Almost all port-related emissions are attributable to five diesel-fueled source categories: ocean-going vessels (OGVs), on-road heavy-duty vehicles (HDVs), cargo handling equipment (CHE), harbor craft and rail locomotives (RL). The responsibility for the emissions control of the majority of these sources falls under the jurisdiction of local (South Coast Air Quality Management District, SCAQMD), state (CARB) or federal (U.S. Environmental Protection Agency, EPA) agencies. The ports of Long Beach and Los Angeles adopted the landmark Clean Air Action Plan (CAAP) in November 2006 to curb port-related air pollution from trucks, ships, locomotives and other equipment by at least 45% in five years. On November 22, 2010, the harbor commissioners of the two ports unanimously approved an update to the CAAP. The 2010 CAAP Update is built upon the successes of the groundbreaking original which, since being enacted in 2006, has initiated a wide range of air emission-reducing measures for the ships, trains, trucks, and other heavy machinery used to move freight through the port complex.

The 2010 CAAP Update is part of the original pledge to ensure that the CAAP is a "living document" which will be adapted as needed to add new emission-control measures. The 2010 CAAP Update sets even more aggressive goals for reducing air pollution and health risks from port operations. A model for seaports around the world, the CAAP Update is the boldest air quality initiative by any seaport, consisting of wide-reaching measures to significantly reduce air emissions and health risks while allowing for the development of much-needed port efficiency projects. Below is a list of recently adopted and proposed regulatory measures in addition to the CAAP measures that will reduce emissions from the ports over the next five years and beyond.

**Ocean-Going Vessels**

*Emissions Standard for Marine Propulsion Engines*

For marine propulsion engines, IMO adopted the NOx emission standards in 1997 and the fuel standards in 2008. The International Maritime Organization (IMO) adopted limits for NOx in Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL) in 1997. These NOx limits apply to marine engines over 130 kilowatts (kW) installed on vessels built on or after 2000. Depending upon the engine speed in revolutions per minute (rpm), the current NOx standards are from 17.0 grams per kilowatt hour (g/kW-hr) (for < 130 rpm) to 9.8 g/kW-hr (for ≥ 2000 rpm). The required number of countries to ratify the Annex in May 2004 and it went into force for those countries in May of 2005. However, engine manufacturers have been certifying engines to the Annex VI NOx limits since 2000 as the standards are retroactive once Annex VI was ratified. In addition, under MARPOL Annex VI regulations, countries could apply for mandatory emissions control area (ECA) to reduce various pollutants in a certain area. Two such areas were enforced in 2007 in Baltics Sea and North Sea for sulfur control in the fuel.
In April 2008, the Marine Environment Protection Committee of the IMO approved a recommendation for new MARPOL Annex VI sulfur limits for fuel and NO\(_x\) limits for engines. In October 2008, the IMO adopted these amendments to international requirements under MARPOL Annex VI, which place a global limit on marine fuel sulfur content of 3.5% by 2012, reduced from the current 4.5%, which will be further reduced to 0.5% sulfur by 2020, or 2025 at the latest, pending a technical review in 2018\(^1\). In Emissions Control Areas (ECAs), sulfur content will be limited to 1.0% in 2010, and further reduced to 0.1% sulfur in 2015 from the current 1.5% limit. In addition, new engine emission rate limits for NO\(_x\) for marine diesel engines installed on newly built ships are based on rated engine speed and the year the ship is built. The NO\(_x\) standards are summarized as follow:

<table>
<thead>
<tr>
<th>Tier</th>
<th>Date</th>
<th>(n &lt; 130) (g/kW-hr)</th>
<th>(130 \leq n &lt; 2000) (g/kW-hr)</th>
<th>(n \geq 2000) (g/kW-hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier I</td>
<td>2000</td>
<td>17.0</td>
<td>45 x (n^{-0.2})</td>
<td>9.8</td>
</tr>
<tr>
<td>Tier II</td>
<td>2011</td>
<td>14.4</td>
<td>44 x (n^{-0.23})</td>
<td>7.7</td>
</tr>
<tr>
<td>Tier III</td>
<td>2016</td>
<td>3.4</td>
<td>9 x (n^{-0.2})</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Finally, existing ships built between 1990 and 2000, would be subject to retrofit requirements of the Tier I NO\(_x\) standard. On July 21, 2008, President Bush signed into law the Maritime Pollution Protection Act of 2008, ratifying MARPOL Annex VI by the United States, and the requirements became enforceable through the Act to Prevent Pollution from Ships (APPS) in January 2009.

In March 2009, the United States and Canada submitted a proposal to the IMO for the designation of an ECA in which the stringent international emission controls described above would apply to ocean-going ships in waters adjacent to the Pacific coast, Atlantic/Gulf coast, and the eight main Hawaiian Islands. On March 26, 2010, the IMO officially designated waters within 200 miles of North American coasts as an ECA. From the effective date in 2012 until 2015, fuel used by all vessels operating in this area cannot exceed 1.0% sulfur level which will be further reduced to 0.1% sulfur level beginning in 2015. Also, starting in 2016, NO\(_x\) after-treatment requirements (Tier III standards) will become applicable in this area.

