California Environmental Protection Agency
AIR RESOURCES BOARD

INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING

PROPOSED AMENDMENTS TO THE REGULATIONS "FUEL SULFUR AND OTHER OPERATIONAL REQUIREMENTS FOR OCEAN-GOING VESSELS WITHIN CALIFORNIA WATERS AND 24 NAUTICAL MILES OF THE CALIFORNIA BASELINE"

Stationary Source Division
Emissions Assessment Branch

May 2011

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State of California
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING

Public Hearing to Consider

PROPOSED AMENDMENTS TO THE REGULATIONS FOR FUEL SULFUR AND OTHER OPERATIONAL REQUIREMENTS FOR OCEAN-GOING VESSELS WITHIN CALIFORNIA WATERS AND 24 NAUTICAL MILES OF THE CALIFORNIA BASELINE

To be considered by the Air Resources Board on June 23-24, 2011, at:

California Environmental Protection Agency
Headquarters Building
1001 "I" Street
Byron Sher Auditorium
Sacramento, California

Stationary Source Division:
Richard Corey, Chief
Daniel Donohoue, Chief, Emissions Assessment Branch
Peggy Taricco, Manager, Technical Analysis Section

State of California
AIR RESOURCES BOARD

PROPOSED AMENDMENTS TO THE REGULATIONS FOR FUEL SULFUR AND OTHER OPERATIONAL REQUIREMENTS FOR OCEAN-GOING VESSELS WITHIN CALIFORNIA WATERS AND 24 NAUTICAL MILES OF THE CALIFORNIA BASELINE

Contributing Authors

Bonnie Soriano (Lead)
Paul Milkey
Ryan Huft
Layla Gonzalez
Andrew Alexis
Jin Lu
Steve Zelinka
Jeff Austin

Legal Counsel

Deborah Kerns, Office of Legal Affairs

Supporting Divisions

Planning and Technical Support Division
Research Division

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EXECUTIVE SUMMARY

The Air Resources Board (ARB or Board) staff is proposing amendments to the *Regulations for Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline* (OGV Clean Fuel Regulation or regulation). The primary purpose of the amendments is to adjust the offshore regulatory boundary in Southern California to lessen the potential for vessels to interfere with operations at the United States Navy's Point Mugu Sea Range and to recapture emission reductions from the regulation. In addition, amendments are proposed to facilitate a successful transition to very low sulfur fuels by aligning implementation dates more closely with recently approved federal requirements.

Presented below is an overview that briefly discusses the information presented in this document.

When was the OGV Clean Fuel Regulation adopted and what does it require?

The ARB adopted the OGV Clean Fuel Regulation in 2008 (title 13, California Code of Regulation (CCR) section 2299.2 and title 17, CCR section 93118.2).[1] (ARB, 2008) This regulation is one of many steps being taken to reduce diesel particulate matter (PM) emissions from goods movement activities. It also is a key measure in meeting the goals of California's State Implementation Plan (SIP) and Goods Movement Emission Reduction Plan. (ARB, 2006)

The OGV Clean Fuel Regulation requires operators of ocean-going vessels (OGVs) to use less polluting marine distillate fuels instead of heavy fuel oil (HFO) in their diesel engines and auxiliary boilers while operating within approximately 24 nautical miles (nm) of the California coastline (Regulated California Waters or regulatory boundary or zone). The fuel requirements are implemented in two phases. The Phase 1 fuel requirements, which began implementation on July 1, 2009, require the use of either marine gas oil (MGO) or marine diesel oil (MDO). Under the Phase 1 requirements, the MGO has a maximum sulfur limit of 1.5 percent (%), and the MDO has a maximum sulfur limit of 0.5%. The Phase 2 requirements, which are scheduled to begin on January 1, 2012, specify the use of either MGO or MDO at 0.1% sulfur.

The regulation includes several exemptions to accommodate special circumstances or situations where it may not be feasible or practical to use the required fuel. For example, a safety exemption is included for situations where the master of the vessel determines that compliance would endanger the safety of the vessel, crew, cargo, or passengers. The regulation also includes a

[1] Two essentially identical regulations were adopted to reflect the authorities granted to the ARB in the California Health and Safety Code to regulate sources of toxic air contaminants and to regulate marine vessel emissions. Throughout this report the regulations are collectively referred to as "the OGV Clean Fuel Regulation" or "the regulation."

noncompliance fee provision that allows the operator to pay a fee in lieu of direct compliance with the regulation under special circumstances where direct compliance would be difficult. Finally, the regulation contains a "sunset" provision that would allow the fuel requirements to cease if the United States adopts and enforces requirements that will achieve equivalent emission reductions within the regulatory zone covered by the ARB regulation.

Emissions from OGVs are significant sources of air pollution and have an adverse impact on public health and air quality. Ocean-going vessels also contribute significantly to community health risks. The use of the marine distillate fuels instead of the heavy fuel oil typically used by OGVs significantly reduces emissions of diesel PM, PM, sulfur oxides (SOx), oxides of nitrogen (NOx), and "secondarily" formed PM (PM formed in the atmosphere from NOx and SOx).

What is the implementation status of the OGV Clean Fuel Regulation?

The Phase 1 fuel requirements began implementation on July 1, 2009 and have been in effect for over 20 months. ARB enforcement staff has actively enforced the regulation and have conducted over 450 vessel inspections. The compliance rate, as determined by ARB enforcement staff, is about 95%. Most violations are the result of fuel switching conducted in the wrong offshore location or recordkeeping violations. Enforcement staff report that the distillate fuels used are almost always within the sulfur content limits specified in the regulation, less than 1.5% sulfur for MGO, and less than 0.5% sulfur for MDO.

The information collected during the inspections is providing useful information on fuel qualities such as fuel sulfur content and viscosity as well as providing an indication of the types of fuels provided at ports throughout the world. The analysis of the collected fuel samples demonstrates that the fuels being used typically have much lower sulfur content than the Phase 1 fuel sulfur limits. Of the 444 fuel samples analyzed as of March 2011, the actual fuel sulfur content of the marine distillate fuels being used by OGV operators averages less than 0.3% sulfur.

Based on the data gathered to date, OGV operators have been able to obtain and operate on the Phase 1 fuels. Since the OGV Clean Fuel Regulation began implementation in July 2009, we estimate that there have been over 18,000 vessel visits to California ports. Complying fuel has proved to be readily available as evidenced by no OGV operators having to pay the noncompliance fee because they were not able to find compliant fuel. In addition, with few exceptions, almost all vessels have successfully switched to the cleaner marine distillate fuels prior to entering the regulated zone.

During the initial months of implementation, there was an increase in reported loss of propulsion (LOP)[2] incidents to the United States (U.S.) Coast Guard, some of which may be attributable to the use of the lower sulfur marine distillate fuels. However, over a period of six months, between July 2009 and December 2009, the frequency of LOP incidents related to the use of lower sulfur marine distillate fuels returned to pre-regulation levels. Out of the estimated 18,000 vessel visits to California ports between July 2009 and March 2011, there have been 37 LOP incidents that were attributable to the use of the low-sulfur distillate fuels. During that same time, there have also been 71 LOP incidents that have not been attributed to the use of low sulfur marine distillate fuels.

ARB staff has worked closely with the U.S. Coast Guard and ship operators to better understand any operational difficulties experienced by vessel operators while on the required fuels. In addition, the California Maritime Academy was brought under contract by ARB to help investigate the root causes of any LOP incidents related to the use of low sulfur marine distillate fuels. Preliminary findings from the study indicate that for vessels having low fuel pressure related problems, the reported fuel-related LOP incidents may be related to the condition of worn fuel injection pumps combined with the lower fuel viscosity. At this time, the U.S. Coast Guard is continuing to investigate LOP from all causes and considering if recommendations for best practices are needed.

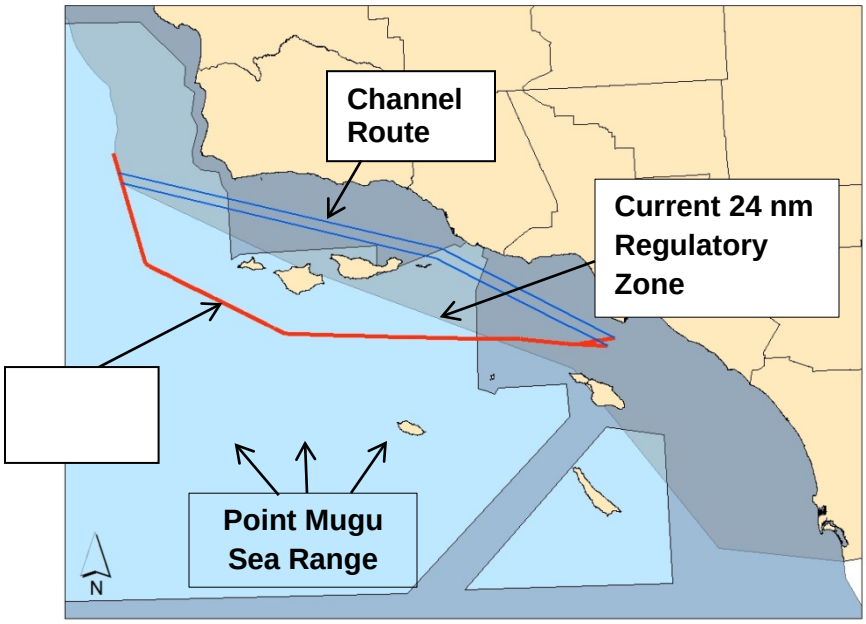
What has happened to vessel traffic patterns in Southern California since the OGV Clean Fuel Regulation began implementation?

Prior to the implementation of the OGV Clean Fuel Regulation, the majority of OGVs going into and out of the Port of Los Angeles (POLA) and Port of Long Beach (POLB) traveled along the California coastline through the Santa Barbara Channel. About 50% of the vessel visits to California come through these two ports. In the Santa Barbara Channel, there is a traffic separation scheme[3] established by the Commandant of the U.S. Coast Guard under the Ports and Waterways Safety Act and in accordance with international agreements. However, soon after the effective date of the OGV Clean Fuel Regulation, a large number of OGVs chose to move from the traditional route through the Santa Barbara Channel (Channel Route), which lies within the regulatory boundary of the OGV Clean Fuel Regulation, to a route (Outer Route) on the southern side of the Channel Islands, an area outside of the regulatory boundary and in the U.S. Navy's Point Mugu Sea Range (Sea Range). The vessel routes are shown in Figure ES-1.

[2] A reportable marine casualty, in accordance with 46 CFR 4.05-1(a)(3), includes a loss of main propulsion, primary steering, or any associated component or control system that reduces the maneuverability of the vessel.

[3] Traffic separation schemes are used to promote vessel safety by regulating the flow of traffic in busy or congested waterways.

Figure ES-1: Vessel Traffic Routes by the Channel Islands in Southern California



Data provided by the U.S. Navy demonstrate that prior to implementation of the regulation, about 30 ships per month, primarily tanker vessels, traveled through the Sea Range. Since implementation of the regulation began, there has been a steady increase with over 200 ships a month choosing to transit through the Sea Range in December 2010. (U.S. Navy, 2011) ARB staff estimates that approximately 50% of the vessel traffic in and out of the POLA and POLB that historically traveled through the Santa Barbara Channel is now transiting through the Sea Range on the southern side of the Channel Islands.

Why have vessel operators chosen to transit through the Sea Range instead of the established shipping lanes in the Santa Barbara Channel?

ARB staff believes the cost of the marine distillate fuel required by the OGV Clean Fuel Regulation has prompted the change in traffic patterns. Because vessels on the southern side of the Channel Islands do not have to use the cleaner marine distillate fuels required by the OGV Clean Fuel Regulation, it reduces the transit costs for the vessel operator on this segment of travel (Port Conception to the POLA and POLB) by about 20% relative to the costs that would be incurred transiting inside the Santa Barbara Channel. While the Outer Route is slightly longer than the Channel Route through the Santa Barbara Channel, resulting in a longer transit time, ship operators have weighed the added travel time and distance against the lower fuel costs and the majority of ship operators have chosen to use the Outer Route.

Table ES-1 presents a comparison between the fuel costs, time, and distance between the Channel Route and the Outer Route. As is shown, a one-way transit using the Outer Route is about 13 nm longer, saves approximately $2,750 dollars and takes about 1 hour longer relative to the Channel Route.

Table ES-1: Estimated Fuel Costs, Distance and Transit Time for Vessels Using the Santa Barbara Channel and the Outer Route

Route	Distance (nm)	Cost	Time (hrs)
Channel Route (150 nm)	MGO:150 nm	$14,390	9.6
Outer Route (163 nm)	MGO: 31 nm HFO: 132 nm	$11,640	10.5
Estimated Distance/Cost and Time Differential	13 nm	$2,750	0.9 (54 minutes)

Unfortunately, this change in routes has reduced the expected emissions reductions from the regulation. Statewide, ARB staff estimate that this change in vessel routing has resulted in about 3 tons per day (T/D) less diesel PM and 21 T/D less SOx emission reductions in 2010 than what could be realized if vessels used the Channel Route as originally anticipated when the regulation was adopted in 2008. It has also raised concerns for the U.S. Navy.

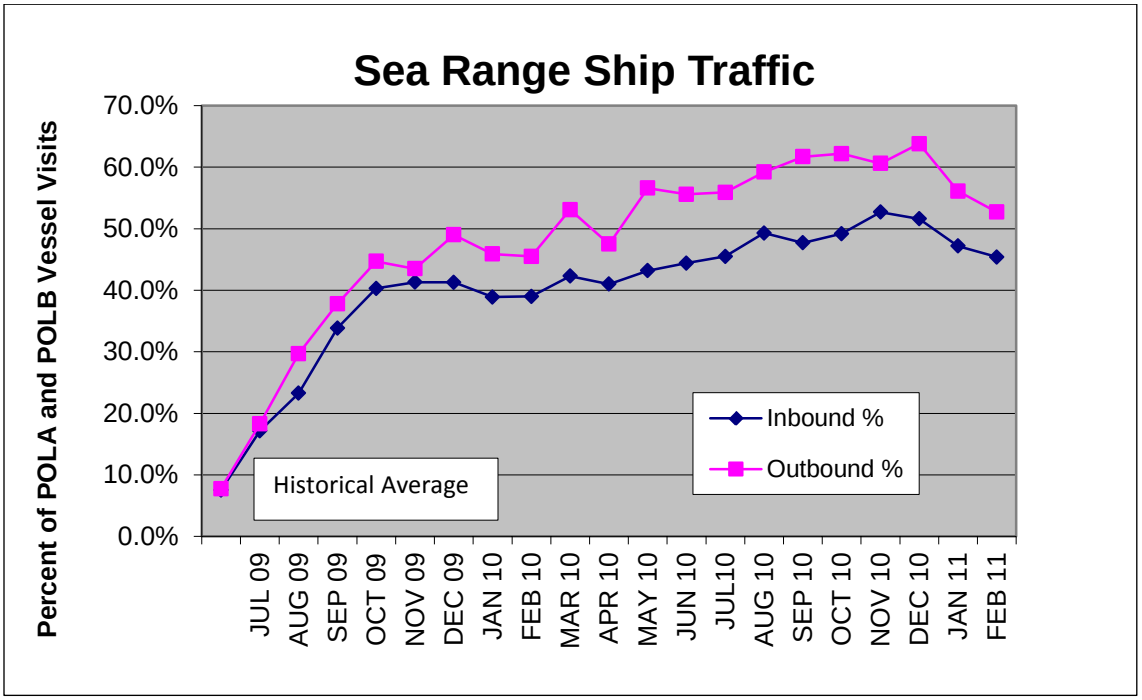
What are the U.S. Navy's concerns regarding the increased vessel traffic through the Point Mugu Sea Range?

During the development of the OGV Clean Fuel Regulation, U.S. Navy representatives expressed concerns about the potential for vessels to shift traffic patterns in Southern California and to transit through the Point Mugu Sea Range to avoid having to use the more expensive marine distillate fuels. At that time, ARB staff did not find sufficient evidence that there would be a significant shift in vessel traffic but agreed to monitor the situation and, at the Board's direction, return with amendments to address the issue if needed.

As noted above, shortly after implementation of the Phase 1 fuel requirements began, vessels began traveling on the southern side of the Channel Islands through the Point Mugu Sea Range instead of using the traffic separation scheme within the Santa Barbara Channel. The U.S. Navy provided ARB staff with vessel traffic data showing the percentage of vessels that are using the Outer Route compared to the total vessels visiting POLA and POLB. (U.S. Navy, 2011) Figure ES-2 shows both the percentage of vessels inbound and outbound from July, 2009 to February, 2011. The data indicate an increase in traffic using the Outer Route traffic from the historical average of about 7.5% (about 30 vessels per month) prior to July 2009 to about 53% (about 200 vessels

per month) inbound and 65% outbound by December 2010. In January and February 2011, there was a decrease in the percent of vessels using the Outer Route, possibly indicating that the percent of vessels using the Outer Route has stabilized.

Figure ES-2: Marine Exchange Vessel Traffic Data - Percent of POLA and POLB Vessel Traffic that use the Outer Route Through the Point Mugu Sea Range



U.S. Navy representatives and members of the Regional Defense Partnership for the 21st Century (RDP-21), a Ventura County non-profit community organization that works to preserve and enhance the military value of Naval Base Ventura County, have raised concerns about the increased ship traffic and the potential impacts it may have on the ability of the Sea Range to accomplish its primary mission. (RDP-21, 2010) (U.S. Navy, 2010)

What is the status of U.S. EPA's efforts to secure an Emission Control Area for the United States?

When the OGV Clean Fuel Regulation was originally approved in 2008, the International Maritime Organization (IMO) was considering amendments to MARPOL Annex VI (International Convention for the Prevention of Air Pollution from Ships) to further reduce air emissions from ships. In October, 2008, the IMO adopted the amendments, enacting more robust new international standards for marine diesel engines and their fuels. The amendments also allowed for creation of Emission Control Areas (ECA) by member states allowing them to implement more stringent requirements upon approval by the IMO.

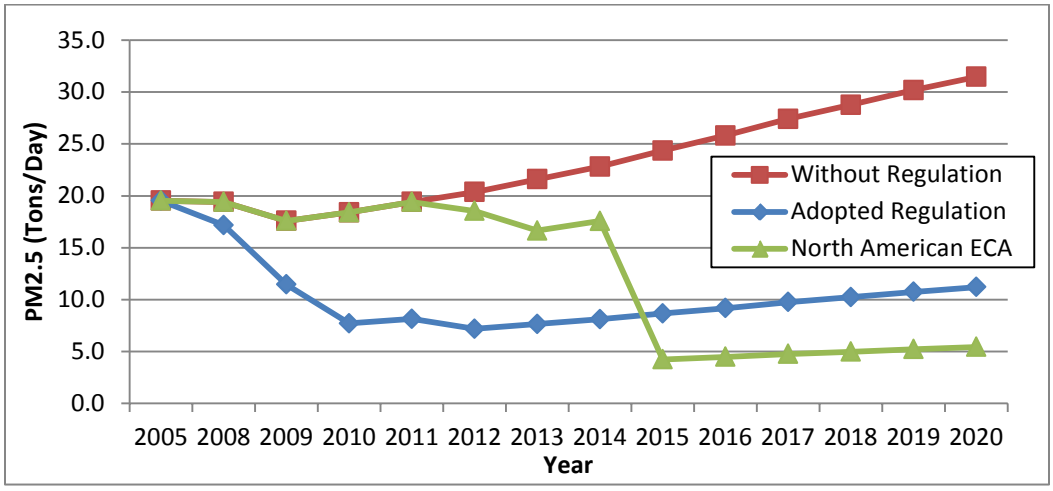
The United States and Canada jointly applied for an ECA designation in July, 2009. In the application for an ECA, the United States Environmental Protection Agency (U.S. EPA) provided extensive documentation on the air quality and public health impacts from the emissions of OGVs throughout the coastal and inland waters of the United States, including California. (U.S. EPA, 2009) On March 26, 2010, the IMO officially designated waters of the United States and Canadian coastlines as an ECA, referred to as the North American ECA. Under the North American ECA, OGVs traveling within a 200 nm zone of the North American coastline are required to use fuels with no more than 1% sulfur beginning in August 2012 and no more than 0.1% sulfur beginning in January 2015. There are also requirements for more stringent engine exhaust standards beginning in 2016. Below in Table ES-2, we provide a comparison between the fuel sulfur requirements in the OGV Clean Fuel Regulation and the North American ECA.

Table ES-2: Comparison of the Fuel Requirements for the OGV Clean Fuel Regulation and the North American ECA

ARB Requirements (24 nm zone)	July 1, 2009 (Phase 1)	Distillate fuel: MGO max 1.5% S MDO max 0.5% S
	Jan 1, 2012 (Phase 2)	Distillate fuel: MGO max 0.1% MDO max 0.1%
North American ECA (200 nm zone)	Aug 1, 2012 (Phase 1)	Fuel Sulfur max 1.0%
	Jan 1, 2015 (Phase 2)	Fuel Sulfur max 0.1%

As mentioned earlier, under the OGV Clean Fuel Regulation, the Executive Officer can “sunset” the OGV Clean Fuel Regulation when he or she determines that U.S. EPA enforces a measure that gets equivalent or greater emission reductions. With the North American ECA now approved, the OGV Clean Fuel Regulation should be able to “sunset” in 2015. However, it is important that the OGV Clean Fuel Regulation continue implementation until that time. As shown in Figure ES-3, the use of the marine distillate fuels required by the OGV Clean Fuel Regulation results in significantly more emissions reductions than the fuels with 1% sulfur limits that will be used to comply with the North American ECA beginning in August 2012. While the 1% sulfur requirement will provide some additional incremental benefit for California, it is not until the North American ECA’s 0.1% sulfur requirement is implemented and enforced that we will achieve equivalent benefits to California’s OGV Clean Fuel Regulation.

Figure ES-3: Comparison of Expected PM Emissions Reductions Between the Adopted OGV Clean Fuel Regulation and the North American ECA (100nm Zone)



Notes: Emission estimates for the "Regulation" are based on the originally adopted regulation that did not incorporate any loss of benefits due to unforeseen route changes in Southern California or incorporate additional reductions from the North American ECA.

Does ARB staff have any concerns regarding the transition to the Phase 2, 0.1% sulfur standard in 2012?

ARB staff is fully committed to reaching the Phase 2 limit of 0.1% sulfur fuel. The use of 0.1% sulfur marine distillate fuel is technologically and operationally feasible and is cost-effective. It is also consistent with the North American ECA Phase 2 limit which will come into effect in 2015. However, ARB staff does have concerns about the timing for implementation of the OGV Clean Fuel Regulation's Phase 2 requirement and we believe there are valid reasons to delay the implementation date by two years. ARB staff believes that providing a two-year delay will help to ensure the successful implementation of the North American ECA's Phase 1 fuel requirements and a successful transition to the 0.1% sulfur fuels. Below, we briefly discuss our rationale.

Under the OGV Clean Fuel Regulation, the Phase 2 sulfur requirement is scheduled to begin implementation on January 1, 2012. As can be seen in Table ES-2 above, later in that same year, the North American ECA's Phase 1 requirement to use 1% sulfur fuel begins implementation. Because of this, ARB staff believes it is appropriate to adjust the implementation timeline for the OGV Clean Fuel Regulation's Phase 2 requirements (0.1% sulfur beginning January 1, 2012) to more closely align with the Phase 2 North American ECA requirement (0.1% sulfur beginning January 1, 2015). In addition, by delaying the OGV Clean Fuel Regulation's Phase 2 implementation date we believe that shippers may be able to more easily locate fuels with higher viscosity levels

during the extension of the Phase 1 requirements. As alluded to earlier, for vessels that have experienced LOP incidents related to the use of low sulfur distillate fuels, on-board management of fuel viscosity is a very important parameter.

The majority of the emissions reductions from the OGV Clean Fuel Regulation, over 90%, are achieved with the Phase 1 requirements. While the use of the Phase 2 fuels will provide additional benefits, a two-year delay will not impact the significant reductions achieved with Phase 1 fuels. For all these reasons, ARB staff believes delaying implementation of the 0.1% sulfur limit by two years will provide more flexibility to acquire fuels with higher viscosity and may help lessen the probability of operational difficulties, while still maintaining over 90% of the emission reduction benefits from the OGV Clean Fuel Regulation.

Why is ARB staff proposing amendments?

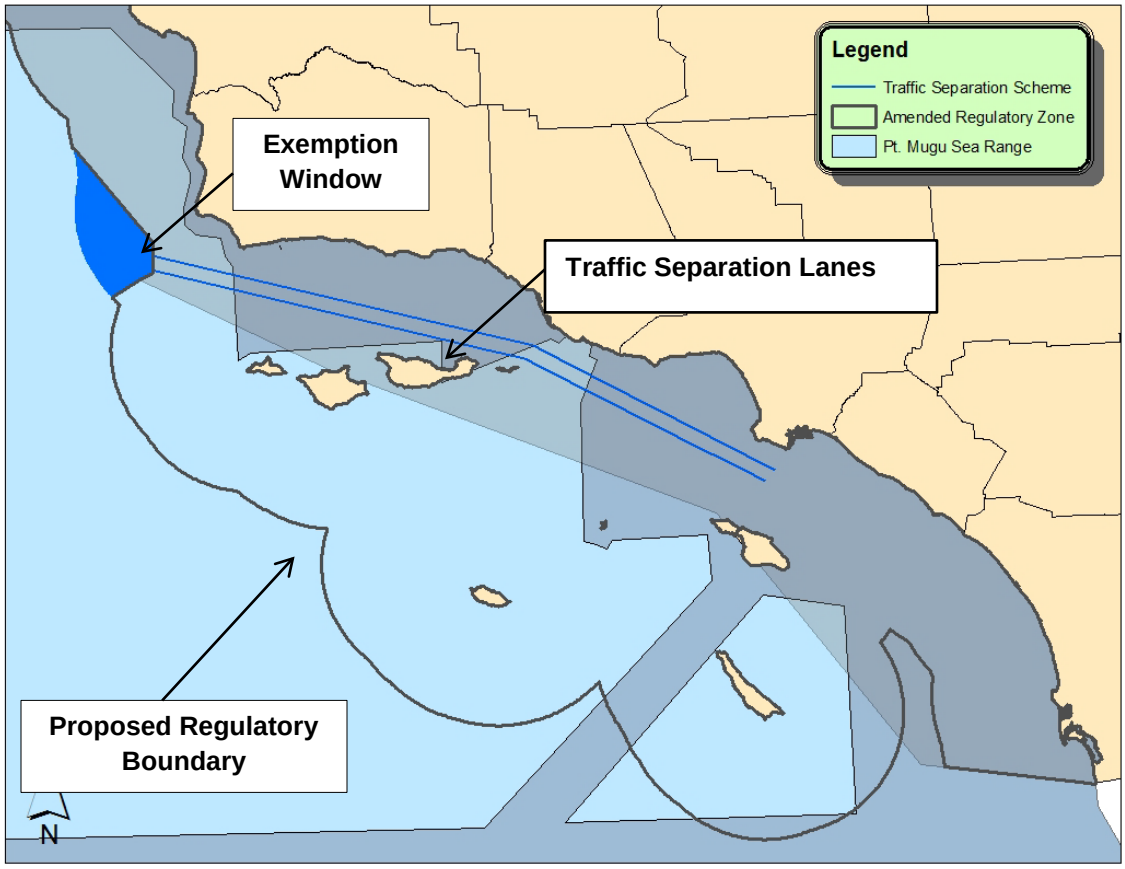
ARB staff is proposing amendments to address the shift in vessel traffic patterns that resulted when the Phase 1 fuel requirements began implementation. As previously discussed, the shift in vessel traffic patterns in Southern California has raised concerns about potential impacts on the U.S. Navy's Point Mugu Sea Range operations and has resulted in less emission reductions in Southern California than originally anticipated when the regulation was adopted. In addition, ARB staff is proposing amendments to reflect new information and provide additional time for industry to successfully transition to the 0.1% sulfur marine distillate fuels.

What amendments are being proposed?

ARB staff is proposing the following amendments to the OGV Clean Fuel Regulation. The strike-out/underline version of the proposed amendments to the regulation is provided in Appendix A.

Regulated California Waters: ARB staff is proposing to amend the regulatory boundary, by extending it further off shore by aligning it more closely in Southern California with the "Contiguous Zone," which is 24 nm from the California Baseline (shoreline), which includes offshore islands. In addition, we are proposing to exempt vessels from the clean fuel requirements when transiting a small region ("window") within the 24 nm boundary off Point Conception. This exemption window is being provided to encourage vessels to travel in the established shipping lanes in the Santa Barbara Channel when headed to or from the POLA and POLB. This proposed change in the boundary will lessen the economic incentive for OGVs to transit through the Point Mugu Sea Range instead of the Santa Barbara Channel and will help reestablish the emission reductions from the regulation. No changes are being proposed to the Regulated California Waters in Northern California. The proposed amended regulatory boundary is shown in Figure ES-4 below.

Figure ES-4: Proposed Amended Regulated California Waters in Southern California



Phase 2 Implementation Date: The original regulation requires the use of Phase 2 0.1% sulfur distillate fuel beginning January 1, 2012. We are proposing to extend the deadline to use the Phase 2 fuel by two years to January 1, 2014. As discussed above, ARB staff believes this two-year delay will help facilitate a more successful transition to the 0.1% sulfur distillate fuels.

Noncompliance Fee Provision: ARB staff is proposing some minor modifications to the "noncompliance fee provision," which in certain specified situations allows the payment of fees in lieu of direct compliance with the rule through the use of cleaner fuels. This provision has been used five times since the OGV Clean Fuel Regulation began implementation. The proposed amendments are based on experience gained through implementation of the regulation to date, and focus primarily on the way fees are assessed. The proposed amendments include adjusting the fee schedule specified in the regulation, reducing the fees by half for vessel operators that purchase and use complying fuels after arriving to a port on noncomplying fuel, and proposing that offshore anchorages made in conjunction with a port visit not be counted as a "port visit. We believe these changes will help to incentivize the use of the cleaner fuels as quickly as possible.

Other Proposed Amendments: ARB staff is proposing to amend the regulation to include a March 2007 update to the National Oceanic and Atmospheric Administration (NOAA) nautical chart 18740 covering California's coastline from San Diego to Santa Rosa Island. These charts are used to help define California Regulated Waters. In addition, ARB staff is proposing to amend the definitions of the fuels required under the OGV Clean Fuel Regulation to reflect recent changes in how these fuels are specified under international standards.

What are the environmental and public health impacts from the amendments?

