

Seaport Air Quality 2020 and Beyond Plan

Memorandum:

Evaluation & Prioritization of Screened Actions



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ACRONYMS AND ABBREVIATIONS

2020 and Beyond Plan	Final Seaport Air Quality 2020 and Beyond Plan (June 13, 2019)
AB	assembly bill
ASC	automated stacking crane
BAAQMD	Bay Area Air Quality Management District
BACT	best available control technology
BNSF	Burlington Northern and Santa Fe Railroad
Board	Board of Port Commissioners
CAAP	Clean Air Action Plan (prepared by the Ports of Los Angeles and Long Beach)
CARB	California Air Resources Board
CE	Clean Energy Fuels, Inc.
CEPP	U.C. Berkeley Goldman School of Public Policy/Center for Environmental Public Policy
CHC	commercial harbor craft (same as harbor craft)
CHE	cargo-handling equipment
City	City of Oakland
CNG	compressed natural gas
CTMP	Port of Oakland Comprehensive Truck Management Plan
DGE	diesel gallon equivalent
DOC	diesel oxidation catalyst
DPF	diesel particulate filter
DPM	diesel particulate matter
EBMUD	East Bay Municipal Utilities District
EDF	Environmental Defense Fund
EIR	environmental impact report
EJ/WOEIP	Earth Justice/West Oakland Environmental Indicators Project
FITS	Freight Intelligent Transportation System

GHG	greenhouse gas
GSPP	U.C. Berkeley Goldman School of Public Policy/Center for Environmental Public Policy
HC	harbor craft
HEPA	high-efficiency particulate filter
HVIP	Hybrid and Zero-Emission Truck and Bus Voucher Incentive Program
IMO	International Maritime Organization
ITS	intelligent transportation system
JPA	joint powers authority
LCFS	Low Carbon Fuel Standard
LEED	Leadership in Energy and Environmental Design
LNG	liquefied natural gas
LPG	liquefied petroleum gas
MARPOL	The International Convention for the Prevention of Pollution from Ships
MOU	memorandum of understanding
MTC	Metropolitan Transportation Commissions
MY	model year
NOx	oxides of nitrogen
NTAP	Seaport Air Quality 2020 and Beyond Plan/Near-Term Action Plan
NZE	near-zero-emissions
OAB	Oakland Army Base
OEM	original equipment manufacturer
OGRE	Oakland Global Rail Enterprise
OGV	ocean-going vessel
OIG	Oakland International Gateway (BNSF Railyard)
PM	particulate matter
Port	Port of Oakland

PETF	Port Efficiency Taskforce
PV	photovoltaic
RTG	rubber-tired gantry crane
SB	senate bill
SCA/MM	standard condition of approval/mitigation measure
SCR	selective catalytic reduction
SEP	supplemental environmental project
STEP	Port of Oakland Secure Truck Enrollment Program
SPBP	San Pedro Bay Ports
TAP	San Pedro Bay Ports' Technology Advancement Program
TCM	transportation control measure
TMP	West Oakland Truck Management Plan
TRU	transport refrigeration unit
UP or UPRR	Union Pacific Railroad Company
U.S. EPA or EPA	United States Environmental Protection Agency
VSR	vessel speed reduction
WOCAP	West Oakland Community Action Plan (AB 617)
ZANZEFF	Zero and Near-Zero Emissions Freight Facilities
ZE	zero emissions

SEAPORT AIR QUALITY 2020 AND BEYOND PLAN: *THE PATHWAY TO ZERO EMISSIONS*

Memorandum - Evaluation and Prioritization of Screened Actions

INTRODUCTION

On June 13, 2019, the Board of Port Commissioners approved the Seaport Air Quality 2020 and Beyond Plan: The Pathway to Zero Emissions (“2020 and Beyond Plan” or “Plan”) (Port 2019a). The 2020 and Beyond Plan was developed with input from stakeholders through the 2020 and Beyond Plan Task Force and includes an on-going process to engage stakeholders in the implementation of the Plan. During development of the 2020 and Beyond Plan, both the Port and stakeholders identified actions that could contribute to implementation of the Plan. These actions are designated “Suggested Actions.”

The 2020 and Beyond Plan includes a comprehensive five-step process to screen and evaluate Suggested Actions. The purpose of the five-step screening and evaluation process is to identify actions that are most effective at furthering the goals of the 2020 and Beyond Plan. This process is detailed in Appendix D: *Screening and Evaluation of Implementing Actions* (see Figure 1: *Screening and Evaluation Process Diagram*). Under the five-step process, Step 1: *Identify*, is the identification of Suggested Actions. All actions, whether identified by the Port or suggested by stakeholders, are initially classified as Suggested Actions and compiled into Pool #1. In Step 2: *Screen*, each Suggested Action is screened to determine whether it meets the criteria in Table D-1: *Screening Criteria*. Actions that pass the screening step are classified as “Screened Actions” and are placed into Pool #2. As described in the *Seaport Air Quality 2020 and Beyond Plan: The Pathway to Zero Emissions Memorandum - Screening of Suggested Actions* (“Screening Memo”) (Port 2020), 196 actions passed Step 2: *Screen*. Of these, 57 are already in progress or completed and do not require evaluation in subsequent steps. The Screening Memo provides a summary of Step 2 and the screening results for each Suggested Action. In addition, as provided for in the 2020 and Beyond Plan, if a new Suggested Action is sufficiently compelling, it may be screened on an individual basis. Suggested Action 282: *Retrofit Tugs with Diesel Particulate Filters*, was screened individually and passed the screening step.

Figure 1: Screening and Evaluation Process Diagram



Source: Port of Oakland 2019 (Port 2019a)

Following Step 2, the Port began Step 3: *Evaluate* and Step 4: *Prioritize and Engage* for the 139 Screened Actions in Pool #2. Given the number of Screened Actions (i.e., 139 actions), the Port is performing evaluation and prioritization by group (i.e., Group 1, Group 2, etc.) of approximately 20 actions at a time. This Evaluation and Prioritization Memorandum (Memorandum) documents the Step 3 evaluation and Step 4 prioritization methodology for Screened Actions and the results for the first group (Group 1) of Screened Actions. The actions that rank highest in Step 4 are classified as “Selected Actions.” In Step 5: *Program*, Selected Actions will be considered for implementation as Port resources capacity allows and as Port-related businesses and other stakeholders are willing to take on new actions. As part of Step 5, Port staff will analyze and recommend the Selected Actions for project and budget approval by the Board. The staff recommendation is informed by the Co-Chairs and Task Force engagement undertaken in Step 4. The Board retains sole and absolute discretion to decide whether to approve or disapprove the recommendation.