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\(^2\) Final Diesel Risk Reduction Plan with Appendices
EPA’s Final Regulation – Control of Emissions of Air Pollution from Locomotive and Marine Compression Ignited Engines Less than 30 Liters Per Cylinder

On March 14, 2008, the EPA finalized a three part program designed to dramatically reduce emissions from marine diesel engines with displacement (i.e. swept volume) less than 30 liters per cylinder. EPA lists the following categories for compression ignition diesel marine engines based on engine displacement per cylinder:

- Category 1: less than 5 liters
- Category 2: equal to 5, less than 30 liters
- Category 3: equal to or greater than 30 liters

The EPA regulation impacts some marine propulsion engines and the marine auxiliary engines used on vessels. When fully implemented, this rule will cut PM emissions from these engines by as much as 90% and NOx emissions by as much as 80%.

The regulations introduced two tiers of standards – Tier 3 and Tier 4 – which apply to both new and remanufactured marine diesel engines, as follows:

- Newly-built engines: Tier 3 standards apply to engines used in commercial, recreational and auxiliary power applications (including those below 37 kW that were previously covered by non-road engine standards). The emissions standards for newly-built engines are phasing in, beginning in 2009. Tier 4 standards apply to engines above 600 kW (800 hp) on commercial vessels based on the application of high-efficiency catalytic after-treatment technology, phasing in beginning in 2014.

- Remanufactured engines: The standards apply to commercial marine diesel engines above 600 kW when these engines are remanufactured and will take effect as soon as certified systems become available.

EPA’s Emission Standards for Marine Diesel Engines Above 30 Liters per Cylinder (Category 3 Engines)

EPA is pursuing two parallel, related actions for establishing emission standards for Category 3 marine diesel engines: (1) EPA is a member of the United States delegation that participated in negotiations at the International Maritime Organization (IMO) with regard to amendments to Annex VI that were adopted in October 2008 including additional NOx limits for new engines, additional sulfur content limits for marine fuel, methods to reduce PM emissions, NOx and PM limits for existing engines, and volatile organic compounds (VOCs) limits for tankers; (2) In January 2003, EPA adopted Tier 1 standards for Category 3 marine engines, which went into effect in 2004, establishing NOx standards based upon internationally negotiated emissions rates and readily available emissions-control technology. In December 2009, EPA finalized emission standards for Category 3 marine diesel engines installed on U.S. flagged vessels as well as marine fuel sulfur limits which are equivalent to the amendments adapted by MARPOL Annex VI in 2008. The final regulation establishes stricter standards for NOx, in addition to standards for hydrocarbons and carbon monoxide.
The final near-term Tier 2 NO\textsubscript{x} standards for newly built engines apply beginning in 2011 and will require more efficient use of current engine technologies, including engine timing, engine cooling, and advanced computer controls. The Tier 2 standards will result in a 15\% to 25\% NO\textsubscript{x} reduction below the current Tier 1 levels. The final long-term Tier 3 standards for newly built engines will apply beginning in 2016 in Emission Control Areas and will require the use of high efficiency emission control technology such as selective catalytic reduction to achieve NO\textsubscript{x} reductions 80\% below the current levels. These standards are part of EPA’s coordinated strategy for addressing emissions from ocean-going vessels; this strategy also includes implementation of recent amendments to MARPOL Annex VI and designation of U.S. coasts as an Emission Control Area.

**CARB’s Low Sulfur Fuel for Marine Auxiliary Engines, Main Engines and Auxiliary Boilers**

On July 24, 2008, CARB adopted low sulfur fuel requirements for marine main engines, auxiliary engines and auxiliary boilers within 24 nm of the California coastline. The regulation requires the use of marine gas oil (MGO) with a sulfur content less than 1.5\% by weight or marine diesel oil (MDO) with a sulfur content equal to or less than 0.5\% by weight. For auxiliary engines, main engines and boilers, the requirements started July 1, 2009. The use of MGO or MDO with a sulfur content of equal to or less than 0.1\% will be required in all engines and boilers by January 1, 2012. The January 2012 start date may change to January 1, 2014 to more closely coincide with ECA Phase 2.

**CARB’s Regulation to Reduce Emissions from Diesel Auxiliary Engines on Ocean-going Vessels While at Berth at a California Port (CARB’s at-Berth Emissions Reduction regulation)**

On December 6, 2007, CARB adopted a regulation to reduce emissions from diesel auxiliary engines on OGVs while at-berth for container, cruise and refrigerated cargo vessels. The regulation requires that auxiliary diesel engines on OGVs are shut down for specified percentages of fleet’s visits and also the fleet’s at-berth auxiliary engine power generation to be reduced by the same percentages. While the use of shore power is expected to be the primary means of compliance, as an alternative, vessel operators may employ any combination of clean emissions control technologies to achieve equivalent reductions. Specifically, by 2014, vessel operators relying on shore power are required to shut down their auxiliary engines at berth for 50\% of the fleet’s vessel visits and also reduce their onboard auxiliary engine power generation by 50\%. The specified percentages will increase to 70\% in 2017 and 80\% in 2020. For vessel operators choosing the emission reduction equivalency alternative, the regulation requires a 10\% reduction in OGV hotelling emissions starting in 2010, increasing in stringency to an 80\% reduction by 2020.

