Ocean-Going Vessel
At-Berth Emissions Reduction Technologies
for use at the Port of Long Beach and
the Port of Los Angeles

REQUEST FOR INFORMATION

October 12, 2010
DATE: October 12, 2010

TO: Vendors/Consultants

SUBJECT: Request for Information for Ocean-Going Vessel At-Berth Emissions Reduction Technologies for use at the Port of Long Beach and the Port of Los Angeles

The Port of Long Beach and the Port of Los Angeles (ports) seek the submittal of Information Packages by vendors of technologies that are effective in substantially reducing exhaust gas emissions from marine engines. This Request for Information (RFI) specifically seeks information on technologies that can be used to reduce ocean-going vessel (OGV) auxiliary engine, and potentially auxiliary boiler exhaust, emissions while the vessel is “at-berth” at the ports.

The technologies for which information is sought are intended to be used as an alternative to “cold ironing” (i.e., shore power) for vessels not covered under the California Air Resources Board (CARB) shore power regulation. The ports’ Clean Air Action Plan (CAAP) established a target of reducing air pollutant emissions from these non-regulated vessels by 50% in the year 2014, increasing to 80% by 2023. This emission reduction target is consistent with the goal established by CARB in their Goods Movement Action Plan. The types of OGVs from which these additional emission reductions are sought include, but are not limited to, bulk carriers, roll-on/roll-off (RO-RO), and tanker vessels.

**This is not a formal solicitation for proposals.** The ports will use this information to better understand the technologies, infrastructure requirements, and unique characteristics of proposed OGV at-berth emissions control strategies. The information provided will allow the ports to determine the cost and schedule requirements for a future port-sponsored demonstration of one or more OGV at-berth emission control technologies. As such, the ports will not make a vendor selection from this Request for Information. Based on information received under this request, however, the ports may pursue development of a formal Request for Proposals (RFP) with a tentative release date in early 2011.

Vendors of exhaust gas emission reduction technologies that could be adapted for use in an at-berth OGV application are encouraged to review the RFI materials included herein and submit an Information Package in accordance with the recommended guidelines. This
information will be essential to allow the ports to appropriately develop the technical and programmatic requirements of a future OGV at-berth emission reduction technology demonstration.

It is requested that vendors submit their Information Packages no later than **November 19, 2010**. Information Package preparation guidelines and submittal instructions are included within this RFI, along with port staff points of contact should you have questions or need additional clarification.

On behalf of the Port of Long Beach and the Port of Los Angeles, thank you for your participation in the “first step” of an important, innovative clean air strategy.
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1.0 BACKGROUND

In 2006, the Port of Long Beach and Port of Los Angeles (ports) created and approved the San Pedro Bay Ports Clean Air Action Plan (CAAP). The CAAP provides the overall strategy for dramatically reducing air pollution emissions from port-related cargo movement. This far reaching and unprecedented plan was developed with the cooperation and assistance of the U.S. Environmental Protection Agency, California Air Resources Board (CARB) and the South Coast Air Quality Management District. Creation of the CAAP was a proactive commitment by the two ports to reduce port-related air pollution. The CAAP’s primary goal was to dramatically reduce emissions and associated health risk for the Southern California region while allowing port development to continue.

The original CAAP was focused on the near-term, five-year planning window between fiscal years 2006 and 2011. The ports agreed that the CAAP would be a “living” document that would undergo periodic reviews and updates. As the first in these planned updates, the ports have updated existing CAAP measures to reflect the most recent implementation status, incorporate new and revised measures, identify changes that have resulted from recent regulatory activities, and include long-term targets for reduction of cancer risk and air pollution from cargo movement at the ports. The 2010 CAAP Update identifies planning goals through the end of 2014, a health risk reduction goal for 2020, and emissions reduction goals for the years 2014 and 2023.

One measure included in the CAAP Update (CAAP Measure OGV-2) specifically targets emission reductions from ocean-going vessels (OGV) at-berth, and highlights the need for technologies to control emissions from vessels that are not subject to the California Air Resources Board (CARB) Shore Power for Ocean-Going Vessels Regulation. The purpose of the CARB regulation is to reduce at-berth emissions and associated health impacts from diesel-fueled auxiliary engines onboard ships docked at California ports.

