

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							
183	Common Drayage Truck Charging Infrastructure	The Port, working with the City of Oakland, could promote off-terminal charging and servicing locations within the Port's land, as part of the ongoing Truck Management Plan effort or within the Oakland Army Base development process. The Plan notes that the Port will be responsible for providing power to trucks domiciled at the Port-provided parking areas (Plan at p. F-24), but does not explain why similar charging infrastructure could not be used by other drayage trucks serving the Port.	Qualitative	N/A	Installing supporting infrastructure does not directly provide exposure reduction. The Port is considering installing common charging stations at the former UP Roundhouse parking area, however, even if a substantial number of trucks purchase zero-emissions trucks, the effect on overall emissions and exposure reduction would be minimal. Truck emissions constitute a very small portion to emissions in West Oakland. According to the Port's 2017 Emissions Inventory (Ramboll 2018) Port-related truck DPM emissions were 0.3 tons in 2017. According to the WOCAP, which also takes into consideration some on-freeway emissions, Port-related truck emissions were 0.5 tons in 2017 for all approximately 6,000 trucks in the Port's Secure Truck Enrollment (STEP) registry combined. According to the WOCAP, Port-related truck DPM emissions are projected to decrease to 0.12 tons in 2024 even without any electrification.	L	While the cost of individual charging stations is affordable, providing sufficient charging stations to accommodate a large number of trucks would not be affordable due to the large number of charging stations that would be required.	N/A	Installing infrastructure does not directly provide emissions reductions, and therefore cost effectiveness cannot be calculated. However, even if the Port worked to provide additional common charging locations outside of the former UP Roundhouse location, the number of additional trucks that could be accommodated would be small, and all 6,000 trucks in the Port's STEP constitute less than 1% of total Port-related emissions. Therefore, any emissions reductions supported by this action would be small.	L	Zero-emissions trucks are still in the pilot/demonstration stage and there is no universal standard for chargers. Until there is a universal standard for chargers or the number of required charging configurations is limited to a small number, chargers are considered TRL 7.	L	While installing chargers is operationally feasible, installing chargers for every type of zero-emissions truck would require a large number and variety of chargers, and the Seaport lacks the space to accommodate charging for all future zero-emissions trucks.	M	The Port is considering installing common chargers at the former UP Roundhouse parking area. Additional common chargers may be installed at a trucker services facility in the former OAB area (if a suitable concessionaire is interested in pursuing such a facility).	M	While this action would support deployment of zero-emissions drayage trucks, deployment of zero-emissions trucks offers only very small reductions in DPM emissions and exposure reduction. This action would help promote limited reductions in GHG emissions.							
186	Adopt Electrical Infrastructure Plan	The Port of Oakland adopts an Electrical Infrastructure Plan for the maritime waterfront areas of Oakland. This Plan seeks to remove barriers to adoption of zero-emission trucks, such as cost, land, and ownership of charging equipment.	Qualitative	N/A	Infrastructure planning itself does not provide direct, quantifiable emissions reductions.	M	The Port can afford to develop this plan; the Port's ability to prepare this plan is subject to staff and budget resources.	N/A	There are no emissions reductions associated with plans and studies; therefore the cost effectiveness criterion does not apply.	N/A	This criterion only applies to equipment actions.	M	It is feasible for the Port to adopt a plan; the capacity of the Port to implement this action is subject to budget and staff resources.	M	It is acceptable for the Port to adopt a plan; the capacity of the Port to implement this action is subject to budget and staff resources.	M	Planning for infrastructure needs is a critical element of the pathway to zero emissions.							
187	Create Sustainable Freight Advisory Committee	The Air District works with the City and Port of Oakland and other agency and local partners to create a Sustainable Freight Advisory Committee to provide recommendations to each agency's governing board or council. The Committee's scope includes: air quality issues, enhanced/enforced enforcement of truck parking and idling, improved referral and follow-up to nuisance and odor complaints related to goods movement, improvements to the Port appointment system, charging infrastructure and rates, developing land-use restrictions in industrial areas, funding, and consideration of video surveillance to enforce truck parking, route, and idling restrictions.	Qualitative	N/A	Forming a Sustainable Freight Advisory Council would not provide direct emissions reductions.	N/A	Most of the tasks proposed for this Committee are already being conducted by the Port or Port-related groups, such as the Port Efficiency Task Force, Truck Working Group, or 2020 and Beyond Plan Task Force.	N/A	There are no emissions reductions associated with plans, studies, and committees; therefore the cost effectiveness criterion does not apply.	N/A	This criterion only applies to equipment actions.	L	The Port is already involved in many of the initiatives that are proposed as part of a proposed Committee. It would be difficult to manage overlapping areas of responsibility with existing initiatives.	L	This effort would be duplicative of existing efforts.	L	The Sustainable Freight Action Plan exists at the State level, and the Port already conducts most of the actions for which the proposed Committee would be responsible.							