**Vessel Speed Reduction Program**

In order to meet the mandates of AB 32, the California Global Warming Solution Act, implementation of VSR has been identified as one of the early action plan measures. This measure has potential to significantly reduce greenhouse gases, NO\textsubscript{x}, SO\textsubscript{2} and PM. CARB is currently evaluating the need to develop a statewide VSR program.
CAAP Measure- SPBP-OGV1; Vessel Speed Reduction (VSR) Program
In May 2001, a Memorandum of Understanding (MOU) between the Port of Long Beach, the Port of Los Angeles, EPA Region 9, CARB, SCAQMD, the Pacific Merchant Shipping Association (PMSA), and the Marine Exchange of Southern California was signed. This MOU called for OGVs to voluntarily reduce speed to 12 knots at a distance of 20 nautical miles (nm) from Point Fermin. Reduction in speed demands less power from the main engine, which in turn reduces NOx emissions and fuel usage. The term of this MOU expired in 2004; however, a significant number of the OGVs operating at the Port have continued to abide by VSR speeds within 20 nm from Point Fermin.

The updated measure OGV1 continues and expands the VSR program by continuing the 12 knot VSR zone between Point Fermin and the 20 nm distance, and expanding it to 40 nm from Point Fermin. There are three primary implementation approaches for this measure: 1) continuation of the voluntary program, 2) incorporation of VSR requirements in new leases, and 3) CARB’s VSR strategy. Parallel to the voluntary, incentive based strategies, compliance with the VSR program to 40 nm from Point Fermin will be negotiated into new and re-negotiated lease requirements. In addition, the ports intend to work closely with CARB to facilitate a statewide VSR program and ensure that the programs are aligned.

Port of Long Beach Green Flag Program
The Port has committed as much as $2.2 million a year to encourage participation in the Voluntary Vessel Ship Speed Reduction Program. Vessels that dock at the Port of Long Beach earn a Green Flag Environmental Achievement Award when they attain 100% compliance with the voluntary vessel speed reduction program for a 12-month period. Carriers that achieve a 90% compliance rate in a 12-month period are eligible for a 15% reduction in dockage otherwise payable to the Port (Green Rate) in the following year.

In 2008, the Board of Harbor Commissioners approved an expansion of the VSR compliance zone to 40 nm from Point Fermin starting in January 2009. Vessel operators that achieve a 90% compliance rate to 40 nm of Point Fermin within a 12-month period would receive an incentive rate that is 25% less than regular dockage otherwise payable to the Port (Green Plus Rate) in the following calendar year. In 2010, the VSR compliance rate was 96% within the 20 nm of the Port and 74% within the 40 nm zone.

CAAP Measure- SPBP-OGV2; Reduction of At-Berth OGV Emissions
This measure not only facilitates CARB’s at-Berth Emissions Reduction regulatory requirement but accelerates encouraging use of shore-power by as many ocean vessel calls as possible including non-regulatory vessel categories such as tankers. It requires the use of shore power to reduce hotelling emissions implemented at all container and cruise terminals and one liquid bulk terminal at the Port of Los Angeles and all container, one crude, and one bulk terminal at the Port of Long Beach by 2014. This measure also requires demonstration and application of alternative emissions reduction technologies for ships that are not good candidate for shore power, to be facilitated through the Technology Advancement Program (TAP).
CAAP Measures- SPBP-OGV3 and 4; OGV Main & Auxiliary Engine Fuel Standards
This measure is designed to require the use of lower sulfur distillate fuels in the auxiliary and main engines of OGVs within 40 nm of Point Fermin and while at berth. Upon lease renewal, this measure requires the use of distillate fuels that have a sulfur content of ≤0.2%. For vessel calls that are subject to these measures due to new lease agreements or renewal, the fuel switch emissions benefits will initially surpass the benefits of CARB’s regulation in the region near the ports by requiring ≤0.2% sulfur MGO or MDO within 40 nm of Point Fermin. However, by January 1, 2012, CARB’s regulation will surpass the CAAP measures, requiring the use of MGO or MDO with a sulfur content limit of 0.1% by weight in the main and auxiliary engines and boilers of all OGVs within 24 nm of the California coastline.

As a further backstop to the ports’ programs and the CARB regulation, as discussed earlier, the IMO adopted international requirements under MARPOL Annex VI in October 2008. These enforce a global limit on marine fuel burned within 200 nm of the coastline; they limit sulfur content to 3.5% by 2012, down from the current 4.5%, which will be further reduced to 0.5% sulfur by 2020, or 2025 at the latest, pending a technical review in 2018. In Emissions Control Areas (ECAs), sulfur content will be limited to 1.0% starting in August of 2012, and further reduced to 0.1% sulfur in 2015.

