In 2011, Pacific Harbor Line (PHL) repowered 16 locomotives in their fleet with new low-emission “Tier 3-plus” engines that emit over 80 percent less diesel particulate matter and 38 percent less nitrogen oxides than the previous generation engines they replaced, making PHL’s fleet one of the cleanest in North America. The previous engines, which came online in 2008, had already reduced air emissions dramatically. Overall, the Tier 3-plus engines represent a greater than 90 percent reduction in diesel particulate matter and almost 75 percent reduction in nitrogen oxide emissions compared to the older, unregulated engines that were servicing the ports just five years ago.

The repower project totaled approximately $12 million and was largely funded by a grant from the Carl Moyer Memorial Air Quality Attainment Program administered by the South Coast Air Quality Management District and the California Air Resources Board. The ports of Long Beach and Los Angeles also facilitated the project by entering into agreements with PHL that made it possible for the railroad company to commit to the long-term use of low emission locomotives.

*Photo Credit: Tom Paiva/Pacific Harbor Line*
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         Bruce Anderson, Principal, Starcrest
         Joseph Ray, Principal, Starcrest

Contributors: Steve Ettinger, Principal, Starcrest
              Ray Gorski, Consultant, Starcrest
              Lars Kristiansson, Consultant, Starcrest
              Jill Morgan, Consultant, Starcrest
              Rose Muller, Consultant, Starcrest
              Sam Wells, Consultant, Starcrest
              Paula Worley, Consultant, Starcrest

Document Preparation: Denise Anderson, Consultant, Starcrest

Cover: Melissa Silva, Principal, Starcrest
ACRONYMS AND ABBREVIATIONS

Act  activity
AAPA  American Association of Port Authorities
AQMP  Air Quality Management Plan
ATB  articulated tug and barge
BNSF  Burlington Northern Santa Fe Railroad
BSFC  brake specific fuel consumption
BTH  Business Transportation and Housing Agency
BW  breakwater
CAAP  Clean Air Action Plan
CARB  California Air Resources Board
CEC  California Energy Commission
CF  control factor
CHE  cargo handling equipment
CH₄  methane
CO  carbon monoxide
CO₂  carbon dioxide
CO₂E  carbon dioxide equivalent
D  distance
DB  dynamic braking
DF  deterioration factor
DMV  Department of Motor Vehicles
DOC  diesel oxidation catalyst
DPF  diesel particulate filter
DPM  diesel particulate matter
DR  deterioration rate
DTR  Drayage Truck Registry
DWT  deadweight tonnage
E  emissions
ECA  Emission control area
EEAI  Energy and Environmental Analysis, Inc.
EF  emission factor
EI  emissions inventory
EPA  U.S. Environmental Protection Agency
FCF  fuel correction factor
g/bhp-hr  grams per brake horsepower-hour
g/hr  grams per hour
g/kW-hr  grams per kilowatt-hour
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>g/mi</td>
<td>grams per mile</td>
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<tr>
<td>GHG</td>
<td>greenhouse gas</td>
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<tr>
<td>GVWR</td>
<td>gross vehicle weight rating</td>
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<tr>
<td>GWP</td>
<td>global warming potential</td>
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<tr>
<td>HC</td>
<td>hydrocarbons</td>
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<tr>
<td>HC</td>
<td>Harbor craft</td>
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<tr>
<td>HDV</td>
<td>heavy-duty vehicle</td>
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<td>HFO</td>
<td>heavy fuel oil</td>
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<tr>
<td>hp</td>
<td>horsepower</td>
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<td>hrs</td>
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<tr>
<td>ICTF</td>
<td>Intermodal Container Transfer Facility</td>
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<tr>
<td>IFO</td>
<td>intermediate fuel oil</td>
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<td>IMO</td>
<td>International Maritime Organization</td>
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<tr>
<td>ITB</td>
<td>integrated tug and barge</td>
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<tr>
<td>kW</td>
<td>kilowatt</td>
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<tr>
<td>kW-hr</td>
<td>kilowatt-hour</td>
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<tr>
<td>lbs/day</td>
<td>pounds per day</td>
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<tr>
<td>LF</td>
<td>load factor</td>
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<tr>
<td>LLA</td>
<td>low load adjustment</td>
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<tr>
<td>Lloyd’s</td>
<td>Lloyd’s Register of Ships</td>
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<td>LNG</td>
<td>liquefied natural gas</td>
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<tr>
<td>LPG</td>
<td>liquefied petroleum gas</td>
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<tr>
<td>LSI</td>
<td>large spark ignited (engine)</td>
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<td>MarEx</td>
<td>Marine Exchange of Southern California</td>
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<td>MCR</td>
<td>maximum continuous rating</td>
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<td>MDO</td>
<td>marine diesel oil</td>
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<td>MGO</td>
<td>marine gas oil</td>
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<tr>
<td>MMGT</td>
<td>million gross tons</td>
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<td>MOU</td>
<td>Memorandum of Understanding</td>
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<tr>
<td>mph</td>
<td>miles per hour</td>
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<tr>
<td>MMGTM</td>
<td>million gross ton-miles</td>
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<td>MY</td>
<td>model year</td>
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<td>N</td>
<td>north</td>
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<td>N2O</td>
<td>nitrous oxide</td>
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<td>nm</td>
<td>nautical miles</td>
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<td>NOx</td>
<td>oxides of nitrogen</td>
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<td>OCR</td>
<td>optical character recognition</td>
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<tr>
<td>OGV</td>
<td>ocean-going vessel</td>
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<td>PHL</td>
<td>Pacific Harbor Line</td>
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