APPENDIX A

AIR QUALITY REGULATORY AND SAN PEDRO BAY PORTS CLEAN AIR ACTION PLAN MEASURES AND PROGRAMS
REGULATORY AND SAN PEDRO BAY PORTS CLEAN AIR ACTION PLAN MEASURES

Sources of emissions evaluated in this inventory include five diesel-fueled source categories: OGVs, HDVs, CHE, harbor craft and locomotives. The responsibility for the control of emissions from these sources falls under the jurisdiction of local [South Coast Air Quality Management District (SCAQMD)], state [California Air Resources Board (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 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 (2010 CAAP Update) which set even more aggressive goals for reducing air pollution and health risks from port operations through the establishment of the San Pedro Bay Standards.

San Pedro Bay Standards
The San Pedro Bay Standards are a statement of the ports’ commitment 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
To complement the CARB’s emission air pollution reduction plan programs, 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 in proximity to port sources and throughout the residential areas in the port region.

Emissions Reduction Standard
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 port-related activities, relative to 2005 levels:

- By 2014, reduce emissions of NOx by 22%, of sulfur oxides (SOx) by 93%, and of DPM by 72% to support attainment of the federal fine particulate matter (PM2.5) standards.
- By 2023, reduce emissions of NOx by 59% to support attainment of the federal 8-hour ozone standard. The corresponding SOx and DPM reductions in 2023 are 93% and 77%, respectively.

Regulatory programs and CAAP measures developed to reduce emissions from Port-related activities are described by source category.
Ocean-Going Vessels

**IMO Emission Standards for Marine Propulsion Engines**

In 1997, the International Maritime Organization (IMO) adopted emission standards for oxides of nitrogen (NO$_x$) from marine propulsion engines, which are contained in Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL), regulations for the Prevention of Air Pollution from Ships.\(^1\) On July 21, 2008, the United States ratified MARPOL Annex VI and signed into law the Maritime Pollution Protection Act of 2008. The requirements became enforceable through the Act to Prevent Pollution from Ships (APPS) in January 2009. Engine manufacturers have been certifying engines to the Annex VI NO$_x$ limits since 2000, as the standards became retroactive once Annex VI was ratified.

In October 2008, the IMO adopted these amendments by introducing new Tier 2 and Tier 3 NO$_x$ engine emission rate limits. The NO$_x$ limits apply to marine diesel engines installed on newly built ships based on the rated engine speed and the year the ship is built.\(^2\) Tier 3 standards are required for vessels that are built on or after January 1, 2016 and operate in an Emissions Control Area (ECA).

Existing ships built between 1990 and 2000, with marine diesel engines less than 5,000 kW and a per cylinder displacement 90 liters or more are subject to retrofit requirements of the Tier 1 NO$_x$ standards, provided that an approved method, by the vessel's flag state, for that engine has been certified and notification has been submitted to IMO. Major conversions, as defined by IMO, of marine diesel engines on all existing ships built prior to January 1, 2000, would be subject to the Tier 1 NO$_x$ standards.

At its 65th session of May 2013, the Marine Environment Protection Committee (MEPC) agreed to consider an amendment to postpone the implementation of the Tier 3 NO$_x$ standards within ECAs from 2016 to 2021. The draft amendments will considered for adoption during the 66th session of MEPC in March 2014.

The NO$_x$ limits for marine diesel engines by tier level, based on the engine’s speed in revolutions per minute (rpm) are summarized in Table A.1 below:

<table>
<thead>
<tr>
<th>Tier</th>
<th>Keel Laid Date</th>
<th>NO$_x$ Limits, g/kW-hr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rpm&lt;130</td>
<td>130 ≤ rpm &lt; 2000</td>
</tr>
<tr>
<td>Tier 1</td>
<td>1/1/2000 – 12/31/2010</td>
<td>17</td>
</tr>
<tr>
<td>Tier 2</td>
<td>1/1/2011 – 12/31/2015</td>
<td>14.4</td>
</tr>
<tr>
<td>Tier 3 (ECA)</td>
<td>1/1/2016 +</td>
<td>3.4</td>
</tr>
</tbody>
</table>