The impacts from the proposed amendments on the statewide SOx and PM emissions from OGVs are shown in Figures ES-5 and ES-6.[4] As is shown, compared to the current regulation where about 50% the vessels traveling to and from the POLA and POLB are using the Outer Route, statewide emissions with the proposed amendments will continue to decline. Statewide, the proposed amendments also will result in lower SOx and PM emissions than with the current regulation. However, in the San Francisco Bay Area, the amendments will result in a small loss of future projected emission reductions of SOx (1.2 T/D in 2012 and 1.4 T/D in 2013) and PM2.5 (0.1 T/D in 2012 and 2013) relative to the projected future emissions under the current regulation. In the South Coast Air Basin, there is also a small loss in the projected future emission reductions of SOx (0.4 T/D in 2013) relative to the emissions projections under the current regulation. While the proposed amendments would not result in an increase in the emissions from what currently exists, the foregone emission reductions in future years in the San Francisco Bay Area and the South Coast Air Basin could be viewed as a potential adverse environmental impact. However, OGV emissions in all areas of the State, including the San Francisco Bay Area and the South Coast Air Basin, will continue to decline in future years and the remaining emissions are far lower than expected when the regulation was originally adopted. This is in part due to the recession which has had an impact on the activity of OGVs and the adoption of the North American ECA.

[4] In Figures ES-5 and ES-6, all the emissions trend lines are based on an updated 2011 OGV Emissions Inventory that reflects of the recession and assumes an average recession recovery scenario. This is discussed in more detail in Chapter IV and Appendix D.

Figure ES-5: Estimated Statewide OGV PM2.5 Emissions (100 nm)

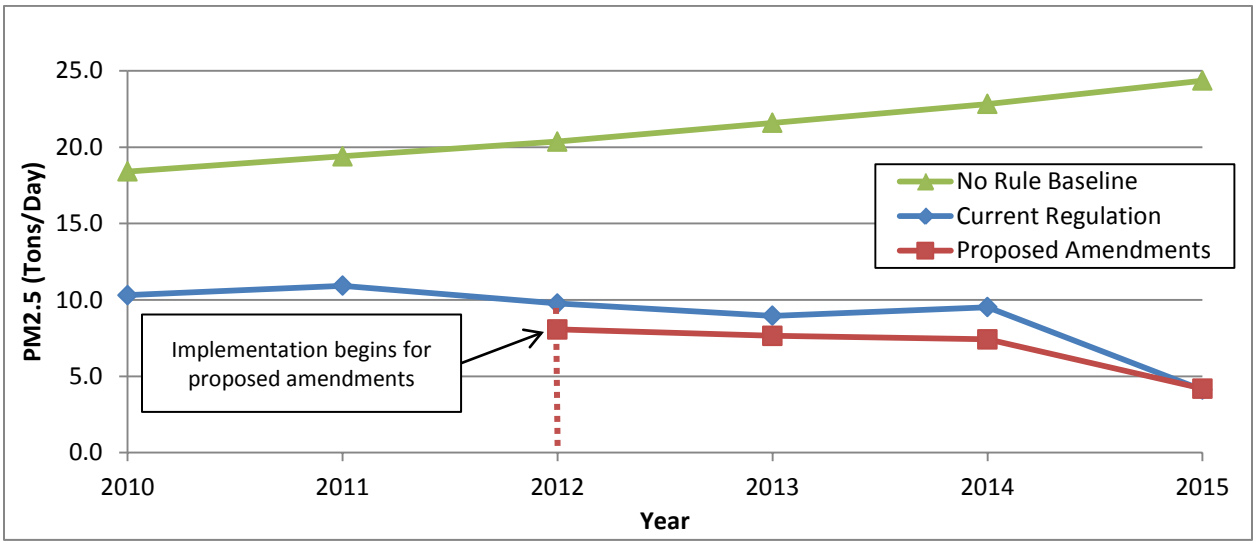
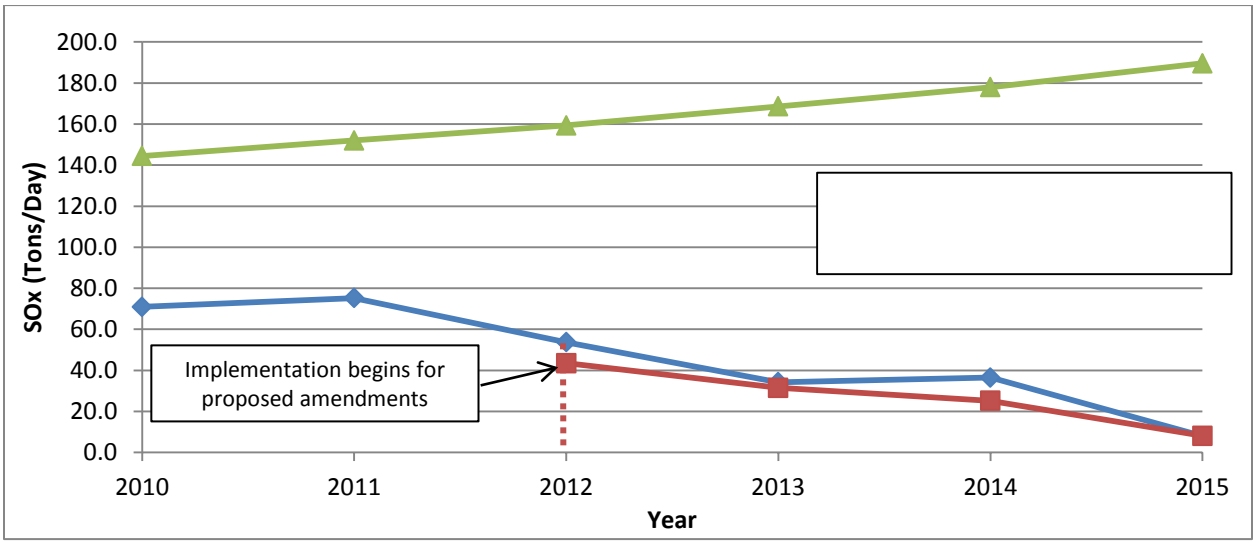


Figure ES-6: Estimated Statewide OGV SOx Emissions (100 nm)



With the proposed amendments, the OGV Clean Fuel Regulation will continue to provide significant health benefits by reducing premature mortality from PM2.5 exposure and localized potential cancer risk from diesel PM. Because the proposed amendments lower projected emissions to levels below the 2008 adopted regulation, the implementation of the proposed amendments will have similar public health benefits associated with the original OGV Clean Fuel Regulation. Extensive modeling was conducted when the OGV Clean Fuel Regulation was originally adopted and demonstrated that upon implementation, the regulation will avoid a significant number of premature deaths, about 3,600,

between 2009 and 2015 associated with the reduction in PM. (ARB, 2008) Since the baseline emissions have decreased due to recession related decrease in vessel calls, the magnitude of the premature deaths avoided that would be attributed to the adopted or proposed amended rule would not be as great as identified above. However, the avoided premature deaths due the adopted regulation with the proposed amendments will remain substantial. Moreover, as the economy rebounds, a greater percentage of the premature death avoided will be because of the rule, not the recession.

During the development of the OGV Clean Fuel Regulation, ARB staff worked with NOAA staff to investigate the potential impact on marine mammals if vessels chose to avoid the Santa Barbara Channel and instead transit on the southern side of the Channel Islands. At that time, based on the available data of densities of blue, fin, humpback, and sperm whales, the likelihood of ship strikes was similar or less if a ship did not use the Santa Barbara Channel. (ARB, 2009) Since that time, NOAA staff has been developing an analysis of the whale population densities in the Santa Barbara Channel and south of the islands and correlating this information with the vessel routes south of the Channel Islands.

Based on a preliminary analysis of whale population densities by NOAA, the data suggests that there is a decreased risk to fin whales, an increased risk to humpback whales, and there is an unclear impact to blue whales if vessels return to the Santa Barbara Channel. Humpback whales have large concentration on the north end of the entrance to the Santa Barbara Channel. However, whale densities shift from year-to-year and variations in the number of ship strikes can change annually depending on the concentrations of whales in a given year. (NOAA, 2010b) Based on this information, ARB staff believes that there is a potential for an adverse environmental impact to humpback whales from the proposed amendments.

What are the economic impacts?

The estimated total costs associated with the proposed amendments are approximately $10 million annually in 2012 and 2013, and $47 million in 2014. These estimated annual costs represent the net additional costs associated with the proposed amendments over and above compliance with the current regulation.

A number of factors affect these net added costs. First, the majority of vessels that historically transited through the Santa Barbara Channel are now transiting outside the regulatory zone via the Outer Route to reduce fuel costs. Under the proposed amendments, we predict that these vessel operators will return to Channel Route and incur the higher costs associated with using the more expensive cleaner marine distillate fuels. These costs were originally attributed to the OGV Clean Fuel Regulation and were avoided by transiting outside the existing regulatory zone in Southern California. These estimated annual costs also represent the added fuel costs for vessels that historically used the Outer Route, such as the tankers. It also represents the cost saving due to the two

year delay of the Phase 2 (0.1%) fuel sulfur limits. These estimated costs do not reflect the cost savings that vessels shifting to the Outer Route incurred from July 2009 until the effective date of proposed amendments. For perspective, the staff report for the original OGV Clean Fuel Regulation estimated the total cost to the industry at about $350 million annually for the years 2012 through 2014.

We estimate the overall total present value cost of the proposed amendments to be approximately $59 million dollars for the years 2012-2014, assuming the total annual costs mentioned above. The added cost to a typical ship operator is estimated to be about $20,000 in years 2012 and 2013, and about $90,000 in 2014. We expect these added costs can be absorbed by typical affected businesses without a significant adverse impact. The average cost-effectiveness of the proposed amendments is estimated to be about $16 per pound of diesel PM reduced over the three year life of the regulation assuming all of the regulatory costs are assigned to the diesel PM reductions. This compares favorably to other diesel PM regulations the Board has adopted previously, as well as to the original regulation.

How did staff develop the amendments?

ARB staff developed the proposed amendments to the OGV Clean Fuel Regulation through consultations with OGV operators and industry representatives, the U.S. Coast Guard, U.S. Navy, the California Office of Spill Prevention and Response, local Harbor Safety Committees, California's Attorney General's Office, and members of the public. Over the last year, the staff held two public workshops to discuss the proposed amendments. More than 2,500 companies, organizations, and individuals were notified of these public workshops through email notification. Workshop notices were posted to ARB's website and e-mailed to subscribers of the "maritime" electronic list serve. Individual meetings also were held with affected stakeholders.

What are the impacts on the SIP?

The federal Clean Air Act (CAA) requires U.S. EPA to establish National Ambient Air Quality Standards (standards) for pollutants considered harmful to public health, including PM2.5 and ozone. Areas in the State that exceed the national standards are required by federal law to develop SIPs describing how they will attain the standards by certain deadlines. Diesel PM, NOx and SOx emission reductions are needed because they contribute to ambient concentrations of PM2.5; NOx emission reductions are needed because NOx leads to formation in the atmosphere of both ozone and PM2.5; and SOx emission reductions are needed because SOx leads to the formation in the atmosphere of PM2.5.

The OGV Clean Fuel Regulation originally adopted by ARB in 2008 provided critical emission reductions needed by the South Coast Air Quality Management District (SCAQMD) to fulfill the SIP obligations and attain the PM2.5 standard in the South Coast Air Basin. The proposed rule amendments will reestablish the emission reductions anticipated from the OGV Clean Fuel Regulation originally

adopted by ARB in 2008. The South Coast Air Basin is required to attain the national standard for PM2.5 by April 5, 2015. Because attainment for the PM2.5 national standard is based on calendar year annual averages, all reductions needed to meet the standard must be in place by January 1, 2014.

What is the status of the lawsuit filed by the Pacific Merchant Shipping Association?

The Pacific Merchant Shipping Association (PMSA) filed a complaint on April 28, 2009, seeking to invalidate the OGV Clean Fuel Regulation. PMSA alleges the regulation conflicts with the Submerged Lands Act and also suggests it is preempted under the Commerce Clause. The lower court denied PMSA's motion for summary judgment on June 30, 2009. On December 11, 2009, the United States Court of Appeals, Ninth Circuit, granted PMSA's petition seeking permission to appeal immediately the lower court's order denying PMSA's motion for summary judgment. The United States Court of Appeals, Ninth Circuit, held oral argument on December 9, 2010, in San Francisco. On March 28, 2011, the Ninth Circuit upheld California's OGV Clean Fuel Regulation. The Court concluded that California can adopt reasonable regulations for air pollution that is emitted beyond our territorial boundaries (which generally are three miles out at sea) when the pollution has a substantial effect within the state and that California is not barred from combating the severe pollution caused by these vessels. (U.S. Court, 2011)

What is staff's recommendation?

We recommend that the Board approve the proposed amendments to the OGV Clean Fuel Regulation. ARB staff believes that the proposed amendments will help to restore the public health and air quality benefits that can be achieved by the regulation, eliminate the economic incentive to go through the Point Mugu Sea Range, will more closely align the OGV Clean Fuel Regulation's Phase 2 requirements with the North American ECA Phase 2 requirements for 0.1% sulfur fuels, and help facilitate a successful transition to the Phase 2 sulfur standards.

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I. INTRODUCTION

In this chapter, the Air Resources Board (ARB or Board) staff provides a brief description of ocean-going vessels (OGV or ships), an overview of the *Regulations for Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline* (OGV Clean Fuel Regulation or regulation), and recently adopted international and federal programs for fuels. Also included in this chapter is information on the implementation status for the OGV Clean Fuel Regulation, why the OGV Clean Fuel Regulation was originally adopted, and why it is important to reduce the emissions from ships. This chapter concludes with a discussion of the regulatory process and actions the ARB undertook to engage stakeholders in this rulemaking process to propose amendments to the OGV Clean Fuel Regulation. Additional information on these topics can also be found in the Staff Report prepared for the adoption of the regulation in 2008. (ARB, 2008)

A. Description of Ocean-Going Vessels

Ocean-going vessels are very large vessels designed for deep water navigation. Ocean-going vessels include large cargo vessels such as container vessels, tankers, bulk carriers, and car carriers, as well as passenger cruise vessels. These vessels transport containerized cargo; bulk items such as vehicles, cement, and coke; liquids such as oil and petrochemicals; and passengers. Ocean-going vessels travel internationally and may be registered by the United States Coast Guard (U.S.-flagged), or under the flag of another country (foreign-flagged). The majority of vessels that visit California ports are foreign-flagged vessels.

Ocean-going vessels have both main propulsion (main engines) and auxiliary diesel engines. Most OGVs are propelled by a single large slow-speed two-stroke direct drive diesel engine, with smaller medium speed four stroke auxiliary engines providing electrical power for lighting, navigation equipment, and other ship-board uses. Diesel-electric vessels such as passenger cruise vessels use very large four-stroke medium speed engines coupled to generators to provide electrical power for both propulsion and ship-board electrical power.

Most OGVs also have auxiliary boilers that are fuel-fired combustion equipment designed primarily to produce steam for uses other than propulsion, such as heating of residual fuel and liquid cargo, heating of water for crew and passengers, powering steam turbine discharge pumps, freshwater generation, and space heating of cabins. Boilers used to provide propulsion (steam ships) are not included in the regulation or proposed amendments because there are very few steamships still in service.

Without regulatory requirements, the large main engine and boilers typically operate on heavy fuel oil (HFO), while the smaller auxiliary engines also typically

run on HFO but some operate on marine distillate fuels such as marine gas oil (MGO) or marine diesel oil (MDO). These vessels generally use HFO, although some have reported using marine distillate fuels close to shore to reduce their emissions. Under the requirements of the regulation and proposed amendments, the main engines, auxiliary engines, and auxiliary boilers are required to use cleaner MGO or MDO.

B. Regulatory Authority

Under State and federal law, ARB can regulate both criteria pollutants and toxic diesel particulate matter (PM) emissions from marine vessels. Health and Safety Code (H&S) sections 43013 and 43018 authorize ARB to regulate marine vessels to the extent such regulation is not preempted by federal law. Also, H&S section 39666 requires ARB to regulate emissions of toxic air contaminants (TAC) from nonvehicular sources, which include ocean-going vessels. The OGV Clean Fuel Regulation reduces emissions of diesel PM, which is both a TAC and criteria pollutant, and PM, oxides of nitrogen (NOx), oxides of sulfur (SOx), and "secondarily" formed PM (PM formed in the atmosphere from NOx and SOx) which are criteria pollutants.

The OGV Clean Fuel Regulation and the proposed amendments are neither preempted under federal law, nor do they violate the dormant Commerce Clause of the U.S. Constitution. Federal authorization under section 209(e) of the Clean Air Act (CAA) is required for regulating new nonroad engines and for requiring retrofits on existing engines. Ocean-going vessel engines fall within the category of nonroad engines. However, no federal authorization is required for implementing in-use operational requirements on existing marine vessels and their engines. The OGV Clean Fuel Regulation establishes an in-use operational requirement, rather than an emissions standard, because it does not apply a numerical emissions limit to be met (e.g., 10 grams NOx per brake horsepower-hour), does not require retrofits, or mandate design changes to the vessel. Rather, the regulation only requires that specified fuels be used on OGV engines and auxiliary boilers operating in Regulated California Waters. The proposed amendments to the OGV Clean Fuel Regulation do not change the existing in-use operational requirement.

In addition, the proposed amendments to the OGV Clean Fuel Regulation do not conflict with the Ports and Waterways Safety Act (PWSA) and U.S. Coast Guard regulations. As a nondiscriminatory regulation with substantial benefits, OGV Clean Fuel Regulation and the amendments being proposed do not violate the dormant Commerce Clause. And, federal and state cases support our assertion of authority to regulate both U.S. and foreign-flagged vessels within the regulated California waters. Therefore, federal law does not preempt or otherwise prohibit the OGV Clean Fuel Regulation and the proposed amendments and their application in the waters off California's coast. Further discussion on ARB's regulatory authority is provided in the Staff Report prepared for the adoption of the regulation in 2008. (ARB, 2008)

C. Ocean-going Vessel Clean Fuel Regulation

The OGV Clean Fuel Regulation was adopted by the ARB in 2008. The OGV Clean Fuel Regulation requires that operators of OGVs use marine distillate fuels in their diesel engines and auxiliary boilers while operating within approximately 24 nautical miles (nm) of the California coastline. Using cleaner burning marine distillate fuels significantly reduces PM, diesel PM, NOx, and SOx emissions. The fuel requirements are implemented in two phases. The Phase 1 fuel requirements, which began implementation on July 1, 2009, require the use of either MGO or MDO. Under the Phase 1 requirements, the MGO has a sulfur limit of 1.5%, and the MDO has a sulfur limit of 0.5%. The Phase 2 requirements, which are scheduled to begin on January 1, 2012, specify the use of either MGO or MDO at 0.1% sulfur.

The regulation includes several exemptions to accommodate special circumstances or situations where it may not be feasible or practical to use the required fuel. For example, a safety exemption is included for situations where the master of the vessel determines that compliance would endanger the safety of the vessel, crew, cargo, or passengers. Exemptions are also provided for vessels that use alternative fuels, for military vessels, and for vessels that are evaluating technologies that will advance the state of knowledge pertaining to exhaust control technology or emissions characterization.

In the event a vessel owner needs to undertake essential modifications to enable the vessel to use the low sulfur distillate fuel, the regulation includes a provision to grant an exemption from the fuel-use requirement provided certain criteria are met. The regulation also includes a noncompliance fee provision that allows the operator to pay a fee in lieu of direct compliance with the regulation under special circumstances where compliance would be difficult.

Finally, the regulation contains a “sunset” provision that would allow the fuel requirements to cease if the United States adopts and enforces requirements that will achieve equivalent emission reductions within the regulated zone covered by the ARB regulation.

D. Implementation Status

The Phase 1 fuel requirements began implementation on July 1, 2009 and have been in effect for over 20 months. ARB enforcement staff has actively enforced the regulation and have conducted over 450 vessel inspections. To enforce the regulation, ARB inspectors board vessels at dockside throughout California. Once on-board they collect fuel samples for testing and analysis and review records and fuel switching documentation. The compliance rate, as determined by ARB enforcement staff is about 95%. Most violations discovered by enforcement staff are the result of fuel switching conducted in the wrong offshore location or recordkeeping violations. Enforcement staff report that the distillate fuels used are almost always within the sulfur content limits specified in the regulation, less than 1.5% sulfur for MGO, and 0.5% sulfur for MDO.

The information collected during the inspections is providing useful data on fuel qualities such as fuel sulfur content and viscosity as well as providing an indication of the types of fuels provided at ports throughout the world. (ARB, 2011) The analysis of the collected fuel samples demonstrates that the fuels being used typically have much lower sulfur content than the Phase 1 fuel sulfur limits. Of the 444 fuel samples analyzed as of March 2011, the actual fuel sulfur content of the marine distillate fuels being used by OGV operators averages less than 0.3% sulfur. This is discussed further in Chapter II of this report. Based on the information data gathered to date, OGV operators have been able to obtain and operate on the Phase 1 fuels. Since the OGV Clean Fuel Regulation began implementation in July 2009, we estimate that there have been over 18,000 vessel visits to California ports. Below, we provide a summary of the use of the provisions in the OGV Clean Regulation that were incorporated to help manage implementation of the regulation.

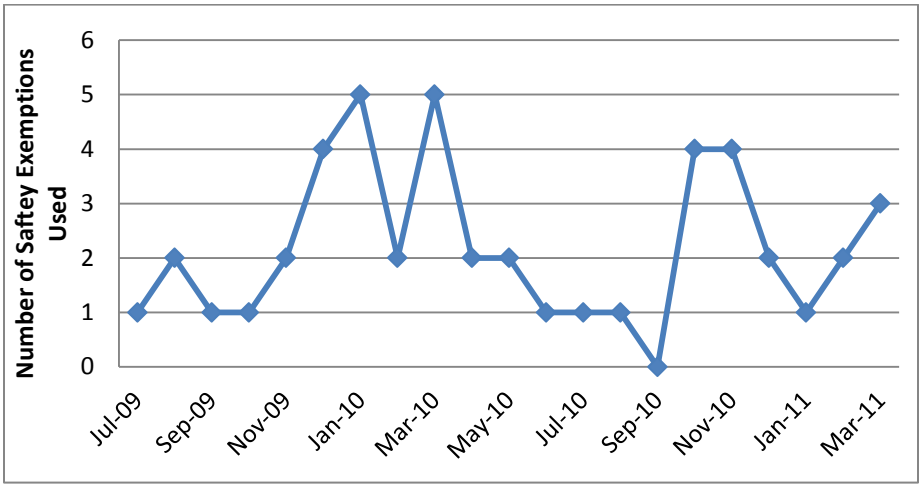
Essential Modifications Exemption

The "essential modifications" provision can provide vessel operators with an exemption from the fuel-use requirement provided they submit an application that demonstrates that the engine or boiler on board their vessel cannot use the low sulfur distillate fuel without making "essential" modifications. When an exemption is granted to the vessel operator, an Executive Order is issued specifying the specific vessels and equipment exempted, and other terms of the exemption. This provision has been used more frequently than anticipated for boilers. To date, over 400 vessels have been granted exemptions for some onboard equipment. Nearly all of the exemptions are for the large, steam-atomized boilers used on tanker vessels. Typically, the essential modifications necessary to these boilers includes installation of different burner equipment, flame detection sensors, and software modifications to adjust operation specific to the lighter distillate. Many of these vessel operators that have received these exemptions have committed to modify their equipment to use the distillate fuels. The Executive Orders that are issued for each essential modification exemption are posted on ARB's website at http://www.arb.ca.gov/ports/marinevess/ogv/ogveos.htm.

Safety Exemption

The safety exemption provides the master of the vessel with an exemption from the regulation in those unusual cases where compliance would endanger the safety of the vessel, crew, or cargo. As shown below in Figure I-1, the safety exemption has been used in a limited number of cases (at most 5 times per month). The exemption has been used for a variety of reasons including inclement weather and heavy seas, engine malfunctions, operational difficulties, mechanical problems, and out-of-specification fuels. ARB staff has worked closely with the U.S. Coast Guard to ensure that vessel operators are aware of the safety exemption provisions.

Figure I-1: Use of the OGV Clean Fuel Regulation Safety Exemption



Noncompliance Fee Provision

There have been five noncompliance fees paid since the regulation began implementation. Three vessel operators used the noncompliance fee provision because they had an unplanned redirection to a California port and did not have sufficient compliant fuel on-board, one vessel operator had defective fuel, and one vessel operator paid the noncompliance because they had plans to take the vessel out of service to perform modifications. No OGV operators have had to pay the noncompliance fee because they were not able to find compliant fuels.

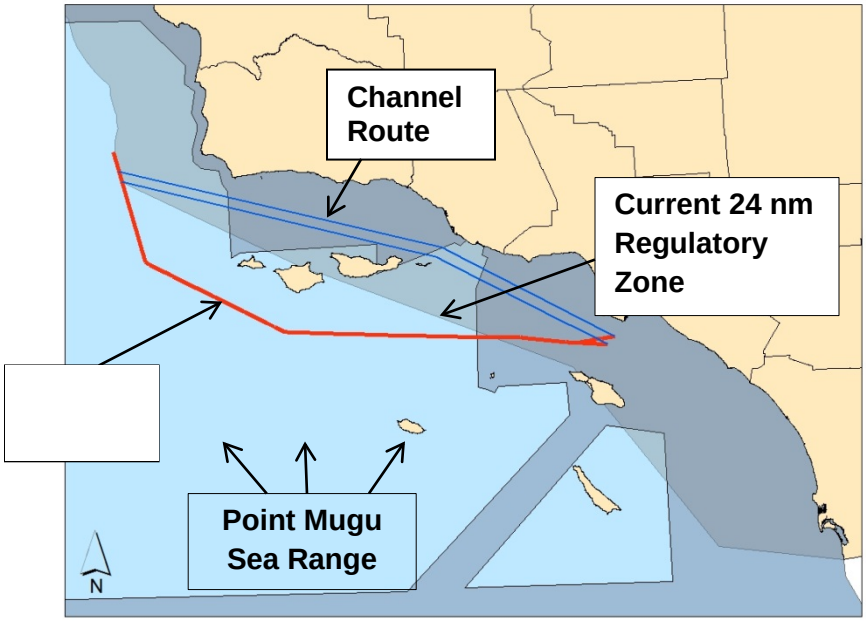
Since implementation of the OGV Clean Fuel Regulation began, there has been a change in vessel traffic patterns, primarily in Southern California. In addition, some vessels have experienced operational difficulties when operating on the required fuels. These are discussed briefly below and in more detail in Chapter II.

Vessel Traffic Patterns

Prior to the implementation of the OGV Clean Fuel Regulation, the majority of OGVs going into and out of the Ports of Los Angeles and Long Beach (POLA and POLB) traveled along the California coastline through the Santa Barbara Channel (the Channel Route). In the Santa Barbara Channel, there is a traffic separation scheme established by the Commandant of the U.S. Coast Guard under the Ports and Waterways Safety Act and in accordance with international agreements. However, soon after the effective date of the OGV Fuel Regulation, a large number of OGVs chose to move from the traditional route through the Santa Barbara Channel, which lies within the regulatory boundary of the OGV Clean Fuel Regulation, to an outer route (the Outer Route) on the southern side of the Channel Islands, an area outside of the regulatory boundary and in the

U.S. Navy's Point Mugu Sea Range (Sea Range). The vessel routes are shown in Figure I-2.[5]

Figure I-2: Vessel Traffic Routes by the Channel Islands in Southern California

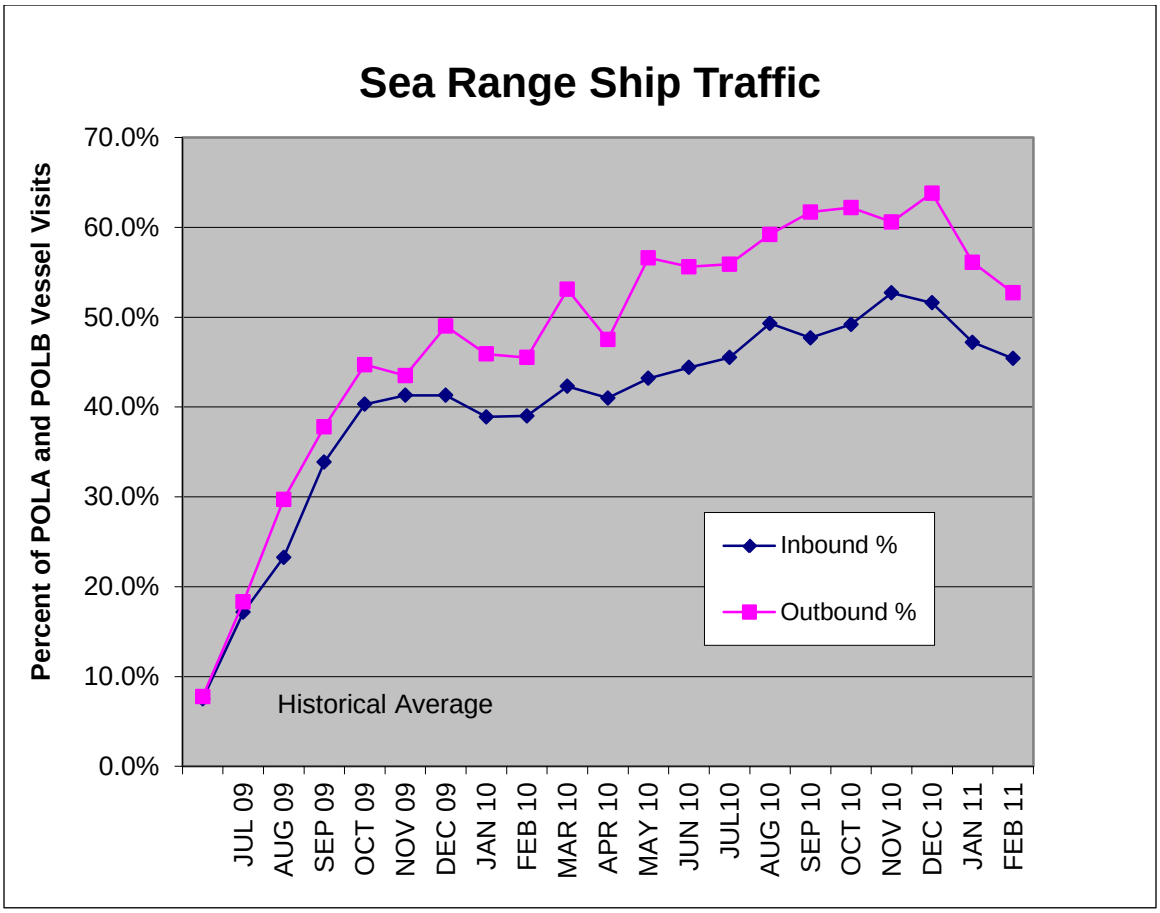


Because vessels on the southern side of the Channel Islands do not have to use the cleaner marine distillate fuels required by the OGV Clean Fuel Regulation, it reduces the transit costs for the vessel operator by about 20% relative to the costs that would be incurred transiting inside the Santa Barbara Channel. In addition, this change in routes has reduced the emissions reductions from the regulation. Statewide, ARB staff estimate that this change in vessel traffic to the Outer Route has resulted in about 3 tons per day (T/D) less diesel PM and 21 T/D less SOx emission reductions in 2010 than what could be realized if vessels used the Channel Route as originally anticipated when the regulation was adopted in 2008.