The CARB regulation requires vessel operators to turn off auxiliary engines for the majority of a vessel's stay in port and connect to the vessel to some other source of power, most typically grid-based shore power. The use of shore electrical power in lieu of running an auxiliary engine/electric generator is commonly referred to as “cold ironing.” Cold ironing permits emergency equipment, refrigeration, cooling, heating, lighting, and other essential equipment to receive continuous electrical power while the vessel loads or unloads its cargo.

Three (3) types of OGVs must comply with the CARB shore power regulation. These include:

- Container Ships
- Refrigerated Cargo (Reefer) Ships
- Passenger Cruise Ships

1 http://www.arb.ca.gov/ports/shorepower/shorepower.htm
Other OGV categories (i.e., tankers, vehicle carriers, and bulk and general cargo ships) are not currently affected by the CARB regulation. Further, CARB is not currently pursuing a regulation to address at-berth emissions from these vessel types due to operational considerations that do not make them good candidates for traditional shore power (e.g. small power demand at-berth, infrequent visits, etc.) and the current lack of available and cost-effective alternative emissions reduction technologies.

The 2010 CAAP Update identified these non-regulated vessels as a source for achieving emission reductions above and beyond those achieved under the CARB regulation. Specifically, the ports established CAAP goals of 50% emission reductions by 2014 and 80% emission reductions by 2023 for non-regulated vessels, consistent with the goals established by CARB in their Goods Movement Action Plan. Therefore, even though there is not currently a regulation affecting these vessels, it remains a commitment by the ports to address at-berth emissions from these vessels and to identify suitable emissions reduction technologies.

Vessel types from which these additional emission reductions are sought include, but are not limited to, bulk carriers, roll-on/roll-off (RO-RO), and tanker vessels.

2.0 INTRODUCTION

The purpose of this Request for Information (RFI) is to obtain technical and programmatic information on exhaust gas emission reduction technologies that can be used to reduce diesel particulate matter (DPM) and nitrogen oxide (NOx) emissions in the exhaust from auxiliary engines on tanker, vehicle carrier, and general and bulk cargo vessels while at-berth at the ports. For the purpose of this RFI, auxiliary engines are defined as an engine on an ocean-going vessel designed primarily to provide power for uses other than propulsion.

Tankers, vehicle carriers (also known as RO-RO), and general and bulk cargo vessels are not typically good candidates for traditional shore power due to their smaller power demand at-berth and the limited number of times the same vessel will call at a particular port, therefore technologies that require vessel retrofits (e.g. traditional shore power) for those vessels would not be cost-effective.

The 2010 CAAP Update Measure OGV2 includes a goal to target at-berth emission reductions from auxiliary engines on-board OGVs that are not subject to the CARB shore power regulation; thus, respondents to this RFI should primarily focus on their technology’s capabilities in treating OGV auxiliary engine exhaust emissions from tankers, vehicle carriers, and bulk and general cargo ships. Respondents to this RFI should also identify whether their technology can be scaled-up to meet the requirements for reducing at-berth emissions from other vessel types, including container vessels, which have greater at-berth power demands and exhaust gas flows.

Respondents are also encouraged to discuss their technology’s capabilities in treating at-berth OGV boiler emissions, if applicable. Any emission reductions achieved from OGV boilers while
at-berth are considered surplus to those targeted under the 2010 CAAP Update. Respondents to this RFI are asked to present their technology’s capabilities for reducing OGV boiler emission reductions in terms of incremental requirements for their proposed technology solution, including impacts on system design, size, power requirements, effluent discharge, system capital cost, operations costs, etc. This will be discussed further in Section 4 of this RFI.

**Who Should Respond to this Request for Information?**

- Vendors of exhaust gas emission reduction technologies that could be adapted for use in an at-berth OGV application are encouraged to review the RFI materials included herein and submit an Information Package. This includes, but is not limited to, developers and manufacturers of industrial exhaust gas scrubbing systems, marine exhaust gas scrubbing systems, diesel emission control devices, selective catalytic reduction systems, distributed generation equipment, non-grid based shore power, alternative fuels, etc.