To complete Step 4, Port staff provide documentation for Steps 1 and 2 for all Suggested Actions, and documentation for Steps 3 and 4 for Group 1 to the 2020 and Beyond Task Force Co-Chairs for their review, presentation to the Task Force, and feedback from the Task Force. The documentation is in the form of memoranda supported by detailed tables. As provided in the Plan in Step 4, where needed or desired, the Co-Chairs may convene Working Sessions, which will include Task Force members, for collaborative problem-solving on Selected Actions specified by the Co-Chairs and the Task Force. The Co-Chairs will document the Working Sessions to inform the qualitative assessment of specified Selected Actions.

Group 1 consists of 1) those strategies from the *West Oakland Community Action Plan* (WOCAP 2019), which designate the Port as the agency to implement these strategies as well as 2) four (4) additional actions identified by Port staff as having high potential for exposure reduction or a high level of stakeholder interest. The evaluation results for Group 1 are presented in matrix format in Table 1: *Step 3 Evaluation - Group 1* provided at the end of this Memorandum.

Following completion of the Step 3 evaluation and Step 4 prioritization for Group 1, the Port will continue with the evaluation and prioritization process for subsequent groups, until all 139 Screened Actions currently in Pool #2 have been evaluated and prioritized. The results of the Step 3 evaluation and Step 4 prioritization for subsequent groups of Screened Actions will be documented in the form of Addenda to this Memorandum. Like the process for Group 1, the Port will provide the Addenda for Steps 3 and 4 to the Co-Chairs. The Task Force Co-Chairs will also present the Step 3 and 4 results for subsequent groups of actions to the Task Force for feedback, and continue to convene Working Sessions, as needed.

In the future, after all Screened Actions currently in Pool #2 have been evaluated and prioritized, the Port will conduct new rounds of evaluation and prioritization. Future rounds of evaluation and prioritization may be triggered as (1) new Suggested Actions are identified and pass Step 2: *Screening*, (2) actions that are currently in progress are completed and the Port and stakeholders have the capacity to undertake additional actions, and (3) technology continues to mature and the ratings of actions change as a result. The frequency of Step 3 and 4 evaluation and prioritization cycles will depend on the rate at which actions that are currently in progress are completed, technology continues to mature and improve, and new Screened Actions are identified. (Note: The Port has committed to tracking technology development as part of the 2020 and Beyond Plan, including specific tracking actions in the Near-Term Action Plan.) All Screened Action will remain in Pool #2 until they are either selected for implementation or it becomes clear over time that an action would never be ranked high enough to be selected for implementation. Any actions removed from Pool #2 because they will never be ranked high enough to be selected for implementation will be documented by the Port as actions that did not pass Step 2: *Screen*.

STEP 3: EVALUATION - METHODOLOGY

Step 3 assesses each Screened Action against the seven feasibility criteria provided in the 2020 and Beyond Plan, Table 2: *Feasibility Criteria*, as applicable. Certain feasibility criteria, such as cost effectiveness, only apply to some actions.

Table 2. Feasibility Criteria	
Feasibility Criterion	Description
Exposure Reduction	Does the Screened Action contribute to efforts to reduce community exposure to pollutants that are harmful to public health?
Affordability	Has the Board of Port Commissioners approved Port of Oakland (Port) funds for the Screened Action or do the Port’s budget projections indicate that sufficient funding is likely to be available given all other budget considerations? How does the cost of any zero-emissions equipment compare to its diesel-powered counterpart? Do projected Port net revenues support any longer-term associated costs? If the Screened Action will be implemented by an organization other than the Port, has that organization decided that the Screened Action is affordable according to its criteria? Is grant or other incentive funding available, and what is the level of effort required to apply for the funding? Would the Screened Action potentially result in stranded equipment or infrastructure, or jeopardize usage requirements for any grant-funded equipment already in place? Would the Screened Action impose an additional expense on the Port or Port-related business which would result in job losses, slowed job growth or other unacceptable, significant economic impacts?

Table 2. Feasibility Criteria	
Feasibility Criterion	Description
Cost-Effectiveness	Does the Screened Action provide cost-effective emissions reductions?
Commercial Availability	Has the proposed technology or system associated with the Screened Action reached commercial availability (Technological Readiness Level [TRL] 9) or, at a minimum, the pre-production stage (TRL 7)? (See Table D-3 for Technological Readiness Levels.) Is the equipment readily available from multiple vendors, and is there adequate competition in the marketplace?
Operational Feasibility	Is there sufficient experience with the technology or equipment to determine that its operational performance is acceptable? Are parts readily available and are repair and maintenance services available nearby? Does the existing workforce have sufficient training and experience to operate the new technology or equipment? Can routine maintenance be performed in-house?
Acceptability	Is there a party or entity willing to undertake the Screened Action, given the range of other considerations, such as availability of land, constraints on current or future operations, or financial capability? Does the Screened Action allow for continued reliable and satisfactory service delivery to customer(s)?
Need	<p>To support the qualitative assessment:</p> <ul style="list-style-type: none"> • Is the Screened Action needed to keep the Port operational, or has a Port tenant or Port-related business determined that the Screened Action is required to keep it operational? • Does the Screened Action complement other initiatives or programs that aim to reduce emissions-related health risk in the local community? • How urgent is the Screened Action (e.g., is lack of electrical infrastructure preventing further deployment of battery-electric equipment)? • Is the Screened Action part of a planned program, such as ongoing investment in capital equipment? • Will the Screened Action result in a delay or cancellation of other (non-air-quality-focused) priority projects? • Will the Screened Action substantially advance experience with a certain type or class of equipment? • If the Screened Action provides emissions reductions benefits, do the associated emissions reductions benefits accrue near the local community? • Will the Screened Action build capacity (such as expanding maintenance and repair services for battery-electric equipment or providing training for electric vehicle mechanics)?

Step 3: *Evaluate* consists of three tasks:

- 3.a: Identify Screened Action that are similar and compile similar actions into Screened Action *Categories* if there are seven or more similar Screened Actions. (Note: Categories are those used in the Plan for Suggested Actions. See Appendix C and tables for detailed presentation of categories.)
- 3.b: Assign Screened Actions to *Groups* based upon factors such as the level of stakeholder interest and potential exposure reduction.
- 3c: Evaluate all Screened Actions against the seven feasibility criteria provided in Table 2, either by category or individually within a group, as applicable.