The loss in emission reductions is significant because a large percentage of vessels are using this Outer Route. Prior to the implementation of the regulation, it was generally only petroleum tankers that used the Outer Route, while now the majority of cargo vessels are using this route. Figure I-3 shows the growth in the use of the Outer Route since the regulation was implemented.

[5] After implementation of the OGV Clean Fuel Regulation began, vessels have also altered transit routes in Northern California choosing to transit further offshore, outside the 24 nm regulatory boundary which is consistent with the Contiguous Zone in this region. There is also a region offshore San Diego where AIS data indicates vessels altered routes to an area outside the 24 nm regulatory zone as they approach the POLA and POLB from the south.

Figure I-3: Marine Exchange Vessel Traffic Data – Percent of POLA and POLB Vessel Traffic that use the Outer Route Through the Point Mugu Sea Range



As noted above, vessels traveling on the southern side of the Channel Islands transit through the Point Mugu Sea Range. The data presented in Figure I-3 show that since the OGV Clean Fuel Regulation began implementation in July 2009, the percent of POLA and POLB vessel visits using the Outer Route has increased from the historical average of about 7.5% (about 30 vessels per month) to about 53% (about 200 vessels per month) inbound and 65% outbound by December 2010. In January and February 2011, there was a decrease in the percent of vessels using the Outer Route, possibly indicating that the percent of vessels using the Outer Route has stabilized.[6]

U.S. Navy representatives and members of the Regional Defense Partnership for the 21st Century (RDP-21), a Ventura County non-profit community organization that works to preserve and enhance the military value of Naval Base Ventura

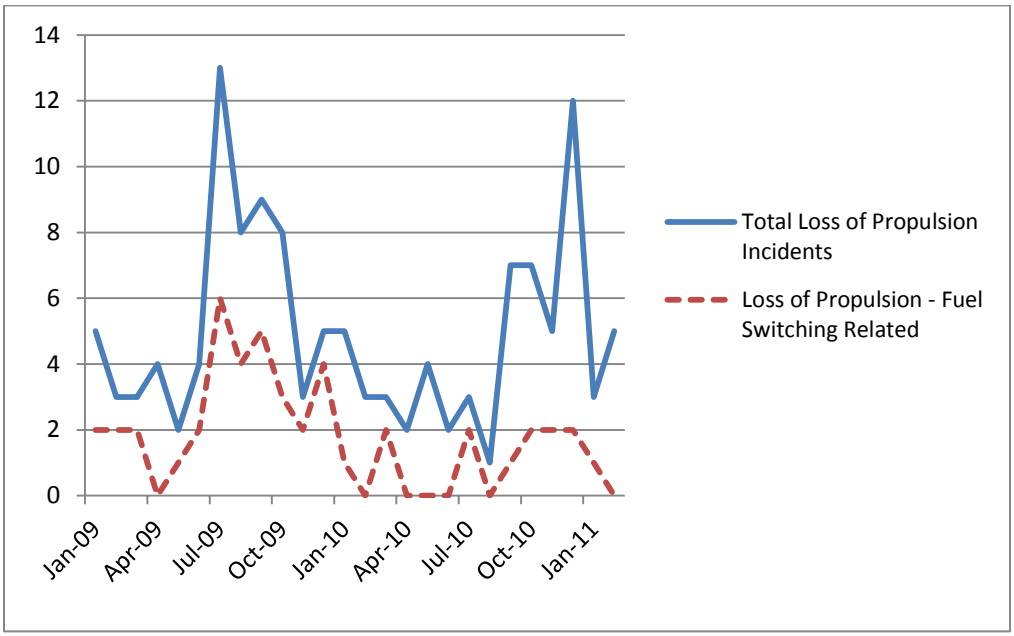
[6] 50 percent of the vessel traffic visiting the POLA and POLB corresponds to about 75% of the total vessel traffic that historically uses the Santa Barbara Channel.

County, have raised concerns about the increased ship traffic and the potential impacts it may have on the ability of the Sea Range to accomplish its primary mission. (RDP-21, 2010) (U.S. Navy, 2010)

Loss of Propulsion Incidents

During the initial months of implementation, there was an increase in reported loss of propulsion (LOP) incidents to the U.S. Coast Guard that may be attributable to the use of the lower sulfur marine distillate fuels. However, over a period of six months, the frequency of LOP incidents related to the use of lower sulfur marine distillate fuels returned to pre-regulation levels. This is shown in the LOP data reported by the U.S. Coast Guard (see Figure I-4). Out of the estimated 18,000 vessel visits (July 1, 2009 through February 2011) to California ports since implementation began, there have been 37 LOP incidents that were attributable to the use of the low-sulfur distillate fuels. During that same time, there have also been 71 LOP incidents that have not been attributed to the use of low sulfur marine distillate fuels. All of the LOP incidents were effectively managed with current procedures and practices and no accidents have occurred.

Figure I-4: United States Coast Guard District 11
Loss of Propulsion Statistics



ARB staff has worked closely with the U.S. Coast Guard and ship operators to better understand any operational difficulties experienced by vessel operators while on the required fuels. In the fall of 2009, the ARB conducted a survey of OGV vessel operators and vessel owners to collect information on operational experiences with the use of low sulfur distillate fuels. About 50 companies responded to the survey. In addition, the California Maritime Academy (CMA)

was brought under contract by ARB to help investigate any operational difficulties related to the use of low sulfur marine distillate fuels.

Specifically, CMA was asked to investigate the root causes of operational difficulties or LOP incidents that could be related to the use of low sulfur distillate fuel and identify strategies or lessons learned that have been used to address or avoid operational issues. Preliminary findings from the study were presented at a public meeting of the Maritime Air Quality Technical Working Group in April 2010. (MWG, 2010) To recap, the more commonly reported operational problems include:

- Fail to start – the main engine will not start on the marine distillate fuel.
- Unstable at dead slow – the main engine RPM varies or the engine stalls when running at dead slow, the engine runs reliably at higher speeds.
- Fail to reverse – main engine can run at low loads and does start normally. However it cannot start in the astern direction.
- External leakages – leaking o-rings on fuel injectors cause excessive fuel leakage and leakage on high-pressure manifolds.

CMA identified failure to maintain proper fuel viscosity as one of the key underlying issues in many of the operational problems. Low viscosity fuel can result in inadequate fuel injection pressures and incomplete combustion. Under these circumstances, LOP can result. Preliminary recommendations for improved practices to avoid operational issues include:

- Ensure fuel viscosity is above minimum levels per engine manufacturer. When sourcing fuels, specify and verify distillate fuel viscosity.
- Monitor fuel injection pump wear, check condition of o-rings and seals, and other fuel system components prior to using distillate fuel to avoid external leaks.
- Adjust preventative maintenance schedule of fuel system components as determined by operational experience.
- Perform test run on distillate prior to California port visit.
- Have written vessel-specific fuel changeover procedures and crew training.
- Transfer control from the Bridge to Engine Control Room if the engine is difficult to start.

It is expected that the final CMA report will be available in summer 2011.

ARB Staff Outreach and Coordination Efforts

ARB staff has conducted a number of activities to help vessel operators to comply with the regulation. ARB staff has issued six advisories providing guidance on complying with the general regulatory requirements, and on particular provisions in the regulation with regard to recordkeeping and the use of the safety exemption. These advisories are available on ARB's website at the following location: http://www.arb.ca.gov/ports/marinevess/ogv/ogvadvisories.htm

On April 28, 2010, ARB staff held a Maritime Working Group Meeting to discuss the status of the regulation after several months of implementation. The meeting included presentations by the following:

- California Maritime Academy on preliminary findings with regard to the ARB contract to investigate LOP incidents;
- Air Resources Board on the results of an ARB Survey of vessel operators' experiences with the use of low sulfur distillate fuel;
- U.S. Coast Guard on the LOP data and investigations;
- California Office of Spill Prevention and Response (OSPR)on their OSPR perspective on the implementation of the regulation; and
- Marine Engine Manufacturers (MAN Diesel and Wartsila) on technical issues and recommended practices when using low sulfur distillate fuel.

The meeting was coordinated with a similar meeting held the following day by the Society of Naval Architects and Marine Engineers (SNAME) that focused on fuel switching under national and international Emission Control Areas.

ARB staff also works closely with a number of key stakeholders regarding implementation of the regulation. ARB staff regularly attends meetings of the San Francisco Harbor Safety Committee, providing updates on the implementation of the regulation. ARB staff is in regular contact with the U.S. Coast Guard regarding LOP incidents that could be related to the use of the low sulfur fuel, and on uses of the safety exemption. ARB staff has also met with staff of the California Office of Spill Prevention and Response, the San Francisco Bar Pilots, and the manufacturers of marine engines.

E. International and Federal Actions

The staff report prepared for the original rule discussed the various international and federal regulations designed to reduce emissions from OGVs. (ARB, 2008). At the time, significant amendments to International Maritime Organization (IMO) regulations were under development, but had not yet been adopted. These amendments have since been adopted and are discussed below as the "2008 Amendments to Annex VI."

As discussed above, the California regulation includes a "sunset" provision under which the ARB would cease enforcement of the regulation if it is determined that the United States Environmental Protection Agency (U.S. EPA) adopts and

enforces regulations that will achieve equivalent or greater emission reductions. This is expected to occur in 2015. However, due to the significant public health impacts associated with these emissions, we believe it is appropriate to regulate these emissions at the state level until the U.S. EPA implements regulations that will achieve equivalent emission reductions.

2008 Amendments to Annex VI

For background, IMO Annex VI ("Regulations for the Prevention of Air Pollution from Ships") of the MARPOL Convention was adopted in 1997, and entered into force in May 2005. Annex VI established some relatively modest emission controls for OGVs. Specifically, Annex VI limited marine fuels to 4.5% fuel sulfur, and provided a process for the creation of sulfur emission control areas (SECAs), which require the use of 1.5% sulfur fuel (generally heavy fuel oil). Annex VI also established modest NOx standards for diesel engines greater than 130 kilowatts (kW) installed on vessels constructed on or after January 1, 2000. The United States ratified Annex VI on October 8, 2008, and it entered into force for the United States on January 8, 2009.

In October 2008, member states of the IMO adopted more robust new international standards for marine diesel engines and their fuels (2008 amendments to Annex VI) that apply globally as of July 1, 2010. The amendments include additional (Tier II and Tier III) new engine NOx standards, additional requirements for pre-2000 engines that were previously not controlled, and fuel sulfur limits.

New Engine NOx Standards

Table I-1 below lists the new engine NOx standards under amended Annex VI. The Tier II standards will achieve approximately a 20% reduction in NOx emissions compared to the existing Tier I standards, while the Tier III standards will achieve an 80% reduction from the Tier I emissions levels. The Tier II standards apply globally, while the Tier III standards would apply only in NOx emission control areas (ECAs), where it is envisioned that add-on emission controls such as selective catalytic reduction would be activated as needed. As discussed below, the United States was granted approval for an ECA designation and therefore the Tier III standards will apply in 2016.

Table I-1: New Engine NOx Emissions Limits Under IMO Annex VI

		n <130	130 ≤ n <2000	n ≥ 2000
Tier I	2000	17	$45n^{-0.2}$	9.8
Tier II	2011	14.4	$44n^{-0.23}$	7.7
Tier III**	2016	3.4	$9n^{-0.2}$	2.0

* Where n is the rated engine rpm
** Tier III standards apply only within NOx Emission Control Areas.

Amended Annex VI also specifies that the Tier I standards (previously applicable only to engines installed on ships beginning January 1, 2000) become applicable to existing engines installed on ships built between January 1, 1990 and December 31, 1999, for engines with a displacement greater than or equal to 90 liters per cylinder and a rated power output greater than or equal to 5,000 kW, subject to the availability of approved engine upgrade kits.

Fuel Sulfur Standards

The amended Annex VI requirements phase in progressively more stringent fuel sulfur limits to control emissions of SOx and PM. On a global basis, the fuel sulfur limit is reduced from the present 4.5% to 3.5% in 2012, and then to 0.5% in 2020, subject to a feasibility study to be performed in 2018 that could potentially delay the 0.5% sulfur standard until 2025.

Under the amendments to Annex VI, there are also special fuel sulfur limits for sensitive areas referred to as an “Emission Control Area” or ECA. Under the ECA, the sulfur level would drop from 1.5% sulfur in existing European ECAs to 1% sulfur in July 2010, and then 0.1% in January 2015. The United States and Canada jointly applied for an ECA designation covering SOx and NOx in July 2009. On March 26, 2010, the IMO officially designated waters of the United States and Canadian coastlines as an ECA referred to as the North American ECA. The region applies 200 nm offshore in the regions shown in Figure I-5 below. The North American ECA is expected to be implemented here starting in August 2012, when the 1% sulfur limit would apply. The United States is also applying for a treaty amendment that would extend this ECA to the Caribbean waters around Puerto Rico and the U.S. Virgin Islands. If the treaty amendment is adopted at the next Marine Environment Protection Committee in July 2011, then the requirements could be implemented by January 2014.

Figure I-5: North American Emission Control Area

F. Need for OGV Clean Fuel Regulation

Air pollution from shipping activities in California is a major public health concern at both regional and community levels. The diesel-powered vessels used to transport goods emit soot, or diesel PM, and other air pollutants that can increase health risks to nearby residents. Two health risk assessments by ARB staff have shown that diesel PM emissions from ocean-going vessels are one of the largest contributors of toxic pollutants and diesel PM in neighboring communities. (ARB, 2006) (ARB, 2008b) Shipping activities are also a significant source of PM, SOx and NOx which can contribute to the formation of regional smog and fine particulate matter. As part of the rulemaking packages for the OGV Clean Fuel Regulation and its predecessor, the Auxiliary Engine Regulation[7], ARB staff provided extensive analysis and documentation on the health effects of the emissions from OGVs and their impacts on air quality and public health in California. (ARB, 2005) (ARB, 2008) Since that time, U.S. EPA has completed Integrated Science Assessments for SOx and PM which provide new information on the adverse health impacts from exposure to these pollutants. (U.S. EPA, 2008) (U.S. EPA, 2009)

The OGV Clean Fuel Regulation is necessary to reduce the public's exposure to diesel PM, which is a component of ambient PM. In addition, the regulation is needed to reduce emissions of PM, NOx, and SOx. NOx is a precursor to the

[7] The Auxiliary Engine Regulation can be found at title 13, California code of Regulations (CCR) section 2299.1 "Emission Limits and Requirements for Auxiliary Diesel Engines and Diesel-Electric Engines Operated on Ocean-going Vessels within California Waters and 24 Nautical Miles of the California Baseline" and the identical section title 17, CCR, section 93118 "Airborne Toxic Control Measure for Auxiliary Diesel Engines and Diesel-Electric Engines Operated on Ocean-going Vessels within California Waters and 24 Nautical Miles of the California Baseline." Due to a successful legal challenge of the regulation, enforcement was suspended in May 2008.

formation of ozone, and both NOx and SOx contribute to secondarily formed PM in the lower atmosphere. Implementation of the OGV Clean Fuel Regulation is resulting in significant air quality and public health benefits. Use of the Phase 1 marine distillate fuels results in about an 80% reduction in SOx and a 75% reduction in PM relative to using HFO. The use of marine distillate fuels instead of HFO also reduces NOx by about 6%. These reductions in diesel PM, PM, NOx and SOx are helping to improve regional ambient air quality levels of PM and ozone. We also anticipate significant health benefits due to reduced incidences of cancer, premature mortality, and hospitalizations associated with PM exposure. When the OGV Clean Fuel Regulation was originally adopted, ARB staff estimated that the implementation of the regulation will avoid a significant number of premature deaths, about 3,600, between 2009 and 2015 due to reduction in directly emitted and secondarily formed PM . (ARB, 2008) With respect to potential cancer risk, the OGV Clean Fuel Regulation is resulting in significant reductions in exposures and potential cancer risks to residents that live near ports in California. For example, during the original rulemaking, based on an analysis of the predicted 2010 and 2015 ambient diesel PM levels statewide, we estimate that in 2010 there will be a 75% reduction in the population-weighted average risk relative to the predicted risk levels in 2010 from OGV diesel PM emissions and an 83% reduction in 2015. (ARB, 2008)

G. ARB Staff Actions and Process to Develop the Proposed Amendments

ARB staff developed the proposed amendments to the OGV Clean Fuel Regulation through consultations with OGV operators and industry representatives, the U.S. Coast Guard, U.S. Navy, the California Office of Spill Prevention and Response, local air pollution control agencies, local Harbor Safety Committees, California's Attorney General's Office, the Ports of Los Angeles and Long Beach, environmental group representatives, the U.S. EPA and members of the public. In addition to discussions with these stakeholders, over the last year, staff held two public workshops to discuss the proposed amendments. Notification for these workshops had been distributed to more than 2,500 companies, organizations, and individuals through ARBs email notification. Workshop notices as well as all meeting materials were posted to ARB's website and e-mailed to subscribers of the "maritime" electronic list serve.

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II. NEED FOR AMENDMENTS

In this chapter, ARB staff provides a discussion on the events and information that have necessitated the proposed amendments to the OGV Clean Fuel Regulation. In addition, ARB staff provides the rationale for the amendments being considered.

A. Changes in Vessel Traffic Patterns in Southern California

As noted earlier, when the OGV Clean Fuel Regulation began implementation in 2009, many vessel operators adjusted vessel routes and began using the Outer Route outside the regulatory zone where vessels could use HFO. Below, ARB staff provides a more detailed discussion on this change in traffic patterns including the impacts on vessel operation, the Point Mugu Sea Range, emissions, and public health.

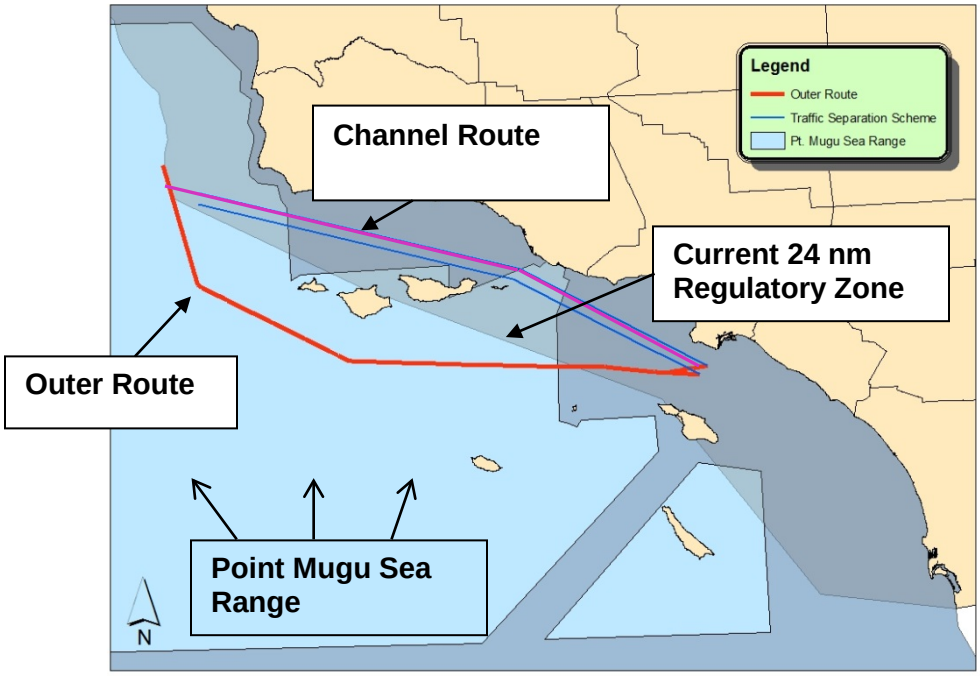
Description of the Change in Vessel Traffic Patterns

Vessels using the portion of the north-south route along the California coastline from about Point Conception to the POLA and POLB have historically used the Channel Route within the Santa Barbara Channel Traffic Separation Scheme (TSS) as shown in Figure II-1.[8]

The Channel Route is within the regulatory zone of the OGV Clean Fuel Regulation which is approximately 24 nm offshore of the of the California coastline. Vessels travelling to and from the POLA and POLB using the Channel Route travel over 150 nm (one-way) within the regulatory zone along the California coastline from Point Conception going to and leaving POLA and POLB. After implementation of the OGV Clean Fuel Regulation began in July 2009, increasing numbers of vessel operators chose to use the Outer Route which is outside the regulatory zone in this region.

[8] A TSS is a designated routing measure that reduces the risk of a collision by providing for the separation of arriving and departing traffic by the establishment of traffic lanes. The Santa Barbara TSS was established by the Commandant of the USCG under the Ports and Waterways Safety Act and in accordance with international agreements.

Figure II-1: Channel and Outer Vessel Routes to the Ports of Long Beach and Los Angeles



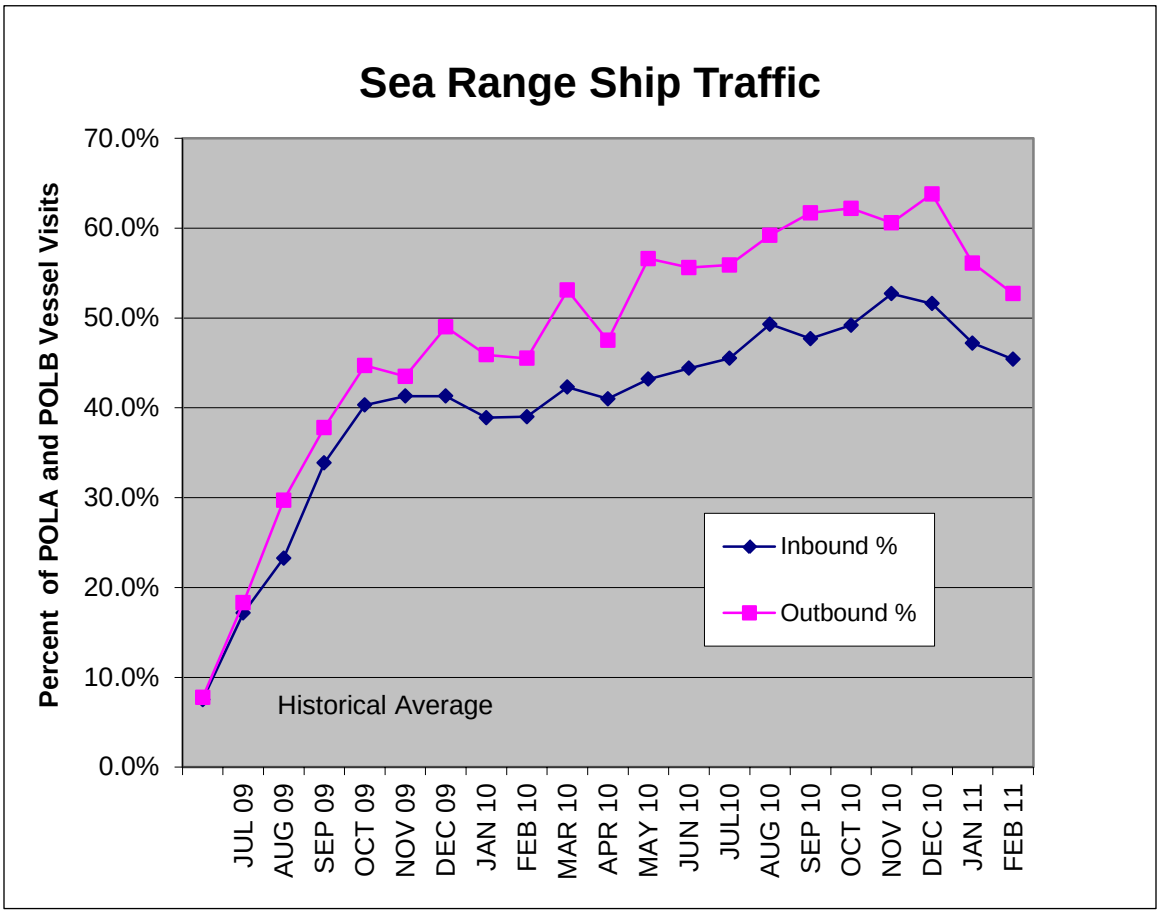
The Outer Route has a shorter portion within the regulatory zone, minimizing the amount of more expensive cleaner fuel used, and thereby reducing fuel costs. For example, vessels traveling to and from the POLA and POLB using the Outer Route will travel a total of about 163 nm, with about 132 nm on HFO outside the regulatory zone and about 31 nm on cleaner fuel within the regulatory zone. Vessels using the Channel Route would operate a total of about 150 nm within the regulatory zone on cleaner fuel. While ship operators typically weigh the added travel time and distance against the lower fuel costs, data collected from Automatic Identification System (AIS) vessel tracking reveals that the number of vessels that are using the Outer Route has increased since the OGV Regulation began implementation even though the Outer Route is longer.[9]

The U.S. Navy provided ARB staff with vessel traffic data showing the number of vessels that are using the Outer Route compared to the total vessels visiting POLA and POLB. (U.S. Navy, 2011) The vessel information was obtained from the Marine Exchange of Southern California. The Marine Exchange is a nonprofit organization that gathers and provides extensive information concerning vessel traffic in the POLA and POLB regions. Figure II-2 shows both

[9] AIS is an automated tracking system used on ships and by Vessel Traffic Services (VTS) for identifying and tracking vessels. AIS provides information concerning vessel identification, position, course, and speed.

the percentage and number of vessels inbound and outbound from July 2009 to February 2011. The data shows an increase in traffic using the Outer Route traffic from the historical average of about 7.5% prior to July 2009 to about 53% inbound and 65% outbound by December 2010. In January and February 2011, there was a decrease in the percent of vessels using the Outer Route, possibly indicating that the percent of vessels using the Outer Route has stabilized.

Figure II-2: Marine Exchange Vessel Traffic Data Listing Vessel Traffic using the Outer Route Through the Point Mugu Sea Range



The fuel cost differential between the Channel Route and the Outer Route may be a significant factor when the shippers chose to change routes. ARB staff performed a cost comparison between the two routes, with each route beginning near Point Conception and ending at POLA and POLB.

To estimate the fuel costs and travel time for each route, a number of inputs, such as vessel speed, fuel consumption rate, and fuel price are necessary. (ARB, 2008 Appendix D) Fuel costs are highly dependent on vessel speed since fuel consumption is proportional to the cube of the vessel speed. To estimate the fuel costs, ARB staff developed an average vessel speed for each of the routes.

ARB staff evaluated vessel speeds by analyzing vessel AIS telemetry data which provides vessel position and time information. The AIS data was evaluated by ship type and for two time periods, as listed in Table II-1. The first time period was January 2009 through June 2009 before the regulation was implemented and the second time period was July 2009 through December 2009, after implementation of the regulation. The data shows that vessels speeds vary somewhat by ship type and time period evaluated. However, the AIS data indicate that for the time period, after implementation of the regulation, the average vessel speeds are essentially the same for the Channel Route compared to the Outer Route (16 knots).

Table II-1: Average Speeds (knots) for Vessel Using the Channel Route and Outer Route Before and After Implementation of the Vessel Fuel Rule in 2009

Prior to Regulation (January 2009-June 2009)			
Inside the Channel		**Outside the Channel**	
Vessel Type	**Average Speed**	**Vessel Type**	**Average Speed**
Bulker	13.0	Bulker	13.5
Container	19.9	Container	21.1
Dry Cargo	13.4	Dry Cargo	11.5
Miscellaneous	8.9	Miscellaneous	11.5
Pass./Ferry	14.8	Pass./Ferry	18.2
Reefer	na	Reefer	na
Roro	16.3	Roro	18.0
Tanker	13.9	Tanker	13.5
All Vessels	17.7	All Vessels	14.9
After Implementation of Regulation (July 2009-December 2009)			
Inside the Channel		**Outside the Channel**	
Vessel Type	**Average Speed**	**Vessel Type**	**Average Speed**
Bulker	12.5	Bulker	13.4
Container	18.7	Container	19.3
Dry Cargo	12.8	Dry Cargo	13.5
Miscellaneous	7.8	Miscellaneous	8.4
Pass./Ferry	15.4	Pass./Ferry	17.1
Reefer	15.0	Reefer	16.0
Roro	14.8	Roro	15.8
Tanker	13.9	Tanker	12.6
All Vessels	16.2	All Vessels	16.1

Data Source: AIS telemetry data obtained from the University of California, San Diego and ARB's telemetry equipment located near Santa Barbara.

Therefore, while the speeds of individual ships may be different based on the route and type of fuel burned, on average, the speeds are similar for both routes after implementation of the OGV Clean Fuel Regulation in July 2009. In the

analysis of costs for the different routes, ARB staff used the same average transit speed of 16 knots for all of the routes.[10] For the portion of the route within the 20 nm voluntary POLA and POLB vessel speed reduction (VSR) zones, staff used an average of 12 knots, which is consistent with the requirement of the VSR program.

The results indicate that for this segment of travel (one-way from Point Conception to the Ports), the cost of using the Channel Route is about 20% higher than using the Outer Route, due to the higher cost of the compliant distillate fuel, as shown in Table II-2. (ARB, 2010) In addition, for the inbound portion of the Channel Route, there is a requirement for a marine oil spill contingency plan in the region where the ships travel within three miles of Anacapa Island. (OSPR, 2009) The cost per inbound vessel trip is approximately $500. (Roloff, 2010) However, this cost is not reflected in the fuel cost estimates listed in Table II-2.

Table II-2: Estimated Fuel Costs*, Route Distance and Transit Time for the Channel and Outer Route Through the Santa Barbara Channel Region with the 24 nm Regulatory Zone

Route	Distance (nm)	Cost	Time (hrs)
Channel Route (150 nm)	MGO:150 nm	$14,390	9.6
Outer Route (163 nm)	MGO: 31 nm HFO: 132 nm	$11,640	10.5
Estimated Distance/Cost/Time Differential	13 nm	$2,750	0.9 (54 minutes)

*Estimates include fuel costs only for a one way transit from Point conception to the POLA or POLB. The oil spill contingency plan cost is not included.