**Is the Proposed Technology Required to be Commercially Available?**

- No. The ports understand that many of the technologies submitted in response to this RFI will be based upon emission reduction technologies used in other industrial applications but not currently available for maritime use. Respondents will be asked, however, to address the degree of “technical maturity” of their proposed At-Berth Emissions Reduction technology. Respondents will also be asked to provide technical and programmatic data as they relate to adapting the proposed technology to an At-Berth Emissions Reduction alternative application.

**What will be the Result of this Request for Information?**

- Depending on the responses received, the following are potential outcomes of this Request for Information:
  
  - The ports may issue a Request for Proposals (RFP) for the development and demonstration of one or more At-Berth Emissions Reduction Demonstration Projects. This would be performed if the Information Packages received in response to this Request for Information indicate that there are multiple technology vendors with viable alternative approaches, and that the demonstration project(s) can be conducted within a reasonable time frame at an acceptable cost to the ports. In the event the ports opt to issue an RFP, the anticipated release date is early 2011.
  
  - The ports may determine that it is premature to embark on the development and demonstration of an At-Berth Emissions Reduction technology demonstration project at this time.
3.0 AT-BERTH EMISSIONS REDUCTION – TECHNICAL OVERVIEW

The following sections discuss the ports’ goals as they pertain to reducing at-berth emissions from non-regulated OGV auxiliary engines, as well as the desired technical attributes of alternative At-Berth Emissions Reduction solutions.

3.1 At-Berth Emissions Reduction Technology Goals

Cold Ironing, also known as shore power or Alternative Maritime Power (AMP), achieves approximately a 90% emissions reduction from OGV auxiliary engines while hotelling at berth. For the purpose of At-Berth Emissions Reduction technologies, the ports set a goal of achieving at least 90% of the emissions reduction achieved by cold ironing; i.e., the goal for At-Berth Emissions Reduction technologies is a minimum of 81% reduction in OGV auxiliary engine emissions (90% of 90% = 81%). Please note that the > 81% emission reduction goal is above and beyond emission reductions achieved through the use of low-sulfur marine fuels. Any emission reductions from OGV boilers achieved through the use of At-Berth Emissions Reduction technology is surplus to the > 81% goal.

3.2 Targeted Pollutants

The “81% or greater” emission reductions sought through the use of At-Berth Emissions Reduction technologies on non-regulated OGVs applies to the following criteria air pollutants:

- Total Particulate Matter (PM)
- Oxides of Nitrogen (NOx)
- Sulfur Oxides (SOx)

Emission reductions are also sought from additional criteria air pollutants, including carbon monoxide (CO) and volatile organic compounds (VOC). Reduction in these criteria pollutants, while beneficial and desired by the ports, is less critical as compared to the primary criteria pollutants PM, NOx, and SOx.

In addition, greenhouse gases (GHG) including carbon dioxide (CO₂), methane (CH₄), etc. are not included within the 81% At-Berth Emissions Reduction goal. However, reductions in GHG are highly sought by the ports; thus, respondents to this RFI should highlight their technology’s capabilities as they pertain to the reduction of CO, VOCs, and GHGs.

3.3 Types of Non-Regulated Ocean-Going Vessels Applicable to At-Berth Emissions Reduction Technologies

The ports identified three classes of ocean-going vessels as primary candidates for At-Berth Emissions Reduction technology application. These vessels are not regulated under the CARB Shore Power for Ocean-Going Vessels Regulation:
**RO-RO Vessels** - A RO-RO vessel carries wheeled cargo such as automobiles, trailers, or railway carriages. RO-RO is an acronym for “roll on/roll off.” RO-RO vessels have built-in ramps, which allow the cargo to be "rolled on" and "rolled off" the vessel when in port. Typically, new automobiles that are transported by vessels around the world are moved on RO-ROs. These large new-car carriers are commonly called Pure Car Carriers (PCCs) or Pure Car Truck Carriers (PCTCs). The largest PCC currently in service can carry over 7,000 cars;

**Bulk Carriers** - Bulk carriers are vessels used to transport bulk items such as mineral ore, grain, and petroleum coke. They have large box-like hatches on their decks, designed to slide outboard for loading. The bulk carriers primarily carry dry cargoes, which are shipped in large quantities and do not need to be carried in packaged form;

**Tanker Vessels** - Tanker vessels are vessels designed to transport liquids in bulk. Tankers can range in size from several hundred tons, designed for coastal service, to several hundred thousand tons, for transoceanic voyages. Different products require different handling and transport, thus special types of tankers have been built, such as "chemical tankers," "oil tankers," and "LNG carriers."