TASK 3.A: COMPILE SIMILAR SCREENED ACTIONS INTO CATEGORIES

As discussed in the Screening Memo, the 39 Suggested Actions that were duplicates of other Suggested Actions were removed from further consideration so that each action was only screened once. Actions that were similar but not identical were screened individually. In Step 3.a, Port staff compiled similar actions into a Category for a generalized evaluation. While there may be small differences in ratings among these actions, the overall assessment is similar. The evaluations for these Categories will be provided the Addenda for Groups 4 and 5 and the evaluation of a specific Screened Action will be presented in the evaluation matrix. The Port currently anticipates generalized evaluations for Screened Actions in the following categories:

- Grant funding (Category: Funding Actions)
- Infrastructure planning (Category: Infrastructure), and
- Lease and other tenant requirements (Category: Operations)

TASK 3.B: ASSIGN SCREENED ACTIONS TO GROUPS

As discussed above, Group 1 consists of Port-related strategies in the WOCAP, as well as four additional actions identified by Port staff as having either a high potential of generating emissions reductions or being of high interest to local stakeholders. Because some of the WOCAP strategies comprise several specific actions, the Port differentiated these specific and for screening in Step 2. Additionally, one WOCAP strategy, Strategy 5 (Suggested Action 185, Accelerated Relocation of Non-Conforming Truck Businesses) did not pass Step 2 because it is under the purview of the City of Oakland pursuant to the West Oakland Specific Plan and does not include a role for the Port. Table 3, below, shows the list of the 20 Screened Actions in Group 1.

Table 3. Screened Actions Included in Group 1

Screened Action No.	Source	Screened Action Name
183	Port Staff	Provide Common Drayage Truck Charging Infrastructure
186	WOCAP # 19	Adopt Electrical Infrastructure Plan Incorporating Trucks
187	WOCAP # 21	Create Sustainable Freight Advisory Committee
188	WOCAP # 26	Establish Permanent Truck Parking & Container Staging in Logistics Area
189	WOCAP # 37	Set Interim Targets for Zero Emissions Trucks
190	WOCAP # 37	Commercialization Effort for ZE Trucks
191	WOCAP # 37	Increase Weight Limit for Single Axle Zero-Emissions Trucks
192	WOCAP # 37	Develop Investment Plan for Port Infrastructure
193	WOCAP # 37	Study Favorable Time-of-Day Electricity Rate Structure for Truckers
194	WOCAP # 42	Award Long-Term Lease for Trucker Services Center
195	WOCAP # 43	Study Effects of Larger Vessels on Truck Traffic
196	WOCAP # 43	Study Feasibility of Off-Dock Yard Using ZE Trucks
197	WOCAP # 43	Study Efficiency Gains from Increased Truck Double-Cycling
198	WOCAP # 50	Use Air District Incentives to Upgrade Tugs and Barges
199	WOCAP # 63	Implement a Clean Ship (Tier 3 Vessel) Program
200	WOCAP # 64	Implement a Clean Locomotive (Tier 4 Locomotive) Program
201	WOCAP # 65	Study Feasibility of Electric Switchers at BNSF, OGRE
217	Port Staff	Low Sulfur Diesel Fuel in Ocean-Going Vessels
280	Port Staff	Pursue a Hydrogen Fuel Cell Demonstration Project
282	Port Staff	Retrofit Tugs with Diesel Particulate Filters

The Port assigned the remaining Screened Actions to Groups 2 through 6, as follows, based on their potential to provide emissions reductions and community and other stakeholder interest in the actions:

- **Group 2:** Actions related to those in Group 1. Evaluation of Group 2 will complete the Port’s evaluation of tug actions, and includes actions for ocean-going vessels (OGVs) and trucks. The information developed by the Port for Group 1 actions is sufficient to complete the evaluation of Group 2 actions.
- **Group 3:** Group 3 actions consist of OGV actions for which quantitative emissions reduction and cost estimate information still need to be developed. These include shore power, “bonnet,” and vessel speed reduction actions, other truck actions not included in Groups 1 and 2, and actions involving differential truck or ship fees to incentivize cleaner equipment (also known as a truck or ship “rate.”)
- **Group 4:** Group 4 includes actions pertaining to technology development not included in Groups 1 – 3 (i.e., demonstration projects, technology tracking, and target-setting actions, etc.), Operations category actions involving lease and other tenant requirements, and the Funding category actions involving grant funding. The Port will provide a generalized

evaluation for actions in the leasing and funding categories, in addition to evaluating and prioritizing specific actions in Group 4.

- Group 5: Actions in Group 5 consist of alternative fuels/NOx emissions reductions actions (including hydrogen infrastructure, LNG tugs, etc.), alternative/green energy actions, and Infrastructure category actions pertaining to infrastructure planning. The Port will provide a generalized evaluation for actions in the infrastructure category, in addition to evaluating and prioritizing specific actions in Group 5.
- Group 6: Group 6 comprises the remaining actions. This group includes other studies not captured in Groups 1 – 5, outreach/partnership actions not captured in Groups 1 – 5, low priority actions, and funding/financial plan actions.

These groups may be adjusted depending on Task Force feedback.

TASK 3.C: EVALUATE AND PRIORITIZE SCREENED ACTIONS IN GROUPS BY FEASIBILITY CRITERIA

The Port evaluates each individual Screened Action or category of actions against the seven feasibility criteria. For some actions, certain feasibility criteria do not apply; for example, conducting a study would not directly reduce emissions or exposure. The evaluation matrix shows the ratings for these actions as N/A, and describes why the criterion is not applicable for that action. Table 1 provides the evaluation matrix for Group 1 actions.

Five of the criteria are *qualitative* criteria. Two criteria, cost effectiveness and commercial availability, can be evaluated on a *quantitative* basis for some actions. Evaluations that include a quantitative evaluation for cost effectiveness and/or technological readiness criteria are considered *quantitative* evaluations. The evaluation matrix shows whether a given action was evaluated on a qualitative or quantitative basis. Evaluation ratings are None, Low, Moderate, or High for each applicable criterion, either quantitative or qualitative. If there is insufficient information to make an evaluation of a specific action against a criterion, that action receives an “Unknown” rating for that action. The basis for each rating is provided in the evaluation matrix. The methodology for assessing each action’s performance against the seven feasibility criteria is provided below.