U.S. Navy Concerns and Request

The U.S. Navy test and training ranges occupy vast overwater regions extending well offshore along the California coast from San Luis Obispo in the north, to San Diego and into international waters off the coast of Mexico in the south. (CCC, 2001) This region is comprised of the Operating Area of Southern California Range Complex (SOCAL OPAREA), to the south of POLA and POLB, and the Point Mugu Sea Range, northwest of the POLA and POLB. According to the U.S. Navy, most of their operations on the Point Mugu Sea Range are

[10] Earlier cost estimates presented at the October 2010 public workshop had been based on a preliminary speed estimate of 17.4 knots. The average speed used in the analysis presented here has been adjusted to 16 knots to reflect the updated information as provided in Table II-1.

conducted in the area surrounding a portion of the Outer Route: south and west of the Northern Channel Islands (San Miguel, Santa Rosa, Santa Cruz and Anacapa), and north and west of San Nicolas Island.

Point Mugu is one of two bases comprising Naval Base Ventura County (NBVC). The Sea Range is an integral and foundational asset of NBVC. A 2006 Economic Impact Study about NBVC, presented by the Workforce Investment Board of Ventura County, reported NBVC as the largest employer in the county, with over 19,000 personnel (military and civilian) working for, or stationed on the base in all categories, and contributing directly or indirectly to another 8,200 jobs throughout the county. (NBVC, 2006) NBVC contributes significantly to the economic health of the area, with an economic impact exceeding $1.2 billion in 2006 and is the fifth-largest base in the country. The U.S. Navy states that the work in electronic warfare, naval weapons systems, and testing and evaluation of a host of technologies have added immeasurably to our national defense. (Parisi, 2011) An additional description of the operational and economic importance of the Point Mugu Sea Range is provided in Appendix B.

According to U.S. Navy representatives, the Point Mugu Sea Range is utilized for military activities on a continual basis. The range is used by the Navy, Air Force, Coast Guard and other agencies and has approximately 17,000 events a year (ARB, 2009). Use is continuous throughout the year, but the intensity of use will vary based on the needs of the users. To ensure that all users meet their RDT&E, training, maintenance and operations requirements, access to the Point Mugu Sea Range must remain available throughout the year.

Oil tankers have travelled through the portion of the Point Mugu Sea Range that is of concern due to an agreement negotiated in the early 1990s to stay 50 nm off the California coastline to avoid oil spills reaching shore, in response to the Exxon Valdez spill. (ARB,2009) An average of two ships per day (one in each direction) travelled through the range. According to the U.S. Navy, these vessels avoided range operations when requested. U.S. Navy representatives said historical interference problems had been mainly with stray pleasure craft or commercial fishing boats.

During the development of the OGV Clean Fuel Regulation rulemaking materials, the U. S. Navy expressed concerns that the OGV Clean Fuel Regulation requirements, alone or combined with proposed or future efforts to reduce vessel speed in the Santa Barbara Channel would cause commercial shippers to abandon existing transit routes through the Santa Barbara Channel. Although laden tank vessels and fishing boats have historically traveled within these test ranges, the U.S. Navy expressed concerns that their weapons testing and training activities would be more difficult if there is a large increase in vessel traffic to the Outer Route. Additionally, the U.S. Navy provided both written and oral comments at the July 2008 Board meeting. (U.S. Navy, 2008) (ARB, 2008b)

At that time, ARB staff did not have sufficient information to find that a shift in traffic patterns would occur. However, in response to the U.S. Navy's concerns, ARB staff prepared a supplemental environmental impact report that evaluated the environmental impacts if vessels did change traffic patterns and made that report available for public comment. (ARB, 2009) In addition, at the public hearing to consider adoption of the OGV Clean Fuel Regulation the Board asked that staff return to them in the event vessels posed problems for U.S. Navy operations at the Point Mugu Sea Range. (ARB, 2008b)

As noted above, shortly after implementation of the Phase 1 fuel requirements began, vessels began traveling on the southern side of the Channel Islands through the Point Mugu Sea Range instead of using the traffic separation scheme within the Santa Barbara Channel. This change in vessel traffic patterns may potentially impact operations in the Point Mugu Sea Range. Both the U.S. Navy and members of the Regional Defense Partnership for the 21st Century (RDP-21), a Ventura County non-profit community organization that works to preserve and enhance the military value of Naval Base Ventura County, have raised concerns about the increased ship traffic and the potential impacts it may have on the ability of the Sea Range to accomplish its primary mission. (RDP-21, 2010) (U.S. Navy, 2010)

The U.S. Navy has a process in place to inform vessels of Point Mugu Sea Range activities such that operators of commercial and noncommercial vessels can plan for alternative routes or fishing locations to avoid military exercises. U.S. Navy representatives state that they publish a Notice to Mariners (NOTMARS) in the United States Coast Guard "Local Notice to Mariners" publications prior to test and training events and issue advisories to let the operators of tankers and other vessels know if the test range will be "active." For example, ship operators can contact a unit known as "PLEAD Control" if they are planning to enter the Sea Range. If PLEAD Control states that the Point Mugu Sea Range is active, ships have historically delayed their travel or taken a longer route avoiding the active area. If a ship does not respond to PLEAD requests, range clearance aircraft are deployed to get the attention of the ship's crew.

Since implementation of the Phase 1 fuel requirements, the Navy worked with the Marine Exchange of Southern California to provide additional information on Sea Range operations to ships. That enhanced communication has helped avoid impacts to operations. However, Navy representatives have indicated that this is only an interim solution and may not be sustainable.

Impacts on Anticipated Emission Reductions and Public Health

The historical Santa Barbara Channel shipping route was primarily chosen to minimize the overwater distances, travel time, and fuel use for the primary great circle route between Asia and Southern California. Because vessel operators have increasingly chosen the longer Outer Route which has a significant portion of the route where these vessels continue to use dirtier HFO, associated emissions have increased in this region, as shown in Table II-3, relative to the emissions that would have occurred if vessels had continued to use the Channel Route. The impact of the associated emissions increase will be mitigated to some extent by the fact that the emissions are occurring farther offshore. However, total emissions have increased by about 3 T/D for PM and 21 T/D for SOx as a result in the shift in vessel traffic to the Outer Route relative to what they could have been if the vessels continued to use the Channel Route.

Table II-3: Estimated OGV Statewide Emissions in Tons Per Day (100 nm SIP Zone, 2010)

	PM2.5 T/D	SOx T/D
Baseline-No Rule	18.4	145
OGV Clean Fuel Rule with Anticipated Traffic Pattern (most Vessels using Channel Route)	7.7	50
OGV Clean Fuel Rule with Current Traffic Pattern (50% of Vessels using Outer Route)	10.3	71

To evaluate the public health impacts, the cardiopulmonary mortality associated with PM was estimated for each route, relative to the Baseline Scenario. Additional details of the evaluation are provided in Appendix C.

Using the model-simulated results, estimates of avoided premature cardio-pulmonary mortality associated with changes in PM2.5 air quality for each route (i.e. relative to the no rule baseline) were generated. These results are presented in Table II-4 for the South Coast Ozone Study (SCOS) domain.

Table II-4: SCOS Domain-wide Annual Avoided Premature Mortality Estimates Due To OGV Clean Fuel Regulation

Scenario	Annual Cardiopulmonary Mortality Avoided*		
	Low	Mean	High
Channel Route-OGV Clean Fuel Rule with Anticipated Traffic Pattern (most Vessels using Channel Route)	540	700	850
Outer Route-OGV Clean Fuel Rule with Current Traffic Pattern (50% of Vessels using Outer Route)	500	650	790

*Compared to no-rule baseline

As can be seen in Table II-4, the cardio-pulmonary premature deaths avoided are significant for both vessel routes. However, there is a small difference in the mean values for the two routes, with the Channel Route scenario having a higher mean value for avoided mortality, compared to the Outer Route scenario.

Proposed Modifications to the Regulatory Zone to Reduce Impacts on the Point Mugu Sea Range

To address the impacts of the shift in vessel traffic on the Point Mugu Sea Range and the loss of emissions reductions, ARB staff is proposing modifications to the regulatory zone that would:

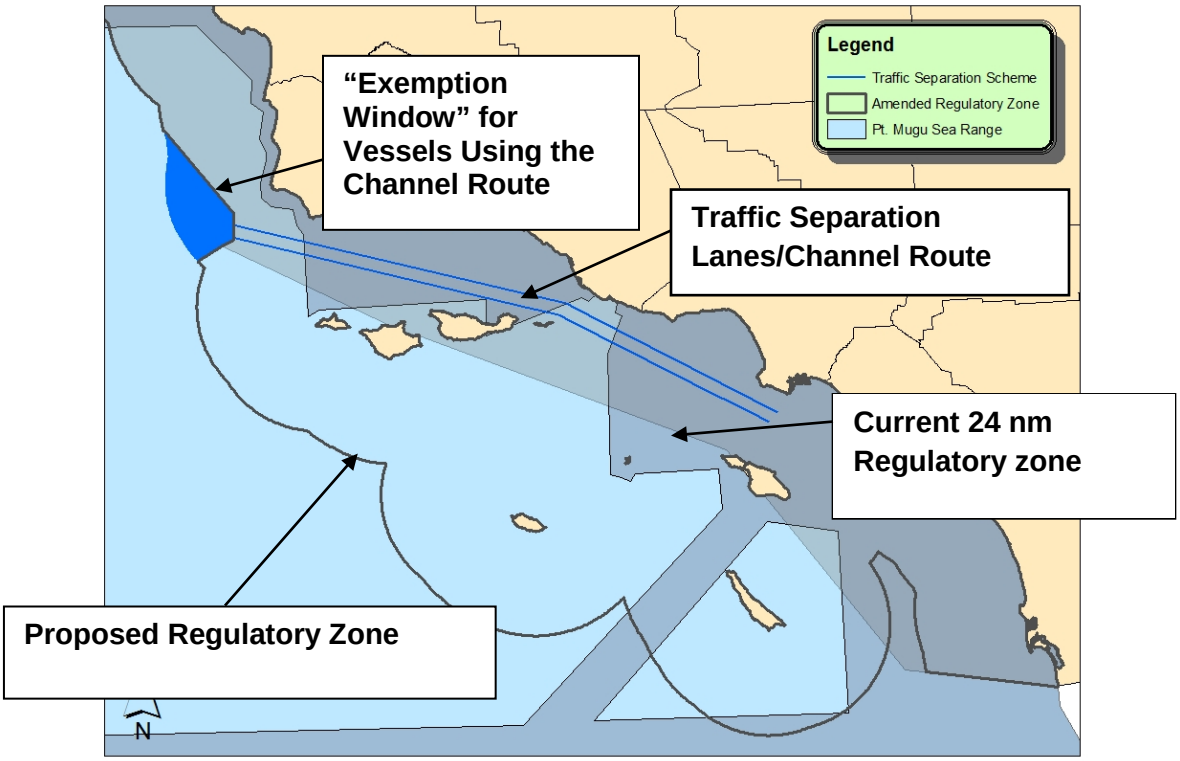
- extend the regulatory zone (around the islands off Southern California) beyond the Outer Route to require vessels operating in this area to comply with the OGV Clean Fuel Regulation requirements, and
- allow vessels accessing the Channel Route from the north and west to delay fuel switching so as to equalize the fuel costs for the Channel Route compared to the Outer Route.

The proposed changes to the regulatory zone are shown in Figure II-3. The proposed modifications include extending the regulatory zone in Southern California out beyond the Channel Islands and excluding a small area, a "window", near the north-western end of the Channel Route off Point Conception. As shown in Figure II-3, the modified zone is aligned with the Contiguous Zone except for the small window. The Contiguous Zone is a recognized NOAA maritime zone and is shown on many maritime charts. (NOAA, 2011)

The window was included to equalize the fuel costs for vessel owner/owner operators that use the Channel Route instead of the Outer Route. The window is located as far offshore as possible to ensure that vessels are not fuel switching

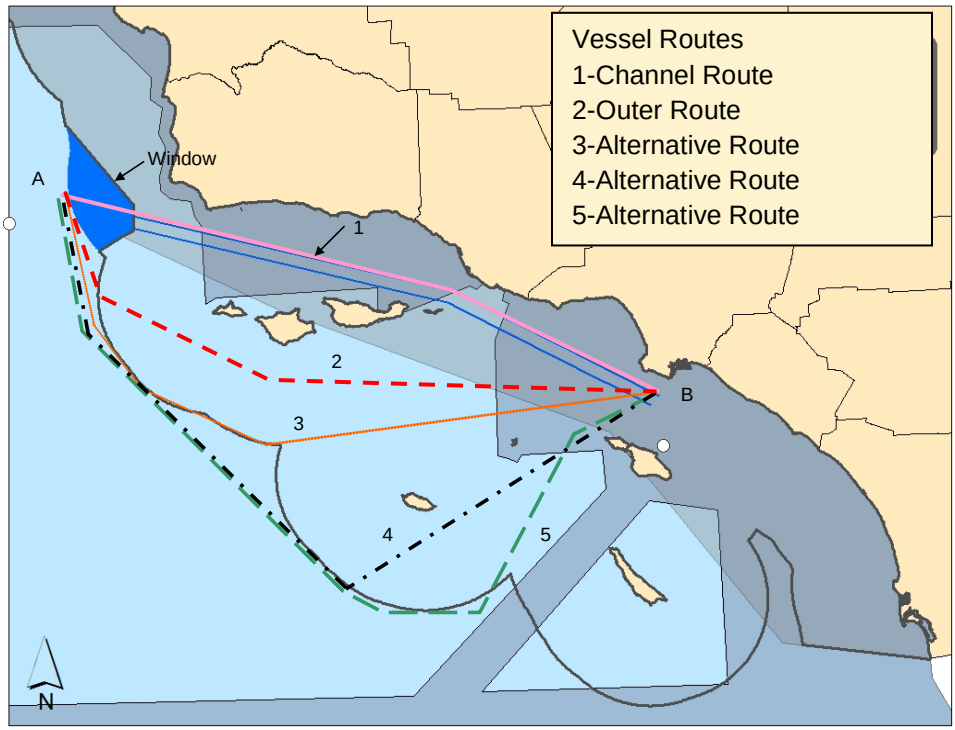
close to shore. Since the start of the Santa Barbara TSS is within the regulatory zone, vessels will have completed the fuel switch prior to entering the TSS and, therefore, will not be switching fuels in the TSS. Additionally, removing the economic advantage of using the Outer Route should promote the return of the vessel traffic to the established traffic separation lanes in the Santa Barbara Channel.

Figure II-3: Proposed Amended Zone in Southern California



To evaluate if there would be a cost incentive for vessel operators to shift to other, farther east, routes if the regulatory zone was extended, ARB staff evaluated the costs of three additional routes through the region (#'s 3, 4, and 5 on map),as shown in Figure II-4. These alternative outer routes maximize the portion of the route that is outside the regulatory zone.

Figure II-4: Channel, Outer, and Alternative Vessel Routes to the Ports of Long Beach and Los Angeles with the Proposed Amended Zone



Using the methodology described earlier in this chapter, ARB staff evaluated the costs, travel time, and distance associated with the Channel Route (#1 in Figure II-4), the Outer Route (#2 in Figure II-4) and each of the alternative routes (#'s 3, 4 and 5 in Figure II-4). As can be seen in Table II-5, the Outer Route and all of the alternative routes have higher costs, longer overall travel distance, and longer travel time compared to the Channel Route. Therefore, there is no cost or time benefit to using any of these outer routes unless ship owner/operators are trying to minimize the operation time or distance while using MGO or MDO.

Table II-5: Estimated Fuel Costs, Distance and Transit Time for Channel and Possible Amended Outer Routes through the Santa Barbara Channel Region with the Proposed Amended Zone

Route	Cost	Distance HFO (nm)	Distance MGO (nm)	Total Distance (nm)	Time (hours)
Channel Route (#1 Pink Line)[11]	$13,870	16	132	148	9.6
Outer Route (#2 Red Dash)	$14,140	19	143	162	10.5
Alternative Outer Route (#3, Orange Dot)	$14,330	83	90	173	11.1
Alternative Outer Route (#4, Black Dot Dash)	$16,210	115	87	201	12.9
Alternative Outer Route (#5, Green Long Dash)	$16,700	166	56	222	14.2

Fuel costs, distances and time are for a one-way transit between Point Conception and the POLA/POLB.

B. Implementation Date for Phase 2 Requirements

ARB staff is fully committed to reaching the Phase 2 limit of 0.1% sulfur fuel. The use of 0.1% sulfur marine distillate fuel is technologically and operationally feasible and is cost-effective. It is also consistent with the North American ECA Phase 2 limit which will come into effect in 2015. However, ARB staff does have concerns about the timing for implementation of the OGV Clean Fuel Regulation's Phase 2 requirement and we believe there are valid reasons to delay the implementation date by two years. Specifically, ARB staff believes that adjustments to the Phase 2 implementation date are necessary for the following reasons:

- better alignment with the North American ECA, and
- greater flexibility to find compliant fuels with higher viscosity.

Providing a two-year delay will help to ensure the successful implementation of the North American ECA's Phase 1 and a successful transition to the 0.1% sulfur fuels. Below, we briefly discuss our rationale.

[11] The estimated fuel cost of the Channel Route as listed in listed in Table II-5 is lower than the cost of the Channel Route as listed in Table II-2 due to the "window" area allowing the use of the lower cost HFO for that portion the Channel Route as listed in Table ii-5.

Better Alignment with the North American ECA

Shippers have voiced concerns about the operational and logistical complexity of having California and federal OGV fuel requirements implemented on differing schedules. Table II-6 provides a comparison between the OGV Clean Fuel Regulation fuel requirements and those of the North American ECA which was approved subsequent to adoption of the ARB regulation.

Table II-6: Fuel Requirements for the OGV Clean Fuel Rule and the North American ECA

ARB Requirements (24 nm zone)	July 1, 2009 (Phase 1)	Distillate fuel: MGO max 1.5% sulfur MDO max 0.5% sulfur
	Jan. 1, 2012 (Phase 2)	Distillate fuel: MGO max 0.1% sulfur MDO max 0.1% sulfur
North American ECA (200 nm zone)	Aug. 1, 2012 (Phase 1)	Fuel Sulfur max 1.0% sulfur
	Jan. 1, 2015 (Phase 2)	Fuel Sulfur max 0.1% sulfur

Additionally, delaying the ARB Phase 2 by two years provides additional flexibility when specifying and obtaining compliant fuel. We believe that shippers will be able to locate fuels with higher viscosity levels during the Phase 1 requirements since we are not excluding the use of MGO or MDO above 0.1% sulfur.

Flexibility to Find Compliant Fuels with Higher Viscosity

Operational challenges may stem from running main propulsion engines, designed to operate primarily on HFO, on a cleaner marine distillate that has very different physical properties than HFO. These differences may include lower viscosity of the distillate fuel compared to HFO. Low fuel pressure related operational problems, possibly related to the condition of fuel pumps or fuel viscosity, have been reported by industry. (MWG, 2010) ARB staff proposes to extend the Phase 1 period to help interim issues with locating compliant fuel that has higher viscosity. (Kjeldson, 2011) Although fuel viscosity is not a function of fuel sulfur content, having a less restrictive cap will provide shippers with more selection and supply to find compliant fuels with higher viscosity levels. Because the sulfur levels are not as restrictive in Phase 1 compared to Phase 2, the operators will have more flexibility in specifying viscosity levels when purchasing compliant fuel at ports throughout the world.

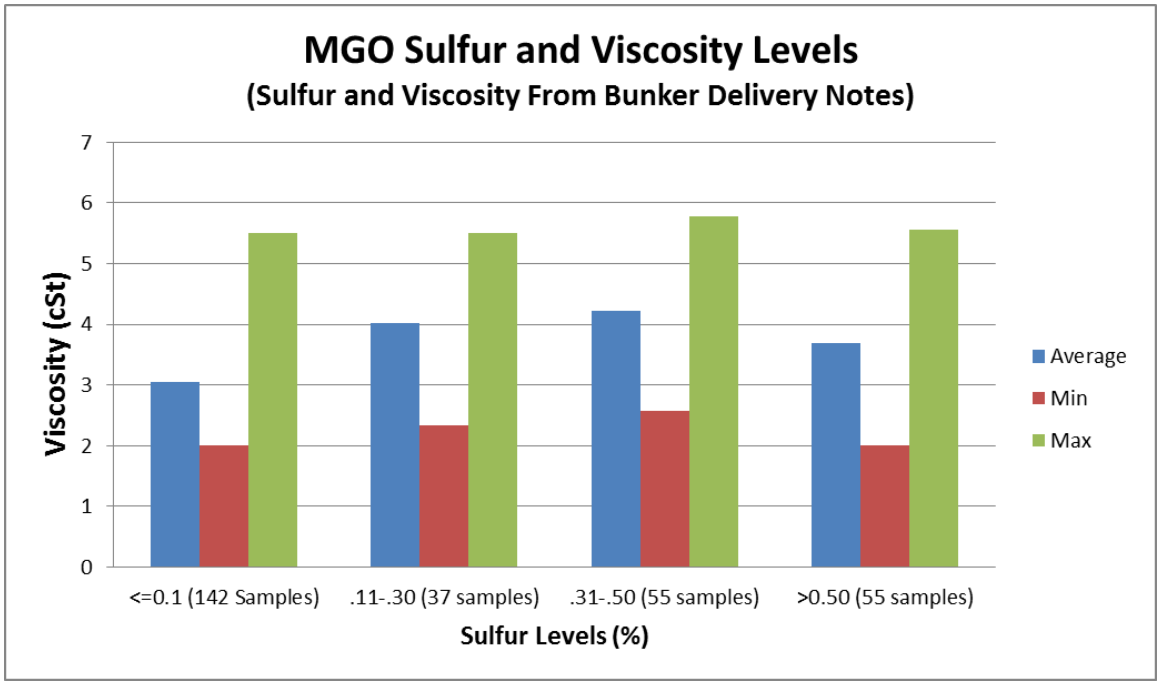
ARB staff evaluated fuel viscosity for MGO and MDO by analyzing bunker records obtained during ARB inspections. The information collected during the inspections provides useful information on fuel qualities such as fuel sulfur

content and viscosity as well as providing an indication of the types of fuels provided at ports throughout the world. ARB staff believes that the fuel properties identified from this data are representative of MGO and MDO fuels currently available to the global OGV fuel market. ARB staff compiled and evaluated the ARB Enforcement Division's records for inspections of vessels from July 2009 to January 2011. About 450 vessel inspections were conducted over this 19 month period. Fuel sulfur content, bunker location, and fuel viscosity were compiled from the fuel bunker delivery notes (BDN) obtained during the inspections. Additionally, as part of the inspection procedure, ARB obtained fuel samples from the vessel, which were typically a mixture of fuels from multiple fuel bunkers, and tested for actual fuel sulfur content per ISO 8217.

As shown in Table II-7, about 80 percent of the bunkered fuel came from six regions, USA-CA, Asia-Korea, Asia-China, Asia-Singapore, Northern Europe and USA-not including CA. The highest percentage of samples originated in California (22% percent), with an average bunkered fuel sulfur content of 0.03%. The next highest percentage of samples originated from Korea, at about 17%, with an average bunkered fuel sulfur content of 0.63%. The percent of samples originating from China and Japan were the third and fourth highest, with about 4% each and with an average bunkered fuel sulfur content of 0.28% and 0.4% respectively.

Fuel viscosity, as listed on the BDN, was evaluated by fuel sulfur content and by region. As shown in Figure II-5, the average fuel viscosity by sulfur content shows some variation between different fuel sulfur ranges. The fuels with sulfur levels in the range of 0.1 to 0.5% sulfur have a somewhat higher average fuel viscosity than those fuels with sulfur content below 0.1% sulfur.

Figure II-5: MGO Fuel Viscosity* Levels from Bunker Delivery Notes Obtained During Enforcement Activity between July 2009 through January 2011



*Kinematic fuel viscosity as measured in centistokes (cSt)

Additionally, there may be bunkering regions where higher viscosity fuel is more readily available. MGO purchased in California and other U.S. ports has average sulfur levels below the ARB 0.1% sulfur Phase 2 requirement; however, the average viscosity is much lower than the other four top bunkering regions. For example, samples from fuel bunkered in China and Singapore have higher average viscosities, 4.8 and 4.1 respectively, but the average sulfur levels do not meet the Phase 2 requirements. Samples from fuel bunkered in Korea have intermediate viscosity levels; however, the average fuel sulfur level is the highest of all the regions at 0.63%. This data indicates that, for the bunkering regions with higher viscosity, the average fuel sulfur is well above 0.1% sulfur that is required in Phase 2. Therefore, to provide shippers more flexibility in 2012 and 2013 to find fuels with higher viscosity, we propose to delay the 0.1% sulfur limit to January 1, 2014.

As a component of the original rulemaking process, ARB staff performed an extensive analysis of fuel availability for Phase 2 compliant fuel (0.1% sulfur MGO or MDO in 2012). The analysis indicated that in 2007, the average sulfur content of MGO and MDO at 25 of the 31 Pacific Rim ports exceeded the Phase 2 fuel sulfur requirements. Furthermore, findings indicated that it was unlikely that a sufficient supply of 0.1% sulfur fuel would be available prior to 2012 due to crude supply, refining capacity, and fueling infrastructure improvements that would have been necessary. However for 2012, these issues would be lessened

due to additional time available for fuel providers and suppliers to develop and implement the necessary fueling infrastructure.

As the 2012 ARB 0.1% sulfur Phase 2 requirement nears, ARB staff evaluated fuel sulfur information obtained from ARB inspection records described above. Although the inspection period aligns with Phase 1 of the rule, we believe that the information is representative of the sulfur content of MGO and MDO fuels currently provided to the global OGV market. About 450 vessel inspections were conducted over a 19 month period from July 2009 through January 2011. (ARB, 2011)

Fuel sulfur content, bunker location and fuel viscosity were compiled from the fuel bunker delivery notes obtained during the inspections. Additionally, as part of the inspection procedure, ARB obtained fuel samples from the vessel, which may be a mixture of fuels from multiple fuel bunkers, and tested for fuel sulfur content per ISO 8217. Based on the fuel sample sulfur test results, ARB has a sampling of the actual average fuel sulfur content, and bunkered sulfur content of the purchased fuel used to comply with the rule. The analysis of the collected fuel samples demonstrates that the fuels being burned typically have much lower sulfur content than the Phase 1 fuel sulfur limits. Of the 444 fuel samples analyzed as of March 2011, the actual fuel sulfur content of the marine distillate fuels being used by OGV operators averages less than 0.3% sulfur and 40% of all the samples were below 0.1% sulfur. In addition, the majority of fuel samples were MGO (402 samples MGO vs. 40 samples MDO).

These results indicate that on average, many of the most significant bunkering regions are providing fuel at or within a few tenths of a percent of 0.1% sulfur. The main exception is Korea, where the average sulfur content of the MGO is about 0.6%. While previous studies have found that the total quantity of fuel needed to meet the demands of this regulation are sufficient, there may be regional issues with the sulfur content of MGO or MDO in 2012.

Table II-7: MGO Bunkering Records by Region Obtained During Inspection Activity Between July 2009 through January 2011

Region	Count (1)	% of Total MGO Samples (1)	Average Reported Viscosity (cSt) (2)	Average Fuel Sulfur Content (%) (2)	Min Fuel Viscosity (cSt) (2)	Max Fuel Viscosity (cSt) (2)	Min Fuel Sulfur Content (%) (2)	Max Fuel Sulfur Content (%) (2)
USA-CA	102	25.4	2.71	0.03	2.00	3.70	0.00	0.74
Asia-Korea	75	18.7	3.55	0.63	2.20	5.56	0.01	1.28
Asia-China	65	16.2	4.78	0.28	2.34	5.50	0.00	0.51
Asia-Singapore	31	7.7	4.13	0.40	2.82	5.78	0.00	1.00
Northern Europe	26	6.5	3.80	0.13	2.00	5.50	0.01	0.95
USA-Not CA	22	5.5	2.76	0.03	2.00	3.60	0.00	0.17
Asia-Japan	18	4.5	3.94	0.14	3.04	5.32	0.00	0.93
Southern Europe	17	4.2	4.11	0.13	2.88	7.00	0.00	0.71
Central America	12	3.0	2.88	0.28	2.58	3.13	0.02	1.50
South America	9	2.2	3.16	0.21	2.68	4.26	0.00	1.50
Asia-other regions	8	2.0	3.35	0.13	2.80	4.34	0.03	0.39
Middle East	7	1.7	3.31	0.34	2.81	3.80	0.08	0.98
North America British Columbia	3	0.7	3.30	0.03	3.20	3.50	0.02	0.04
Australia	2	0.5	2.90	0.00	2.87	2.93	0.00	0.00
S. Africa	1	0.2	3.30	0.52	3.30	3.30	0.52	0.52

1. Only records for MGO are listed. Total of 402 samples, 4 samples did not have information on bunkering region.
2. Values reflect “as bunkered” fuel viscosity and fuel sulfur content as reported on fuel Bunker Delivery Notes

Based on reviewing the average and minimum fuel sulfur content regionally, ARB staff has concluded that 0.1% fuel sulfur MGO is currently provided in most of the Pacific Rim bunkering regions where fuel is being purchased to comply with the rule. However, there are a small number of bunkering regions, such as Korea, where the current fuel sulfur averages are significantly higher than 0.1%, indicating that most of the MGO provided in that region currently does not meet the 0.1% Phase 2 requirement. ARB staff believes that while there is sufficient global availability of the 0.1% sulfur fuels, there may be isolated situations regionally where the 0.1% sulfur fuel may not be provided in 2012. (ARB, 2008 Appendix F) By delaying the Phase 2 implementation to January 1, 2014, any isolated fuel sulfur issues should further decline as supply increases due to crude supply, refining capacity, fueling infrastructure improvements and demands of the North American ECA requirements in 2015.

Proposed Modifications for Phase 2 Implementation

Based on the fuel samples obtained and analyzed from OGV enforcement inspections as of January 2011, the actual fuel sulfur content of the marine distillate fuels being used by OGV operators averages less than 0.3% sulfur and 40% of all the samples were below 0.1% sulfur. This information indicates that about 40% of vessels are currently operating on 0.1% sulfur distillate and that the use of 0.1% sulfur marine distillate fuel is technologically and operationally feasible and is cost effective. However, ARB staff believes it is appropriate to adjust the implementation timeline for the OGV Clean Fuel Regulation's Phase 2 requirements (0.1% sulfur in January 1, 2012). Staff believes that adjustments to the Phase 2 implementation date are necessary for the following reasons:

- better alignment with the North American ECA,
- greater flexibility to find compliant fuels with higher viscosity, and
- additional time for the marine fuel industry to provide distillate fuels with properties that meet the enhanced specifications of the newly revised ISO 8217.