CAAP Measure- SPBP-OGV5 and 6; OGV Main & Auxiliary Engine Emissions Improvements
Measure OGV5 seeks to maximize the early introduction and preferential deployment of vessels to the San Pedro Bay Ports with cleaner/newer engines meeting the new IMO NOx standard for Emission Control Areas. Measure OGV6 focuses on reducing DPM and NOx from the legacy fleet through identification and deployment of effective emission reduction technologies.

CARB’s Regulation Related to Ocean-going Vessel Onboard Incineration
This regulation was adopted by CARB’s board in 2005 and was amended in 2006. As of November 2007, it prohibits all cruise ships and ocean-going vessels of 300 registered gross tons or more from conducting on-board incineration within 3 nm of the California coast. Enactment of this regulation was expected to reduce toxics air contaminants such as dioxins and toxics metals exposure to public. It was also expected to reduce PM and hydrocarbon emissions generated during incineration.

San Pedro Bay Standards Included in the 2010 SPBP CAAP Update
One of the major enhancements included in the 2010 SPBP CAAP update is the inclusion of the San Pedro Bay Emissions Standards and Health Risk Reduction Standards. The San Pedro Bay Standards are a statement of the ports’ commitments to significantly reduce the air quality impacts from port operations. Achievement of the Standards listed below will require diligent implementation of all of the known CAAP measures and aggressive action to seek out further emissions and health risk reductions from port-related sources from strategies that will emerge over time.
**Health Risk Reduction Standard**

The Ports of Long Beach and Los Angeles have developed the following standard for reducing overall port-related health risk impacts, relative to 2005 conditions:

- By 2020, reduce the population-weighted cancer risk of ports-related DPM emissions by 85%, in highly-impacted communities located proximate to port sources and throughout the residential areas in the port region.

**Emissions Reduction Standards**

Consistent with the ports’ commitment to meet their fair-share of mass emission reductions of air pollutants, the Ports of Long Beach and Los Angeles have developed the following standards for reducing air pollutant emissions from ports-related activities, relative to 2005 levels:

- By 2014, reduce emissions of NO\textsubscript{x} by 22%, of sulfur oxides (SO\textsubscript{x}) by 93%, and of DPM by 72%, to support attainment of the federal fine particulate matter (PM\textsubscript{2.5}) standards.

- By 2023, reduce emissions of NO\textsubscript{x} by 59% to support attainment of the federal 8-hour ozone standard. The corresponding SO\textsubscript{x} and DPM reductions in 2023 are 93% and 77%, respectively.

**Harbor Craft**

*EPA’s Emission Standards for Harbor Craft Engines*

On March 14, 2008, EPA finalized the latest regulation establishing new emission standards for new Category 1 and Category 2 diesel engines rated over 50 horsepower (hp) used for propulsion in most harbor craft. The new Tier 3 engine standards began phasing in starting in 2009. The more stringent Tier 4 engine standards (based on the application of high-efficiency catalytic after-treatment technologies) will phase in beginning in 2014 and will apply only to commercial marine diesel engines greater than 800 hp. The regulation also includes requirements for remanufacturing commercial marine diesel engines greater than 800 hp.

*CARB’s Low Sulfur Fuel Requirement for Harbor Craft*

In 2004, CARB adopted a low sulfur fuel requirement for harbor craft. Starting January 1, 2006 (in SoCAB) harbor craft are required to use on-road diesel fuel (e.g., ULSD), which has a sulfur content limit of 15 ppm and a lower aromatic hydrocarbon content. The use of lower sulfur and aromatic fuel has resulted in NO\textsubscript{x} and DPM reductions. In addition, the use of low sulfur fuel will facilitate retrofitting harbor craft with emissions control devices such as diesel particulate filters (DPFs), one of the promising emissions control device, that have the potential to reduce PM by an additional 85%.
CARB’s Regulation to Reduce Emissions from Diesel Engines on Commercial Harbor Craft

As a part of the Diesel Risk Reduction Plan and Goods Movement Plan, \(^2\) CARB adopted a regulation in November 2007 that will reduce DPM and NO\(_x\) emissions from new and in-use commercial harbor craft operating in Regulated California Waters (i.e., internal waters, ports, and coastal waters within 24 nm of the California coastline). Under CARB’s definition, commercial harbor craft include tug boats, tow boats, ferries, excursion vessels, work boats, crew boats, and fishing vessels. This regulation implements stringent emission limits from auxiliary and propulsion engines installed in commercial harbor craft. All in-use, newly purchased, or replacement engines must meet EPA’s most stringent emission standards per a compliance schedule set by the CARB for in-use engines and from new engines at the time of purchase. In addition, the propulsion engines on all new ferries, with the capacity of more than 75 passengers, acquired after January 1, 2009, will be required to use control technology that represents the best available control technology in addition to an engine that meets the Tier 2 or Tier 3 EPA marine engine standards, as applicable, in effect at the time of vessel acquisition. For harbor craft with home ports in the SCAQMD, the compliance schedule is accelerated by two years (compared to statewide requirements) in order to achieve the earlier emission benefits required in SCAQMD. The in-use emission limits only apply to ferries, excursion vessels, tug boats and tow boats. The compliance schedule for in-use engine replacement begins in 2009.