### 3.4 Non-Compliant Container Ships

As stated in Section 3.3, At-Berth Emissions Reduction technologies are principally sought for application to non-regulated OGVs. However, it is foreseeable that a Container Ship not in compliance with the CARB Shore Power Regulation (i.e., not configured to be compatible with shore power) may call at the ports. Although it is anticipated that non-compliant vessel calls to the ports will be infrequent, the ports are interested in learning the capability and compatibility of At-Berth Emissions Reduction technologies as they relate to reducing emissions from Container Ship auxiliary engines. As discussed below, container ships typically have significantly higher hotelling power requirements as compared to non-regulated OGVs, and thus generate significantly higher levels of exhaust pollutants. A container ship typically has twice the exhaust flow rate compared to a RO-RO vessel.

### 3.5 Vessel Auxiliary Engine Characterization

The following Sections are intended to provide general guidance relative to exhaust characteristics of OGVs. While At-Berth Emissions Reduction technologies are primarily sought for reducing criteria air pollutant emissions from non-regulated OGV auxiliary engines, exhaust gas data are also provided for OGV boilers as well as container ships. Any emission reductions that an At-Berth Emissions Reduction technology can achieve from OGV boilers and/or a container ship auxiliary engine are surplus to the CAAP goal. **Respondents to this RFI are asked to focus primarily on non-regulated bulk carrier, tanker, and RO-RO auxiliary engine emission reductions, but also to include a description of how the technology being offered could**
potentially be scaled to accommodate boiler emissions, as well as the occasional container ship auxiliary engine’s emissions.

3.5.1 – OGV Fuel Specifications

OGVs are required, under the California Air Resources Board’s Ocean-Going Vessel Fuel Rule, to use low-sulfur content marine distillate fuels within 24 nautical miles of the California coast and when at berth. The allowable sulfur content, currently 0.5% for marine diesel oil, will be further reduced to 0.1% for both marine diesel oil and marine gas oil as of January 1, 2012:

Table 3.5-1: Fuel Requirements for Ocean-going Vessel Main (Propulsion) Diesel Engines, Auxiliary Diesel Engines, and Auxiliary Boilers

<table>
<thead>
<tr>
<th>Fuel Requirement</th>
<th>Effective Date</th>
<th>Fuel Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>July 1, 2009</td>
<td>Marine gas oil (DMA) at or below 1.5% sulfur; or Marine diesel oil (DMB) at or below 0.5% sulfur</td>
</tr>
<tr>
<td>Phase II</td>
<td>January 1, 2012</td>
<td>Marine gas oil (DMA) or Marine diesel oil (DMB) at or below 0.1% sulfur</td>
</tr>
</tbody>
</table>

3.5.2 – OGV Auxiliary Engine & Boiler Exhaust Emission Factors

Average emission factors for OGV auxiliary engines and boilers are shown in Table 3.5-2, below. Note that Heavy Fuel Oil (HFO) factors are included. While expected to be infrequent, there is a possibility that a vessel not in compliance with the fuel requirements could call at the ports:

Table 3.5-2: Estimated Average Emission Factors for OGV Auxiliary Engines and Boilers (g/kW-hr)

<table>
<thead>
<tr>
<th>Fuel</th>
<th>HFO</th>
<th>Marine Distillate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur Content</td>
<td>4.5% - 5%</td>
<td>0.5%</td>
</tr>
<tr>
<td><strong>Auxiliary Engines</strong></td>
<td>Emission Factor (g/kW-hr)</td>
<td></td>
</tr>
<tr>
<td>NOx</td>
<td>14.7</td>
<td>13.9</td>
</tr>
<tr>
<td>SOx</td>
<td>11.1</td>
<td>2.1</td>
</tr>
<tr>
<td>PM</td>
<td>1.5</td>
<td>0.38</td>
</tr>
<tr>
<td><strong>Boilers</strong></td>
<td>Emission Factor (g/kW-hr)</td>
<td></td>
</tr>
<tr>
<td>NOx</td>
<td>2.1</td>
<td>2.0</td>
</tr>
<tr>
<td>SOx</td>
<td>16.5</td>
<td>3.0</td>
</tr>
<tr>
<td>PM</td>
<td>0.8</td>
<td>0.2</td>
</tr>
</tbody>
</table>