As discussed in the following section, the ISO 8217 marine fuels standard, which was recently revised in 2010, includes higher minimum fuel viscosity and newly added lubricity requirements. These revisions will take some time to be more widely integrated by industry, but should be more commonly applied as industry prepares for the demands of the Phase 2 ECA (0.1% sulfur fuel) in 2015. To provide better regulatory alignment, flexibility and additional time for industry's integration of newly revised fuel standards, providing a two-year delay will help to ensure the successful implementation of the North American ECA's Phase 1 and a successful transition to the 0.1% sulfur fuels.

While complete alignment with the North American ECA Phase 2 would suggest that the ARB 0.1% sulfur Phase 2 be delayed to January 1, 2015, ARB staff does not recommend the delay past January 1, 2014. Reductions that can only be achieved with the ARB 0.1% sulfur Phase 2 requirement are necessary in 2014 for both the SIP and POLA and POLB Clean Air Plan (CAP).

C. New Revisions to ISO 8217

The International Organization for Standardization (ISO) sets standards for marine fuels under International Standard ISO 8217, including MGO, designated as DMA, and MDO, designated as DMB. In the original rulemaking, both MDO and MGO were required to meet all the specifications in ISO 8217, as revised in 2005. The ISO 8217 standard has since been revised and staff proposes to modify the definition of both MGO and MDO.

The 2010 version has some additional specifications that will benefit the industry. A new distillate category designation DMZ has been added, due to the recent experiences with possible viscosity related operational issues. DMZ has increased minimum viscosity of 3 cSt at 40°C, but is otherwise identical to the DMA grade. Staff proposes to amend the definition of MGO to include both DMA and DMZ. In addition, the minimum viscosity of DMA has been raised to 2 cSt from 1.5 cSt in the 2005 version. In the 2005 version, DMB did not have a minimum viscosity, but this has been set to 2 cSt in the 2010 version.

A lubricity requirement has been included in the 2010 version and is applicable to all distillate grades with sulfur contents below 500 mg/kg (500 ppm or 0.05% sulfur). The lubricity limit is based on the existing wear testing requirements for high speed automotive and heavy duty industrial diesel engines (a maximum 520 micrometer wear scar diameter). The lubricity requirements reflect industry's concern of possible engine wear damage due to fuels without sufficient lubricity.

Staff evaluated the option of referencing only the latest 2010 standard, but found that the 2005 standard is still used widely by industry. Therefore, staff proposes to allow compliant fuel to meet either the 2005 or the 2010 version.

D. Noncompliance Fee Option

<u>Vessels Using the Noncompliance Fee That Can Obtain and Subsequently Operate on Compliant Fuel During a California Visit</u>

In the prior rulemaking, the noncompliance fee option was developed to address events where: (1) a vessel operator cannot obtain the required fuel prior to coming into California; (2) the vessel has an unplanned redirection and does not have the required fuel on-board; (3) a vessel operator inadvertently purchases defective fuel; or (4) the vessel is to be taken out of service for modifications. Our experience implementing this rule showed that very few vessel operators needed to use the noncompliance fee provision. Over the 21 months between July 2009 and March 2011, vessel operators paid a noncompliance fee only five times out of the estimated 18,000 vessel visits in California. In each case, the vessel operator was required to pay a fee of $45,500, which is about twice the cost of using the compliant fuel for a typical visit. However, in most of these uses of the noncompliance fee, the operators requested a reduction in the

fee if they were able to bunker the fuel at the earliest opportunity and operate on the compliant fuel for the remainder of the visit.

To address this issue and to encourage direct compliance with the rule where possible, ARB staff proposes to prorate the fee for these vessels. Since the vessel operators have indicated that they can typically bunker fuel at the first port or anchorage and switch to compliant fuel at the earliest safe opportunity, staff proposes to prorate the fee by half since the operators will use the compliant fuel for about half of the total visit. Compared to the cost of the fuel under direct compliance, the prorated fee is still about twice the cost of compliance because the distance travelled within the regulated zone on noncompliant fuel is about half of that for a round trip, while the fee is also halved. This will ensure that there is no cost advantage to using the noncompliance fee. Looked at another way, staff determined that a typical cargo vessel would have to travel about 300 nm within the regulatory zone a full cruising speed on noncompliant fuel to save $22,750 (one half the noncompliance fee). This compares with typical routes to or from the major California ports that range from about 40 to 150 nm within the regulatory zone.

Vessels that Anchor in Conjunction with a Noncompliant Port Visit.

Again, experience gained in implementing the rule showed that many times vessels, primarily tankers, may anchor prior to a port visit for such purposes as bunkering, waiting for a scheduled cargo discharge, or mandatory or voluntary inspection. In the prior rulemaking, except for mandatory inspections, the anchorage was considered a separate port visit for the noncompliance fee calculation. Staff proposes that when anchorage is made in conjunction with one or more noncompliant port visits, the anchorage is not included in calculating the noncompliance fee for the vessel visit. If, however, the vessel is only anchoring during the noncompliant visit, for example, waiting for redirection or tendering cruise passengers to shore, then the anchorage will be included in calculating the noncompliance fee.

Noncompliance Fee Schedule

The noncompliance fees were designed such that they do not confer an economic advantage to participants relative to vessel operators who use the specified low sulfur fuels. The noncompliance fee for the first port visit is about two times the average fuel differential cost for a complete vessel visit. The graduating structure, where the fee doubles for each additional port stop during a visit, was incorporated to discourage multiple uses of the noncompliance fee provision and encourage direct compliance. Because of the possibility of regional issues with availability of 0.1% sulfur MGO or MDO Phase 2 fuel, staff proposes to modify the noncompliance fee schedule, beginning the graduation of the fee structure after the second port visit as shown in Table II-8. We do not believe that this option will be used in the remainder of Phase 1, since the noncompliance fee provision has only been used a few times to date, and has not been used for more than one port visit. The proposed amendment to the fee schedule does

not provide an economic advantage to participants, but does reduce the graduated fees when using the provision for multiple visits or multiple port stops in a single visit.

Table II-8: Noncompliance Fee Schedule, Per Vessel

Port Visit	Per-Port Visit Fee
1st Port Visited	$45,500
2nd Port Visited	$45,500 ~~$91,000~~
3rd Port Visited	$91,000 ~~$136,500~~
4th Port Visited	$136,500 ~~$182,000~~
5th or more Port Visited	$182,000 ~~$227,500~~

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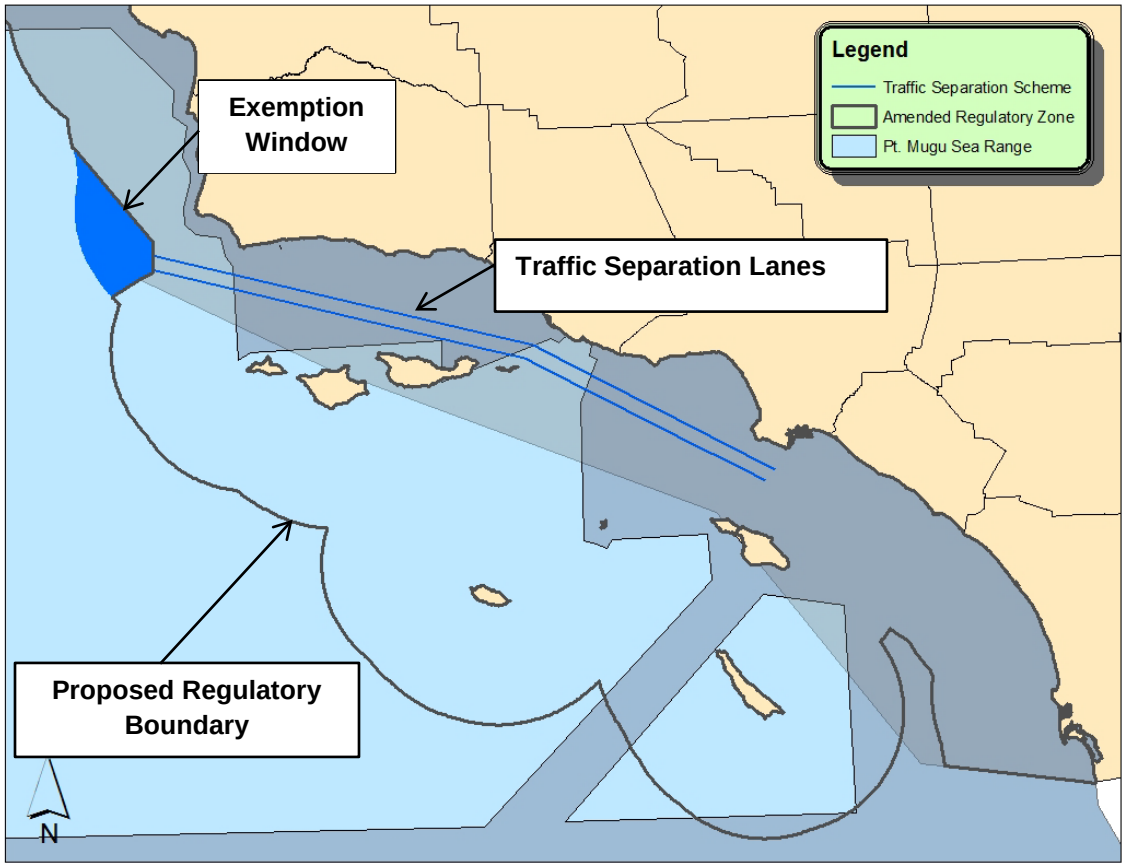
III. PROPOSED AMENDMENTS

In this chapter, we provide a plain English discussion of the key amendments we are proposing to the OGV Clean Fuel Regulation. For a discussion of the entire regulation, including the sections that we are not proposing to modify, please see the staff report for the original regulation. (ARB, 2008) This chapter is intended to satisfy the requirements of Government Code section 11346.2, which requires that a non-controlling "plain English" summary of the regulation be made available to the public.

A. Regulatory Boundary

As discussed previously, we are proposing to amend the regulatory boundary, referred to as "Regulated California Waters," to align more closely in Southern California with the "Contiguous Zone," which is 24 nautical miles from the California Baseline (shoreline), which includes offshore islands. The proposed amendments to the regulatory boundary are found in subsections (b), "Applicability," and (d) "Definitions." The proposed amended regulatory boundary is shown in Figure III-1 below.

Figure III-1: Proposed Amended Regulated California Waters in Southern California



In the original regulation, the regulatory boundary followed the Contiguous Zone in Northern California, but in Southern California it approximated a boundary 24nm from the mainland shore using two straight-line segments. This boundary was selected to maximize the emission reductions from the rule at the same time to lower the cost with the expectation that vessels would continue to use the Channel Route with the established TSS. The proposed amendments will follow the Contiguous Zone consistently throughout the length of California, including islands. The proposed amended regulatory boundary will extend farther offshore of the California mainland in Southern California because each of the Channel Islands has its own 24 nm boundary surrounding it.

In addition, we are proposing to exempt a small ”window” within the 24 nm boundary to encourage vessels to travel in the established shipping lanes in the Santa Barbara Channel. This region falls within an area within the Contiguous Zone.[12]

B. Phase 2 Implementation Date

The existing OGV Clean Fuel Regulation requires the use of Phase 2 0.1% sulfur distillate fuel beginning January 1, 2012. We are proposing to extend the deadline to use the Phase 2 fuel by two years to January 1, 2014. ARB staff believes that adjustments to the Phase 2 implementation date are necessary to better align with the North American ECA, provide more flexibility to find compliant fuels with higher viscosity, and provide additional time for the marine fuel industry to provide distillate fuels with properties that meet enhanced specifications of the newly revised ISO 8217. As discussed earlier in the staff report, for vessels that have experienced LOP incidents possibly related to the use of low sulfur distillate fuels, on-board management of fuel viscosity is an important parameter. Providing a two-year delay will help to ensure the successful implementation of the North American ECA’s Phase 1 and a successful transition to the 0.1% sulfur fuels.

C. Noncompliance Fee Provision

Staff is proposing minor modifications to the “noncompliance fee provision,” which in certain specified situations allows the payment of fees in lieu of direct compliance with the rule through the use of cleaner fuels. These proposed amendments are based on experience gained through implementation of the regulation to date, and focus primarily on the way fees are assessed.

First, staff is proposing to adjust the fee schedule specified in the regulation. As shown in Table III-1 below, under the current regulation, the fee for a first noncompliant port visit is $45,500, which helps to offset the economic advantage gained by using the less expensive noncomplying fuel. In addition, the fee escalates for subsequent port visits to encourage direct compliance with the rule. We are proposing to allow the fee to stay at

[12] The Contiguous Zone is an internationally recognized over-water boundary that is adjacent to the Territorial Sea. The Territorial Sea extends 12 nm offshore of the California coastline, while the Contiguous Zone extends from the Territorial Sea to 24 nm offshore of the California coastline.

$45,500 for the second port visit to accommodate visiting vessels that may stop at two California ports in their voyage (e.g. visits to the ports of Los Angeles and Oakland). We have found the current fee to provide sufficient disincentive for ship operators to frequently use of the provision. It has only been used five times since the regulation began implementation in July, 2009.

Table III-1: Noncompliance Fee Schedule

Port Visit	Fee Under Current Regulation	Fee Under Proposed Amendments*
1	$45,500	$45,500
2	$91,000	$45,500
3	$136, 500	$91,000
4	$182,000	$136,500
5 or more	$227,500	$182,000

* Fees are halved if vessel operator purchases and uses compliant fuels as soon as possible.

In addition, staff is proposing that the applicable fees shown in Table III-1 be halved for vessel operators that purchase and use complying fuels after arriving to a port on noncomplying fuel. Under the current regulation, there is no incentive for vessel operators to purchase and use compliant fuels when using the noncompliance fee provision. In fact, there is a disincentive in that the noncompliant fuels are much less expensive, and there is no adjustment of the fees for operators to make the effort to come into compliance as soon as possible. The proposed modification would provide ship operators with the incentive to purchase and use compliant fuel in those situations where it is feasible.

Finally, for the purpose of assessing the applicable noncompliance fees, staff is proposing that offshore anchorages made in conjunction with a port visit not be counted as another “port visit.” There are numerous situations where a vessel operator may conduct business at a port visit, but also conduct an offshore anchorage for secondary reasons. For example, the vessel operator may schedule a vessel inspection, take on fuel at anchorage, or perform other technical or logistical activities. In these situations, we believe that it is appropriate not to count this anchorage as a separate “port visit” for the purposes of calculating noncompliance fees.

D. Other Proposed Amendments

In addition to the proposed modification of "Regulated California Waters," staff is proposing to amend two additional definitions to reflect recent updates to nautical charts and fuel specifications, as discussed below.

California Baseline

The California coastline is defined in the regulation as the "baseline," the mean lower low water line along the California coast, as shown in seven NOAA nautical charts covering portions of California's coastline. These NOAA charts are periodically updated to reflect changes in the coastline that occur over time. Since the adoption of the regulation, one of the charts (the April 2005 version of Chart 18740 covering California's coastline from San Diego to Santa Rosa Island) was updated and we are proposing to include this updated (March 2007) chart in the amendments to the regulation.

Marine Fuels

Staff is proposing to amend the definitions of the fuels required under the ARB regulation to reflect recent changes in how these fuels are specified under international standards. For background, the regulation requires the use of either MGO or MDO. These fuels are defined in the regulation as specific grades of distillate fuels in the 2005 version of international standard ISO 8217 under the International Organization for Standardization. Under the current regulation, MGO is defined as any fuel meeting the 2005 ISO specifications for DMA or DMX fuel grades, and MDO is defined similarly as DMB grade fuel. However, since the adoption of the regulation, a new 2010 version of the ISO 8217 fuel specifications has been adopted. This new version was issued partly in response to the revised Annex VI fuel sulfur regulations under the International Maritime Organization. The new version includes some important changes to the specifications for distillate fuels, as well as a new grade of distillate fuel referred to as DMZ. The new specifications set higher minimum fuel viscosity levels, and a lubricity specification for distillate fuels with sulfur levels below 0.05%.

Staff is proposing to change the definitions of MGO and MDO in the regulation to allow fuels that meet the applicable grades of distillate fuel under either: (1) the older 2005 version of the ISO 8217 specifications; or (2) the new June 15, 2010 version of the ISO 8217 specifications, which staff is proposing to incorporate into the regulation by reference. While staff strongly encourages the use of fuels meeting the new 2010 ISO 8217 specifications, many fuel suppliers are not currently offering fuels meeting the new ISO 8217 specifications. Therefore, to ensure an adequate supply of the distillate fuels required under the regulation, staff is proposing to allow distillate fuels meeting either the 2005 or 2010 versions of the ISO 8217 standards.

E. Regulatory Alternatives

The Government Code section 11346.2 requires ARB to consider and evaluate reasonable alternatives to the proposed regulation and provide the reasons for rejecting those alternatives. ARB staff evaluated two alternative strategies to the proposed amendments. Based on the analysis, none of the alternative control strategies were considered more effective in reducing emissions than the proposed regulation. This section discusses each of the alternatives and provides reasons for rejecting those alternatives.

Alternative 1: Do Nothing/No Project (Do not amend the existing regulation)

This alternative would leave the situation as it currently exists. The existing OGV Clean Fuel Regulation would continue to be in effect. No action would be taken to address the loss in emission reductions anticipated by the original rule or the adverse impact on the U.S. Navy's Point Mugu Sea Range operations due to the shift in vessel traffic. Further, no action would be taken to provide better alignment of the ARB OGV Clean Fuel Regulation with the 2015 requirement for the North America ECA. The adverse impacts of this alternative would be that a majority (and potentially even a greater percentage in the future) of vessel traffic coming into the Ports of Los Angeles and Long Beach would use the Outer Route resulting in greater emissions and a significant adverse impact on Point Mugu Sea Range Operations. We would also miss an opportunity to make adjustments to the Phase 2 schedule that is appropriate given our experience in the implementing Phase 1. Based on the adverse impacts identified above and discussed in greater detail in Chapter V, staff rejected Alternative 1.

Alternative 2: Suspend the original regulation and rely on international and federal regulations

This alternative would have the Board suspend the current rule and instead rely on the North America ECA OGV fuel standards and schedule. Prior to 2015, relying only on international and federal regulations would result in substantial increases in PM and SOx emissions. This is because under IMO/U.S. EPA regulations (i.e. an ECA zone), ship operators would be not be required to use lower sulfur OGV fuel until August 2012 and the allowable fuel sulfur content would be 1% and most likely HFO. Under the ARB OGV Clean Fuel Regulation, Phase I fuel is currently averaging below 0.3% sulfur, and the Phase II fuel would be at or below 0.1% sulfur. In addition, the ARB rule specifies distillate fuels that burn cleaner than the HFO likely to be used to meet the 1% sulfur fuel, independent of sulfur levels. An emissions analysis prepared in the original staff report that compares the original regulation to the then pending ECA requirements shows the dramatic difference in emission reductions between these two options. This analysis would be very similar to the difference between the proposed amended regulation and the currently adopted North American ECA. (ARB, 2008)

The emission reductions that would be achieved under the proposed regulation are critical to reducing the cancer and non-cancer health risks to the public. They are also

necessary to make progress toward compliance with State and federal air quality standards for ozone and PM in nonattainment areas throughout the State. Finally, these reductions are an important element of California's Diesel Risk Reduction Plan, the California Goods Movement Emission Reduction Plan, and marine port clean air plans. For the above reasons, staff rejected Alternative 2.

F. Necessity of Proposed Amendments

The need and rationale for the proposed amendments were discussed extensively in Chapter II. In addition, in this chapter, ARB staff provides a plain English description of the proposed amendments to the OGV Clean Fuel Rule.

Pursuant to Government Code section 11349.1, Government Code section 11346.2(b)(1), and title 1, California Code of Regulations, section 10, ARB staff is providing a brief summary below that identifies each section in the regulation where amendments are proposed and describes the rationale for each proposed amendment.

California Code of Regulations, title 13, section 2299.2 and title 17, section 93118.2

Section 2299.2(b)(1) and Section 93118.2(b)(1). Applicability

Summary of Section 2299.2(b)(1) and Section 93118.2(b)(1)

These sections identify the OGV Clean Fuel Regulation boundary wherein vessels must use the specified fuel.

Rationale for Proposed Amendments to Section 2299.2(b)(1) and Section 93118.2(b)(1)

The proposed amendments revise the regulated zone farther offshore in Southern California to be consistent with the Contiguous Zone (i.e. include zone around the Channel Islands) and add a small exemption area i.e. exemption window, for ships using the Channel Route. With these changes, ARB staff believes vessel operators will choose to transit of the Channel Route instead of the Outer Route because it is less costly and is a shorter distance. If they do choose to continue to use the Outer Route, under the proposed amendments they would have to use the cleaner marine distillate fuels.

Section 2299.2(d)(18) and (19) and Section 93118.2(d)(18) and (19). Definitions

Summary of Section 2299.2(d)(18) and (19) and Section 93118.2(d)(18) and (19)

These sections define Marine Diesel Oil (MDO) and Marine Gas Oil (MGO) which are required by the regulation.

Rationale for Proposed Amendments to Section 2299.2(d)(18) and (19) and Section 93118.2(d)(18) and (19)

The proposed amendments will revise the definition of MGO and MDO to refer to both the 2005 version of the ISO 8217 fuel standard, which is still commonly used by industry, or the 2010 revision which includes a higher viscosity MGO "DMZ" grade.

Section 2299.2(e)(1)(A) and Section 93118.2(e)(1)(A). Operational Requirements

Summary of Section 2299.2(e)(1)(A) and Section 93118.2(e)(1)(A)

These sections describe the fuel requirements for vessels entering the regulated zone.

Rationale for Proposed Amendments to Section 2299.2(e)(1)(A) and Section 93118.2(e)(1)(A)

The proposed amendments will delay the Phase 2 (0.1% S) implementation by two years to January 1, 2014 to better align with the North American ECA and to provide more flexibility to vessel operators to find compliant fuels with higher viscosity.

Section 2299.2(h)(5) and Section 93118.2(h)(5). Noncompliance Fee in Lieu of Meeting Subsection (e)(1)

Summary of Section 2299.2(h)(5) and Section 93118.2(h)(5)

These sections describe a provision in the rule, the Noncompliance Fee Provision, which in certain specified situations allows the payment of fees in lieu of direct compliance with the regulation through the use of cleaner fuels.

Rationale for Proposed Amendments to 2299.2(h)(5) and Section 93118.2(h)(5)

The proposed amendments to these sections modify the fee structure to reduce the costs for vessel operators that purchase compliant fuel and use that fuel after arriving to a port on noncomplying fuel. This will help promote direct compliance with the regulations. The proposed amendments also adjust how the fee is assessed for vessels that bunker at anchorage prior to coming into a California port.

REFERENCES

(ARB, 2008) State of California, Air Resources Board, Staff Report: Initial Statement of Reasons for Proposed Rulemaking: Proposed Regulation for Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels Within California Waters and 24 Nautical Miles of the California Baseline, June 2008

IV. EMISSIONS AND ENVIRONMENTAL IMPACTS FROM THE PROPOSED AMENDMENTS

This chapter describes the potential environmental impacts of the proposed amendments to the OGV Clean Fuel Regulation. The impacts on statewide and regional emissions estimates are presented as well as impacts on air quality and public health. In addition, the potential biological impacts and impacts on greenhouse gas emissions are described.

A. Legal Requirements

The California Environmental Quality Act (CEQA) and ARB regulations require an analysis to determine the potential environmental impacts of proposed regulations. Because ARB's program involving the adoption of regulations has been certified by the Secretary of Resources pursuant to Public Resources Code section 21080.5, the CEQA environmental analysis requirements may be included in the Initial Statement of Reasons (ISOR) for this rulemaking. In the ISOR, ARB must include a "functionally equivalent" analysis rather than adhering to the format described in CEQA of an Initial Study, a Negative Declaration, and an Environmental Impact Report. Staff will respond to all significant environmental issues raised by the public during the public review period or at the Board public hearing in the Final Statement of Reasons for the proposed amendments.

Public Resources Code section 21159 requires that the environmental impact analysis conducted by ARB include the following:

- an analysis of reasonably foreseeable environmental impacts of the methods of compliance;
- an analysis of reasonably foreseeable feasible mitigation measures; and
- an analysis of reasonably foreseeable alternative means of compliance with the control measure.

Compliance with the proposed amendments is expected to improve air quality overall and potentially affect other environmental media as well. A summary of the analysis of potential environmental impacts resulting of the methods of compliance are presented in the discussion below. Regarding reasonably foreseeable mitigation measures, CEQA requires an agency to identify and adopt feasible mitigation measures that would minimize any significant adverse environmental impacts described in the environmental analysis.

The OGV Clean Fuel Regulation reduces the risk from exposures to diesel PM and helps to fulfill the goals of the Diesel Risk Reduction Plan, the State Implementation Plan, and the Goods Movement Emission Reduction Plan. Implementation of the OGV Clean Fuel Regulation is reducing emissions of directly-emitted diesel PM, NOx, SOx; and secondarily-formed PM from NOx and SOx. ARB staff is proposing amendments to the OGV Clean Fuel Regulation to adjust the offshore regulatory boundary in Southern California to lessen the potential for vessels to interfere with operations at the United States (U.S.) Navy's Point Mugu Sea Range. In addition, the proposed amendments

will help to reestablish the emission reductions from the regulation and help facilitate a successful transition to very low sulfur fuels by aligning implementation dates more closely with recently approved federal requirements. As indicated in the above paragraph, compliance with the proposed amendments may result in impacts to other environmental media, such as biological resources, and ARB is employing an adaptive management approach to mitigating impacts associated with potential adverse impacts. A more detailed discussion in included in this analysis in Section F.

CEQA also requires that a "No Project" Alternative be evaluated, which would mean that the proposed amendments would not be implemented. Alternatives to the proposed amendments, including a "No Project" alternative, were discussed previously in Chapter III of this report. Implementation of the "No Project" alternative was rejected because the adverse impacts of this alternative would be that a majority (and potentially even a greater percentage in the future) of vessel traffic coming into the POLA and POLB would use the Outer Route resulting in greater emissions and a significant adverse impact on Point Mugu Sea Range Operations. We would also miss an opportunity to make adjustments to the Phase 2 schedule that is appropriate given our experience in implementing Phase 1. Section G of this chapter presents three additional potential alternative compliance methods which are characterized as routing scenarios. ARB staff has concluded that there are no alternative means of compliance with the requirements of H&S section 39666 that would result in equivalent or greater diesel PM emission reductions at a lower cost.

B. Baseline

For the purposes of this environmental analysis, the physical environmental conditions that existed at the beginning of ARB's informal rulemaking process to develop the proposed amendments constitute the environmental setting or "baseline" for purposes of analyzing whether the proposed amendments will result in significant adverse environmental effects. Work on the proposed amendments began in 2010 so the environmental baseline for purposes of ARB's analysis are conditions as they existed in 2010. Based on data supplied by the U. S. Navy, by early 2010, approximately 50% of the vessel traffic going to and from the POLA and POLB that historically had travelled within the Santa Barbara Channel had relocated to the Outer Route which was described previously in Chapter II. (U.S. Navy, 2010) For the baseline, it is assumed that all the relocated vessel traffic and any vessels that travel outside the regulated zone uses HFO with 2.5% sulfur content. All other traffic within the 24 nm regulatory zone uses the marine distillate fuels as required by the OGV Clean Fuel Regulation. In the analysis of the proposed amendments, it is assumed that 100% of the vessels will move back into the Santa Barbara Channel when they visit the POLB and POLA because the amendments will remove the financial incentive to use the Outer Route.

C. Methodology of Estimating Emissions

To estimate the emissions from OGV, ARB staff relied upon the methodology developed during the initial rulemaking for the OGV Clean Fuel Regulation. However, the emission inventory has been adjusted since that time and the changes are reflected in the emission inventory used for the development of the proposed amendments to the OGV

Clean Fuel Regulation. The adjustments to the emissions inventory include a number of minor revisions and corrections. These are: recoding the model to increase calculation speed, updating auxiliary engine information, updating ship routing, adding an adjustment factor to estimate the effects of the recession, and making improvements in the user interface of the model. These changes to the emission inventory are briefly described below and discussed in more detail in Appendix D. The updated inventory and emissions model, Marine Emissions Model, is also posted on ARB's website at http://www.arb.ca.gov/ports/marinevess/ogv/ogv1085.htm. (ARB, 2011b)

Updated Auxiliary Engine Information

The inventory for the original OGV Clean Fuel Regulation rulemaking, referred to as the 2008 OGV Inventory, relied on the average auxiliary engine power from the 2005 ARB Ocean Going Vessel Survey for estimating the emissions for auxiliary engines. In the updated inventory, referred to as the 2011 OGV Inventory, ARB staff used additional sources of information for auxiliary engine power in the emissions estimates. Approximately 60% of ship auxiliary engine power ratings are now based on auxiliary power generation capacity from the Lloyds-Fairplay PC Register database (2007). Another 15% of ships have auxiliary engine power ratings from the POLA and POLB vessel boarding program, and the remaining ships utilize the average power ratings from the 2005 survey.

Updated Ship Routing

In both the 2008 OGV Inventory and the 2011 OGV Inventory, vessel routing between ports assumes that ships will take the shortest route between origin and destination on the vessel traffic network.

For the 2011 OGV Inventory, minor adjustments to the shipping lane network have been made to ensure that vessel routes conform to known transit routes, such as in the Santa Barbara Channel. Vessel routes were verified with automated instrumentation system (AIS) ship data to the extent possible. Additionally, in the 2011 OGV Inventory, tankers travelling to and from Northern and Southern California are routed further away from shore, to conform to existing practice.

Other Revisions and Corrections

The coding for the 2011 OGV Inventory was updated to improve performance and reduce processing time. A number of minor corrections and refinements were also made. These include calculating low load adjustment factors rather than using a lookup table, implementing Tier 1 IMO NOx standards for auxiliary and propulsion engines based on ship age, excluding cruise ships from low load adjustments, and an improved graphic user interface for the model. The emissions model was also updated to calculate the benefits of the San Pedro Bay Ports 20 and 40 nm vessel speed reduction (VSR) programs, including revised compliance rates for the years after 2006. Finally, the model was updated to account for the benefits of the North American ECA.