CAAP Measure- SPBP-HC1- Performance Standards for Harbor Crafts

All harbor craft operating in the ports of Long Beach and Los Angeles are required to comply with the CARB harbor craft regulation. Besides the implementation of CARB’s In-Use Harbor Craft regulation and the USEPA’s recently adopted Tier 3 and 4 standards, the ports are working towards a goal of repowering all harbor craft home-based in the San Pedro Bay to Tier 3 levels, within five years after the Tier 3 engines are available and use of shore power at their home port location. The SPB Ports plan to accelerate harbor craft emission reductions through emerging technologies such as the hybrid tug, new more-efficient engine configurations, alternative fuels, shore power for tugs at-berth and at the staging areas, and repowered vessels through incentives or voluntary measures.

Cargo Handling Equipment

Emissions Standards for Non-road Diesel Powered Equipment

The EPA’s Tier 1, Tier 2, Tier 3, and Tier 4 (interim Tier 4 and final) emissions standards for non-road diesel engines require compliance with progressively more stringent standards for hydrocarbon, CO, DPM, and NO\(_x\). Tier 4 standards for non-road diesel powered equipment complement the 2007+ on-road heavy-duty engine standards which require 90% reductions in DPM and NO\(_x\) compared to current levels. In order to meet these standards, engine manufacturers will produce new engines with advanced emissions control technologies similar to those already in place for on-road heavy-duty diesel vehicles. These standards for new engines will be phased in starting with smaller engines in 2008 until all but the very largest diesel engines meet NO\(_x\) and PM standards in 2015. Currently, the interim Tier 4 standards include a 90% reduction in PM and a 60% reduction in NO\(_x\).

\(^2\) Final Diesel Risk Reduction Plan with Appendices

http://www.arb.ca.gov/diesel/documents/rrpapp.htm
CARB’s Cargo Handling Equipment Regulation

In December 2005, CARB adopted a regulation designed to reduce emissions from CHE such as yard tractors and forklifts starting in 2007. The regulation called for the replacement or retrofit of existing engines with engines that use Best Available Control Technology (BACT). Beginning January 1, 2007 the regulation required newly purchased, leased, or rented yard tractors to be equipped with a 2007 or later on-road engine or a Final Tier 4 off-road engine. Newly purchased, leased or rented non-yard tractors must be equipped with a certified on-road or off-road engine meeting the current model year standards in effect at the time the engine is added to the fleet. If the engine is pre-2004, then the highest level available verified diesel emission control system (VDEC) must be installed within one year. In-use yard tractors are required to meet either 2007 or later certified on-road engine standards, Final Tier 4 off-road engine standards, or install verified controls that will result in equivalent or fewer DPM and NOx emissions than a Final Tier 4 off-road engine. In-use non-yard tractors must either install the highest level available VDEC and/or replace to an on-road or off-road engine meeting the current model year standards. For all CHE, compliance dates are phased-in beginning December 31, 2007, based on the age of the engine and number of equipment in each model year group. In October of 2009, CARB amended3 the CHE regulation such that it exempted sweepers and mobile cranes (other than rubber-tired gantry cranes) from the Cargo Handling Equipment Regulation, placing them under either the In-Use Off-Road Diesel Vehicle Regulation or the In-Use Heavy-Duty Diesel Vehicle Regulation (On-Road Truck and Bus Regulation), depending on the engine configuration. In February of 2011, CARB held a workshop4 to discuss amendments to the Cargo Handling Equipment regulations which relates to providing additional compliance flexibility for certain equipment and clarifying certain definitions that exist in the current adopted regulatory language.

CAAP Measures- SPBP-CHE1- Performance Standards for CHE

This measure calls for CHE emission reductions beyond CARB’s CHE regulation at the time of terminal lease renewal. As of 2007, all CHE purchases must meet the following performance standards of the cleanest available NOx alternative-fueled engine meeting 0.01 g/bhp-hr PM, available at time of purchase; or cleanest available NOx diesel-fueled engine meeting 0.01 g/bhp-hr PM, available at time of purchase. If there are no engines available that meet 0.01 g/bhp-hr PM, then must purchase cleanest available engine (either fuel type) and install cleanest VDEC available.

3 http://www.arb.ca.gov/ports/cargo/cargo.htm; Amended Regulation posted on January 14, 2010
In addition, as of the end of 2010, all yard tractors operating at the San Pedro Bay Ports are required to meet at a minimum the EPA 2007 on-road or Tier 4 engine standards. By the end of 2012, all pre-2007 on-road or pre Tier 4 off-road top picks, forklifts, reach stackers, rubber tired gantry cranes (RTGs), and straddle carriers <750 hp must meet at a minimum the EPA 2007 on-road engine standards or Tier 4 off-road engine standards. By end of 2014, all CHE with engines >750 hp must meet at a minimum the EPA Tier 4 off-road engine standards. Starting in 2007 (until equipment is replaced with Tier 4), all CHE with engines >750 hp will be equipped with the cleanest available VDEC verified by CARB.