\(^1\) IMO, [http://www.imo.org/ourwork/environment/pollutionprevention/airpollution/pages/air-pollution.aspx](http://www.imo.org/ourwork/environment/pollutionprevention/airpollution/pages/air-pollution.aspx)

IMO Low Sulfur Fuel Requirements for Marine Engines
In October 2008, the IMO adopted amendments under MARPOL Annex VI, placing a global limit on marine fuel sulfur content of 3.5% by 2012, reduced from the previous 4.5% sulfur limit. The sulfur limit will be further reduced to 0.5% by 2020, or at the latest, by 2025, pending a technical review in 2018. In all ECAs, fuel sulfur content was capped at 1.0% in 2012, and will be further reduced to 0.1% sulfur in 2015. The waters within 200 miles of North American coasts were officially designated an ECA on March 26, 2010.

IMO Energy Efficiency Design Index (EEDI) for International Shipping
On July 15, 2011, IMO amended MARPOL to include energy efficiency standards for new ships through the designation of an Energy Efficiency Design Index (EEDI).\(^3\) The EEDI standards are expressed as percent emissions reductions from reference lines established for each ship class and are applicable to container ships, general cargo ships, refrigerated cargo carriers, gas tankers, oil and chemical tankers, dry bulk carriers, and combination dry/liquid bulk carriers. The reference lines by ship class were developed by fitting a curve through data on EEDI values of the existing fleet. At the 66th session of MEPC to be held in between March 31 to April 4, 2014, the committee will consider an amendment to extend the EEDI implementation to RoRo cargo, passenger ships, LNG carriers, and cruise passenger ships.

By requiring minimum efficiency levels for ships, reductions in fuel consumption will subsequently result in reductions of CO\(_2\) emissions and other pollutants emitted into the air. The EEDI standards were included in the new chapter 4 of MARPOL Annex VI are phased in over several years as follows:

- 2013: meet or exceed applicable reference line
- 2015: 10% reduction from the applicable reference line
- 2020: 20% reduction from the applicable reference line
- 2025: 30% reduction from the applicable reference line

EPA 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.\(^4\) EPA lists the following categories for compression ignition diesel marine engines based on engine displacement per cylinder:

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

The EPA regulation impacts some marine propulsion engines and the marine auxiliary engines used on vessels. When fully implemented, this rule will cut particulate matter (PM) emissions from these engines by as much as 90% and NO\(_x\) emissions by as much as 80%.

---


\(^4\) EPA, [http://www.epa.gov/otaq/marine.htm#regs](http://www.epa.gov/otaq/marine.htm#regs)
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 or 800 horsepower (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 Emission Standards for Marine Diesel Engines above 30 Liters per Cylinder (Category 3 Engines)**

In 2004, Tier 1 standards for Category 3 marine engines went into effect, 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 that are equivalent to the amendments adopted by MARPOL Annex VI in 2008. The final regulation establishes stricter standards for NOx, in addition to standards for hydrocarbons (HC) and carbon monoxide (CO) as summarized in Table A.2.

**Table A.2: EPA Emission Standards for Category 3 Marine Diesel Engines, g/kW-hr**

<table>
<thead>
<tr>
<th>Tier Level</th>
<th>Model Year</th>
<th>Engine Speed (n), rpm</th>
<th>NOx g/kW-hr</th>
<th>HC g/kW-hr</th>
<th>CO g/kW-hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1</td>
<td>2004</td>
<td>rpm &lt; 130</td>
<td>14.4</td>
<td>2.0</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>130 ≤ 2,000</td>
<td>17</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rpm ≥ 2,000</td>
<td>45 × n^{−0.20}</td>
<td>9.8</td>
<td></td>
</tr>
<tr>
<td>Tier 2</td>
<td>2011</td>
<td>rpm &lt; 130</td>
<td>3.4</td>
<td>2.0</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>130 ≤ 2,000</td>
<td>7.7</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rpm ≥ 2,000</td>
<td>44 × n^{−0.25}</td>
<td>2.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Tier 3</td>
<td>2016</td>
<td>rpm &lt; 130</td>
<td>9.0 × n^{−0.20}</td>
<td>2.0</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>130 ≤ 2,000</td>
<td>2.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>rpm ≥ 2,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CARB 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 nautical miles (nm) of the California coastline. Enforcement of the regulation began on July 1, 2009 requiring the use of marine gas oil (MGO) with a sulfur content less than or equal to 1.5% by weight or marine diesel oil (MDO) with a sulfur content less than or equal to 0.5% by weight. Amendments to the low sulfur fuel requirements were approved by the Office of Administrative Law and starting on August 1, 2012, the maximum fuel sulfur limit for MGO decreased from 1.5% to 1.0%, while the fuel sulfur limit for MDO remained at 0.5 %. Starting January 1, 2014, the use of MGO or MDO with sulfur content equal to or less than 0.1 % will be required in all engines and boilers.