OGVs are typically configured with multiple auxiliary engines. Table 3.5-3 shows the typical number of auxiliary engines as a function of vessel type:
Table 3.5-3: Number of Auxiliary Engines per Vessel

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Number of Auxiliary Engines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>Auto Carrier/RO-RO</td>
<td>1</td>
</tr>
<tr>
<td>Bulk Carrier</td>
<td>1</td>
</tr>
<tr>
<td>Tanker</td>
<td>1</td>
</tr>
<tr>
<td>Container Ship</td>
<td>1</td>
</tr>
</tbody>
</table>

3.5.3 – At-Berth (hotelling) OGV Auxiliary Engine & Boiler Exhaust Flow Rates

Table 3.5-4, below, provides an estimate of the average total auxiliary engine and boiler power load and exhaust flow rates as a function of vessel types. The auxiliary engine load represents the total average auxiliary power used per vessel. The boiler fuel use rates were converted to equivalent kilowatts. The estimated average and peak auxiliary engine and boiler exhaust flow rates are based on the auxiliary engine and boiler loads and are presented as a function of vessel type.

Table 3.5-4: Estimated Average OGV Auxiliary Engine and Boiler Hotelling Loads and Flow Rates as a Function of Vessel Type

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Auxiliary Engine(s)</th>
<th>Boilers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Load (kW)</td>
<td>Average Flow Rate (SCFM)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto Carrier/RO-RO</td>
<td>780</td>
<td>2,339</td>
</tr>
<tr>
<td></td>
<td>246</td>
<td>738</td>
</tr>
<tr>
<td></td>
<td>608</td>
<td>1,824</td>
</tr>
<tr>
<td></td>
<td>1,468</td>
<td>4,404</td>
</tr>
<tr>
<td></td>
<td>278</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,593</td>
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<tr>
<td></td>
<td></td>
<td>380</td>
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<td></td>
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</tr>
</tbody>
</table>
3.5.4 – Average Vessel Hotelling Time per Port Call

The average length of time an OGV spends hotelling at the ports is shown below in Table 3.5-5 as a function of vessel type. Please note that these are average times, and individual vessel port calls will have varying call durations.

3.5-5: Average Hotelling Time

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Average Hotelling Time (hours per call)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Carrier/Ro-Ro</td>
<td>28.4</td>
</tr>
<tr>
<td>Bulk Carrier</td>
<td>64.5</td>
</tr>
<tr>
<td>Tanker</td>
<td>33.5</td>
</tr>
<tr>
<td>Container Ship</td>
<td>34.9</td>
</tr>
</tbody>
</table>

3.6 Additional Considerations

Respondents to this RFI should be cognizant of additional factors that may influence their At-Berth Emissions Reduction technology design and operation. Additional factors that may or may not be applicable to a specific technology solution include wastewater discharge and ammonia slip. Please note that technology solutions must be compatible with all current Port of Los Angeles and Port of Long Beach environmental requirements.

3.6.1 – Wastewater Discharge Quality

Proponents of At-Berth Emissions Reduction technologies that utilize water-based exhaust gas scrubbing should include a characterization of the discharge effluent in their RFI response. The ports have not established any thresholds as they relate to wastewater discharge quality at this time. The data provided by respondents to this RFI will assist the ports in understanding potential disposal and infrastructure requirements, should this technology be pursued under a future port-funded demonstration project.

3.6.2 – Ammonia Slip

It is anticipated that a number of At-Berth Emissions Reduction technologies will propose the use of selective catalytic reduction (SCR) as a strategy to reduce auxiliary engine NOx emissions. While SCR has been proven effective in marine applications, the ports will require that any excess ammonia emissions resulting from the use of an SCR reductant such as urea (i.e., ammonia slip) be mitigated. A threshold for an acceptable level of ammonia slip has not yet
been established by the ports; respondents to this RFI are encouraged to estimate the amount of ammonia slip associated with their specific technology, if applicable.