188	Establish Permanent Truck Parking and Container Staging in Logistics Area	The City and Port of Oakland work to establish permanent locations for parking and staging of Port related trucks and cargo equipment, i.e. tractors, chassis, and containers. Such facilities will provide long-term leases to parking operators and truck center operators at competitive rates. Such facilities will be at the City or Port logistics center or otherwise not adjacent to West Oakland residents.	Qualitative	L	The Port is committed to creating a permanent 15-acre, most likely at the former UP Roundhouse property for truck parking and associated container staging. Because truck parking and associated container staging is currently occurring within the Port area, this action would not provide any surplus emissions reductions.	M	The Port is committed to creating a permanent 15-acre, most likely on the site of the former UP Roundhouse property for permanent truck parking and associated container staging, doing so would potentially prevent the Port from earning higher lease fees if the property were leased for another purpose.	N/A	There are no emissions reductions associated with continuing to provide truck parking and associated temporary container staging within the Port area.	N/A	This criterion only applies to equipment actions.	H	The Port is currently providing truck parking and associated container staging at the former UP Roundhouse location; this is highly feasible.	H	Setting aside 15 acres for truck parking and associated container staging on a permanent basis is highly acceptable to the Port. Setting aside further acreage would not be acceptable to the Port.	M	There is an on-going need for truck parking and related storage for chassis, containers, etc.; the 15-acre area, in combination with the City of Oakland's dedication of 15 acres in the former OAB area, is projected to address the commitment for overnight truck and container staging.							
189	Set Interim Targets for Zero Emissions Trucks	The Port of Oakland, as part of the 2020 and Beyond Seaport Air Quality Plan, supports the transition to zero-emission drayage truck operations, including setting interim year targets out to 2035.	Qualitative	N/A	Setting targets does not provide direct emissions reductions.	N/A	The Port completed the Zero-Emissions Drayage Truck Feasibility Study (Port 2019b), which concluded that, due to technological readiness and commercial availability limitations, it is not feasible to set targets at this stage of Plan implementation. No further expenditures are anticipated.	N/A	There are no emissions reductions associated with setting targets.	N/A	This criterion only applies to equipment actions.	L	The Port's Zero-Emissions Drayage Truck Feasibility Study (Port 2019b) determined that it was not feasible to set targets at this stage of Plan implementation.	L	As shown in the Port's Zero Emissions Drayage Truck Feasibility Study (Port 2019b), it is premature to set targets at this stage of technology development.	L	Setting targets in advance of technology development would not accelerate the technological trajectory. Targets already exist in the SPBP's CAAP 4.0, yet technology development has lagged expectations (see staff report at the March 9, 2020 special board meeting of the Ports of Los Angeles and Long Beach to determine whether to approve an ordinance for a truck rate).							