**Railroad Locomotives**

EPA’s Emissions Standards for New and Remanufactured Locomotives and Locomotive Engines- Latest Regulation Finalized on 14 March 2008

In March 1998, EPA adopted Tier 0 (1973-2001), Tier 1 (2002-2004), and Tier 2 (2005+) emissions standards applicable to newly manufactured and remanufactured railroad locomotives and locomotive engines. These standards require compliance with progressively more stringent standards for emissions of hydrocarbon, CO, NOₓ, and DPM. Although the most stringent standard, Tier 2, results in over 40% reduction in NOₓ and 60% reduction in DPM compared to Tier 0, the full potential of these reductions will not be realized in the next five years because of the long life of diesel locomotive engines.

In March 2008, EPA finalized the regulation – “Control of Emissions of Air Pollution from Locomotive and Marine Compression Ignited Engines Less than 30 Liters per Cylinder.” When fully implemented, this rule will cut PM emissions from these engines by as much as 90% and NOₓ emissions by as much as 80%.

The regulation introduces two tiers of standards – Tier 3 and Tier 4 – which apply to new locomotives as well as standards for remanufactured locomotives, as follows:

- **Newly-Manufactured Locomotives:** The new Tier 3 emission standards will achieve 50% reduction in PM beyond the current Tier 2 standards and will become effective in 2012. The longer term Tier 4 emission standards which are based on the application of high efficiency catalytic after-treatment technologies for NOₓ and PM will become effective in 2015 and will achieve over 80% reduction in PM and NOₓ compared with the current Tier 2 standards.

- **Remanufactured Locomotives:** The regulation also establishes emission standards for remanufactured Tier 0, 1, and 2 locomotives which would achieve approximately 50% reduction in PM and up to 20% reduction in NOₓ.

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6 EPA 2008. [http://www.arb.ca.gov/msprog/offroad/loco/loco.htm](http://www.arb.ca.gov/msprog/offroad/loco/loco.htm)
CARB’s Low Sulfur Fuel Requirement for Intrastate Locomotives

In 2004, CARB adopted a low sulfur fuel requirement for intrastate locomotives. Intrastate locomotives are defined as those locomotives that operate at least 90% of the time within the borders of the state, based on hours of operation, miles traveled, or fuel consumption. Mostly applicable to switchers, since January 1, 2006 statewide, intrastate locomotives have been required to use CARB off-road diesel fuel which has a sulfur content limit of 15 ppm and a lower aromatic content. The use of fuel with lower sulfur and aromatics will result in NOx and DPM reductions. In addition, use of low sulfur fuel will facilitate retrofitting locomotives with emissions control devices such as DPFs that have potential to reduce DPM by 85%.

Statewide 1998 and 2005 Memorandum of Understanding (MOU)7

In order to accelerate the implementation of Tier 2 engines in the SoCAB, CARB and EPA Region 9 entered into an enforceable MOU in 1998 with the two major Class 1 freight railroads [Union Pacific (UP) and Burlington Northern Santa Fe (BNSF)] operating in California. This MOU requires UP and BNSF to concentrate their nationwide introduction of Tier 2 locomotives preferentially within the SoCAB, which will achieve 65% reduction in NOx by 2010. In 2005, CARB entered into another MOU with UP and BNSF whereby the two railroads agreed to phase out non-essential idling and install idling reduction devices, identify and expeditiously repair locomotives that smoke excessively and maximize the use of 15 ppm sulfur fuel. The railroads agreed to provide information to CARB documenting their compliance with the MOUs during the second quarter of 2011, and CARB has reported that they expect to complete their evaluation of this data by mid-year 2011.

In addition to the 1998 and 2005 MOUs between CARB and the Class 1 rail operators described above, in June 2010, CARB’s Board proposed, on voluntary basis, railyard-specific commitments with Class 1 operators to accelerate further DPM emission and risk reductions at four railyards in the South Coast Air Basin, including the ICTF located in the port area. The voluntary commitments would establish reporting and tracking mechanisms and deadlines to accelerate reductions of DPM emissions. The rail commitments would also require Class 1 operators to reduce DPM emissions by 85% by 2020 relative to 2005 emission levels within the fenceline of each of the four railyards. Specific strategies to achieve this level of reduction are up to the discretion of the Class 1 operators, and could include a combination of cleaning up their fleet of cargo handling equipment, drayage trucks, switcher locomotives or line haul locomotives.

CAAP Measure- SPBP-RL1- Pacific Harbor Line Rail Switch Engine Modernization

This measure implements the switch locomotive engine modernization and emission reduction requirements included in the operating agreements between the ports and Pacific Harbor Line (PHL). In 2010, PHL and the ports entered into a third amendment to their operating agreements which, if PHL is successful in receiving grant funding, will result in an additional upgrade of the Tier 2 switcher locomotive fleet to meet “Tier 3-plus” standards by the end of 2011.