4.0 INFORMATION PACKAGE PREPARATION GUIDELINES

The ports request that Information Packages submitted in response to this RFI be prepared in accordance with the following guidelines.

Page Limit – Information Packages submitted in response to this RFI should be limited to a maximum of 20 pages, double sided, including all narrative, diagrams, brochures, etc. It is recommended that the response be written concisely and include existing information as appropriate (i.e., company experience, background information, etc).

4.1 Contact Information – provide the information indicated below:

<table>
<thead>
<tr>
<th>Business Name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Division of</td>
<td></td>
</tr>
<tr>
<td>Subsidiary of</td>
<td></td>
</tr>
<tr>
<td>Website Address</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Address</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>City/Town</td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>Zip</td>
</tr>
<tr>
<td>Phone (  ) - Ext</td>
<td>Fax (  ) -</td>
</tr>
<tr>
<td>Contact</td>
<td>Title</td>
</tr>
<tr>
<td>E-mail Address</td>
<td></td>
</tr>
</tbody>
</table>
4.2 Technology Description

Provide a technical description of the proposed At-Berth Emissions Reduction technology, including the following elements to the extent possible:

4.2.1 Proposed Technology

Provide the following information regarding the proposed At-Berth Emissions Reduction technology:

1. Description of the proposed technology, including scientific principle(s) of operation for the emissions treatment system;
2. Technology development status and degree of technical maturity.
3. Description of any prototype units that have been demonstrated or placed into operation.
4. Description of known limitations of the technology, where it can only work on a certain kind of vessel.

4.2.2 Vessel Interface – Exhaust Emissions Capture Strategy

Provide a description of the interface between the proposed At-Berth Emissions Reduction system and the OGV exhaust system. Include drawings, diagrams, etc. if possible to accurately convey the interface between the exhaust capture system and the OGV exhaust system.

4.2.3 Port Berth Infrastructure Requirements

Provide a description of the infrastructure requirements at the ports to accommodate the proposed At-Berth Emissions Reduction technology. This would include, but is not limited to:

- Utility Requirements (power, water, etc.)
- Installation Requirements (number of dedicated square feet of wharf space required, water space for barge, etc.)
- Vessel Requirements (retrofits, etc.)

4.2.4 Waste Generation and Disposal

Provide a description of the waste, both solid and liquid, generated by the proposed At-Berth Emissions Reduction technology, as well as the proposed method(s) of disposing of solid and liquid waste. Identify waste that is deemed hazardous material and discuss method of disposal.

4.3 Emission Reduction Potential

4.3.1 Emission Reductions from Non-Regulated OGVs

The Information Package submitted in response to this RFI should include a concise discussion of the proposed At-Berth Emissions Reduction technology’s capabilities to reduce exhaust air pollutant emissions from hotelling OGVs. The focus is non-regulated OGVs – RO-ROs, Bulk
Carriers, and Tankers. Provide estimates of the proposed At-Berth Emissions Reduction technology’s potential to reduce PM, NOx, and SOx emissions. The data included in Tables 3.5-2 through 3.5-5 can be used as a baseline. If applicable, please include information relative to the proposed technology’s capabilities to obtain surplus emission reductions, including CO, VOCs, and GHGs, as applicable. Also, please address to the extent feasible, the proposed technology’s capability to reduce emissions from OGV boilers in addition to auxiliary engines. The following chart is included as an example of how the projected technology performance data could be presented; respondents to this RFI are welcome to use an alternative data presentation format at their discretion.

Example:

<table>
<thead>
<tr>
<th>Vessel Type: RO-RO</th>
<th>Auxiliary Engines (% Reduction)</th>
<th>Auxiliary Engines PLUS Boiler Emissions (% Reduction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulate Matter (PM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen Oxides (NOx)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfur Oxides (SOx)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volatile Organic Compounds (VOC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greenhouse Gases (CO2E)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.3.2 System Capabilities for Regulated Vessels

If possible, please include a discussion of the proposed At-Berth Emissions Reduction technology’s capability to interface with and achieve emission reductions from a Container Ship that is not compatible with shore power.