The amendment to the low sulfur fuel regulation also allowed for the expansion of the regulatory boundary in Southern California to be consistent with the Contiguous Zone. In December 2011, CARB started enforcement of the expanded regulatory boundary. This new boundary includes the region 24 nm from the California shoreline, including 24 nm from the shoreline of the Channel Islands. There is also a small region near the north end of the Santa Barbara Channel that was excluded from the regulatory boundary to encourage vessels to use the established shipping lanes in the Channel. The amended regulatory area is shown in Figure A.1.\(^5\)

**Figure A.1: Amended CARB Marine Fuel Regulatory Area**

CARB 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 require that auxiliary diesel engines on OGVs be shut down for specified percentages of fleet’s visits and also the fleet’s at-berth auxiliary engine power generation 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. This regulation is applicable to container, cruise, and refrigerated cargo vessels. 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 percentage of required shore power visits per fleet 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 hoteling emissions starting in 2010, increasing to an 80% reduction by 2020.

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

CAAP Measure: OGV1; Vessel Speed Reduction (VSR) Program
In May 2001, 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 entered into a Memorandum of Understanding (MOU) for OGVs to voluntarily reduce their speed to 12 knots at a distance of 20 nautical miles (nm) from Point Fermin through the year 2004. With reduced speeds, less power is needed from the main engine, which in turn reduces NOx emissions and fuel consumption.

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.

VSR was identified as an early action measure in CARB’s Climate Change Scoping Plan developed under the California Global Warming Solutions Act, or Assembly Bill 32 to reduce greenhouse gas emissions. 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 between Point Fermin and the 20 nm distance for a 12-month period. Carriers that achieve a 90% or better 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 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 2012, the VSR compliance rate was 96% within the 20 nm of the Port and 83% within the 40 nm zone.

CAAP Measure OGV2; Reduction of At-Berth OGV Emissions
OGV2 requires the use of shore power to reduce hoteling emissions at all container, one crude, and one bulk terminal at the Port of Long Beach and at all container and cruise terminals and one liquid bulk terminal at the Port of Los Angeles by 2014. This measure also facilitates CARB’s at-berth emissions reduction regulatory requirement but also accelerates the use of shore-power including vessel categories not covered under the state’s shore power regulation, such as tankers. This measure also requires demonstration and application of alternative emissions reduction technologies for ships that are not good candidates for shore power, to be facilitated through the Technology Advancement Program (TAP).

CAAP Measures OGV3 and 4; OGV Main & Auxiliary Engine Fuel Standards
For vessels subject to a lease requirement, this measure requires the use of lower sulfur distillate fuels with a maximum sulfur content of 0.2% in the auxiliary and main engines of OGVs within 40 nm of Point Fermin and at berth until the requirements under the CARB low sulfur regulation and ECA come into effect.

CAAP Measures OGV5 and 6; OGV Main & Auxiliary Engine Emissions Improvements and Green Ship Award Program
OGV5 maximizes 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 ECAs. Measure OGV6 focuses on reducing diesel particulate matter (DPM) and NOx from the legacy fleet through identification and deployment of effective emission reduction technologies.

On June 18, 2012 the Port of Long Beach Board of Harbor Commissioners adopted the voluntary, incentive-based Green Ship Award program. Vessels with main engines meeting IMO’s Tier 2 or Tier 3 standards are eligible for incentives ranging from $2,500 to $6,000 per ship call. The Green Ship program goal is for 50 percent of all ship calls at the Port of Long Beach be made with Tier 2 vessels and 40 percent with Tier 3 vessels by 2023.