Criterion 1: Exposure Reduction

Exposure reduction can be provided by emissions reductions relative to existing operations and by moving emissions sources farther from the community. Exposure reduction was evaluated on a qualitative basis because conducting a health risk assessment is not within the scope of the Plan.

The evaluation of whether an action by itself would provide exposure reduction through emissions reductions requires consideration of related actions. Often it is related actions, which contribute the most to emissions reductions and, by extension, reduces exposure. As an example, to promote increased use of zero-emissions cargo handling equipment (CHE) at the Seaport, the Port or tenant would first conduct comprehensive infrastructure planning, then conduct specific engineering for the tenant's location followed by infrastructure construction and deployment of zero-emissions CHE. There may also be required demonstration testing for each class of CHE as well as grant applications to minimize financial barriers to equipment deployment. Given the complexity of evaluating related actions, the Port evaluated exposure reduction only for actions that directly resulted in a change to cleaner equipment (i.e., either deploying cleaner equipment or incentives that resulted in cleaner equipment, etc.), thereby providing emissions reductions and by extension, exposure reduction.

The sources for emissions reductions estimates were 1) technical memoranda prepared for this evaluation (see Ramboll 2020a, b, c, d) and 2) available information on emissions by equipment category from the 2017 Emissions Inventory (Ramboll 2018), and the associated information on the number of pieces of equipment contained in that equipment category. This information provides an estimate of the emissions reductions achievable by converting each piece of equipment to zero emissions and can then be combined with the likely number of pieces of equipment to be upgraded to cleaner equipment because of the action. For example, for actions leading to the replacement of diesel trucks with zero-emissions trucks, the exposure reduction criterion considers the average per-truck DPM emissions reduction and the number of trucks likely to be affected. The estimated annual DPM emissions reduction benefit associated with converting all trucks in the Port's STEP registry (approximately 6,000 trucks) to zero-emissions trucks is 0.3 tons,^{1,2} leading to estimated DPM emissions reductions of 0.00005 tons per truck converted to zero emissions. Therefore, the exposure reductions achievable by converting many trucks to zero emissions would be very small. As another example, actions reducing diesel truck emissions (e.g., by reducing the number of truck trips) would result in smaller emissions reductions than converting a truck to zero emissions. For context, the total estimated annual Seaport-related DPM emissions in 2017 was 35.8 tons (Ramboll 2018). The qualitative assessment approach provides sufficient information to evaluate the exposure reduction potential of an action based upon the likely emissions reductions and rate the specific action accordingly.

¹ This is the Port's "best estimate" of Calendar Year 2017 truck-related DPM emissions developed using current methodology. Emissions estimates based on current methodology are found in Tables 8.1a and 8.1b of the 2017 Port emissions inventory (Ramboll 2018).

² 2020 emissions would be even lower because turn-over of older trucks to trucks with cleaner engines is an on-going process.

Criterion 2: Affordability

Affordability was evaluated for each action individually. Where applicable, the rating was adjusted to reflect the affordability of a group of similar actions. For example, an individual study may be affordable for the Port; however, concurrent multiple studies may be less affordable. Consequently, studies that would be performed by the Port were generally rated as moderate in affordability. Affordability will also be a consideration in the selection of actions recommended for implementation. As the current (Spring 2020) COVID-19 crisis indicates, the Port's and its partner agencies' ability to support implementation is subject to many factors, some of which are outside the Port's control.

Criterion 3: Cost Effectiveness

Quantitative emissions reductions estimates were developed for equipment actions only and are provided in four technical memoranda referenced above. Emissions reductions estimates were developed for DPM, criteria air pollutants, and GHGs, as appropriate for the equipment type. Quantitative estimates of emissions reductions form the basis for the cost effectiveness evaluation.

Costs for most actions were very difficult to define. Unlike cost effectiveness calculations for grant applications, where the specific types of equipment and associated installation or construction cost have been determined, estimated costs here can only be defined in ranges. In many cases there is insufficient information to develop a reasonable cost range. This is particularly true for actions that focus on technology that is not yet available. Developing cost estimates for actions that involve providing incentives to deploy cleaner equipment is also challenging as the amount of incentives that will achieve specific levels of response at the Port of Oakland is unknown. In most cases therefore, a unit cost effectiveness (\$/tons of emissions reduced) could not be established. However, it was sometimes possible to estimate *relative* costs as discussed in the presentation of results for Group 1.

Where reasonably accurate cost estimates could be developed, cost effectiveness was calculated as the *estimated annual cost per ton of annual emissions reduced*. The cost effectiveness criterion considered criteria pollutants and GHGs. These constituents were evaluated independently, considering both the total quantity of emissions reductions and, where available, the cost per ton of emissions reductions. When the cost/ton of emissions reductions is low, cost effectiveness is high. Low cost effectiveness means that the cost/ton of emissions reduced is high.

For certain actions, the Port developed a qualitative cost effectiveness assessment. The 2017 Emissions Inventory (Ramboll 2018) provides total emissions by equipment category. When an equipment class contains many pieces of equipment and generates only small quantities of emissions, as is the case for drayage trucks, the small quantities of emissions reductions that could be achieved would generally have a high cost because a lot of equipment would have to be replaced or upgraded. Therefore, actions pertaining to drayage trucks would have low cost effectiveness.

Criterion 4: Commercial Availability

This criterion only applies to actions involving equipment or infrastructure. As discussed in Appendix D of the Plan, commercial availability is evaluated using Technological Readiness Levels (TRLs). The TRLs presented in Appendix D were modified slightly from those used by the US Department of Energy to be more specifically applicable to actions that could occur as part of Plan implementation. Equipment and infrastructure actions meeting or exceeding TRL 9 were rated as High for commercial availability. Equipment and infrastructure actions meeting TRL 8 were rated as Moderate; all other TRL levels were rated as Low. The commercial availability rating of various equipment and infrastructure actions will change over time and will be updated as needed in future rounds of evaluation.

Criterion 5: Operational Feasibility

The operational feasibility criterion is focused on equipment and infrastructure actions. However, certain other actions could have operational constraints such as staffing or other administrative factors. For example, it is operationally feasible for the Port to conduct studies. However, the number of studies that the Port can conduct is subject to availability of staffing and budget resources. Thus, while studies are operationally feasible for the Port, they received a rating of Moderate to reflect the fact that only a limited number of studies can effectively be contracted and managed at any one time. A similar situation exists for Port actions involving planning and incentive programs. Planning and incentive programs actions received a Moderate rating for operational feasibility.