4.3.3 CARB Certification or Verification

Discuss whether the proposed At-Berth Emissions Reduction technology is currently certified or verified by the California Air Resources Board (CARB) for ANY APPLICATION; i.e., a SCR currently verified for marine engines that is proposed for adaptation to an OGV auxiliary engine application. If the proposed technology has a CARB Executive Order Number, please provide it in your response. Also, if your technology is currently in the CARB certification or verification protocol, please discuss the status of earning CARB certification/verification in your Information Package response.

4.4 Schedule Requirements

To the extent feasible, provide an estimate of the proposed At-Berth Emissions Reduction technology Schedule Requirements. The ports understand that this schedule information is preliminary and thus
subject to change. The ports require this information to facilitate development of a potential future demonstration project(s):

1. Identify the earliest feasible date to conduct a Prototype Demonstration of the proposed At-Berth Emissions Reduction technology on an at-berth OGV at the Port of Los Angeles or Port of Long Beach. Identify technology development milestones that must be met prior to implementing a Prototype Demonstration.

4.5 Cost Estimate

To the extent feasible, provide an estimate of the proposed At-Berth Emissions Reduction technology costs for the following. The ports understand that these are preliminary costs and subject to change. The ports require this information to facilitate development of a potential future demonstration project(s):

1. Estimated Cost to conduct a Prototype Demonstration at the Port of Los Angeles or Port of Long Beach. If possible, include an estimate of the following cost elements:
   - Site Preparation and At-Berth Emissions Reduction System Installation Cost
   - At-Berth Emissions Reduction Prototype System Capital Cost
   - Demonstration Operating Cost
   - Emissions Testing Cost
   - At-Berth Emissions Reduction Prototype System Disassembly and Pier Restoration (if applicable)
   - Other Costs in addition to those listed above
   - Potential Cost Share – Identify potential sources of demonstration project co-funding
   - Preliminary Total Cost to the ports to conduct a prototype demonstration of the proposed At-Berth Emissions Reduction technology

2. Estimated Costs for the Proposed At-Berth Emissions Reduction when Fully Commercialized. To the extent possible, include costs for the following:
   - Estimated Capital Acquisition Cost for the Fully Commercialized System
   - Estimated Operations Cost for an Average Port Call – please state the assumptions used in estimating operations costs (see Table 3.5.4 for average call durations as a function of vessel type)
   - Estimated Life Cycle Cost for the Fully Commercialized System – please state the assumptions used in estimating Life Cycle Cost
   - Business plan strategy for technology
5.0 INFORMATION PACKAGE SUBMITTAL INSTRUCTIONS

Information Packages should be submitted no later than **November 19, 2010**. Review of Information Packages submitted after November 19, 2010, cannot be guaranteed. All Information Packages should be submitted in hardcopy form using a double-sided format, including the use of recycled paper. It is requested that a minimum of two (2) copies be provided.

In addition, it is requested that an electronic copy of the information be provided in either e-mail PDF or CD-ROM format.

Information Packages should be submitted to:

Port of Long Beach  
Environmental Planning Division  
Attention: Justin Luedy  
925 Harbor Plaza  
Long Beach, CA 90802

The electronic copy of the Information Package may be sent on CD-ROM to the above address, or sent in PDF format via e-mail to luedy@polb.com.

6.0 IF YOU NEED HELP...

If you need additional assistance or clarification with regard to this Request for Information, please feel free to contact:

Carter Atkins  
Environmental Specialist  
Phone: (310) 732-7649  
FAX: (310) 547-4643  
E-mail: Catkins@portla.org

Justin Luedy  
Environmental Specialist Assistant  
Phone: (562) 590-4160  
FAX: (562) 901-1728  
E-mail: luedy@polb.com

7.0 PUBLIC INFORMATION

Please note that any information and materials submitted in response to this Request for Information becomes public information and may be released under a Public Records Act request without further notification. Therefore, it is recommended that Company Proprietary and Trade Secret information not be included in any response submitted under this solicitation. All Information Packages submitted become the property of the ports.