Recession Adjustment

The impact of the recession on net registered tonnage was estimated in August, 2009 from California port calls and Twenty-foot Equivalent Unit (TEU) data spanning January 1, 2006 through July 31, 2009. Partial year totals for 2009 were scaled to the whole year. These totals were checked in 2011 with the final totals for 2009 and 2010.

To forecast activity following the recession, staff developed three recovery scenarios to encompass the possible rate of growth ("fast", "slow", and "average"). The fast recovery scenario assumed that total activity would return to projected historically average levels in 2017 and then grow at the historical average rate. A return to trend by 2017 was based on the Congressional Budget Office forecast which indicated that real gross domestic product at a nationwide level will converge with potential gross domestic product trends no later than 2015. This forecast was modified with the assumption that California's recovery will lag the nation by several years, yielding the 2017 recovery date assumed for the fast recovery scenario. For the slow recovery scenario, staff assumed that activity would be permanently depressed relative to historical levels, but continue to grow at the growth rate in the 2009 San Pedro Bay Ports Forecast Update beginning in 2011. (San Pedro Bay, 2009) The average scenario is the average of the fast and slow scenarios.

The impact of the recession on net registered tonnage in 2009 was estimated from port call and TEU data spanning January 1, 2009 through July 31, 2009 and scaling the results to the entire year. These totals were then checked at the beginning of 2011 with the final totals from 2009 and 2010.

Given the uncertainty in forecasting emissions after such a deep recession, staff relied on the average recovery scenario. This scenario, for the years of interest for these regulatory amendments, is also supported by the most recent San Pedro Bay forecasts.

Comparison of Emissions Estimates

Table IV-1 and IV-2 provide a comparison between the 2008 OGV Emission Inventory and the 2011 OGV Emission Inventory for the years 2006, 2010, 2015, and 2020. To allow for comparison, the emission estimates in each table reflect the same assumptions for program implementation, in this case only the 2007 Shore Power Regulation and the 20 nm POLB and POLA VSR program at 2006 compliance levels are included in the projections.

Table IV-1: OGV Statewide Emission Inventory based on the 2008 OGV Emission Inventory Methodology

2008 Ocean Going Vessel Inventory (100 nm)						
Tons/Day						
Year	CO2	NOx	PM10	PM2.5	ROG	SOx
2006	10,140	230	21.1	20.6	9.0	160
2010	11,750	270	24.7	24.1	10.5	190
2015	13,870	330	29.6	28.9	12.7	225
2020	16,950	400	36.6	35.7	15.8	275

Table IV-2: OGV Statewide Emission Inventory based on the 2011 OGV Emission Inventory Methodology[13]

2011 Ocean Going Vessel Inventory (100 nm)						
Tons/Day						
Year	CO2	NOx	PM10	PM2.5	ROG	SOx
2006	10,530	230	21.8	21.2	9.6	170
2010	9,490	210	19.8	19.3	8.8	150
2015	12,400	290	26.4	25.6	11.8	200
2020	15,760	370	33.9	33.0	15.3	260

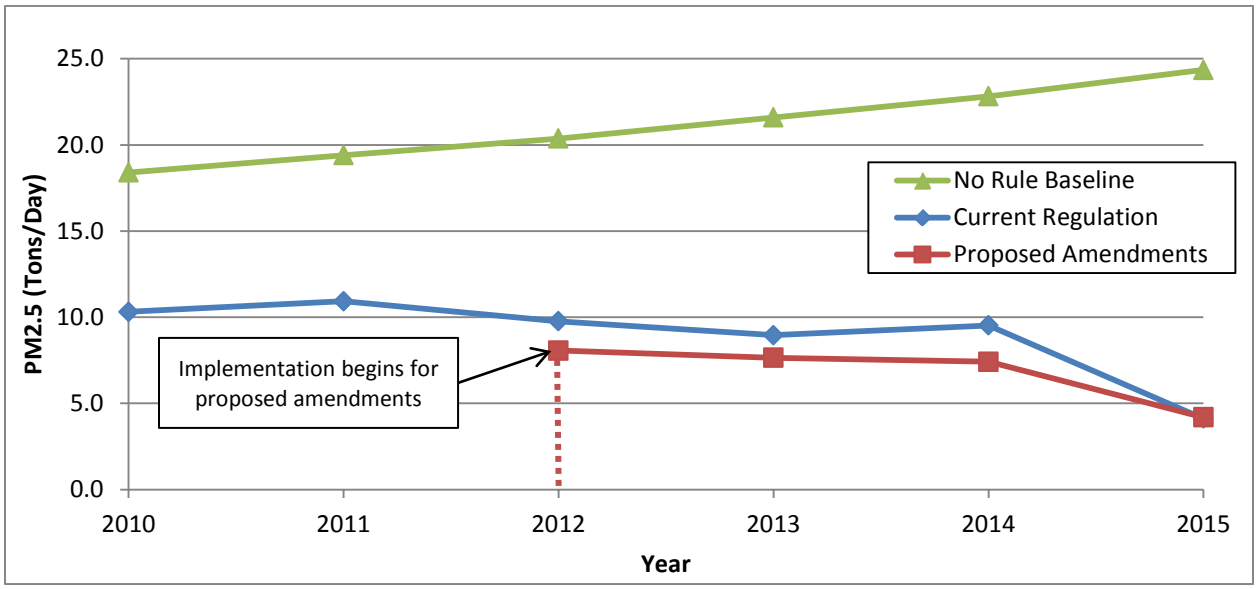
Because the recession did not officially begin until late 2007, a comparison between the emission inventories for 2006 provide an indication of the impacts of the updates to the ship routing, power assumptions for auxiliary engines, and the low load adjustment factor. As can be seen, these changes had a minor impact on the emissions estimates, in most cases the emissions increases are less than 5%. However, for the years 2010 through 2020, it is clear that the recession is having a significant impact on the projected emissions of OGV, reducing emissions by about 20% in 2010 and 10% in 2015 relative to what was expected in the 2008 OGV Emission Inventory.

D. Emission Impacts from the Proposed Amendments

With the proposed amendments, statewide emissions of PM and SOx from OGV will continue to decline and will be lower than what would be expected without the amendments. Statewide, the emissions of PM and SOx will decrease about 30% between 2012 and 2014. This is shown graphically in Figures IV-1 and IV-2 and numerically in Tables IV-3 and IV-4.

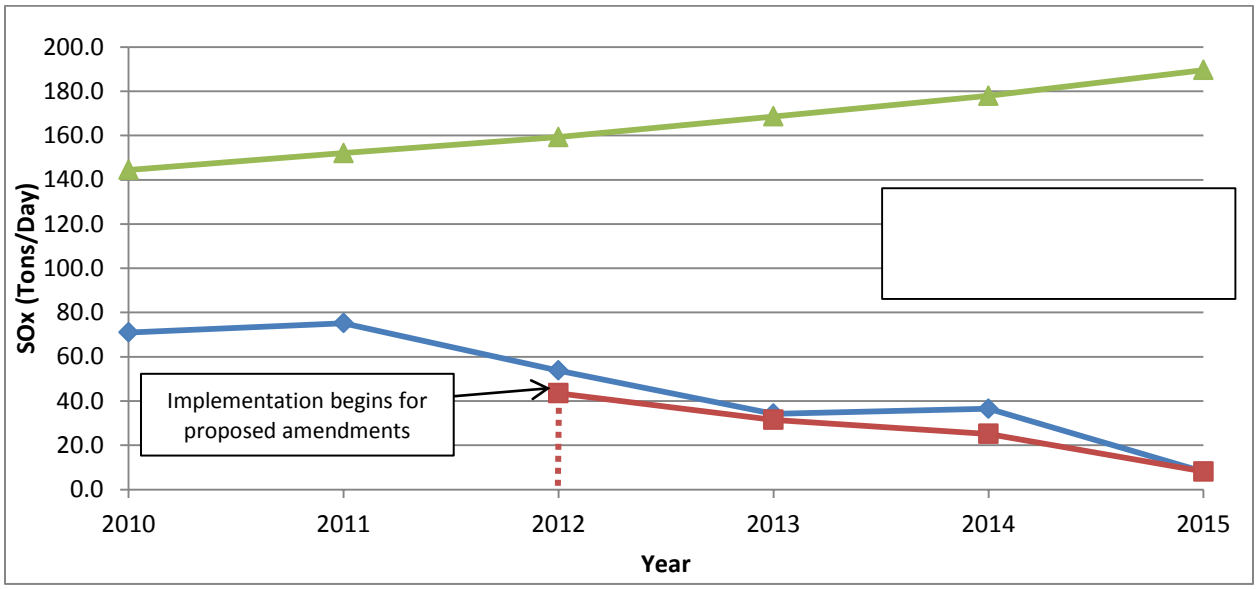
[13] The emissions estimates shown in Table IV-4 include the impacts of the 0 to 20 nm POLA and POLB VSR program, but do not include the impacts of the POLA and POLB 20 to 40 nm VSR program. Therefore, the estimates in Table IV-4 are higher than the estimates provided for 2010 in Table II-3 where the emission reducing impacts of both the 0 to 20 and the 20 to 40 nm VSR programs are included in the estimates.

Figure IV-1: Estimated Statewide OGV PM2.5 Emissions (100 nm)*



*All scenarios use the updated inventory to reflect the impacts of the recession. The current regulation and proposed amendments include impacts from the ECA.

Figure IV-2: Estimated Statewide OGV SO_x Emissions (100 nm)*



*All scenarios use the updated inventory to reflect the impacts of the recession. The current regulation and proposed amendments include impacts from the ECA.

Table IV-3: Estimated Statewide OGV Emissions (Tons/Day) with Current Regulation (100 nm)*

Pollutant	Year					
	2010	2011	2012	2013	2014	2015
SO_x	71	75	54	34	36	8
PM2.5	10.3	10.9	9.8	9.0	9.5	4.1
NO_x	198	209	215	228	241	257
CO_2	8,760	9,060	9,360	9,970	10,570	11,170

*Uses the updated inventory, assumes 0.5% sulfur distillate fuel until 2012 and 0.1% sulfur after 2012.

Table IV-4: Estimated Statewide OGV Emissions (Tons/Day) with Proposed Amendments (100 nm)*

Pollutant	Year					
	2010**	2011**	2012	2013	2014	2015
SO_x	--	--	44	32	25	8
PM2.5	--	--	8.1	7.6	7.4	4.1
NO_x	--	--	219	232	246	262
CO_2	--	--	9,360	9,970	10,570	11,170

*Uses the updated inventory, assumes 0.5% sulfur distillate fuel until 2012, 0.3% sulfur distillate fuel for 2012-2013 and 0.1% in 2014 and after.
**Implementation is anticipated to begin in 2012 for proposed amendments.

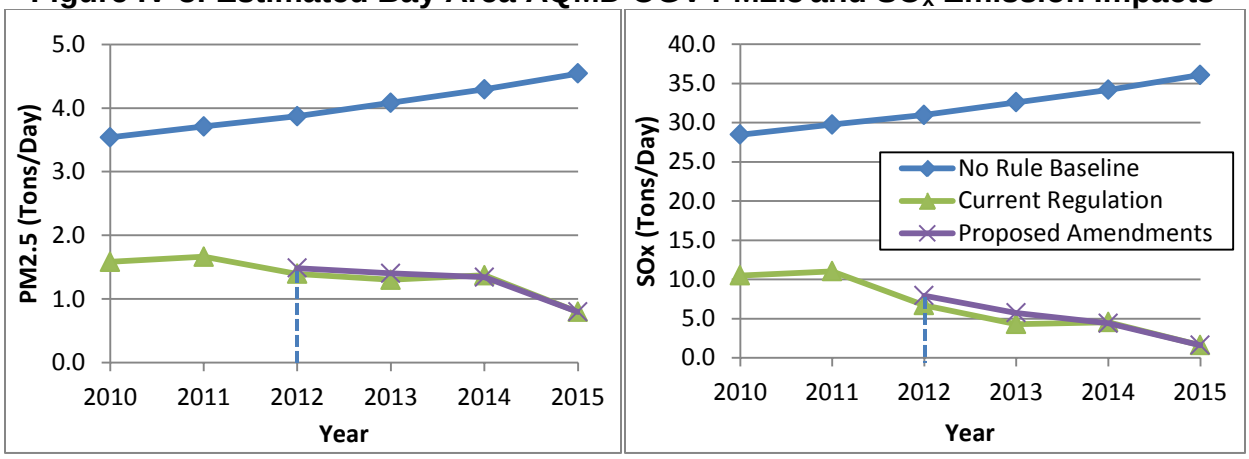
It should be noted that there is an anomaly in the emissions comparisons due to the 100 nm boundary for the inventory and the fact that when vessels use the Outer Route there is a small region where they travel outside the inventory boundary. In other words, when OGV use the Outer Route, the emissions associated with the route that occur outside the inventory boundary are not reflected in the inventory. Because the use of the marine distillate fuels result in only a 5-6% difference in NOx emissions, this anomaly is most apparent in the emissions for NOx. Hence, as can be seen in Tables IV-3 and IV-4, it would appear that there is actually an increase in NOx when the vessels use the Channel Route. However, if the emission inventory boundary were increased beyond 100 nm, the comparison between the current regulation and the proposed amendments would reflect a small decrease in NOx emissions with the proposed amendments.

Regional Emissions Impacts

ARB staff also investigated the impacts of the proposed amendments on the emissions in several coastal districts that are impacted by OGV emissions including the Bay Area Air Quality Management District (AQMD), the Ventura Air Pollution Control District (APCD), Santa Barbara APCD, San Diego APCD, and the South Coast AQMD. As shown in Figures IV-3 through IV-7, similar to the impacts Statewide, emissions of PM

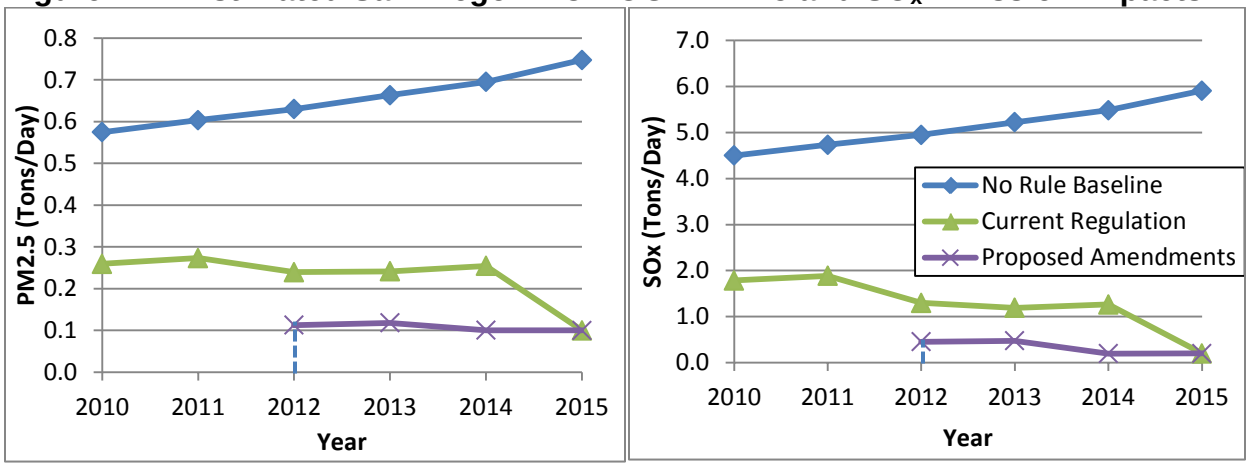
and SOx from OGVs will continue to decline over the next four years and in most all cases will be lower than what would be expected without the amendments. However, in the Bay Area AQMD there are two years, 2012 and 2013, where there is a small loss in projected PM2.5 and SO_x emission reductions with the proposed amendments when compared to the projected emissions under the current regulation. The same is true for the South Coast AQMD in 2013. In both regions, emissions continue to decline over time, however, under the proposed amendments they do not decrease as quickly as anticipated with the current regulation. This is discussed further after the figures below.

Figure IV-3: Estimated Bay Area AQMD OGV PM2.5 and SO_x Emission Impacts*



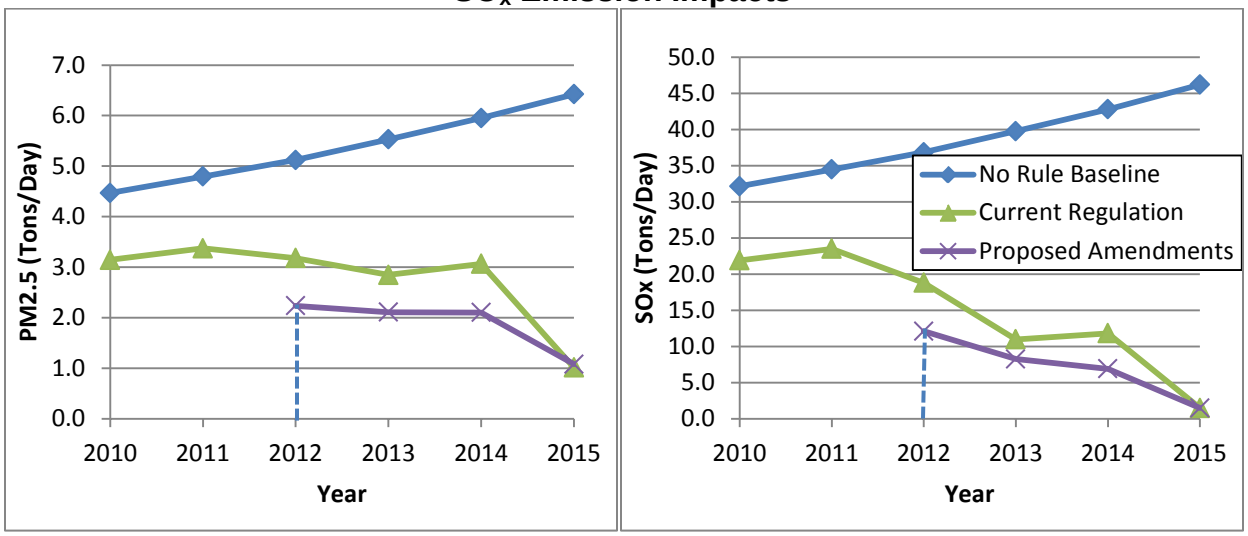
*All scenarios use the updated inventory to reflect the impacts of the recession. The current regulation and proposed amendments include impacts from the ECA. Implementation is anticipated to begin in 2012 for proposed amendments.

Figure IV-4: Estimated San Diego APCD OGV PM2.5 and SO_x Emission Impacts*



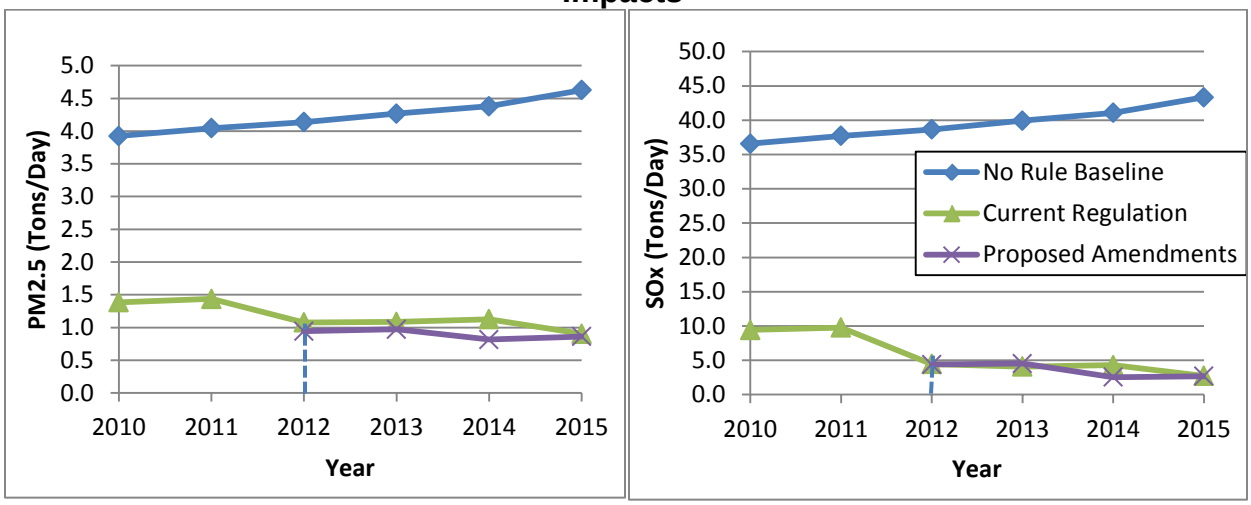
*All scenarios use the updated inventory to reflect the impacts of the recession. The current regulation and proposed amendments include impacts from the ECA. Implementation is anticipated to begin in 2012 for proposed amendments.

Figure IV-5: Estimated Santa Barbara County APCD OGV PM2.5 and SO_x Emission Impacts*



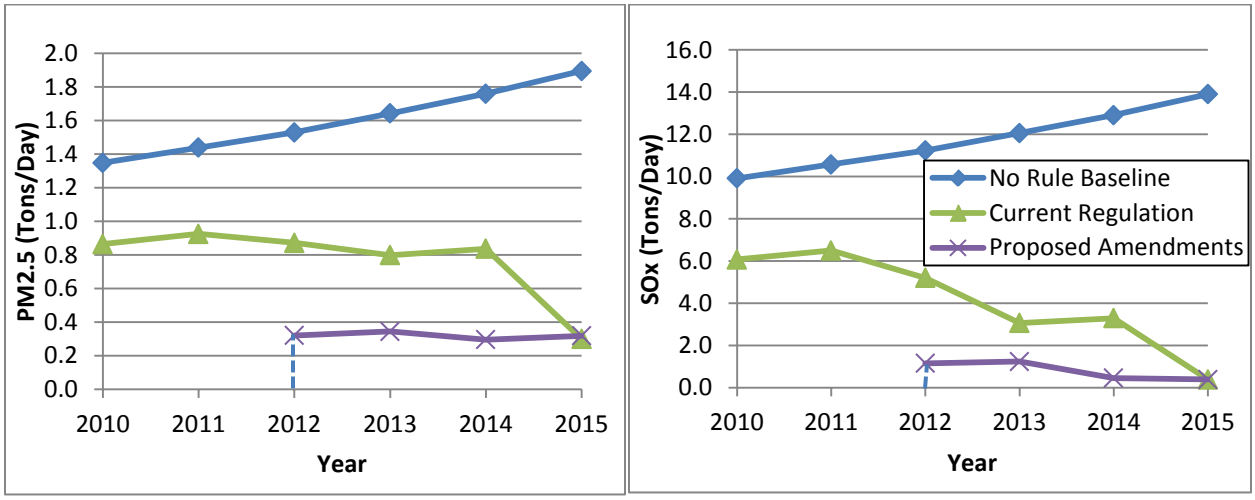
*All scenarios use the updated inventory to reflect the impacts of the recession. The current regulation and proposed amendments include impacts from the ECA. Implementation is anticipated to begin in 2012 for proposed amendments.

Figure IV-6: Estimated South Coast AQMD OGV PM2.5 and SO_x Emission Impacts*



*All scenarios use the updated inventory to reflect the impacts of the recession. The current regulation and proposed amendments include impacts from the ECA. Implementation is anticipated to begin in 2012 for proposed amendments.

Figure IV-7: Estimated Ventura AQMD OGV PM2.5 and SO_x Emission Impacts*



*All scenarios use the updated inventory to reflect the impacts of the recession. The current regulation and proposed amendments include impacts from the ECA. Implementation is anticipated to begin in 2012 for proposed amendments.

In both the South Coast AQMD and the Bay Area AQMD, emissions of SOx and PM2.5 from OGVs will continue to decline in future years with the proposed amendments. The resulting emissions in future years are far lower than what was originally anticipated when the OGV Clean Fuel Regulation was adopted in 2008 ensuring that the public health and air quality benefits originally anticipated are preserved. For the Bay Area AQMD, the projected SOx emissions with the proposed amendments are 30% lower in 2012 than originally anticipated and 50% lower in 2013. For PM2.5, the projected PM25 emissions are about 20% lower in 2012 and 30% lower in 2013. In the South Coast AQMD, the projected SOx emissions in 2013 are over 40% lower than anticipated. This is due in part to the recession which has significantly affected the activity of OGVs and the adoption of the North American ECA.

As noted earlier, the proposed amendments will result in a small loss of future projected PM2.5 and SOx emission reductions for the South Coast AQMD in 2013 and the Bay Area AQMD in 2013 and 2014. As is shown in Table IV-5, for the South Coast, the proposed amendments will result in the loss of about 0.4 T/D of projected SOx emission reductions in 2013. For the Bay Area, as shown in Table IV-6, the foregone emission reductions of SOx are about 1.4 T/D in 2012 and 1.6 T/D in 2013 and 0.1 T/D of PM2.5 in 2012 and 2013. While the proposed amendments would not result in an increase in the emissions that currently exist, the foregone emission reductions in 2012 and 2013 in the San Francisco Bay Area and 2013 in the South Coast will be treated as an adverse environmental impact for the purposes of this analysis. However, as noted above, because the emission are much lower today than originally anticipated when the current regulation was adopted in 2008, the potential adverse environmental impacts have been significantly lessened.

Table IV-5: Estimated Statewide OGV SO_x Emissions in the South Coast AQMD (Tons/Day)*

Scenario	2010	2011	2012	2013	2014	2015
Baseline Inventory	36.6	37.7	38.6	39.9	41.1	43.3
2008 Adopted Rule	13.3	13.7	7.7	8.0	8.4	8.8
Current Rule	9.4	9.8	4.5	4.1	4.3	2.7
Proposed Amendments	--**	--**	4.4	4.5	2.5	2.7
Foregone Emission Reductions	N/A	N/A	N/A	0.4	N/A	N/A

Table IV-6: Estimated Statewide OGV PM2.5 and SO_x Emissions in the Bay Area AQMD (Tons/Day)*

PM2.5						
Scenario	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Baseline Inventory	5.1	5.2	5.3	5.5	5.6	5.8
2008 Adopted Rule	2.1	2.2	1.9	2.0	2.1	2.1
Current Rule	1.6	1.7	1.4	1.3	1.4	0.8
Proposed Amendments	--**	--**	1.5	1.4	1.3	0.8
Foregone Emission Reductions	N/A	N/A	0.1	0.1	N/A	N/A
SOx						
Scenario	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Baseline Inventory	28.5	29.8	31.0	32.6	34.2	36.1
2008 Adopted Rule	14.5	14.9	10.5	10.9	11.3	11.7
Current Rule	10.5	11.0	6.7	4.3	4.6	1.6
Proposed Amendments	--**	--**	7.9	5.7	4.4	1.6
Foregone Emission Reductions	N/A	N/A	1.2	1.4	N/A	N/A

*All scenarios in Tables IV-5 and IV-6 use the 2011 inventory adjusted for the recession except for the 2008 Adopted Rule Scenario, which uses the 2008 inventory used in the original rulemaking. The Baseline Inventory and 2008 Adopted Rule scenarios do not account for the ECA.
**Implementation is anticipated to begin in 2012 for proposed amendments.

Potential Greenhouse Gas Impacts

In development of the original rulemaking, an in-depth analysis was done to determine the potential greenhouse gas (GHG) impacts from the OGV Clean Fuel Regulation. (ARB, 2008) ARB contracted with Dr. James Corbett and Dr. James Winebrake of Energy and Environmental Research Associates to do a study of the total fuel-cycle emissions. The study can be found in Appendix H of the 2008 Staff Report. Their analysis estimated the total fuel cycle for CO_2 and SO_x emissions associated with fuel extraction, fuel processing, fuel distribution, and fuel consumption. To estimate the emissions at each stage, they used a modification of the peer-reviewed Total Energy & Emissions Analysis for Marine Systems (TEAMS) model, which was originally based on Argonne National Laboratory's, GREET model (Greenhouse Gases, Regulated

Emissions, and Energy Use in Transportation). The TEAMS model was modified to allow analyses for the particular set of fuels under study.

Corbett and Winebrake estimated that requiring a switch from residual fuel to the distillate fuels specified in the regulation would correspond to a net increase in CO_2 emissions of approximately 1 to 2 percent over the total fuel cycle (and an 86 to 97 percent decrease in SO_x emissions). This slight increase in net fuel-cycle CO_2 emissions is primarily a function of the increased energy required at refineries that produce compliant distillate fuels. This offsets the localized decrease in CO_2 emissions from ship operations (fuel combustion) in California due to the higher energy content of the distillate fuel, as compared to HFO. But this study assumes that refineries will make no efforts to improve energy efficiency while maintaining, upgrading, or expanding their capacity to produce distillate fuels. This is unlikely given rising energy costs and global efforts to reduce GHG.

The proposed amendments will result in OGV using slightly more marine distillate fuels relative to what is being used now. However, as seen in Tables IV-3 and IV-4 this small change does not impact the OGV CO_2 emissions. As noted above, the net increase in GHG emissions attributed to the OGV Clean Fuel Regulation described in the previous paragraphs is largely attributed to the refining process. ARB staff believes the small increase in the use of marine distillate fuels under the proposed amendments will have a negligible impact on the production of fuel, thus the results of the study are still relevant. An increase of 1 to 2 percent over the total fuel cycle is still applicable to the proposed amendments.

E. Public Health Impacts

With the proposed amendments, the OGV Clean Fuel Regulation will continue to provide significant health benefits by reducing premature mortality from PM2.5 exposure and localized potential cancer risk from diesel PM. Because the proposed amendments reduce projected emissions to levels below the 2008 adopted regulation, the implementation of the proposed amendments will have similar public health benefits to the original rule. Extensive modeling was conducted when the OGV Clean Fuel Regulation was originally adopted and demonstrated that upon implementation, the OGV regulation will avoid about 3,600 premature deaths between 2009 and 2015 associated with the reduction in PM.[14] (ARB, 2008) Since the baseline emissions have decreased due to recession-related decreases in vessel calls, the magnitude of the premature deaths avoided that would be attributed to the adopted or proposed amended rule would not be as great as identified above. However, the avoided premature deaths due the adopted regulation with the proposed amendments will remain substantial. Moreover, as the economy rebounds, a greater percentage of the premature deaths avoided will be because of the rule, not the recession.

[14] The methodology for estimating premature deaths was updated since the release of the estimate made in 2008. The basis of the updated methodology is the same as that of the U.S. EPA (U.S. EPA, 2010) which relies on the study by Krewski et.al. (Krewski, 2009) The application of the U.S. EPA method to the proposed amendments would result in a small increase (approximately 3%) in the number of premature deaths avoided compared to the estimate made in 2008.