7 http://www.arb.ca.gov/msprog/offroad/loco/loco.htm
Last updated by CARB on April 11, 2011
CAAP Measure - SPBP-RL2 - Class 1 Line-haul and Switcher Fleet Modernization
The focus of this measure is to ensure all of the emission reductions associated with the CARB Class 1 railroads MOU and the 2008 USEPA locomotive engine standards are met and appropriately accounted for. The ultimate goal of this measure is that by 2023, all Class 1 locomotives entering the ports will meet emissions equivalent to Tier 3 locomotive standards.

CAAP Measure - SPBP-RL3 - New and Redeveloped Near-Dock Rail Yards
This measure focuses on new and redeveloped near-dock rail facilities located on port properties. The goal of this measure is to incorporate the cleanest locomotive, CHE, and HDV technologies into near-dock rail operations. One of the significant goals of this measure is to achieve significant reductions in locomotive emissions through the accelerated turnover of the existing locomotive fleet to newer, lower emitting models. The ports will work with regulatory agencies (USEPA, CARB and SCAQMD) toward the goal of achieving a line-haul and switcher locomotive fleet with an emissions equivalent of 95% Tier 4 compliant engines operating within the ports, and statewide, as expeditiously as possible.

Heavy-Duty Vehicles
Emission Standards for New 2007+ On-road Heavy-Duty Vehicles
In 2001, CARB adopted EPA’s stringent emission standards for 2007+ On-road Heavy Duty Vehicles (HDV), which will ultimately result in 90% reductions in emissions of NOx and particulate matter (PM). This regulation will require HDV engine manufacturers to meet a 0.01 g/bhp-hr PM standard starting in 2007, which is 90% lower than the 2004 PM standard of 0.1 g/bhp-hr. The regulation requires a phase-in of a 0.2 g/bhp-hr NOx standard between 2007 and 2010. By 2010, all engines will be required to meet the 0.2 g/bhp-hr NOx standard, which represents a greater than 90% reduction compared to the 2004 NOx standard of 2.4 g/bhp-hr. It is expected that between 2007 and 2010, on average, manufacturers will produce HDV engines meeting a PM standard of 0.01 g/bhp-hr and a NOx standard of 1.2 g/bhp-hr. This latter is referred to as the 2007 interim standard.

CARB’s Heavy-Duty Vehicle On-Board Diagnostics Requirement
In 2005, CARB adopted a comprehensive HDV On-Board Diagnostics regulation, which ensures that the increasingly stringent HDV emissions standards being phased in are maintained throughout the vehicle’s useful life. The OBD regulation requires manufacturers to install a system in HDVs to monitor virtually every emissions related component on the vehicle. The OBD regulation will be phased in beginning with the 2010 model years with full implementation required by 2016.

CARB’s Ultra-Low Sulfur Diesel (ULSD) Fuel Requirement
In 2003, CARB adopted a regulation requiring that diesel fuel produced or offered for sale in California for use in any on-road or non-road vehicular diesel engine (with the exception of locomotive and marine diesel engines) contain no more than 15 ppm of sulfur by weight, beginning June of 2006, statewide. This ULSD fuel is needed in order for retrofit technologies, such as diesel particulate filters, to work successfully.
CARB’s Regulation for Reducing Emissions from On-road Heavy-Duty Diesel Trucks Dedicated to Goods Movement at California Ports

As a part of CARB’s emissions reduction plan for ports and goods movement in California, in December of 2007, CARB board adopted a regulation to modernize the class 8 (trucks with gross vehicle weight rating greater than 33,000 pounds) drayage truck fleet that operate at California’s ports. This objective is to be achieved in two phases:

1. By 31 December 2009, all pre-1994 model year (MY) engines were to be retired or replaced with 1994 and newer MY engines. Furthermore, all drayage trucks with 1994 – 2003 MY engines were required to achieve an 85% PM emission reduction through the use of an ARB approved Level 3 VDECS.

2. By 31 December 2013, all trucks operating at California ports must comply with the 2007+ on-road heavy-duty truck engine standards.

In December 2010, CARB’s Board acted on amendments that staff had proposed to the drayage truck regulation. It specifically included Class 7 drayage trucks (with gross vehicle weight rating greater than 26,000 pounds and less than 33,001 pounds) in the drayage truck regulation as follows: (a) to accelerate the filter requirement to January 1, 2012 for Class 7 drayage trucks in the South Coast Air Basin, and (b) to require Class 7 drayage trucks statewide to operate with 2007 or newer emission standard engines by January 1, 2014.

In addition, CARB expanded the definition of drayage trucks to include those non-compliant trucks that may not directly come to the ports to pick up or drop off cargo but that engage in moving cargo, destined to or originated from port facilities, to or from near-port facilities or rail yards. This practice, known as “dray-off,” reduces the effectiveness of the drayage truck regulation because otherwise non-compliant trucks still operate near the ports and rail yards.