190	Commercialization Effort for ZE Trucks	The Port of Oakland, as part of the 2020 and Beyond Seaport Air Quality Plan, supports the transition to zero-emission drayage truck operations, including... coordinating an extensive zero-emission truck commercialization effort.	Qualitative	L	A commercialization effort would result in some very small immediate DPM emissions reductions, as well as some limited GHG emissions reductions, as a small number of diesel trucks are replaced by zero-emissions trucks being evaluated in various types of service as part of the commercialization effort. Even long-term, replacing all diesel-powered trucks with zero-emissions trucks would only provide small DPM emissions reductions. Even absent electrification, the approximately 6,000 trucks serving the Port are forecast in the WOCAP to produce only 0.12 tons of DPM in 2024 while working at the Port and driving near West Oakland.	L	Coordinating an extensive zero-emissions truck commercialization effort would be very costly, requiring not only pilot testing of zero-emissions trucks in various applications, but also developing the necessary charging and electrical supply infrastructure, and service and supply systems. Such an effort is not affordable to the Port.	L	Even if all diesel-powered trucks were eventually replaced with zero-emissions trucks, DPM emissions reductions would be very small, and not cost-effective compared to other more feasible emissions reductions actions. This action is also not cost-effective for GHGs, as replacing all trucks with zero-emissions vehicles would only provide 50% of the GHG emissions reductions achievable by replacing all CFE with zero-emissions equipment.	N/A	This action would be designed to create commercial availability.	L	This action is not operationally feasible for the Port. The Port does not control the means of production, supply, or service for zero-emissions trucks, and does not control infrastructure outside of the Seaport area. In addition, the Port does not have the staff resources to manage the logistical requirements of such a program.	None	This action is not acceptable to the Port.	M	Technology, market, and regulatory drivers are slowly creating a market for zero-emissions heavy-duty trucks. Replacing all diesel-powered trucks serving the Port with zero-emissions trucks would only provide minor reductions in DPM emissions; complete conversion of the Port drayage truck fleet could reduce current Seaport-related GHG emissions by approximately 8.8% once the source of electricity is 100% carbon free (required by 2045 for California's Renewable Portfolio Standard).							
191	Increase Weight Limit for Single-Axle Zero-Emissions Trucks	The Port of Oakland, as part of the 2020 and Beyond Seaport Air Quality Plan, supports the transition to zero-emission drayage truck operations, including... working with the City of Oakland to amend local ordinances to increase the allowable weight limits for single-axle zero-emissions trucks on local streets within the Port and the Oakland Army Base/Gateway areas.	Qualitative	N/A	Only a small fraction of drayage trucks could work exclusively in the Port area (most trucks require the flexibility to be able to take on trucks of any length) and even if yard tractors are included in this action, it is unlikely that more than 10% of all drayage within the Port area would occur using single-axle zero-emissions trucks. Given that all drayage trucks combined contribute less than 1% of all Seaport-related DPM emissions, this action would provide only very minor DPM emissions reductions (i.e., less than 0.1% of all Port-related DPM emissions). This action would also provide some GHG emissions reductions, estimated to be a maximum of no more than 1% of all Seaport-related GHG emissions.	L	The Port could theoretically afford to support development of an ordinance by the City, through passing a Board resolution and providing information on truck use. However, this ordinance would raise safety (truck overturning) and maintenance (increased roadway damage due to higher axle weights) concerns.	L	Although DPM emissions reductions would be very minor, this action would not require the purchase of any new equipment or other expenditures. In addition, this action would result in limited GHG emissions reductions. However, the heavier per-axle weight would lead to increased wear and tear on Seaport roads, requiring either a stronger pavement section (i.e., replacement of the current paving section) or more frequent repaving. The increased maintenance would lead to slightly higher emissions from construction equipment, and the manufacture and placement of asphalt.	N/A	This criterion only applies to equipment actions.	L	Allowing single-axle zero-emissions trucks on surface street could create a potential safety hazard, as these vehicles could flip when turning while hauling a loaded container. In addition, the heavier axle weight would increase the cost of road maintenance in the Seaport area.	None	This action is not acceptable to the Port as an ordinance allowing use of these types of trucks could create safety hazards. However, the Port is working on an overweight corridor study to evaluate the possibility of raising the overweight limit from 95,000 lbs. to 110,000 lbs. and to determine any necessary associated requirements for trucks.	L	This ordinance would be applicable to only a small fraction of all trucks, and could result in safety and maintenance concerns.							
192	Develop Investment Plan to Support Port Infrastructure for Truck Charging	The Port of Oakland, as part of the 2020 and Beyond Seaport Air Quality Plan, supports the transition to zero-emission drayage truck operations, including... developing an investment plan for needed upgrades to the Port's electrical infrastructure.	Qualitative	N/A	Developing a plan does not generate direct emissions reductions.	M	This action is affordable to the Port; the Port's capacity to conduct studies, prepare plans, and implement other planning actions is subject to budget and staff resources. Language	N/A	Preparing a plan does not generate any direct emissions reductions; therefore this criterion does not apply.	N/A	This criterion only applies to equipment actions.	M	The has the ability Port to develop this plan provided that sufficient staff and budget resources are available.	M	The Port supports analysis of costs and financing options associated with the 2020 and Beyond Plan. The Board of Port Commissioners directed staff to provide an agenda report to the Board by December 2020 on costs and financing aspects associated with the 2020 and Beyond Plan including discussions of grant and incentive funding opportunities from outside sources (i.e., CARB, BAAQMD, and the California Energy Commission, etc.) and private sector and Port resources.	M	There will be an on-going need for investment in infrastructure, both for the Port as a whole (i.e., ensuring a sufficient and reliable supply of electrical power), and for specific projects. The Port's approach, as described in the 2020 and Beyond Plan, is to build out needed infrastructure as the technology develops and tenants make commitments for purchasing zero-emissions equipment.							