Criterion 6: Acceptability

The acceptability criterion reflects the willingness of an organization to implement the action. Step 2: *Screen* included consideration of potential adverse side effects, and thus addressed the potential for an action to be unacceptable to stakeholders affected by that action. Screened Actions would be undertaken by the Port or a Port-related business. The evaluation provides information on the acceptability of various actions to the Port, and the Port's understanding of Port-related businesses' willingness to undertake actions under their purview.

Criterion 7: Need

The Need criterion addresses qualitative aspects not reflected in the other feasibility criteria that may influence decision to select an action for implementation, such as increasing operational experience with zero-emissions equipment. While the description of this criterion included eight factors, other factors might affect the assessment of Need. The evaluation describes how the Screened Action satisfies any of the identified Need factors or other Need factors that are not specifically enumerated in the description of the criterion. Screened Actions that do not address a specific Need factor rate Low on this criterion. Screened Actions that address multiple Need factors (i.e., three or more) rate High on this criterion.

STEP 3 EVALUATION RESULTS SUMMARY - GROUP 1 SCREENED ACTIONS

Group 1 consists of 20 Screened Actions. Table 1 provides the detailed evaluation results for each of these Screened Actions. Based on availability of data, the Port conducted a qualitative evaluation for 14 of the Group 1 actions, and a quantitative evaluation for six of the Group 1 actions.

The evaluations showed that several actions received multiple high ratings (e.g., Action 198: *Use Air District Incentives to Upgrade Tugs and Barges* was rated High for four criteria), and some actions only received low ratings (e.g., Action 187: *Create Sustainable Freight Advisory Committee*). A summary of findings for each evaluation criterion is provided below.

Criterion 1: Exposure Reduction

Nine of the 20 actions evaluated provide exposure reduction through emissions reductions. The remaining actions are studies, plans, or similar actions that would not on their own provide direct emissions reductions, and therefore would not provide any exposure reduction. The potential direct emissions reductions ranged from very small reductions (e.g., Action 280: *Pursue a Hydrogen Fuel Cell Demonstration Project*) to substantial reductions for Action 198: *Use Air District Incentives to Upgrade Tugs and Barges*.

Criterion 2: Affordability

The Port had sufficient information to evaluate affordability for 16 of the 20 Group 1 actions. Affordability was not applicable to two actions (Actions 187: *Create Sustainable Freight Advisory Committee* and 189: *Set Interim Targets for Zero Emissions Trucks*). The Port had insufficient information to evaluate the affordability of Action 200: *Implement a Clean Locomotive (Tier 4 Locomotive) Program* and Action 280: *Pursue a Hydrogen Fuel Cell*

Demonstration Project. These two actions were rated Unknown (“Unk.”) for affordability. The affordability of other actions ranged from Low to High. Studies, plans, and similar actions that are individually affordable to the Port but could result in a high cumulative cost if several of these actions are implemented were rated as Moderate for affordability.

Criterion 3: Cost Effectiveness

As previously stated, nine actions would provide emissions reductions. Of these, six were evaluated on a quantitative basis and three on a qualitative basis. The Port developed a cost estimate for four of the twenty actions in Group 1. This is not surprising because much of the technology included in the Screened Actions is too new to have established pricing. In some cases, information on equipment pricing was available, but operational costs could not be determined. Table 1 provides available cost information as part of the discussion for the cost effectiveness criterion. Because all criteria are rated on a None/Low/Moderate/High scale, qualitative information is sufficient to develop a rating for the cost effectiveness criterion.

Criterion 4: Commercial Availability

The commercial availability criterion was applicable to seven actions. In all cases, it was apparent whether a given technology was commercially available. Three of the seven actions received a High rating; the other three, associated with technology that is still in the developmental stage, received a Low rating.

Criterion 5: Operational Feasibility

The operational feasibility criterion was applicable to all 20 Group 1 actions. Actions based on proven, in-use technology were rated High for this criterion. Conversely, if the technology or process is still in the developmental stage, the action was rated Low. Studies, plans, and similar actions are individually operationally feasible for the Port, but could result in a high cumulative cost if several of these actions are implemented. Therefore, these types of actions were rated as Moderate for operational feasibility.

Criterion 6: Acceptability

The Acceptability criterion was applicable to all 20 Group 1 actions. In general actions that are low in cost and high in operational feasibility are rated High for acceptability. Increasing cost and complexity typically reduce the rating for this criterion. Actions that pose a potential safety hazard or produce negligible emissions reductions at a high cost are rated “None” for acceptability. The acceptability criterion was the only criterion for which any actions received a “None” rating.

Criterion 7: Need

The Need criterion was applicable to all 20 Group 1 actions. Only three actions were rated High for the Need criterion; nine did not satisfy any of the factors comprising the Need criterion and received a Low rating.

STEP 4: PRIORITIZATION - METHODOLOGY

In Step 4: *Prioritize and Engage*, the Port first converts the ratings for each Screened Action into a numerical score to provide an initial assessment of the relative performance of each Screened Action. Next, the Port reviews all the actions relative to each other. For example, Action 282: *Retrofit Tugs with Diesel Particulate Filters (DPFs)* would result in emissions reductions approximately equal to either 1) converting all drayage trucks serving the Port to zero emissions or 2) converting all locomotives in the Seaport area to zero emissions. In addition, Action 282 would be easier and less costly to implement, thus making it preferable to actions that would convert all drayage trucks or all locomotives serving the Seaport area to zero emissions. However, Action 282 is also the only action that would result in an increase in fuel consumption (and therefore GHG emissions) and is one of the few actions that might result in increased operational costs for tug operators. In addition, its cost effectiveness is much lower than the cost effectiveness of Action 198: *Use Air District Incentives to Upgrade Tugs and Barges*. Relative considerations of this type influenced prioritization of actions in Step 4.

If two actions ranked similarly in the initial assessment, the action providing more cost-effective emissions reductions would be deemed preferable. If cost effectiveness could not be calculated, the action providing higher overall emissions reductions would be generally preferable, provided the action were also affordable.

STEP 4: PRIORITIZATION - GROUP 1 SCREENED ACTIONS

Table 4 summarizes the evaluation ratings for each of the 20 Screened Actions in Group 1. The highest-ranking actions are:

- Action 198: *Use Air District Incentives to Upgrade Tugs and Barges*
- Action 188: *Establish Permanent Truck Parking & Container Staging in Logistics Area*

These actions are described further below.