F. Other Environmental Impacts

In this section, ARB staff provides a discussion of other environmental impacts from the proposed amendments including potential impacts on water quality, biological impacts, and oil spills. Since the regulation relies on the existing infrastructure which is operating at a lower level than prior to the recession, no new facilities, expansion of existing facilities, or changes in operations from the status quo are likely to occur due to the proposed amendments. Therefore, ARB staff finds that there will be no adverse impacts on aesthetics, land-use/planning, population and housing, transportation, agricultural and forestry resources, cultural resources, hazards and hazardous materials, mineral resources, public services, utility and service systems, geology and soils, hydrology and water quality, or recreation.

Potential Water Quality Impacts

ARB staff does not expect these proposed amendments to have any adverse impacts on water quality. The proposed amendments to the OGV Clean Fuel Rule apply only to the fuel being used by the vessels. The proposed regulation's requirements, particularly the reduction in sulfur content of the engine fuels, should result in reduced formation of sulfuric acid, nitric acid and other harmful compounds to the extent the vessel emissions actually come into contact with ocean or inland waters. And because scrubbers and other exhaust treatment technologies are not allowable methods of compliance with this proposal, there are no impacts that might otherwise result from the byproducts of such methods (e.g., ash, salts, heavy metals from catalytic oxidizers, etc.).

Biological Impacts

The Southern California Bight (SCB) is a coastal region of unique oceanographic conditions, marine ecosystems, and biodiversity. The SCB extends from Point Conception in Southern California to Cabo Colonett and Bahia de San Quintin in Baja California. Habitats within Southern California's ocean ecosystem contain some of the most biologically diverse natural communities in the world. NOAA and other marine groups have carefully assessed the population of marine wildlife in Southern California.

The 2008 staff report provided an in depth analysis which examined, at length, biological impacts to marine mammals due to ship strikes, the acoustic impacts of vessels on marine mammals, and the changes in risks of oil spills. (ARB, 2008) In this report, only derivations from the discussion in the 2008 staff report due to vessels returning to the Channel Route in the Santa Barbara Channel will be discussed in the following sections.

Risk of Marine Mammal Ship Strikes

The highest risk of ship strikes is to large mammals that are too large to move out of the way of the vessels in time. There are at least 34 species of cetaceans (marine mammal) that have been identified in the Southern California Bight. The most common species of large whales found in the region are blue, fin, humpback, gray, and sperm whales. All of these species, except for gray whales, are listed as endangered under

the U.S. Endangered Species Act (ESA) (16 U.S.C S 1531). Additionally, all marine mammals are protected by the Marine Mammal Protection Act (MMPA 1972, amended 1994, 16 U.S.C. S 1431).

During the development of the OGV Clean Fuel Regulation, ARB staff worked with NOAA staff to investigate the potential impact on marine mammals if vessels chose to avoid the Santa Barbara Channel and instead transit on the Southern side of the Channel Islands. At that time, based on the available data of population densities of blue, fin, humpback and sperm whales, the likelihood of ship strikes was similar or less if a ship did not use the Santa Barbara Channel. (ARB, 2008) Since that time, NOAA staff has been developing an analysis of the whale densities in the Santa Barbara Channel and south of the islands and correlating this information with the vessel routes south of the Channel Islands. Based on a preliminary analysis by NOAA, the whale density data suggests that there is a potential decreased risk to fin whales, a potential increased risk to humpback whales, and there is an unclear impact to blue whales if vessels return to the Santa Barbara Channel. Humpback whales have large concentrations on the northern end of the entrance to the Santa Barbara Channel. However, whale population densities shift from year to year and variations in the number of ship strikes can change annually depending on the concentrations of whales of a given year. (NOAA, 2010b) Based on this information, ARB staff believes that there is a potential for an adverse environmental impact to humpback whales from the proposed amendments. However, this impact existed before the regulation was adopted and is basically returning vessel traffic to the pre-regulation routes.

Effects of Vessel Noise on Marine Mammals

In 2009, ARB published a Supplemental Environmental Analysis and the results of that study are still relevant to these amendments. It was found that ship noises, from container ships, tankers and other large OGVs, are the dominant source of underwater frequencies below 300 Hz and are pervasive in areas of high ship traffic. While the sound produced by ships is unlikely to cause direct acute physical harm (for example, to the ear or internal organs), it could cause disruption in diving patterns or cause hearing loss, and it may interfere with or mask important communication signals from marine mammals whose vocalizations are in the low frequency range. The impacts of shipping noise on marine mammals are not clearly understood and research is ongoing, but the impacts could result in stress or behavior pattern changes in the animals. However, NOAA staff believes that if there are impacts from vessel noise, it is likely to be related to cetacean population densities. Population densities of large whales can vary on an annual basis as migration patterns change. As a result, the impacts from vessel noise can change each year as the population densities of whales shift. Since, as shown earlier, the population densities of humpback whales are generally higher in the Santa Barbara Channel; this may create a potential adverse impact to humpback whales. However, with ships moving back into the Channel there would be a beneficial impact to fin whales.

Oil Spills Due to Ship Collisions or Groundings

Substantial volumes of petroleum products are transported off the California Coast from Alaska, foreign countries and between California production sources. POLA and POLB include some of the highest volume oil transfer facilities in the United States. Collisions or ship groundings can occur as a result vessels transiting to and from these facilities. While oil spills are disastrous any place that they occur, there are several programs and practices in place in the case of an oil spill in the Santa Barbara Channel. To prevent collision and potential spills, there are traffic separation lanes in the Santa Barbara Channel for northbound and southbound vessels to travel. This helps to organize vessels to ensure that there is less of a chance of collision or running aground. Vessels traveling southbound in the Channel will generally pass within three miles of the Santa Cruz and Anacapa Islands. Vessels must have a contingency plan in place providing for a response team being on the scene within six hours of a spill. Each contingency plan must be exercised and tested annually. (OSPR, 2009) There are no traffic lanes set up south of the Channel Islands. If a spill occurs, response time is longer because the vessels are farther out from the response facilities, and there is no requirement to have a contingency plan in place.

In 1992, major oil companies, members of the Western States Petroleum Association (WSPA), entered into a voluntary, non-binding agreement, with the guidance of Office of Spill Prevention and Response (OSPR) and the U.S. Coast Guard, to route all tankers carrying crude oil from Alaska to California ports at least 50 nm offshore. This agreement has resulted in approximately 90 percent of all tanker traffic transiting at least 25 nm offshore and approximately 50 percent transiting at least 50 nm offshore. As a result of this agreement, many of the tankers using the Ports of Los Angeles and Long Beach travel through the Point Mugu Sea Range in Southern California. (ARB, 2009) ARB does not expect the traffic patterns of oil tankers to change as a result of the amendments. Before the original implementation of the regulation, oil tankers traversed the Point Mugu Sea Range to stay as far out as long as possible. As a result, there should be no adverse environmental impacts from oil spills due to the proposed amendments.

G. Reasonably Foreseeable Environmental Impacts as a Result of Potential Compliance Methods

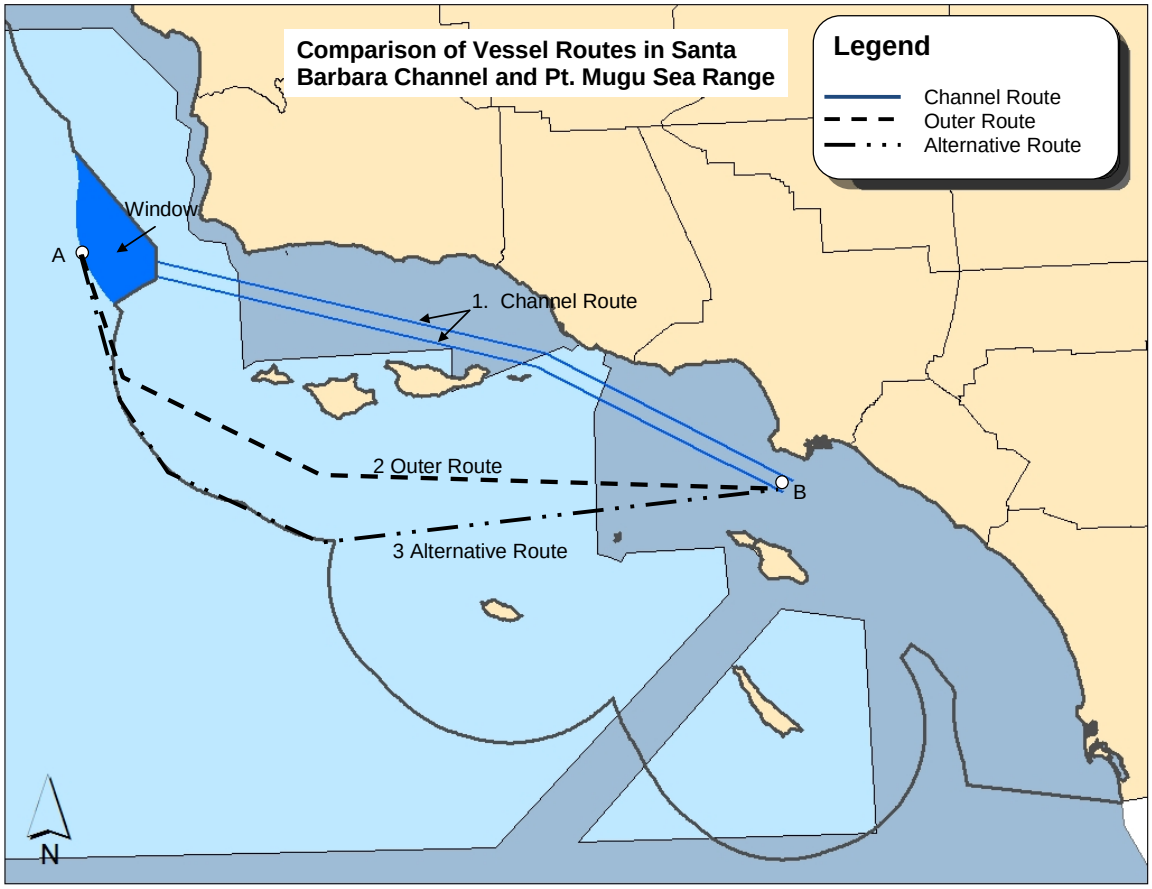
The goal of the proposed amendments is to remove the financial incentive for vessels to avoid using the Channel Route. Because of this, ARB staff believes that once the proposed amendments are implemented, OGV operators will return to using the Channel Route instead of the Outer Route. However, in the event this does not occur, ARB staff evaluated the environmental impacts of three possible alternative compliance methods. These include:

- 75% of the vessels transit in the Channel Route and 25% continue to transit in the Outer Route;
- 75% use the Channel Route and 25% of vessels use an alternative route (Alternative Route), further offshore to minimize the amount of marine distillate fuels required; and

- 100% of vessels use the Alternative Route.

The routes analyzed can be seen below in Figure IV-8. The Outer Route is shown as the dashed line and the Alternative Route is the dot and dashed line. Route #3 is a new Alternative Route that could be used if vessel operators want to minimize the time a vessel must operate on the marine distillate fuel. This route would follow the contour of the contiguous zone and ships would use HFO for as long as possible before they must switch to distillate fuel to transit the clean fuel zone. It is labeled as the Alternative Route in the following tables and charts.

Figure IV-8: Possible Southern California Shipping Routes



Using the methodology described earlier in Chapter II, ARB staff evaluated the costs, travel time, and distance associated with the Outer Route, Alternative Route and the Channel Route. As can be seen in Table IV-7, both the Outer Route and the Alternative Route have higher costs, longer overall travel distance, and longer travel time compared to the Channel Route. Therefore, there is no cost or time advantage to using either of these routes.

Table IV-7: Estimated Fuel Costs, Distance and Transit Time for Channel, Outer, and Alternative Routes through the Santa Barbara Channel Region with the Proposed Amended Zone

Route	Cost	Distance HFO (nm)	Distance MGO (nm)	Total Distance (nm)	Time (hours)
Channel Route (#1, Solid)	$13,870	16	132	148	9.6
Outer Route (#2, Dashed)	$14,140	19	143	162	10.5
Alternative Route (#3, Dot Dashed)	$14,330	83	90	173	11.1

Scenario #1: 75% of Vessels Use Channel Route, 25% Use Outer Route

Impact on Emissions: For this scenario, ARB staff assumes that 75% of the vessels will travel in the Channel Route but 25% will choose to transit further offshore in the Outer Route. The emissions impacts for this scenario are presented below in Table IV-8. Emissions of SOx and PM2.5 are essentially equivalent relative to the expected emissions if all vessels use Channel Route (presented previously in Table IV-4). NOx and CO2 emissions also remain unchanged.

Table IV-8: Estimated Statewide OGV Emissions (tons/day) with 25% Transit Along the Outer Route

Pollutant	Year			
	2012	**2013**	**2014**	**2015**
SO_x	44	31	25	8
$PM_{2.5}$	8.1	7.6	7.4	4.1
NO_x	216	229	242	259
CO_2	9,400	9,930	10,380	11,150

Impact on Marine Mammals: Using the whale density information from NOAA discussed in the previous section, the 25% of vessels choosing to use the Outer Route could potentially present an adverse environmental impact to fin whales south of the Channel Islands. This change in traffic could result in a decreased risk to humpback whales in the Santa Barbara Channel. There is little impact on blue whales.

Impact on Risk of Oil Spills: An analysis of the risk from oil spills was done in the 2009 EIR Study. In 2002, a taskforce sponsored in part by the U.S. Coast Guard and OSPR issued recommendations to reduce the risk of vessel collisions or drift groundings off the U.S. West Coast. The project addressed four risk factors most amenable to change, including vessel distance offshore. The recommendations regarding the

distance offshore risk factor indicated that higher risks were generally within 25 miles from land along the West Coast of California. The workgroup found that vessels transiting within the higher risk areas have a greater potential for grounding than if they transited further offshore. The workgroup also found that for consistency with existing agreements, where there are not other prevention agreements, tank ships laden with crude oil or other petroleum cargo, transiting coastwise should voluntarily stay within a minimum distance of 50 nm offshore. Based on this assessment, it can be determined that there is no adverse impact if vessels choose to use the Outer Route.

Scenario #2: 75% of Vessels Use Channel Route, 25% Use Alternative Route

For this scenario, ARB staff assumes that 75% of the vessels will travel in the Channel Route but 25% will choose to transit further offshore in the Alternative Route. Because a significant portion of the Alternative Route is outside the Contiguous Zone using this route would minimize the distance where the vessel would need to operate on marine distillate fuel. As shown in Table IV-7, while the Alternative Route is about 25 nm longer, vessels using the Alternative Route would operate on marine distillate fuels for about 90 nm whereas vessels using the Channel Route would operate on marine distillate fuels for about 130 nm. However, transiting this route would take approximately an hour and a half longer to traverse than the Channel Route.

Impact on Emissions: The emissions impacts for this scenario are presented in Table IV-9. A portion of the Alternative Route is located outside of the 100nm inventory zone. As a result, the emissions have to be adjusted to account for Scenario #2. ARB staff estimated that for this scenario there was approximately a 5% increase in emissions attributed to the portion outside of the inventory zone compared to Table IV-4.

Table IV-9: Estimated Statewide OGV Emissions (tons/day) with 25% Transit Along the Alternative Route

Pollutant	Year			
	2012	2013	2014	2015
SO_x	46	33	26	8
$PM_{2.5}$	8.4	8.0	7.8	4.3
NO_x	222	235	249	266
CO_2	9,690	10,240	10,700	11,380

Impact on Marine Mammals: Similar to the discussion for the first scenario, based on the whale density information from NOAA, the 25% of vessels choosing to use the Alternative Route could potentially present an adverse environmental impact to fin whales south of the Channel Islands. This change in traffic could also result in a decrease in risk to humpback whales. There is little impact on blue whales.

Impact on Risk of Oil Spills: As discussed in the previous section, when vessels move further out from shore it lowers the risk factor of vessels coming aground. The Alternative Route takes vessels further out than the Outer Route. As such, there would

be no harmful environmental impacts related to oil spills if ships choose to traverse the Alternative Route.

Scenario #3: 100% of Vessel Use Alternative Route

The third scenario evaluated assumed that all the vessels that historically used the Channel Route would choose to transit using the Alternative Route.

Impact on Emissions: The emissions impacts for this scenario are presented in Table IV-10. A portion of the Alternative Route is located outside of the 100nm inventory zone. As a result, the emissions have to be adjusted to account for this scenario. ARB staff estimated that for Scenario #3 there was approximately a 15% increase in emissions attributed to the portion outside of the inventory zone compared to Table IV-4.

Table IV-10: Estimated Statewide OGV Emissions (tons/day) with 100% Transit Along the Alternative Route

	Year			
Pollutant	**2012**	**2013**	**2014**	**2015**
SO_x	52	36	30	8
$PM_{2.5}$	9.3	8.6	8.5	4.4
NO_x	224	238	252	268
CO_2	9,960	10,520	10,970	11,660

Impact on Marine Mammals: Based on NOAA whale density data, this scenario could also potentially result in increased risks to fin whales south of the Channel Islands and decrease the risk to humpback whales. There is little impact on blue whales.

Impact on Risk of Oil Spills: As discussed in the previous section, when vessels move further out from shore it lowers the risk factor of vessels coming aground. The Alternative Route takes vessels further out than the Outer Route. As such, there would be no adverse environmental impacts related to oil spills if ships choose to traverse the Alternative Route.

Conclusions

The emissions impacts from scenario 1 are similar to the emissions when it is assumed the vessels use the Channel Route. For the other scenarios, in each case, the resultant emissions are higher than what would be projected if the vessels transited the Channel Route. However, in each case, the resultant emissions are less than the current and projected emissions for the OGV Clean Fuel Regulation without the proposed amendments (see Table IV-3). For these reasons, ARB staff does not expect any adverse environmental impacts from the emissions should vessel operators choose one of the alternative routes.

Based on the analysis presented above, if vessel operators choose to use either the Outer Route or the Alternative Route, ARB staff does not expect any adverse

environmental impacts related to oil spills. The use of the Alternative Route or the Outer Route may pose potential adverse environmental impacts to fin whales. In addition, the use of these routes could create operational issues for the U.S. Navy's Point Mugu Sea Range. However, ARB staff does not believe any of these alternative compliance methods will be attractive to vessel operators due to the higher costs and longer transit times. As previously shown in Table IV-7, transiting the Outer Route will cost approximately $270 more than the using the Channel Route and require an additional hour of travel time. Use of the Alternative Route will cost about $460 more and will take an hour and a half longer to travel. Because of this, ARB staff believes that transiting the Channel Route will be the preferred method of compliance.

H. Reasonably Foreseeable Mitigation Measures

In this section, ARB staff discusses reasonably foreseeable mitigation measures to address the potential adverse environmental impacts from the proposed amendments. As described earlier, with the proposed amendments statewide emissions of PM and SOx from OGV will continue to decline and also be lower than what would be expected without the amendments. However, the proposed amendments will result in a small loss of projected SOx emission reductions for the Bay Area AQMD and the South Coast AQMD. While the proposed amendments would not result in any adverse environmental impacts compared to the environmental conditions that currently exist, the foregone emission reductions in future years could be viewed as a significant adverse environmental impact. Additionally there is a potential for adverse impacts on humpback whales from potential vessel strikes when vessels transit the Channel Route instead of the Outer Route.

Potential Mitigation Measures for PM2.5 and SOx Emissions Adverse Environmental Impacts in the Bay Area AQMD and South Coast AQMD

The small foregone projected emission reductions in future years in the Bay Area AQMD and the South Coast AQMD are primarily due to the proposal to delay implementation of the Phase 2 requirements for two years. The only potential mitigation measure available to reduce the projected PM2.5 SOx emissions in the Bay Area AQMD and projected SOx emissions in South Coast AQMD is to implement the proposed amendments without the two year delay of Phase 2. However, ARB staff believes that the delay in the Phase 2 implementation date is necessary to provide:

- better alignment with the North American ECA,
- greater flexibility to find compliant fuels with higher viscosity, and
- additional time for the marine fuel industry to provide distillate fuels with properties that meet the enhanced specifications of the newly revised ISO 8217.

ARB staff believes that these considerations override any adverse environmental impacts that may result from the two-year implementation date delay.

Implement the proposed amendments, except keep the requirement to use the Phase 2 fuel in 2012

Under this mitigation measure, the proposed amendments would be implemented as proposed, except that the Phase 2 (0.1% sulfur) fuel would be implemented in 2012 rather than 2014. This option would result in additional reductions in PM and SOx in 2012 and 2013 compared to the proposal. However, as previously discussed in this staff report, ARB staff has concerns about the timing for implementation of the OGV Clean Fuel Regulation's Phase 2 requirement and believes there are valid reasons to delay the implementation date by two years. ARB staff believes that providing a two-year delay will help to ensure the successful implementation of the North American ECA's Phase 1 and a successful transition to the 0.1% sulfur fuels. This was discussed in detail in Chapter II and will be briefly summarized here.

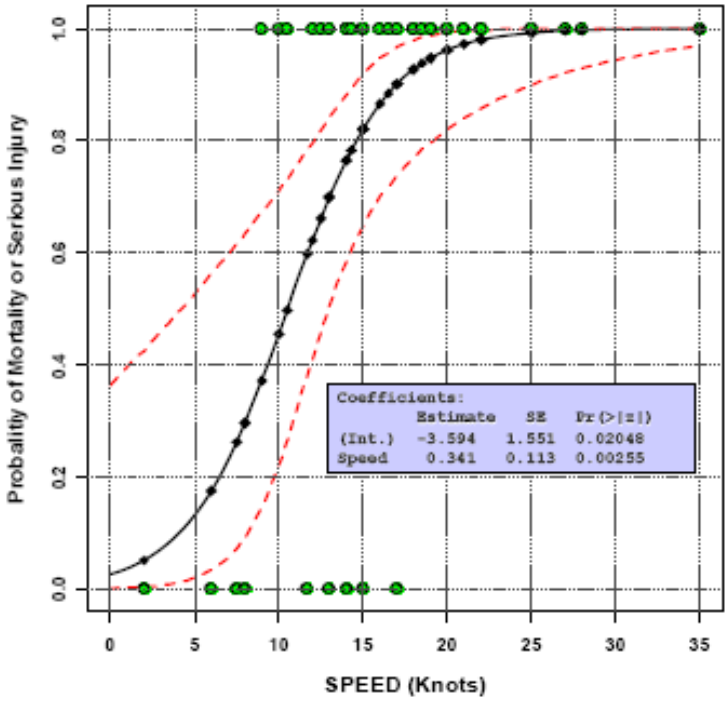
Under the OGV Clean Fuel Regulation, the Phase 2 (0.1%) sulfur requirement is scheduled to begin implementation on January 1, 2012. Later in that same year, the North American ECA's Phase 1 requirement to use 1% sulfur fuel begins implementation. Because of this, ARB staff believes it is appropriate to adjust the implementation timeline for the OGV Clean Fuel Regulation's Phase 2 requirements (0.1% sulfur beginning January 1, 2012) to more closely align with the Phase 2 North American ECA requirement (0.1% sulfur beginning January 1, 2015).

In addition, ARB staff believes that shippers may be able to more easily locate fuels with higher viscosity levels during the extension of the Phase 1 requirements. As alluded to earlier, for vessels that have experienced LOP incidents related to the use of low sulfur distillate fuels, on-board management of fuel viscosity is a very important parameter. Because of this, ARB staff believes delaying implementation of the 0.1% sulfur limit by two years will provide more flexibility to acquire fuels with higher viscosity may help lessen the probability of operational difficulties. For all of these reasons, ARB staff does not believe it is feasible or appropriate to implement this mitigation measure, and that these considerations override any potential environmental impacts that may occur.

Potential Mitigation Measures for Adverse Environmental Impact to Humpback Whales

There are multiple mitigation efforts already in place to help reduce the risk of ship strikes on humpback whales. Ship speed is an important factor when it comes to the lethality of ship strikes to whales. Figure IV-9 below shows the relationship of ship speed and the mortality of whale strikes. As shown, as the speed of vessels increases there is an increase in the mortality rate. NOAA recommends that vessels greater than 300 gross tons slow to 10 knots during periods of high whale concentrations to reduce the mortality rate of ship strikes. Inside of the Santa Barbara Channel there are groups dedicated to the research and monitoring of whales and how traffic affects them. The Sanctuary Aerial Monitoring and Spatial Analysis or (SAMSAP) monitoring and sightings database provides nine years of sightings data. (NOAA, 2010) This project helps to alert vessel owners to whale densities and migrating patterns. This information could be used to help owners know when it would be best to slow down their vessel to help mitigate the threat of a lethal impact on a whale.

Figure IV-9: Relationship Between Vessel Speed and Probability of Mortality for Whale Strikes (ARB, 2009)



The POLA and POLB also have voluntary vessel reduction programs in place to offer incentives to vessels coming into port. To comply with the local programs vessels must travel at or below 12 knots within 20 nm or 40 nm depending on which incentives they want to obtain. In 2010, the POLA saw a 90% and 61% compliance rate at 20nm and 40nm, respectively. (POLA, 2011) In 2010, the POLB saw a 96% and 74% compliance rate at 20nm and 40 nm, respectively. (POLB, 2011) To comply with the voluntary speed reduction programs, vessel operators must begin slowing their vessels down while they are in the Santa Barbara Channel such that they are at the required speed when they at the 40 nm or 20 nm mark. This reduction in ship speeds will help to mitigate the potential risk to humpback whales when OGV use the Channel Route.

NOAA is proactive about warning mariners about whales in the Santa Barbara Channel. They work with the U.S. Coast Guard to include whale sightings in the Notice to Mariners. These Notices can be found on the U.S. Coast Guards website and are updated weekly. Vessel operators who observe live, injured or dead whales are encouraged to immediately notify NOAA with the position and time of the encounter. NOAA has an updated website that provides information to vessel operators about how to avoid whale ship strikes as well as a listing of current sightings of whales. This information is available at http://channelislands.noaa.gov/focus/alert.html.

ARB will also use an adaptive management approach to ensure any potential adverse environmental impacts to fin or humpback whale are avoided or mitigated. Whale strike data is collected and monitored by NOAA. In the event that the data indicates that there

is an increase in strikes, ARB staff will work with NOAA, the U.S. Coast Guard, the shipping industry, and others to identify appropriate solutions that mitigate the impact.

I. Environmental Justice

The ARB is committed to evaluating community impacts of proposed regulations, including environmental justice concerns. As noted previously, many communities experience elevated exposures to toxic and criteria pollutants emitted from the regulated vessels. Because of this, it is a priority of ARB to ensure that full protection is afforded to all Californians. The proposed amendments to the OGV Clean Fuel Regulation are not expected to result in significant negative impacts in any community. Rather, with the proposed amendments the OGV Clean Fuel Regulation will continue to ensure that PM, SOx, and NOx emissions from OGV continue to decline in future years, resulting in decreased exposures to these pollutants and lowering their associated potential health risks for all communities, particularly those located near the ports.

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V. ECONOMIC IMPACTS

In this chapter, we present the estimated costs and economic impacts associated with implementation of the proposed amendments to the OGV Clean Fuel Regulation. The costs presented are the estimated *incremental* costs relative to the baseline, which is the cost of industry compliance with the current OGV Clean Fuel Regulation, using current vessel traffic patterns.

The cost analysis will present the total cost over the expected life of the regulation, total annual cost, and the cost-effectiveness of the proposed regulation. The economic impacts associated with the costs of the proposed amendments are also presented for typical businesses that operate OGVs.

It should be noted that much of the cost associated with the proposal was accounted for in the original rulemaking. This is because the estimated cost of the original regulation assumed that vessel operators traveling to and from the Ports of Los Angeles and Long Beach would stay in the Santa Barbara Channel Route where use of the cleaner, low sulfur marine distillate fuel is required. Since the implementation of the original rule, many vessel operators have decided to travel by an "Outer Route" south of the Santa Barbara Channel, and outside the 24 nm regulatory boundary. Using this route is less expensive because the complying fuel is not required for a large portion of the route. In other words, vessel operators are avoiding some of the costs that were attributed to the original rule. These cost savings to the shipping industry are significant because this is among the most heavily travelled route to and from California.

Because the new boundary in the proposed amendments will make "avoidance" of the OGV Clean Fuel Regulatory zone less attractive from a cost and time perspective, we believe that many vessel operators will elect to go back to the original Santa Barbara Channel route. As a result, the estimated cost of the regulation with the proposed amendments will be close to what we originally estimated for the OGV Clean Fuel Regulation rulemaking. However, for some vessels, such as those that historically transited on the southern side of the Channel Islands and those coming into the Ports of Los Angeles and Long Beach from the west will incur costs not anticipated in the original rulemaking due to the expanded regulatory boundary.

A. Summary

The estimated total annual cost associated with the proposed amendments is approximately $10 million annually in years 2012 and 2013, and about $47 million in 2014. These estimated annual costs represent the net additional costs associated with the proposed amendments over and above compliance with the current regulation.

A number of factors affect these net added costs. First, the majority of vessels that historically transited through the Santa Barbara Channel are now transiting outside the regulatory zone via the Outer Route to reduce fuel costs. Under the proposed amendments, we anticipate that these vessel operators would return to the Santa Barbara Channel Route and would incur the higher costs associated with using the

more expensive cleaner marine distillate fuels. These costs were originally attributed to the OGV Clean Fuel Regulation and were avoided by transiting outside the existing regulatory zone in Southern California. As discussed in Chapter II, on a per trip basis, the added cost of transiting through the Santa Barbara Channel is about $2,750 more than the Outer Route (one-way) for an average vessel. As discussed below in more detail, moving vessels back to their historical shipping lanes in the Santa Barbara Channel where the low sulfur fuel is required accounts for most of the added costs of the proposed amendments.

In addition, due to the larger regulated zone in the proposed amendments there are added costs for other vessel routes in Southern California. For example, vessels that visit the Ports of Los Angeles and Long Beach by a western route would travel a longer distance within the regulatory zone. Laden tankers, which travel to and from the Ports of Los Angeles and Long Beach by a route south of the Channel Islands in accordance with a voluntary agreement to stay 50 nm offshore of the coastline, would also incur higher costs.

Finally, the net cost estimates also reflect cost savings associated with the two-year delay of the Phase 2 fuel requirements. This accounts for the lower cost increases in years 2012 and 2013, relative to 2014.