193	Study Favorable Time-of-Day Electricity Rate Structure for Truckers	The Port of Oakland also works with the California Public Utilities Commission and the California Energy Commission to study the development of time-of-day electric rate structures favorable to truck operators.	Qualitative	N/A	Modifying electrical rates would not provide any direct emissions reductions.	M	This action is affordable to the Port; the Port's capacity to conduct studies, prepare plans, and implement other planning actions is subject to budget and staff resources. Language	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	The Port has the ability to work with the CEC to conduct this study, provided that sufficient staff and budget resources are available.	M	It is acceptable to the Port to conduct this study provided that sufficient staff and budget resources are available.	M	Determining the types of rates that would incentivize truckers to purchase zero-emissions vehicles would enable the CEC and the Port to determine whether such rates are feasible at the Port.							
194	Award Long-Term Lease for Trucker Services Center	The City and Port of Oakland award long-term leases to vendors that will deliver trucker services (including mini-market and convenience stores, fast food, and fast casual restaurants) and parking to keep trucks off West Oakland streets.	Qualitative	N/A	Awarding a long-term lease would not result in direct emissions reductions.	L	Negotiating and awarding such a lease would be affordable to the Port, depending on the lease terms. The Port's capacity to implement this is limited by the interest level of potential concessionaires. It is uncertain whether such a site could be commercially viable.	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 to award a lease for a trucker services area, provided there is a viable, interested tenant and the Port had identified a suitable location for a trucker services location and had initiated planning for such a site; due to factors outside of the Port's control, the project is currently on hold.	L	There is no currently no viable, interested tenant for such a facility and the availability of a suitable site is uncertain.	M	Providing a range of services for truckers at the Seaport may potentially reduce truck travel into West Oakland, and would provide the opportunity to offer other emissions-reductions features, such as renewable diesel and charging stations for zero-emissions vehicles as well as services for truckers such as food, showers, and minor truck maintenance and repair.							
195	Study Effects of Larger Vessels on Truck Traffic	The Port of Oakland studies the effects on truck flow and congestion due to increasing visits from larger container ships.	Qualitative	N/A	Conducting a study does not provide direct emissions reductions.	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.	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.	M	It is acceptable to the Port to conduct this study, provided that sufficient staff and budget resources are available.	L	While it is feasible for the Port to conduct a study, implementation of this action would not provide surplus emissions.							
196	Study Feasibility of Off-Terminal Yard Using ZE Trucks	The Port of Oakland studies... the feasibility of an off-terminal container yard that utilizes zero-emission trucks to move containers to and from the marine terminals.	Quantitative	L	The Port assessed the potential benefit of converting all truck trips to and from Port area rail yards to zero-emissions truck trips (trips to and from the rail yards comprise the largest group of short-haul truck trips). The maximum DPM emissions reduction benefit from this action would be 0.045 tons of DPM if more than 400,000 truck trips are converted to zero-emissions trips (Ramboll 2020a). These emissions reductions would decrease as regulations require the use of cleaner diesel trucks.	L	The Port has conducted an initial assessment (Ramboll 2020a). The Port has the ability to conduct a more detailed study; the Port's capacity to conduct studies, prepare plans, and implement other planning actions is subject to budget and staff resources. Converting all trucks serving the rail yard to zero-emissions and would have low affordability and provides only low emissions reductions.	L	Replacing all truck trips associated with the Port-area rail yards with a substantial number of short-haul truck trips would only reduce DPM emissions by 0.045 tons (17%). This action would also generate a 10% reduction in GHG emissions (3,710 tons) from trucks (Ramboll 2020a) once grid electricity is 100% renewable in 2045 (prior to 2045, the GHG emissions reductions would be lower). Given that a lot (hundreds or thousands) of trucks would have to be converted to zero-emissions, implementation of this action would have low cost effectiveness for DPM and GHG emissions reductions.	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.	None	This study would not be necessary and is therefore not acceptable to the Port.	L	The Port is already evaluating the feasibility of using zero-emissions trucks in short-haul service through the testing of BYD trucks by Port tenant Shippers Transport Express. Shippers Transport Express currently provides off-terminal container storage and management; a separate study to evaluate an exclusively zero-emissions off-terminal yard is not required.							