Action 198 is ranked first. Action 198 assumes that all tugs would be upgraded to Tier 4 engines prior to the regulatory deadline for doing so (anticipated for 2026). Retrofitting the nine tugs that

Table 4. Summary of Evaluation and Prioritization Results for Group 1 Actions

Action No.	Name of Suggested Action	Qualitative or Quantitative Evaluation?	1 - Exposure Reduction	2 - Affordability	3 - Cost Effectiveness	4 - Commercial Availability	5 - Operational Feasibility	6 - Acceptability	7 - Need
198	Use Air District Incentives to Upgrade Tugs and Barges	Quantitative	H	M	M	H	M	H	H
188	Establish Permanent Truck Parking & Container Staging in Logistics Area	Qualitative	L	M	N/A	N/A	H	H	M
217	Low Sulfur Diesel Fuel in Ocean-Going Vessels	Quantitative	H	L	L	H	M	L	H
186	Adopt Electrical Infrastructure Plan Incorporating Trucks	Qualitative	N/A	M	N/A	N/A	M	M	M
192	Develop Investment Plan to Support Port Infrastructure for Truck Charging	Qualitative	N/A	M	N/A	N/A	M	M	M
193	Study Favorable Time-of-Day Electricity Rate Structure for Truckers	Qualitative	N/A	M	N/A	N/A	M	M	M
195	Study Effects of Larger Vessels on Truck Traffic	Qualitative	N/A	M	N/A	N/A	M	M	L
280	Pursue a Hydrogen Fuel Cell Demonstration Project	Qualitative	L	Unk.	L	L	L	H	H
194	Award Long-Term Lease for Trucker Services Center	Qualitative	N/A	L	N/A	N/A	M	L	M
197	Study of Efficiency Gains from Increased Truck Double-Cycling	Qualitative	N/A	M	N/A	N/A	M	L	L
201	Study Feasibility of Electric Switchers at BNSF, OGRE	Qualitative	N/A	M	N/A	N/A	M	L	L
183	Provide Common Drayage Truck Charging Infrastructure	Qualitative	N/A	L	N/A	L	L	M	M
282	Retrofit Tugs with Diesel Particulate Filters (DPFs)	Quantitative	L	L	L	L	L	L	M
200	Implement a Clean Locomotive (Tier 4 Locomotive) Program	Quantitative	L	Unk.	L	H	L	L	L
187	Create Sustainable Freight Advisory Committee	Qualitative	N/A	N/A	N/A	N/A	L	L	L
189	Set Interim Targets for Zero Emissions Trucks	Qualitative	N/A	N/A	N/A	N/A	L	L	L
199	Implement a Clean Ship (Tier 3 Vessel) Program	Quantitative	L	L	L	L	L	L	L
190	Commercialization Effort for ZE Trucks	Qualitative	L	L	L	N/A	L	None	M
196	Study Feasibility of Off-Dock Yard Using ZE Trucks	Quantitative	L	L	L	N/A	M	None	L
191	Increase Weight Limit for Single Axle Zero-Emissions Trucks	Qualitative	N/A	L	L	N/A	L	None	L

provide approximately 80% of tug services related to the Seaport with Tier 4 engines would provide substantial DPM emissions reductions (an estimated 2.09 tons/year). Tug emissions comprise the second largest category of DPM emissions at Seaport after ocean-going vessels. Based on the 2017 Emissions Inventory (Ramboll 2018), DPM emissions from tugs exceed the *combined* DPM emissions from dredges, cargo-handling equipment, trucks, locomotives, and construction and maintenance equipment. Due to the location of the emissions (close to the ground), tug emissions also have a high per-ton exposure factor compared to ocean-going vessels (which have tall exhaust stacks providing greater dispersion of emissions). Tier 4 engines for tugs are available. While retrofitting a tug is a complex undertaking, substantial emissions reductions could be generated from retrofitting a relatively small amount of equipment (i.e., nine tugs). The primary challenges with this Selected Action are likely to be the availability of sufficient incentives to modify all nine tugs and the ability of tug boat operators to take their vessels out of service for the duration of the retrofit period.

Action 188 is ranked second. This action was evaluated on a qualitative basis and received high ratings for operational feasibility and acceptability. Providing a permanent truck parking area within the Seaport would maintain existing emissions reductions achieved by the temporary parking currently being provided by the Port. This action could also provide an opportunity to install common truck charging stations in the future.

These highest-ranking actions are considered Selected Actions, and may be recommended for implementation in Step 5: *Program*. The Port will conduct other rounds of evaluation and prioritization in the future. The frequency of future rounds will be determined by: (1) the rate at which new Suggested Actions are identified and pass Step 2: *Screen*, (2) actions currently in progress are completed (the Port and stakeholders have the capacity to undertake additional actions), and (3) technology continues to mature and the ratings of actions may change as a result.

NEXT STEPS

The information developed as part of the evaluation and prioritization of Group 1 actions will be presented to the 2020 and Beyond Plan Task Force Co-Chairs in April 2020 for their review and presentation to the Task Force. The Port has scheduled Task Force meetings in May 2020 in the form of one-hour webinars in conformance with public health guidelines during the COVID-19 period. At the webinars, the Co-Chairs will receive input from the Task Force members on the Co-Chairs review of the analysis documentation of Steps 2-4 developed and provided by the Port. As appropriate, the Co-Chairs will convene a Working Session, which will include Task

Force members, for collaborative problem-solving on Selected Actions specified by the Co-Chairs and the Task Force. The Co-Chairs will document the Working Sessions to inform the qualitative assessment of specified Selected Actions.

After the Co-Chairs and the Task Force complete their review, as part of Step 5, Port staff will recommend certain Selected Actions for project and budget approval by the Board. The staff recommendation will be informed by the Co-Chairs and Task Force engagement undertaken in Step 4. The Board retains sole and absolute discretion to decide whether to approve or disapprove the recommendation. Following Board approval, the Selected Action is classified as a “Programmed Action” and implementation planning can begin. Programmed Actions will be added to the Near-Term Action Plan. If the Board does not approve the Port staff recommendation, Port staff will respond to the Board’s direction. Other organizations may choose to fund and schedule an Implementing Action. In this case, Port staff will classify a non-Port-sponsored actions as a “Programmed Action.”