EPA Emission Standards for Harbor Craft Engines

On March 14, 2008, EPA finalized new emission standards for new Category 1 and Category 2 diesel engines rated over 50 hp used for propulsion in most harbor craft. The new Tier 3 engine standards began phase-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 Regulation to Reduce Emissions from Diesel Engines on Commercial Harbor Craft

In November 2007, CARB adopted a regulation that reduces DPM and NOx 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 includes tugboats, towboats, ferries, excursion vessels, workboats, crew boats, and fishing vessels.

All in-use, newly purchased, or replacement engines must meet the EPA’s most stringent emission standards according to the compliance schedule set by CARB. In addition, propulsion engines on all new ferries acquired after January 1, 2009, with a capacity of more than 75 passengers, are required to apply best available control technologies to engines to meet EPA Tier 2 or Tier 3 marine engine standards at the time of vessel acquisition. For harbor craft home ported in the SCAQMD, the compliance schedule is accelerated by two years compared to statewide requirements. Enforcement of the CARB commercial harbor craft regulation began in August 2012 after the EPA granted CARB authorization to enforce the emissions/engine standard provisions under the Clean Air Act. CARB amended the commercial harbor craft regulation in 2010 to include crew and supply vessels, barges and dredges, but is deferring enforcement of the emissions requirements for these harbor craft until they receive an authorization from the EPA. As of May 2013, CARB has approved three marine engine rebuild kits that can be used to meet Tier 2 standards.

CARB Low Sulfur Fuel Requirement for Harbor Craft

Starting January 1, 2006 harbor craft operating in the SCAQMD are required to use ultra-low sulfur diesel (ULSD) fuel, which has a sulfur content limit of 15 parts per million (ppm) and a lower aromatic hydrocarbon content. While the use of ULSD results in NOx and DPM reductions, the use of low sulfur fuel in harbor craft retrofit with emissions control devices such as diesel particulate filters (DPFs) can effectively reduce PM by an additional 85% or more.

CAAP Measure HC1 - Performance Standards for Harbor Craft

In addition to the implementation of CARB’s commercial harbor craft regulation and the EPA’s Tier 3 and 4 standards, HC1 seeks to further reduce emissions by encouraging repowering all harbor craft home based in the San Pedro Bay to Tier 3 levels within five years after the engines become

---

available; and requiring the use of shore power for tug boats. The ports also plan to accelerate harbor craft emission reductions through emerging technologies such as the hybrid tug, more-efficient engine configurations, alternative fuels, and the use of incentives or voluntary measures to encourage engine repower or retrofit.

Cargo Handling Equipment

EPA Emission 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 HC, CO, DPM, and NO\textsubscript{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\textsubscript{x} compared to previous levels. In order to meet these standards, engine manufacturers are producing 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 were phased in starting in 2008 with smaller engines until all but the very largest diesel engines meet NO\textsubscript{x} and PM standards in 2015. Currently, the interim Tier 4 standards include a 90% reduction in PM and a 60% reduction in NO\textsubscript{x}.

CARB Cargo Handling Equipment Regulation
In December 2005 CARB adopted a regulation designed to reduce emissions from cargo handling equipment (CHE) at ports, such as yard tractors and forklifts. The regulation calls for the replacement or retrofit of existing engines with engines that use Best Available Control Technology (BACT). Beginning January 1, 2007 the regulation requires 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 are required to 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 a fleet. If the engine is a pre-2004 model year, then the highest-level available Verified Diesel Emission Control System (VDECS) 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 emission controls that result in equivalent or fewer DPM and NO\textsubscript{x} emissions than a Final Tier 4 off-road engine. In-use non-yard tractors must install the highest-level available VDECS, and/or replace an on-road or off-road engine meeting the current model year standards. Compliance dates were phased in beginning on December 31, 2007 based on the age of the engine and number of equipment in each model year group. In September 2012, CARB adopted amendments to the original regulation that provides additional flexibility in the options to control CHE emissions.