197	Study of Efficiency Gains from Increased Truck Double-Cycling	The Port of Oakland studies... the potential efficiency gains from increasing the number of trucks hauling loaded containers on each leg of a roundtrip to the Port.	Qualitative	N/A	Hauling loaded containers on each leg of a roundtrip to the Port is called double-cycling. Maximizing double-cycling would result in emissions reductions of 0.061 tons of DPM (Ramboll 2020a) under current conditions, and would decrease as regulations require cleaner diesel trucks.	M	The Port has conducted an initial assessment (Ramboll 2020a). A definitive study would be complex due to the level of systems information required (i.e., increasing the current level of double cycling would require that information from all ocean carriers be available to truckers and the terminal operators so that containers can be sorted and stacked accordingly) and therefore likely costly.	N/A	Maximizing double cycling would reduce emissions by 0.061 tons of DPM and 4,648 tons CO2e (GHGs) (Ramboll 2020a). Estimating the cost effectiveness of maximizing double-cycling would require detailed information on the costs associated with developing software connectivity among many organizations, which is not available at this time. However, the maximum amount of emissions reductions achievable would be small.	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	A detailed study would be difficult to implement due to the sensitive nature of much of the information and the action would only result in a small amount of emissions reductions. This action has low acceptability to the Port.	L	Increasing double cycling would reduce the total number of truck trips to and from the Port, but is a complex undertaking due to the level of systems integration required to make it feasible. The maximum emissions reductions achievable are low.							
198	Use Air District Incentives to Upgrade Tugs and Barges	The Air District plans to offer financial incentives to upgrade tugs and barges operating at the Port of Oakland with cleaner engines every year.	Quantitative	H	In 2017, approximately 80% of the towing work related to the Seaport was conducted by two companies with a combined nine tugs. Six of these tugs are equipped with Tier 3 engines, two with Tier 2 engines, and one with Tier 1 engines (Ramboll 2020a). If the three tugs currently at Tier 3 are upgraded to Tier 3, DPM emissions would decrease by an estimated 0.56 tons per year. Upgrading all of the tugs to Tier 4 engines (including the three not at Tier 3) would generate total estimated emissions reductions of 2.09 tons of DPM, or 46% of all tug-related emissions in the 2017 inventory (Ramboll 2020a). (The 2017 inventory shows a total of 6.5 tons of DPM emissions for harbor craft; this total includes an estimated 1.6 tons associated with dredging; estimated tug-related emissions were 5.0 tons.) Tug emissions represent the highest exposure risk of all Port-related sources, as shown in Figure 5-10 of the WOCAP. The combined estimated DPM emissions associated with drayage trucks (0.3 tons), cargo-handling equipment (1.6 tons), railroad activity (0.2 tons), and other activities (maintenance and construction, 0.3 tons) equal the emissions reductions achievable by upgrading all nine tugs to Tier 4.	M	Based on a study performed by Cal Maritime, the estimated capital cost to retrofit a Tier 3 to Tier 4 is \$2.812 million, plus an additional annual operating cost of \$62,950 (this total reflects a fuel savings offset of approximately \$14,400) (Ramboll 2020a). The capital cost does not include the cost of tug downtime to retrofit the engines. The total capital cost to retrofit nine tugs would be approximately \$25.3 million. The rating given for this criterion assumes that the Air District has sufficient budget to provide meaningful incentives, and reflects the future budget uncertainty for the Air District as well as the cost burden to tug operators from the on-going increase in operating costs.	M	It is anticipated that regulation will require tugs to be upgraded to Tier 4 with DPF by 2026; surplus emissions reductions would therefore accrue for a maximum of 8 years if tugs are retrofitted in early 2021. Based on the estimated retrofit cost of an estimated \$2.9 million of DPM over the 6 year period, if Cal Moyer factors are used to estimate the cost effectiveness of criteria pollutants avoided (tons of ROG and NOx, and tons of PM2.5), tug retrofits would provide emissions reductions at a cost of \$44,400/Cal Moyer ton. The literature also suggests that the retrofit would result in a 4% reduction in fuel use, leading to a corresponding reduction in GHGs. However, the urea used in the selective catalytic regeneration (SCR) process that is part of the Tier 4 engine also generates additional GHG emissions estimated to be 5.15 tons/ton urea on a lifecycle basis (Ramboll 2020a).	H	Tier 4 engines are available. Several tugs in the Bay Area are equipped with Tier 4 engines.	M	Providing incentives is expected to have a high level of acceptability for stakeholders, assuming the incentive levels are sufficiently high.	H	Reducing emissions from tugs is an important component of reducing overall DPM emissions. Providing incentives would help accelerate the transition to cleaner tugs.									