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Table 1: Evaluation of Group 1 Screened Actions

Action No.	Name of Suggested Action	Description of Suggested Implementing Action	Qualitative or Quantitative Evaluation?	Evaluation by Criterion															
				1 - Exposure Reduction		2 - Affordability		3 - Cost Effectiveness		4 - Commercial Availability		5 - Operational Feasibility		6 - Acceptability		7 - Need			
				Rating	Notes	Rating	Notes	Rating	Notes	Rating	Notes	Rating	Notes	Rating	Notes	Rating	Notes		
200	Implement a Clean (Tier 4) Locomotive Program	The Port of Oakland implements a Clean Locomotive Program to increase the number of U.S. EPA Tier 4 compliant locomotives used by the UP, BNSF, and OGRE railroads to provide service in and out of the Port of Oakland.	Quantitative	L	The UPRR is not on Port property, therefore this action would only apply to the BNSF and OGRE. OGRE does not use line-haul locomotives, but rather switcher engines, so this action does not apply to the OGRE. While emissions reductions from cleaner locomotives would occur in the vicinity of the community, line-haul locomotives only spend a small amount of time at any one railyard. Estimated emissions reductions from accelerating line-haul engine turn-over to Tier 4 are only 0.001 tons of DPM in 2023, relative to the estimated 2020 baseline. A greater benefit could be achieved by upgrading switcher engines to Tier 4 (see evaluation of Screened Action 239).	Unk.		L	The level of incentives that would be required to accelerate use of Tier 4 locomotives in and out of the OGD is unknown. This would require a study to understand how much money would be involved to influence railroad behavior.	L	The cost effectiveness of this action would be low because the emissions reductions that are achievable at the Port are extremely low.	H	Tier 4 engines are commercially available, and the changes in locomotive fleet composition from 2017 to 2020 indicate that Tier 4 engines are starting to be integrated into line-haul service without incentives.	L	While use of Tier 4 locomotives is operationally feasible and providing incentives is also operationally feasible, allocating specific line-haul locomotives to service in and out of Oakland is likely to have low feasibility. Railroads use their line-haul locomotives all over the county as needed to meet demand for rails service; they do not dedicate them to a specific route.	L	Given the low emissions reductions achievable, this action has a low priority for the Port of Oakland.	L	While this action would provide emissions reductions in the vicinity of the community, substantially greater local benefits can be achieved from upgrading switcher engines to Tier 4 (see Screened Action 239), and the funds that would be devoted to a clean locomotive program would provide more emissions reductions benefits if used for other actions.
201	Study Feasibility of Electric Switchers at BNSF, OGRE	The Port of Oakland studies the feasibility of using electric switcher locomotives at the two Port railyards.	Qualitative	N/A	Conducting a study does not provide direct emissions reductions.	M		M	The Port has the ability to conduct this study, the Port's capacity to conduct studies, prepare plans, and implement other planning actions is subject to budget and staff resources. However, electric switchers do not currently exist.	N/A	This action would not provide any direct emissions reductions. Therefore, this criterion does not apply.	N/A	This criterion only applies to equipment actions.	M	It is feasible for the Port to conduct a study; the capacity of the Port to implement these types of administrative actions is subject to budget and staff resources.	L	It is acceptable to the Port to conduct a study, provided that sufficient staff and budget resources are available. However, given that electric switchers do not currently exist, a study of this nature has low priority for the Port.	L	Electric switcher engines are currently unavailable. BAAQMD recently included this idea in a list of options for reducing emissions from port related activity (Ramboll 2020c) but the option referenced (a CARB and SCAQMD funded demonstration project) has not moved beyond the planning stage (Ramboll 2020c). The Port has conducted an initial assessment of the benefit of replacing existing switcher engines with Tier 4 switchers. Changing to Tier 4 switchers would provide approximately 96% of the total DPM emissions reductions possible relative to current emissions from switcher (a reduction of 0.243 tons/year compared to total emissions of 0.252 tons/year) (Ramboll 2020c). OGRE has already replaced its old switcher engine with a Tier 4 engine. Given the current state of the technology and the minimal amount of incremental emissions reductions that could be achieved by deploying electric switchers, there is little need to conduct this study.
217	Low Sulfur Diesel Fuel in Ocean-Going Vessels	Sulfur is a significant contributor to PM emissions. Ships maneuvering within the North American Emission Control Area (ECA), including California, are required to use fuel that contains no more than 0.1% sulfur. Reducing the sulfur content of fuel used in OGVs could reduce PM emissions by approximately 10.8% for fuel containing 0.1% sulfur, and by 8.5% for fuel containing 0.02% sulfur. The Port could investigate the feasibility of creating incentives for vessel operators to use ultra-low-sulfur fuels in vessels calling the Port of Oakland.	Quantitative	H	Based on the Port's review, the sulfur content of fuel used by ocean-going vessels on the West Coast is much lower than the requirement. Analysis shows in-use fuel is approximately 0.05% sulfur, rather than the default 0.1% used by CARB in their assumptions (0.1% reflects the maximum allowable sulfur content within the U.S. West Coast Emissions Control Area [ECA]). Relative to the 0.1% default assumption used in the 2017 Emissions Inventory (Ramboll 2018) fuel containing 0.05% sulfur would result in an approximately 30% reduction in DPM emissions (Ramboll 2020b). This reduction is already being achieved. If vessels were able to use California on-road or off-road diesel, which contains no more than 0.0015% sulfur and is also known as ultra-low sulfur diesel (ULSD), then emissions of DPM could be reduced by approximately 6 tons relative to the 2017 Emissions Inventory, or 3 tons over current actual conditions.	L		L	Fuel containing 0.05% sulfur is already in use; therefore the evaluation of this criterion focuses on use of ULSD diesel. California compliant ultra-low sulfur fuel costs approximately 35% - 47% (\$238 - \$331) more per metric ton than the marine gas oil currently in use. If ULSD diesel is bought outside of California (i.e., not compliant with California volatility standards), the cost differential is approximately 18% (\$125/metric ton) (Ramboll 2020b). Given that fuel is a substantial portion of the operating cost for a container vessel, the affordability of ULSD diesel is low.	L	Use of California-compliant ultra-low sulfur diesel has an estimated cost effectiveness of \$2,800,000 - \$3,900,000 per PM ton reduced (equivalent to \$140,000 - \$195,000 per Carly Moyer ton). Using the lower non-California compliant ULSD diesel price, the cost effectiveness would be on the order of \$1,500,000 per PM ton (\$75,000 per Carly Moyer ton) reduced. There would be no GHG emissions reductions from using ULSD diesel.	H	ULSD diesel fuel is readily available.	M	ULSD diesel could easily be delivered by bunkering operations that currently deliver approved higher sulfur content fuel. However, use of this fuel may not be feasible in larger marine engines given current IMO limits on fuel volatility (minimum flashpoint) for the large marine engines used on OGVs. In addition, sulfur provides lubricity, and if fuel sulfur content is reduced below a critical threshold, manufacturers may require higher sulfur-content engine oils, counteracting the benefit of sulfur reduction in fuel.	L	The high incremental costs of using ultra low sulfur fuel would likely make it unacceptable to ocean carriers.	H	Reducing DPM emissions from ocean-going vessels is critical, as they represent by far the largest single source of DPM associated with the Seaport. This measure would provide benefits for vessels at berth as well as maneuvering and in transit, and would not adversely affect implementation of any other measures to reduce emissions associated with ocean-going vessels.