In 2012, CARB received EPA authorization to enforce the cargo handling equipment regulation, including the new and in-use engine emission limits.

CARB New Emission Standards, Test Procedures, for Large Spark Ignition (LSI) Engine Forklifts and Other Industrial Equipment

Since 2007, CARB promulgated more stringent emissions standards for hydrocarbon and oxides of nitrogen combined and implemented emissions test procedures for LSI engines with a horsepower rating of 25 horsepower or greater. The stringent new engine emission standards and test procedures were implemented in two phases. The first phase (2.0 g/hp-hr of HC + NO\textsubscript{x}) was implemented for engines built between January 1, 2007 and December 31, 2009. The second phase (0.6 g/hp-hr of HC + NO\textsubscript{x}) was implemented for engines built starting in January 1, 2010.\textsuperscript{14}

CARB Fleet Requirements for Large Spark Ignition Engines\textsuperscript{15}

Initially promulgated in 2007 and amended in 2010, CARB established fleet average emissions requirements for the existing fleet of LSI engines with a horsepower rating of 25 horsepower or greater. The regulation also establishes verification procedures for manufacturers of retrofit emission control systems. The fleet requirements only apply to forklifts, sweepers/scrubbers, industrial tow tractors, and ground support equipment, agricultural and forest operations; boneyard, in-field, operations, retired, and service equipment.

The fleet requirements for HC + NO\textsubscript{x} standards were phased in on January 1 of 2009, 2011, and 2013. Depending upon the size of the fleet, the fleet standards vary within the same year of implementation.

CAAP Measures 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 NO\textsubscript{x} alternative-fueled engine meeting 0.01 grams per brake horsepower (g/bhp-hr) PM available at time of purchase; or cleanest available NO\textsubscript{x} diesel-fueled engine meeting 0.01 g/bhp-hr PM available at time of purchase. If no engines are available meeting the 0.01 g/bhp-hr PM standard, then operators must purchase the cleanest available engine (either fuel type) and install the cleanest VDEC available.

As of 2011, all yard tractors operating at the San Pedro Bay Ports are required to meet at a minimum, EPA 2007 on-road or Tier 4 engine emission 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 are required to meet at a minimum EPA 2007 on-road engine emission standards or Tier 4 off-road engine emission standards. By the 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 were to be equipped with the cleanest available VDECS verified by CARB.

\textsuperscript{14} CARB, \url{http://www.arb.ca.gov/regact/2008/lsi2008/lsi2008.htm}.

\textsuperscript{15} CARB, \url{http://www.arb.ca.gov/regact/2010/offroadlsi10/lsifinalreg.pdf}
Locomotives


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, NO\textsubscript{x}, and DPM. Although the more stringent standard, Tier 2, results in over 40% reduction in NO\textsubscript{x} 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 adopted its final 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 NO\textsubscript{x} 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 achieved 50% reduction in PM beyond the Tier 2 standards and became effective in 2012. The longer term Tier 4 emission standards which are based on the application of high efficiency catalytic after-treatment technologies for NO\textsubscript{x} and PM will become effective in 2015 and will achieve over 80% reduction in PM and NO\textsubscript{x} compared with the Tier 2 standards.

- **Remanufactured Locomotives:** The regulation also establishes emission standards for remanufactured Tier 0, 1, and 2 locomotives that would achieve approximately 50% reduction in PM and up to 20% reduction in NO\textsubscript{x}.

**CARB 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. Since January 1, 2007 statewide, intrastate locomotives have been required to use CARB off-road diesel fuel that has a sulfur content limit of 15 ppm and a lower aromatic content, mostly applicable to switchers. The use of fuel with lower sulfur and aromatics will result in NO\textsubscript{x} 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%.