199	Implement a Clean Ship (Tier 3 Vessel) Program	The Port of Oakland implements a Clean Ship Program to increase the frequency of visits by ships with International Maritime Organization Tier 2 and Tier 3 engines.	Quantitative	L	Cleaner ships are those with more modern engines (a higher engine tier). However, the CARB emissions model reports that NOx emissions factors are affected by the Tier level of the ship (Ramboll 2020b). Based on the CARB model, higher engine tiers do not provide any DPM emissions reductions. DPM emissions reductions could be achieved by reducing fuel sulfur content (see Screened Action 217) and/or reducing vessel speed. The Port included the feasibility of implementing a vessel speed reduction program in the 2020 and Beyond Plan's Near-Term Action Plan (Item 21, scheduled to be implemented in 2020).	L	The Port of Los Angeles grants a \$5,000 per call incentive for Tier 3 vessels. It is unknown what level of incentives would be required to further increase the number of Tier 3 vessels in the West Coast fleet.	L	Each call by a Tier 3 vessel would reduce NOx emissions by approximately 1 to 1.16 tons relative to a lower tier vessel. If a \$5,000 per call Port of Oakland incentive would result in additional Tier 3 vessels being assigned to the West Coast fleet, the incentive would result in a cost of \$4,300 - \$6,000 per NOx ton reduced (not including administrative costs of implementing an incentive program). No DPM emissions reductions benefits would accrue (Ramboll 2020b). There are no associated GHG emissions reductions that could be quantified. Based on a paper prepared by the U.S. Merchant Marine Academy (U.S. Merchant Marine Academy, undated), fuel efficiency is primarily a function of vessel size rather than age (i.e., newer vessels are not necessarily more fuel efficient than older vessels).	L	Tier 3 vessels requirements were effective starting with a lead list date of 2016, meaning that Tier 3 vessels have only been built for the past few years. In 2017 there were no calls by Tier 3 vessels at the Port. In 2018, the Tier 3 vessel calls at the Ports of Los Angeles and Long Beach were 0.1% and 0.2%, respectively; the Port of LA Tier 3 vessel calls were by cruise ships. A 2017 study by the San Pedro Bay Ports Forecast that substantial numbers of Tier 3 vessels would not call the ports until the 2030s or later (SPBP 2017). Tier 3 vessels are commercially available, but the supply is still limited.	L	The likelihood of reaching a substantial number of Tier 3 vessel calls at the Port of Oakland in the near future is low, as shown by the San Pedro Bay Ports study and 2018 Tier 3 vessel call data. The SPBP's vessel call data already reflect the SPBP's incentive program. It would take some time to identify the optimal existing system to track incentive eligibility and administer incentive payments, or to develop such a system for the Port. More importantly, any vessel incentive system needs to be coordinated with the other West Coast ports to ensure incentives are complementary and that ocean carriers can "stack" incentives to increase the total incentive to bring cleaner vessels to the West Coast. The incremental value of adding incentives for vessels at Oakland by these vessels is unknown. Tier 3 vessels are operationally feasible (proven in service).	L	Provided that incentives are affordable to the Port, this action is acceptable to the Port; however, the potential benefits would be low in the near-term and would be limited to NOx emissions reductions.	L	Increasing the percentage of Tier 3 vessels calling the Port would only offset NOx emissions reductions; other actions (e.g., retrofitting tugs with Tier 4 engines) could provide NOx emissions reductions while also reducing DPM.							

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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 OIG 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.