)	32	1	4	N/A	N/A	Per LA Pilots, there are wave interaction concerns with using a barge-based C+C system at this berth. Staff assumed a land-based C+C system and crane would be best suited for the terminal. POLA staff advised that berth 149 will be left in place as a non-oil vessel i.e. barge servicing reinforced berth and construction of a new oil terminal is proposed for Berth 151 after demolition of the existing 150-151 berth.
Berth 151 (To Be Upgraded)	Assume similar visit count as Berth 149 after it is demolished	---	---	2 cranes	No (already upgrading)	
Shell	38	0	0	1 Land-based C+C, 2 cranes	o (already upgrading)	
Berth 168	1	0	0	N/A	N/A	LA Pilots advised there is room for a barge-based system navigational at this location, however, CARB staff assuming land-based C+C and crane due to industry preference considering safety concerns about barge tying up to a tanker vessel. Per POLA staff, Berth 168 is currently under MOTEMS reconstruction, and replaced with a new MOTEMS-compliant terminal while the tenant operates at the existing Berth 169. Berth 169 will be demolished in 2022 after commissioning of Berth 168. Per terminal staff, new design and construction would be required, and no upgrading has been considered for any CARB project as of the date of this document.
Berth 169	37	0	0	2 cranes	No (already upgrading)	

One berth used 155 days of the year, two berths used at same time 2 days of the year (in 2017)

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Port/Terminal/Berth	# of Tanker Visits in 2017	# of Frequent Tanker Vessels Visiting Terminal in 2017	# of Visits by Frequent Tanker Vessels in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed	Additional Infrastructure Improvements Needed?	Reasoning
Valero	24	0	0	1 Land-based C+C, 1 crane	o (already upgrading)	
Berth 164	24	0	0	1 crane	No (already upgrading)	LA Pilots advised there is room for a barge-based system navigationally at this location, however, CARB staff assuming land-based C+C and crane due to industry preference considering safety concerns about barge tying up to a tanker vessel. Per POLA staff the berth will be replaced with a MOTEMS compliant structure.
Vopak	73	0	0	1 Land-based C+C, 2 cranes	Yes	
Berth 187	18	0	0	1 crane	Yes	LA Pilots advised there is room for a barge-based system
Berth 189	55	0	0	1 crane	Yes	navigationally at this berth, however, CARB staff
One berth used 215 days of the year, two berths used at same time 30 days of the year (in 2017)						

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Port/Terminal/Berth	# of Tanker Visits in 2017	# of Frequent Tanker Vessels Visiting Terminal in 2017	# of Visits by Frequent Tanker Vessels in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed	Additional Infrastructure Improvements Needed?	Reasoning
Richmond	391	15	215	4 Land-based C+C, 14 cranes	Yes	
BP/ARCO	40	2	39	1 Land-based C+C, 2 cranes	Yes	
Berth RCH 9	40	2	39	2 cranes	Yes	SF Bar Pilots did not have any significant navigational concerns about using a barge-based C+C system at this berth location, however CARB staff assuming land-based C+C due to terminal's concerns about barge tying up to a tanker vessel at this berth. Staff assumed a land-based C+C and crane is employed, and that the berth would probably have to be structurally reinforced. CARB staff's analysis of satellite imagery shows the parking lot south of the main building structure adjacent to the berth may be a suitable location for an onshore emissions treatment facility.
Chevron - Richmond Long Wharf	283	12	160	1 Land-based C+C, 8 cranes	Yes	
Berth RLW 1	45	1	7	2 cranes	Yes	SF Bar Pilots did not have any significant navigational concerns about using a barge-based C+C system at this berth location, however, Chevron-specific docking pilots did express concern about weather and wave interaction from passing vessels, increasing vessel traffic congestion if barges are used, and the ability to disembark the vessel within 30 minutes. For this analysis, CARB staff are assuming land-based C+C due to the docking pilot's and terminal's concerns about barge tying up to a tanker vessel at this berth. Staff made the assumption that two cranes would be needed per berth rather than one, based on a comment letter from Chevron (dated March 8, 2019) advising staff that two cranes may be needed at each berth at the long wharf to provide flexibility when vessels dock.
Berth RLW 2	67	2	18	2 cranes	Yes	
Berth RLW 3	38	2	18	2 cranes	Yes	
Berth RLW 4	133	7	117	2 cranes	Yes	
One berth used 111 days of the year, two berths used at same time 147 days of the year, three berths used at same time 74 days of the year, four berths used at same time 15 days of the year (in						

Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
September 2019

Port/Terminal/Berth	# of Tanker Visits in 2017	# of Frequent Tanker Vessels Visiting Terminal in 2017	# of Visits by Frequent Tanker Vessels in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed	Additional Infrastructure Improvements Needed?	Reasoning
Phillips 66/Kinder Morgan	38	0	0	1 Land-based C+C, 2 cranes	Yes	
Berth RCH 11	38	0	0	2 cranes	Yes	SF Bar Pilots did not indicate any significant navigational concerns about using a barge-based C+C system at this berth. Terminal staff raised concerns about RCH 11 using the barge strategy, since one of the berths is dedicated as a berthing spot for barges while the other berth is for ocean-going tanker vessels. CARB staff analysis of satellite imagery indicates that if a land-based C+C system is used, the available room to place the onshore emissions treatment facility may either be the space between the berth and the tank farm or west past the tank farm, and that the berth itself may need to be reinforced to accommodate for the additional piping.
Pacific Atlantic	30	1	16	1 Land-based C+C, 2 cranes	Yes	
Berth RCH 22	30	1	16	2 cranes	Yes	SF Bar Pilots indicated the channel that the berth faces is too narrow for barge-based C+C system. Basis CARB staff analysis of satellite imagery, the berth may have to be reinforced to be able to handle the additional piping needed for a land-based C+C, and the parking lot behind the warehouse adjacent to the berth (or part of the warehouse itself) could potentially be used to site the onshore emissions treatment facility.

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Port/Terminal/Berth	# of Tanker Visits in 2017	# of Frequent Tanker Vessels Visiting Terminal in 2017	# of Visits by Frequent Tanker Vessels in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed	Additional Infrastructure Improvements Needed?	Reasoning
Rodeo	108	1	4	2 Land-based C+C, 6 cranes	Yes	
Phillips 66 - Oleum	85	0	0	1 Land-based C+C, 4 cranes	Yes	
Berth ROD3	85	0	0	2 cranes	Yes	SF Bar Pilots have raised concerns that barge-based C+C systems would present a navigational risk for this terminal. CARB staff's analysis of satellite maps of the berth indicate there may be room on the berth to run additional pipings to the shore if a land-based C+C and cranes are used. CARB staff analysis also indicates potential shoreside space for the onshore emissions treatment facility may be available if it is situated west of the roadway connecting the shore to the berth.
Berth ROD4		0	0	2 cranes	Yes	
One berth used 108 days of the year, two berths used at same time 12 days of the year (in 2017)						
NuStar - Selby	23	1	4	1 Land-based C+C, 2 cranes	Yes	
Berth ROD 8	23	1	4	2 cranes	Yes	SF Bar Pilots indicated barge-based C+C systems would present a navigational risk for this terminal. CARB staff's analysis of satellite maps of the onshore infrastructure for ROD 8 indicates there is sufficient space for an onshore emissions treatment facility. CARB staff analysis also indicates that the berth may need reinforcing in order to accommodate the additional piping and crane.

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Port/Terminal/Berth	# of Tanker Visits in 2017	# of Frequent Tanker Vessels Visiting Terminal in 2017	# of Visits by Frequent Tanker Vessels in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed	Additional Infrastructure Improvements Needed?	Reasoning
Stockton	34	1	7	1 Land-based C+C, 2 cranes	No	CARB staff is still in the process of the Port evaluation.
Stockton Port Authority	34	1	7	1 Land-based C+C, 2 cranes	No	
Berth SCK 7-8	34	1	7	2 cranes		SF Bar Pilots did not indicate any significant navigational concerns about using a barge-based C+C at this berth.
One berth used 131 days of the year, two berths used at same time 23 days of the year, three berths used at same time 2 days of the year (in 2017)						



Berth Level CARB Staff Analysis of Potential Emission Reduction Strategies  
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Port/Terminal/Berth	# of Tanker Visits in 2017	# of Frequent Tanker Vessels Visiting Terminal in 2017	# of Visits by Frequent Tanker Vessels in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed	Additional Infrastructure Improvements Needed?	Reasoning
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Port/Terminal/Berth	# of Tanker Visits in 2017	Assumed Control Technology & Estimated # of C+C Systems Needed
Statewide #s	1356	21 Land-based C+C, 47 cranes

\*CARB staff made the assumption that all tanker terminals will use a land-based capture and control (C+C system) due to safety concerns industry has expressed with having a barge-based C+C

\*\*CARB staff made assumption that all tanker terminals using a land-based C+C will use a centralized exhaust gas treatment system that is installed on available land space on the terminal, and

\*\*\*CARB Staff made the following assumptions for selecting a bonnet capture system that will direct exhaust gas onshore for treatment

1. Sending the auxiliary engine/boiler exhaust to an onshore situated treatment facility (instead of located on the berth) would not violate the intrinsic concerns raised by industry of
2. CARB staff assumes that terminals with more than one berth would route the emissions from each bonnet to a single, appropriately scaled emissions treatment facility onshore.
3. Even though CARB staff assumes the bonnet capture system with a crane will be the most likely control option for tankers, this does not preclude the terminals or vessels from