---

19 CARB, [http://www.arb.ca.gov/mstp/ff/loco/loco.htm#intrastate](http://www.arb.ca.gov/mstp/ff/loco/loco.htm#intrastate).
CARB Statewide Strategies to Reduce Locomotive and Associated Rail Yard Emissions

To accelerate the implementation of Tier 2 locomotive engines in the SoCAB, CARB and EPA Region 9 entered into an enforceable memorandum of understanding (MOU) in 1998 with the two major Class 1 freight railroads operating in California, Union Pacific (UP) and Burlington Northern Santa Fe (BNSF). The MOU requires UP and BNSF to concentrate their nationwide introduction of Tier 2 locomotives preferentially within the SoCAB, which would achieve 65% reduction in NO\textsubscript{x} by 2010. In 2005, CARB entered into another MOU with UP and BNSF 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 2012, and CARB has reported that they expect to complete their evaluation of this data by mid-year 2012.

In June 2010, CARB proposed, voluntary rail yard-specific commitments with the Class 1 operators to accelerate further DPM emission and risk reductions at four rail yards in the SoCAB, including the Intermodal Container Transfer Facility (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 fence line of each of the four rail yards. 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 RL1- Pacific Harbor Line Rail Switch Engine Modernization

RL1 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, and in 2012 completed the repower of 16 Tier 2 switcher locomotives meet “Tier 3-plus”. “Tier 3-plus” standards have PM emissions that are exceeding Tier 3 PM emission rates but not meeting Tier 4 standards.

CAAP Measure 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 EPA 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 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 major 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 (EPA, CARB and

---

20 CARB, http://www.arb.ca.gov/msprog/offroad/loco/loco.htm
Last updated by CARB on April 11, 2011
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**

*EPA Engine Emission Standards for New 2007+ On-road Heavy-Duty Vehicles*

In 2001, CARB adopted EPA’s stringent emission standards for 2007+. This regulation requires 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 NO\textsubscript{X} standard between 2007 and 2010. By 2010, all engines are required to meet the 0.2 g/bhp-hr NO\textsubscript{X} standard, which represents a greater than 90% reduction compared to the 2004 NO\textsubscript{X} standard of 2.4 g/bhp-hr.

*CARB Heavy-Duty Vehicle On-Board Diagnostics Requirement*

In 2005 CARB adopted a comprehensive HDV On-Board Diagnostics (OBD) 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 was phased in beginning with the 2010 model years with full implementation required by 2016.

*CARB 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 statewide, beginning in June 2006. This ULSD fuel is needed in order for retrofit technologies, such as diesel particulate filters, to work successfully.

*CARB 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 2007, CARB’s Board adopted a regulation to modernize the class 8 drayage truck fleet, trucks with gross vehicle weight rating greater than 33,000 pounds that operate at California’s ports. This objective was to be achieved in two phases:

1. **By December 31, 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 December 31, 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 to include 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.

CARB also 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 On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation**

In December 2008, CARB adopted a regulation that requires existing HDVs to be replaced or retrofitted to meet the latest NOx and PM Best Available Control Technology (BACT). By January 1, 2021, all model year 2007 class 8 drayage trucks are required to meet NOx and PM BACT (i.e. 2010+ EPA engine standards). Model year 2008 and Model year 2009 on-road heavy-duty engines must be replaced with 2010+ engines by January 1, 2022 and January 1, 2023 respectively.

**CARB 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-2012 model year tractors that pull affected trailers, are required to use SmartWay verified low rolling resistance tires beginning January 1, 2012. Pre-2012 model year 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 model year 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 HDV1- Performance Standards for On-road Heavy-Duty Vehicles; Clean Trucks Program**

The ports of Long Beach and Los Angeles Clean Trucks Programs progressively banned older trucks from operating at the two ports. The ban was implemented in three phases as follows:

1. By October 1, 2008 – All pre-1989 trucks are banned from port services.
3. By January 1, 2012 – All trucks that do not meet 2007 and later on-road heavy-duty engine standards are banned from port services.
In January 2012, the Port of Long Beach Board of Harbor Commissioners adopted a resolution that includes Class 7 drayage trucks and bans the “dray-off” practice under the Clean Trucks Program.