CARB’s On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation

In December 2008, CARB adopted a regulation that places requirements on in-use HDVs operating throughout the state. Under the regulation, existing HDVs are required to be replaced with HDVs meeting the latest NOx and PM Best Available Control Technology (BACT), or retrofitted to meet these levels. By January 1, 2021, all MY 2007 class 8 drayage trucks are required to meet NOx and PM BACT (i.e. 2010+ EPA engine standards). MY 2008 and MY 2009 must be replaced with 2010+ engines by January 1, 2022 and January 1, 2023 respectively.
CARB’s Heavy-Duty Vehicle Greenhouse Gas Emission Reduction Regulation
In December 2008, CARB adopted a new regulation to reduce greenhouse gas emissions by improving the fuel efficiency of heavy-duty tractors that pull 53-foot or longer box-type trailers through improvements in tractor and trailer aerodynamics and the use of low rolling resistance tires. All pre-2011 MY tractors that pull affected trailers, are required to use SmartWay verified low rolling resistance tires beginning January 1, 2012. Pre-2011 MY 53-foot or longer-type box trailers are required to be SmartWay certified or retrofitted with SmartWay verified technologies by December 31, 2012 with the exception of 2003-2008 MY refrigerated-van trailers equipped with 2003 or later transport refrigeration units which will have a compliance phase-in between 2017 and 2019. Drayage tractors and trailers that operate within a 100 mile radius of a port or intermodal rail yard are exempt from this regulation.

CAAP Measures- SPBP-HDV1- Performance Standards for On-road Heavy-Duty Vehicles; Clean Trucks Program
Per the stated goals of the CAAP, the ports of Long Beach and Los Angeles approved the Clean Trucks Program which progressively bans older trucks from operating at the two ports. The ban is implemented in three phases as follows:

1. By 1 October 2008 – All pre-1989 trucks are banned from port services.
2. By 1 January 2010 – All 1989-1993 trucks along with un-retrofitted 1994-2003 trucks are banned from port services.
3. By 1 January 2012 – All trucks that do not meet 2007 and later on-road heavy-duty engine standards are banned from port services.

In January of 2011, harbor commissioners from the Port of Long Beach adopted a resolution that included Class 7 drayage trucks and banned the “dray-off” practice under the Clean Truck Program.

Greenhouse Gases
Assembly Bill 32 (AB32), the California Global Warming Solutions Act of 2006, establishes a first-in-the-world comprehensive program requiring CARB to develop regulatory and market mechanisms that will ultimately reduce greenhouse gas (GHG) emissions to 1990 levels by the year 2020 and further reduce GHG emissions to 80% below 1990 levels by 2050. Mandatory caps will begin in 2012 for significant sources and ratchet down to meet the 2020 goals.
On October 25, 2007, CARB approved several emission reduction strategies to reduce GHG emissions as “early action measures.” Early action measures pertaining to goods movement activities for ships, port drayage trucks, cargo handling equipment and transport refrigeration units included:

- Green Ports (Ship Electrification)
- SmartWay Truck Efficiency
- Tire Inflation Program
- Anti-idling Enforcement
- Refrigerant Tracking, Reporting, and Recovery Program
- Low Carbon Fuel Standard

In December 2007, CARB approved the 2020 statewide GHG emission limit of 427 million metric tons of carbon dioxide equivalent (MMT CO₂E). Also in December 2007, CARB adopted a regulation requiring the largest industrial sources to report and verify their greenhouse gas emissions. In December 2008, CARB adopted the Climate Change Scoping Plan to achieve the reductions in greenhouse gas (GHG) emissions mandated in AB32. The AB32 Scoping Plan contains the main strategies California will use to reduce the GHGs that cause climate change. Several of these measures are targeted at goods movement, including ports and are expected to achieve a combined 3.7 million metric tons of carbon dioxide equivalent. Proposed measures in the Scoping Plan include:

- T-5: Ship electrification at ports (previously adopted as regulation in December 2007)\(^8\)
- T-6: Goods movement efficiency measures (Port Drayage Trucks regulation adopted in December 2007 and later amended in December 2010 to include class 7 trucks that were not covered under original regulation but found to be engaging in drayage activities at the ports; other measures under development)
- T-7: Heavy-Duty Vehicle GHG Emission Reduction (adopted December 2008)\(^9\)

\(^8\) [http://www.arb.ca.gov/ports/shorepower/shorepower.htm](http://www.arb.ca.gov/ports/shorepower/shorepower.htm)
Updated as of December 29, 2010

\(^9\) [http://www.arb.ca.gov/cc/hdghg/regulation.htm](http://www.arb.ca.gov/cc/hdghg/regulation.htm)
Updated as of March 29, 2011
In addition, the following Scoping Plan’s specific measures are planned for adoption in the next few years with potential impacts on Port-related sources:

- Transport Refrigeration Units Cold Storage Prohibition and Energy Efficiency
- Refrigerant Recovery from Decommissioned Refrigerated Shipping Containers
- Medium and Heavy-Duty Vehicle Hybridization
- Cargo Handling Equipment – Anti-Idling, Hybrid, Electrification
- Commercial Harbor Craft Maintenance and Design efficiency
- Goods Movement System-Wide Efficiency Improvements
- Vessel Speed Reduction
- Clean Ships

The recently adopted CARB regulations, the anticipated CARB rulemakings, and the measures in the CAAP will provide a vital and complementary combination of measures that support the overall effort to meet both the State and San Pedro Bay Ports air quality improvement goals.