280	Pursue a Hydrogen Fuel Cell Demonstration Project	Identify opportunities for demonstration testing of a hydrogen fuel cell commercial vehicle.	Qualitative	L	Testing one, or even a few, hydrogen fuel cell vehicles would have a negligible exposure reduction benefit.	Unk.		L	The affordability of demonstration testing would depend on whether the Port and its partners could obtain grant funding or other substantial support (e.g., from OEMs) if the Port and its partners have to pay the entire cost of a hydrogen fuel cell vehicle and associated infrastructure for a pilot test; affordability would be low.	L	One or a few demonstration fuel cell vehicles would generate negligible emission reductions, and due to the state of the technology, the vehicles would be costly.	L	Hydrogen fuel cell trucks are considered to be TRL 6 or 7 (SPBP 2019). They are not commercially available.	L	Hydrogen fuel cell vehicles require availability of hydrogen fueling, either through on-site delivery of hydrogen or at hydrogen fueling stations. If the demonstration project involves at piece of cargo-handling equipment (e.g., a top-pick) hydrogen could be delivered by tanker truck. If the demonstration test involves a long-haul truck, hydrogen fueling stations would be required. There are few hydrogen fueling stations in the Bay Area. In its March 6, 2020 update of the list of hydrogen fueling stations in the State of California, the California Fuel Cell Partnership showed only one retail location in Oakland, at 350 Grand Avenue (CFCP 2020). The listing shows a total of 13 hydrogen fueling stations currently being operable in the Bay Area, with up to 6 additional stations possibly opening by the end of 2020. The listing shows a total of 41 stations in California (including the Bay Area stations), with up to 18 additional stations that may open by the end of this year (including the 6 in the Bay Area).	H	Port staff see promise in conducting a hydrogen fuel cell vehicle demonstration project, and are open to working with any tenant who expresses interest and a willingness to contribute.	H	This action would increase knowledge about the performance of hydrogen fuel cell vehicles in Port service. It is also important to continue to develop multiple zero-emissions options for vehicles. This action would complement other initiatives, such as hydrogen fuel power generation for resiliency.
282	Retrofit Tugs with Diesel Particulate Filters (DPFs)	Tugs represent a substantial fraction of Seaport-related DPM emissions. Because tug operations often occur relatively close to the ground, tug-related DPM emissions pose a higher exposure risk than corresponding levels of emissions from ocean-going vessels, if they are technically viable (i.e., able to perform effectively across the highly variable engine loads required by tug operations), diesel particulate filters could substantially reduce DPM emissions from tugs.	Quantitative	L	Among the Seaport-related emissions sources, tugs pose the greatest exposure risk (WOCAP 2019). CARB provides three levels of control for DPFs (Level 1: 25%, Level 2: 50%, and Level 3: 85%). Currently the only certified DPF system for marine applications is a Level 2 system. Retrofitting the nine tugs that provide 80% of Seaport-related tug services with a Level 3 PM reduction system (aka DPF) would reduce tug-related DPM emissions by an additional 0.31 tons over Tier 4 upgrades only. The evaluation of this action focused on upgrades from Tier 4 only because it is unlikely that tug operators would retrofit Tier 3 or lower engines with DPF (see discussion of operational feasibility). The discussion of Screened Action 198 provides the evaluation of upgrading tug engines from their existing tiers to Tier 4.	L		L	There are no certified Level 3 systems for tugs currently on the market; it is likely that manufacturers would develop certified Level 3 systems if new regulations require tugs to be retrofitted with DPF's (this may be implemented in the mid-2020s as part of new harbor craft regulations currently in the preliminary development stages by CARB). Based on a Cal Maritime study (Cal Maritime 2019) cited in Ramboll 2020a) the capital cost of retrofitting a Tier 4 tug with DPF would be approximately \$614,000 in addition to the approximately \$2.8 million to upgrade the tug to Tier 4. This is a substantial added cost. The study also estimates that fuel consumption would increase approximately 10% by adding the DPF, resulting in incremental operating costs of around \$36,000/year for fuel only (Ramboll 2020a). Additional operating costs would accrue for filter maintenance. Unless incentives are provided, affordability of DPF for tugs is likely to be low.	L	Considering capital and operational costs associated with DPFs, the estimated cost per ton of DPM reduced by adding DPF to a Tier 4 engine is \$3.95 million, and \$163,300 for a Carly Moyer ton. The addition of DPFs to Tier 4 tugs would have an adverse effect on GHG emissions. Use of DPFs would increase GHG emissions by an estimated net 6% due to increased fuel consumption over Tier 3 tugs not equipped with DPF (Ramboll 2020a).	L	Only one certified Level 2 system is currently available. Certified Level 3 systems are not available yet, and are unlikely to be available until after the Tier 4 engine standard is implemented (tentatively mid 2020s).	L	Due to the complexity of implementing a DPF system, it is likely that tug operators would simultaneously upgrade to Tier 4. This would also avoid the need to take a tug out of service twice for upgrades. Earlier DPF systems that could have achieved Level 3 emissions reductions failed due to the rugged service environment of tugs. The certified Level 2 system is operationally feasible. There is no information on operational feasibility of certified Level 3 systems.	L	Until certified Level 3 systems are available, retrofitting a tug with a Level 3 system is likely to be unacceptable to tug operators. However, given that a Level 3 DPF may be a requirement in the future, tug operators are unlikely to be willing to install a Level 2 system at this time.	M	Retrofitting Tier 4 tugs with Level 3 DPF would result in emissions reductions approximately equal to either converting all drayage trucks to zero emissions or converting all locomotives in the Seaport area to zero emissions.

Source: Port of Oakland 2020
 For a description of the evaluation criteria, please see the text of this evaluation memorandum.
 Acronyms and abbreviations are defined in the list of acronyms and abbreviations found following the table of contents of this evaluation memorandum.