**Greenhouse Gases**

Assembly Bill 32 (AB32), the California Global Warming Solutions Act of 2006, established a comprehensive program requiring CARB to develop regulatory and market mechanisms to 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 began in 2012 for significant sources and were to be ratcheted down as needed 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. CARB also 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 (Scoping Plan) containing the main strategies California will use to reduce the GHG emissions in the State. The Scoping Plan includes measures targeted at goods movement, expected to achieve a combined 3.7 million metric tons reduction of carbon dioxide equivalent. Proposed measures in the Scoping Plan include:

- T-5: Ship electrification at ports, previously adopted as regulation in December 2007
- 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, previously adopted as regulation in December 2008

---

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

22 CARB, [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 2013, CARB expects to bring an updated Scoping Plan document to their Board for consideration. This update will outline CARB’s priorities to reduce GHG emissions over next five years to ensure that California is on the right track to meet 2020 GHG emissions reduction goals. The update will also have a post-2020 element. Transportation, fuels, and infrastructure is one of the five key areas that CARB will focus on for its post-2020 strategies.

2012 South Coast Air Quality Management District Air Quality Management Plan (AQMP)

The SCAQMD Governing Board adopted the Final 2012 AQMP on December 7, 2012. Currently, South Coast Air Basin is classified as nonattainment for the federal 24-hour PM$_{2.5}$ standards. The region has to achieve attainment by December 2014 and the submittal of the State Implementation Plan (SIP) to EPA by December 2012 is required. Attainment of the 24-hour PM$_{2.5}$ SIP should be demonstrated by 2014 with a 5-year extension option. The 2012 AQMP as mandated by the California Health & Safety Code must demonstrate achievement and maintenance of state and federal ambient air quality standards through adoption of all feasible measures. The 2012 AQMP is an integrated multi-pollutant plan which will demonstrate a strategy to attain the 24-hour PM$_{2.5}$ federal standard by 2014; provide an annual standard PM$_{2.5}$ SIP update and maintenance plan; and provide revisions to the 8-hour ozone SIP, including an update on “black box” measures for 8-hour ozone standard by 2023 and EPA’s recently adopted final rule for the implementation of 8-hour ozone standard of 75 ppb by 2032.

NO$_x$, SO$_x$, VOC, directly emitted PM$_{2.5}$, and ammonia are major contributors resulting in the formation of PM$_{2.5}$. In the 2012 AQMP, weighing factors in terms of the value in tons per day of emissions reductions relative to ambient concentration improvements of PM$_{2.5}$ are developed to aid in assessing various combinations of different pollutant reduction to achieve the PM$_{2.5}$ goal in 2014. After demonstrating 2014 PM$_{2.5}$ attainment in 2014, the SCAQMD and CARB must demonstrate strategies to attain the 1997 and 2008 8-hour ozone standards in 2023 and 2032.

Vision for Clean Air: A Framework for Air Quality and Climate Planning

The Vision for Clean Air is a multi-pollutant (air quality and climate) planning draft document developed in collaboration by CARB, SCAQMD and the San Joaquin Valley Air Pollution Control District to integrate strategies to meet Clean Air Act requirements as part of SIPs/AQMPs, and AB 32 goals, as well as freight transport planning. The 2012 PM$_{2.5}$ AQMP recently finalized by SCAQMD draws upon the framework outlined in the Vision for Clean Air document.

---

25 CARB, http://www.arb.ca.gov/planning/vision/vision.htm
The Vision for Clean Air examines what needs to be done to meet both air quality and climate goals over time. This plan lays out several scenarios that will guide planners to determine combinations of current and future advanced technologies, energy, and efficiency assumptions needed to meet various SIPs, Health Risk and climate goals between now and 2050. The following are the air quality goals used in the scenario development process:

- Achieve the 0.08 ppm 8-hour federal ozone standard by 2023 by reducing NOx emissions by 80 percent from 2010 levels.
- Achieve the 0.075 ppm 8-hour federal ozone standard by 2032 by reducing NOx emissions by 90 percent from 2010 levels.
- Reduce greenhouse gas emissions by 80 percent below 1990 levels by 2050. This is equivalent to 85 percent from today’s levels.

Freight Sector is one of the key areas included in the scenarios. It covers all five mobile sources operated at the port. The scenarios highlight the acceleration of zero- and near-zero emissions technologies, fuels and electrical energy generation from renewal sources and gains in operational efficiencies to meet the state and local multi-pollutant goals and sustain economic growth.