We estimate the overall total present value ($2011) cost of the proposed amendments to be approximately $59 million dollars for the years 2012-2014, assuming the total annual costs mentioned above. For perspective, the staff report for the original OGV Clean Fuel Regulation estimated the total cost to the industry at about $350 million annually for the years 2012 through 2014. The added cost of the amendments to a typical ship operator is estimated to be about $20,000 in years 2012 and 2013, and about $90,000 in 2014. We expect these added costs can be absorbed by typical affected businesses without a significant adverse impact. The average cost-effectiveness of the proposed amendments over the three year life of the regulation is estimated to be about $32,000 per ton or $16 per pound of diesel PM reduced, assuming all the regulatory costs are attributed to the diesel PM emission reductions. This compares favorably to other diesel PM regulations the Board has adopted previously, as well as to the original regulation.

Impacts on Government Agencies and Business Competitiveness, Employment, Creation, Elimination or Expansion

We do not expect significant economic impacts to the industry based on the added costs of the proposed amendments. The added costs of the proposed amendments are relatively small compared to the overall operating expenses of the businesses which operate OGVs. Based on an analysis of the change in “return on owner’s equity” (ROE) for typical businesses, the added costs of the proposed amendments would not result in a significant impact on profitability.

Because the proposed amendments would not alter significantly the profitability of most businesses, we do not expect a noticeable change in employment, business creation, elimination, or expansion, and business competitiveness in California. We also do not

expect significant economic impacts on governmental agencies on the local, state, or federal level. Military and government owned or operated vessels, used for government non-commercial purposes, are exempt from the proposed regulation.

Impacts on Individuals

We do not expect significant impacts on the customers served by OGV operators, even assuming that all of the added costs of the proposed amendments are passed on to customers. We also expect that the value of health benefits will greatly outweigh the costs.

B. Legal Requirements

In this section, we will discuss the legal requirements that must be satisfied in analyzing the economic impacts of the proposal.

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include a consideration of the impact of the proposed regulation on California jobs, business expansion, elimination or creation, and the ability of California business to compete with businesses in other states. This assessment is provided in subchapter F below.

State agencies are required to estimate the cost or savings to any State or local agency and school district in accordance with instructions adopted by the Department of Finance (DOF). The estimate must include any non-discretionary cost or savings to local agencies and the cost or savings in federal funding to the State. This is discussed in subchapter G.

H&S section 57005 requires the ARB to perform an economic impact analysis of submitted alternatives to a proposed regulation before adopting any major regulation. A major regulation is defined as a regulation that will have a potential cost to California business enterprises in an amount exceeding $10 million in any single year. The estimated cost of the proposed regulation exceeds $10 million in a single year, although much of the cost will be borne by businesses based outside of California. Nevertheless, we conducted the required economic impact analysis of submitted alternatives to the proposal.

In addition, the ARB is required under H&S section 43013(b) to adopt standards and regulations, consistent with H&S section 43013(a), for marine vessels to the extent permitted by federal law. Health and Safety Code section 43013(a) authorizes ARB to adopt and implement “motor vehicle emission standards, in-use performance standards, and motor vehicle fuel specifications…which the State board has found to be necessary, cost-effective, and technologically feasible…”

A literal reading of H&S section 43013(a) would lead one to conclude that the criteria “necessary, cost-effective, and technologically feasible” do not apply to a marine vessel

regulation because marine vessels are nonvehicular by definition.[15] However, because the Legislature placed the authorization to regulate marine vessels in H&S section 43013(b), we will infer a legislative intent to require ARB to determine that its proposed regulations on marine vessels are "necessary, cost-effective, and technologically feasible." The rulemaking for the original regulation extensively analyzed the necessity of the emission reductions and the technological feasibility of complying with the regulations (ARB, 2008). These analyses apply to the proposed amendments as well, which simply extend the regulatory boundary in Southern California, and delay the implementation of the Phase 2 fuel for two years. With regard to the cost-effectiveness of the proposed amendments, an analysis was performed below in subchapter H. The analysis estimates the average cost-effectiveness to be about $32,000 per ton ($16 per pound) of diesel PM reduced, assuming all costs are attributed to the PM reductions. This is lower than the cost-effectiveness of the original regulation and many other recent ARB rulemakings to control diesel PM emissions.

C. Methodology

In this section, ARB staff describes the methodology used to estimate the economic impacts from the proposed amendments. The methodology is based on essentially the same approach that was used when estimating the costs associated with the original 2008 rulemaking. That is, we estimated the fuel consumed by vessels within the regulatory zone, and compared the cost of using the more expensive low sulfur distillate fuel required by the regulation, to the less expensive standard HFO used prior to August, 2012, and the 1% sulfur HFO required under the newly established Emission Control Area) starting in August, 2012.

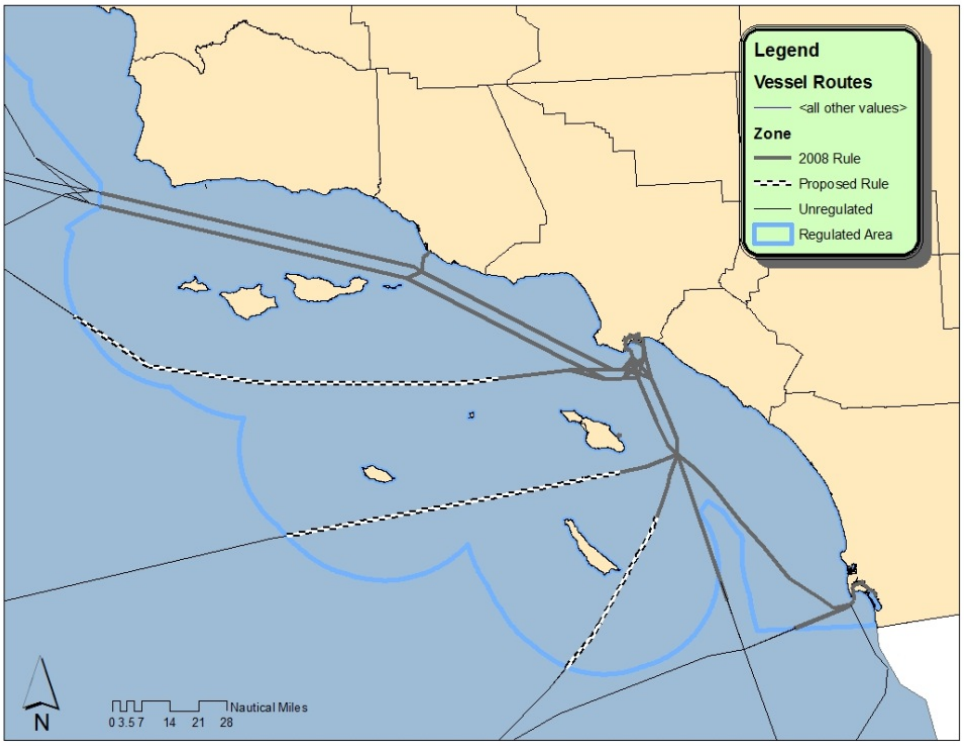
Under the proposed amendments to the OGV Clean Fuel Regulation, vessel operators would incur higher compliance costs on average due to the larger regulatory zone in Southern California. Due to this revised boundary, vessel operators would be required to use the more expensive distillate fuel for longer distances under the revised boundary of "Regulated California Waters." Figure V-1 shows some of the major vessel routes that would be affected by the proposed amendments. The heavy gray lines show the portions of the routes that are currently covered by the regulation, while the checkered portions show the additional distances that would be covered under the proposed amendments. As shown in Figure V-1, the distances traveled through the regulatory zone where the cleaner fuel is required would be longer.

However, it should be noted that the cost analysis for the original regulation assumed the vessels traveling to the Ports of Los Angeles and Long Beach would continue using the Santa Barbara Channel rather than the Outer Route that avoids the 24 nm regulatory zone. The proposed amendments seek to move vessels back to the established shipping lanes in the Santa Barbara, with costs similar to what was estimated for the original rule. This change would result in the majority of the costs estimated for the proposed amendments to the regulation, meaning that the regulatory cost of this proposal would be much lower otherwise. Specifically, to estimate the

[15] See H&S § 39039.

increased cost of the larger regulatory zone, less the costs associated with moving vessels back to the Santa Barbara Channel, staff compared the cost of: (1) complying with the current regulation with no vessel re-routing to avoid the Santa Barbara Channel; and (2) the proposed amendments. Comparing these two scenarios showed cost savings on the order of $35 million annually in 2012 and 2013, and similar costs in 2014. This compares to the much higher costs estimated in this chapter for the proposed amendments ($10 million in 2012 and 2013, and $47 million in 2014).

Figure V-1 – Major Shipping Routes in Southern California



The proposed amendments would also result in some cost savings that would offset the higher costs associated with the expansion of the boundary. Moving the implementation date of the Phase 2 (0.1% sulfur) fuel from 2012 to 2014 will result in significant savings during years 2012-2013, compared to what was estimated for the original rule.

We estimated the net costs of complying with the proposed amendments to the regulation only for years 2012 through 2014. It is possible that the proposed regulation will be implemented a few months earlier, in late 2011. However, we are not analyzing these potential costs because they are uncertain, and would add unnecessary complexity to the analysis. In addition, we are only analyzing the costs through the end of 2014 because in 2015 we expect federal regulations established under the International Maritime Organization to require equivalent emission reductions to the OGV Clean Fuel Regulation. As specified in the current regulation, when the Executive Officer of the ARB issues written findings that federal requirements are in place that will

achieve equivalent emission reductions in Regulated California Waters, then the fuel requirements in the ARB regulation shall cease to apply. In the following paragraphs, we provide a discussion on the expected capital and recurring costs associated with the proposed amendments.

Capital Costs

We expect that the proposed amendments will result in no significant capital costs to ship operators. While the extension of "Regulated California Waters" in southern California will require the use of the complying distillate fuel over somewhat longer distances for some routes to California ports, we expect that most vessels will have sufficient tank capacity for distillate fuel. In addition, the current regulation includes an "Essential Modifications Exemption" that provides vessel operators with an exemption from the fuel requirements if they submit an application to ARB demonstrating that modifications to the vessel (such as increasing tank capacity) are essential to their ability to comply with the regulation. Under the current regulation, this provision has been used in only a few cases based on inadequate fuel tank capacity for distillate.

Recurring Costs

The recurring (on-going) costs associated with the proposed amendments are due to the extended regulatory boundary in which vessel operators must use the more expensive marine distillate fuels. These costs are partially offset by the cost savings associated with delaying the implementation of the Phase 2 (0.1% sulfur) fuel until 2014. We calculated the overall net costs based on the difference between: (1) the current estimated fuel consumption under the existing regulation, and (2) the estimated fuel consumption under the proposed amendments to the rule. This analysis uses current fuel prices, as discussed below. In addition, the types of fuels used will vary with the specific year. We did not attempt to forecast fuel price increases over the three years covered by this analysis given the highly volatile and unpredictable nature of petroleum prices. Our assumptions for fuel consumption rates and the fuel prices are described below.

Fuel Consumption and Cost Estimates

The estimated fuel consumption and cost of the relevant fuels was calculated for two scenarios: (1) The baseline case under the current regulation with current traffic patterns and vessel routes, including 50% of vessels visiting the Ports of LA/LB routing outside the Santa Barbara Channel; and (2) the proposed amended regulation with predicted vessel routes, assuming vessels return to the Santa Barbara Channel.

These estimates were calculated within the 100 nm offshore boundary used for emissions inventory purposes. While this boundary extends beyond the regulatory boundaries used in the current regulation and under the proposed amendments, this is appropriate because some vessels are using alternative routes outside the relevant regulatory boundaries, and because the *difference* between consumption under the current regulation and the proposed amendments is needed to determine the added

cost of the proposed amendments. The estimated fuel consumption, in tonnes, was estimated based on the ARB's Emissions Inventory (ARB Marine Emissions Model, version 2.3g). The estimate is based on: (1) the estimated energy consumed by vessels using vessel specific information and shipping lane distances within the 100 nm boundary; (2) the appropriate brake specific fuel consumption figures for medium-speed, four-stroke auxiliary engines and slow-speed, two-stroke main engines; and (3) estimated average auxiliary boiler fuel consumption by vessel type. This analysis also accounts for the impact of the ARB Shore-side Power Regulation and the voluntary vessel speed reduction program at the Ports of Los Angeles and Long Beach.

For this analysis, we assume that all fuel used by main engines and auxiliary boilers outside the regulatory zone is HFO. This is based on the ARB's 2007 Ship Survey, which indicates that over 90 percent of main engines operate on HFO. For auxiliary engines outside the regulated zones, we assume that about 78 percent of the fuel used is HFO (ARB, 2007a). Regarding the use of HFO outside the California regulatory zone, we assume that standard heavy fuel oil (grade IFO 380) will be used prior to implementation of the North American ECA in August 2012, and that 1% sulfur HFO (grade IFO 380) will be used after the North American ECA is implemented.

Fuel prices were estimated as shown in Table V-1 using the average of data from the previous five months (November 2010 through March 2011) at five major bunker ports (Petromedia Corporation, 2011). For some ports, not all of the fuels were offered or the data were unavailable, so the estimated average prices reflect only the data from the remaining ports. For 0.1% sulfur MGO, the price was estimated using regular MGO and adding a $60 premium, which was the adjustment used in the cost analysis for the original regulation (ARB, 2008). The Port of Los Angeles generally offers MGO at or below 0.1% sulfur, so in this case the MGO fuel prices were used without adjustment.

Table V-1: Marine Fuel Prices ($/tonne)[1]

Fuel Type	Los Angeles	Rotterdam	Fujairah	Singapore	Houston	Average
Standard MGO	--	$831	$867	$828	--	$842
0.1% S MGO[2]	$862	$891	$927	$888	--	$892
IFO 380	$564	$527	$560	$555	$538	$549
1.0% IFO 380[3]	--	$548	--	$590	--	$569

1 Petromedia, 2011. Overall average fuel prices are based on the prices on Nov. 10, 2010, Dec. 10, 2010, Jan. 11, 2011, February 11, 2011, and March 11, 2011 at the listed ports, where available. (Petromedia, 2011).

2 A $60/ metric tonne premium was added for 0.1% sulfur distillate fuel compared to standard distillate based on the estimate used in the staff report for the original Ocean-Going Vessel Fuel Rule (ARB, 2008). For Los Angeles, the MGO is generally at or below 0.1% sulfur, so the MGO prices were used as is without adjustment.

3 It is uncertain which type of 1% sulfur fuel will be used by ship operators to meet the ECA in North America. We used readily available price data for ports that offer 1% sulfur heavy fuel oil (IFO 380 grade).

In Tables V-2 and V-3, we provide estimates of the fuel consumption and fuel cost within 100 nm of the California coastline for both the existing regulation and the proposed amended regulation. These estimates were made using the fuel price information from Table V-1. Note that the estimated fuel cost under the proposed amended regulation (Table V-3) is somewhat higher (about 1.5% higher in 2012 and 2013, and 6% higher in 2014) than the estimated fuel cost under the current regulation (Table V-2) due to the expanded regulatory boundary in which the cleaner fuel is required.

Table V-2: Total Statewide Annual Fuel Consumption and Cost (Current Regulation)*

	2012		2013		2014	
Fuel Type	Tonne	Cost ($)	Tonne	Cost ($)	Tonne	Cost ($)
Standard MGO	5,300	4,457,100	5,700	4,769,300	6,000	5,088,700
0.1% S MGO	501,400	447,345,200	524,800	468,233,700	547,200	488,261,100
IFO 380	233,200	127,937,300	0	0	0	0
1.0% S	166,600	94,791,700	428,500	243,855,200	458,000	260,623,600
Totals	906,500	674,531,300	959,000	716,858,200	1,011,200	753,973,400

*Includes the impact of 50% of vessels visiting the Ports of LA/LB rerouting to avoid the regulatory zone.

Table V-3: Total Statewide Annual Fuel Consumption and Cost (Proposed Amendments)*

	2012		2013		2014	
Fuel Type	Tonne	Cost ($)	Tonne	Cost ($)	Tonne	Cost ($)
Standard MGO	658,588	554,643,397	693,380.25	583,944,042	3,260	2,745,836
0.1% S MGO	0	0	0	0	724,229	646,178,728
IFO 380	136,479	74,877,964	0	0	0	0
1.0% S	97,485	55,478,807	250,096.39	142,329,857	266,558	151,697,959
Totals	892,553	685,000,167	943,476.64	726,273,898	994,047	800,622,523

*Assumes no vessel rerouting to avoid using the Santa Barbara Channel.

Total Annual Recurring (Fuel) Costs

The total annual recurring costs of the proposed amendments above the baseline costs of the existing regulation are presented in Table V-4 for years 2012 through 2014. These estimates are based on the differences in estimated fuel cost using our best estimates of the resulting shipping routes. As shown in Table V-4, the added annual fuel costs are estimated at about $10 million in years 2012 and 2013, and about $47 million in 2014. The added costs are due to the longer distances that ship operators will use the low sulfur distillate fuels in the expanded regulatory zone in Southern California. In years 2012 and 2013, the additional costs are lower because the proposed amendments would delay the requirement to use the Phase 2 fuel to 2014.

Table V-4: Estimated Additional Fuel Costs with the Proposed Amendments*

Year	Total Estimated Fuel Cost Under Proposed Amendments ($)	Total Estimated Fuel Cost Under Current Rule ($)	Incremental Fuel Cost Increase Under Proposed Amendments ($)
2012	$685,000,000	$674,531,000	$10,469,000
2013	$726,274,000	$716,900,000	$9,416,000
2014	$800,622,000	$754,000,000	$46,649,000

*Fuel cost figures for usage within 100 nm of California mainland shoreline.

Added costs of the proposed amendments that were already accounted for in the 2008 rulemaking for the original rule

The cost estimates above reflect the added cost of the proposed amendments over and above the actual baseline case, represented by vessels rerouting outside the regulated zone and reducing costs that were not accounted for in the original 2008 rulemaking. If vessels had continued to use the established shipping lanes in the Santa Barbara Channel as expected, the proposed amendments would have resulted in net cost savings in 2012 and 2013 compared to the existing rule due to the delay in the Phase 2 fuel standard, and similar costs in 2014.

D. Total Regulatory Costs

Total Industry Cost

We estimate the total statewide incremental additional cost of the proposed amendments to the regulation at about $59 million (2011 dollars). This estimated cost was derived from the 2011 present value of annual costs shown in Table V-4 for years 2012-2014. The total estimated industry cost is shown in Table V-5.

Table V-5: Estimated Total Cost (2011 Present Value)

Year	Future Cost ($)	Discount*	Present Value ($)
2012	10,469,000	0.952	9,970,000
2013	9,416,000	0.907	8,540,000
2014	46,649,000	0.863	40,300,000
Total	--	--	58,800,000

*Discount = 1/(1+i)^n, where i=5% and n=years

Total Annual Cost

The total annual cost of the proposed regulation is the same as the added fuel costs shown in Table V-5 because we estimate no significant capital costs.

Potential Additional Costs or Savings

There may be some other costs and potential cost savings that could be incurred under the proposed regulation, but data were not available to enable quantification of these possible impacts. Nevertheless, the net impact of these costs and savings is not expected to be significant. These are briefly described below.

Capital costs

We expect that the proposed amendments to the regulation will result in no significant capital costs. Any capital costs to the industry due to the use of distillate fuel would probably have already been incurred under the current regulation. In addition, the regulation contains an Essential Modifications Exemption that provides an exemption for equipment that cannot use the complying distillate fuel without modifications. Nevertheless, it is possible that some ship operators may undertake certain equipment changes in response to the increased use of distillate fuel under the proposed amendments, even if these changes are not essential. For example, it is possible that some vessels that travel frequently within the expanded region of Regulated California Waters in Southern California (e.g. to the Ports of Los Angeles and Long Beach) may choose to add tanks and piping to allow for more extensive use of distillate fuel. However, we estimate that capital costs would not increase the overall cost of the proposal by more than ten percent.

Greater Use of distillate fuel may result in lower or higher maintenance costs

As discussed in the staff report for the existing OGV Clean Fuel Regulation (ARB, 2008), the use of lower sulfur marine distillate fuel may result in a reduction in engine maintenance in some engines and boilers due to a reduction in deposit formation. On the other hand, the use of lower viscosity distillate fuel may lead to more frequent maintenance of fuel injection pumps, and may result in more leaks at pipe joints compared to the use of heavier fuels. Both of these effects, to the extent they occur, may be slightly more pronounced if vessels are operating for longer periods of time on the distillate fuels under the proposed amendments. ARB staff are not aware of any data to quantify these potential costs or savings.

E. Estimated Cost to Businesses

The proposed amendments would primarily impact businesses that operate large OGVs that visit Southern California ports. Most of these businesses are foreign-owned businesses, or domestic businesses located outside of California. The additional costs of the proposed amendments compared to the existing regulation are estimated below for typical (average) businesses. However, the cost to individual businesses will vary widely based on factors such as the following:

- number of vessels visiting California ports;
- number of California port visits per vessel;
- specific ports visited and the overwater route to these ports; and

- engine power and associated fuel consumption.

For example, since the proposed amendments extend the regulatory boundary only in Southern California, vessel operators that only visit Northern California ports would experience a net savings due to the delay of the Phase 2 0.1% sulfur fuel requirement until 2014. On the other hand, a vessel operator visiting the Ports of Los Angeles or Long Beach would incur additional costs due to the larger regulatory zone that may exceed the savings due to the extension of the Phase 2 fuel.

Table V-6 below shows the estimated average additional cost per port call. The average cost per call is estimated at about $1,100 in 2012, $1,000 in 2013, and $4,800 in 2014, when the Phase 2 (0.1% sulfur) fuel limit is proposed to be implemented. These costs per port call are estimated by dividing the total annual cost of the regulation by the estimated number of port visits.

The cost to an individual company will vary widely based on the number of California port calls they make. Most ship operators make less than 10 California port calls in a year, while only a very few make over 100 calls annually.

Table V-6: Estimated Average Cost per Port Call

Year	Total Annual Cost ($)	Total Annual Port Visits*	Average Cost/Port Call ($)
2012	$10,469,000	9,797	$1,100
2013	$9,416,000	9,797	$1,000
2014	$46,649,000	9,797	$4,800

*2009 California port visits. Assume no significant changes in 2012-2014.

We do not believe that the vessel operators affected by the proposed amendments to the OGV Clean Fuel regulation would qualify as small businesses due to the large capital and operating costs associated with vessel operation. Typical container vessels are estimated to cost on the order of $50 to $100 million (Mercator, 2005). In addition, Government Code section 11342.610 excludes businesses in transportation and warehousing with annual gross receipts exceeding one and a half million dollars from its definition of “small business.” We believe that the annual gross receipts for a vessel owner or operator would far exceed this level in order to be profitable. For example, a single Asia to U.S. West Coast voyage for a typical container vessel costs about $2 to $3 million. (*Ibid*) Therefore, we do not believe there are any small businesses directly affected by the proposed regulation. As such, we have only included costs in this analysis for typical businesses.

The costs to typical businesses are discussed below. However, it should be noted that the total cost to a particular company will vary widely, as discussed above.

Recurring (Fuel) Costs to Typical Businesses

The recurring cost for a typical business is presented below. To determine the average annual recurring cost for a typical business, we divided the total annual recurring cost of the proposed regulation for all vessels by our estimate of the number of shipping companies that operate in California, based on port visit data compiled by the California

State Lands Commission (CSLC, 2011). As shown in Table V-7, the average cost per company ranged from about $20,000 to $90,000 annually.

Table V-7: Estimated Average Added Annual Fuel Costs per Company

Year	Total Annual Cost	Number of Operators*	Average Annual Cost Per Company
2012	$10,469,000	524	$20,000
2013	$9,416,000	524	$18,000
2014	$46,649,000	524	$89,000

* Based on California State Lands Commission port visit data.

F. Potential Business Impacts

In this section, we analyze the potential impacts of the estimated costs of the proposed regulation on business enterprises. Section 11346.3 of the Government Code requires that, in proposing to adopt or amend any administrative regulation, State agencies shall assess the potential for adverse economic impact on California business enterprises and individuals. The assessment shall include a consideration of the impact of the proposed or amended regulation on the ability of California businesses to compete with businesses in other states, the impact on California jobs, and the impact on California business expansion, elimination, or creation.

This analysis is based on a comparison of the annual ROE for affected businesses before and after the inclusion of the costs associated with the proposed regulation. The analysis also compares the estimated added costs of the proposed regulation to the overall operating costs of these vessels

ARB staff does not have access to financial records for many of these companies. It should be noted that many of these businesses are not California-based businesses.

As stated in subchapter E above, we do not believe that the businesses subject to this proposed regulation would qualify as small businesses due to the large capital and operating costs associated with vessel operation.

Analysis of Return on Owner's Equity (ROE)

In this section, we evaluate the potential economic impact of the proposed regulation on California businesses as follows:

(1) Typical businesses affected by the proposed regulation are identified from port visit data from the California State Lands Commission. The Standard Industrial Classification (SIC) codes associated with these businesses are listed in Table V-9 below;

(2) The annual costs of the proposed regulation are estimated for each of these businesses based on the SIC code. For ranges in cost estimates, the high end of the range was used;
(3) The total annual cost for each business is adjusted for both federal and state taxes; and
(4) The adjusted costs are subtracted from net profit data and the results used to calculate the ROE. The resulting ROE is then compared with the ROE before the subtraction of the adjusted costs to determine the impact on the profitability of the businesses.

Using publicly available financial data from 2008 to 2010 for the representative businesses, staff calculated the ROEs, both before and after the subtraction of the adjusted annual costs, for the typical businesses from each industry category. These calculations were based on the following assumptions:

(1) All affected businesses are subject to federal and state tax rates of 35 percent and 9.3 percent, respectively; and
(2) Affected businesses neither increase the cost to their customers, nor lower their cost of doing business through cost-cutting measures due to the proposed regulation.

These assumptions, though reasonable, might not be applicable to all affected businesses.

The results of the analysis are shown in Table V-8 below. Using the ROE to measure profitability, we found that the ROE range for typical businesses from all industry categories would have declined by less than one percent due to the proposed amendments. This represents a small decline in the average profitability of the affected businesses. Overall, most affected businesses will be able to absorb the costs of the proposed amendments to the OGV Clean Fuel Regulation with no significant impacts on their profitability.

Table V-8: Return on Owners Equity Analysis of Businesses

SIC Code	Description of SIC Code	Percent Change in ROE
4412	Deep Sea Foreign Transportation of Freight	-0.020
4424	Deep Sea Domestic Transportation of Freight	-0.357
4481	Deep Sea Passenger Transportation	-0.017
Average		-0.13

Potential Impact on Business Competitiveness

The proposed amendments would generally result in higher costs for vessel operators visiting ports in Southern California. However, ARB staff does not believe that the

added costs of the proposed amendments to the regulation are high enough for vessel operators to consider alternative ports in Northern California, or ports outside California. There are several reasons for this. First, many vessel operators utilize Southern California ports because there is already a local market for their goods in the greater Los Angeles area, or because California exporters choose to utilize Southern California ports to transport their goods overseas. Second, other vessel operators find that the overall cost of transporting goods to their final destination beyond California is lowest by using Southern California ports because of the ports' existing and well established infrastructure, including road and rail access. Third, in some cases, vessel operators would have to factor in the added costs of fuel and other costs of traveling greater distances to alternative ports, which may negate the cost savings in not purchasing the lower sulfur fuel. Finally, the added costs resulting from the proposed amendments to the regulation are a small fraction of the overall operating costs of these vessels, and these costs are not expected to result in a significant adverse impact on the profitability of typical companies.

Most of the affected businesses that operate vessels are large businesses and can either absorb or pass-through the increased costs associated with the proposed amendments with no significant impact on their ability to compete with non-California businesses. For these reasons, we do not believe the relatively low costs of this proposal are high enough to significantly affect the competitiveness of those businesses that are integrally linked to the movement of goods through Southern California ports.

Potential Impact on Employment, Business Creation, Elimination, or Expansion

The proposal is not expected to have a noticeable impact on employment, or business creation, elimination, or expansion. As stated above, the added costs of the proposed amendments are a small percentage of the overall operating costs for both cargo and cruise vessels. In addition, an analysis of the impact of the proposal on the profitability of typical businesses indicated no significant adverse impacts.

Potential Impacts on Individuals

We do not expect significant impacts on the customers served by OGV operators, even assuming that all of the added costs of the proposed amendments are passed on to customers. Under a typical scenario with the existing regulation, we estimated in the 2008 rulemaking that the added cost of the OGV Clean Fuel Regulation would add about $6 per shipping container for importers or exporters shipping containerized goods overseas (ARB, 2008). We estimated that this represents less than one percent of the shipping cost. For passenger cruise ships, we estimated the added cost of the OGV Clean Fuel Regulation for a typical Los Angeles to Mexico cruise would be about $15 per passenger, representing about a 3 to 4 percent fare increase. Under the proposed amendments, these costs would not change significantly.

In addition, the health benefits of implementing the original regulation were found to be substantial. The proposed amendments will achieve somewhat greater emission reductions than originally estimated for the rule, preserving and slightly increasing these benefits.

G. Potential Costs to Local, State, and Federal Agencies

Local Agencies

We do not expect any significant fiscal impacts on local agencies from the proposed amendments. We are not aware of any local government agency that operates an OGV as defined in the proposed regulation, and there is an exemption in the regulation for government-owned or operated vessels. However, some minor impacts are possible on ports, which in California are established by state government and are operated by entities such as port authorities and departments of municipal governments.

We do not expect significant fiscal impacts on local air pollution control agencies due to the proposed regulation because ARB intends to enforce the provisions of the proposal statewide.

State Agencies

We also do not expect any significant fiscal impacts on State agencies from the proposed amendments. Government owned or operated vessels are exempted from the regulation. In addition, ARB staff enforcement of the regulation will continue unchanged with implementation of the proposed amendments.

Federal Agencies

We are not aware of any fiscal impacts on federal funding of State programs.

H. Cost-Effectiveness

For the purposes of this section, cost-effectiveness is defined as the ratio of the cost of compliance per ton (or pound) of pollution reduced. Cost-effectiveness figures allow different regulations to be compared to determine the most economical way to reduce a given amount of emissions.

In this section, we calculate the cost-effectiveness in two ways. First, we attribute the total annual cost of the proposed amendments to diesel PM alone. This results in the highest cost-effectiveness, and may overestimate the overall cost-effectiveness of the proposed amendments. For example, a regulation that resulted in the same costs and diesel PM emission reductions, but no reductions in other pollutants, would have the same cost-effectiveness in terms of diesel PM as the proposed amendments (which also reduce NOx and SOx). Therefore, consistent with rulemaking efforts for other regulations that control multiple pollutants, we also calculate the cost-effectiveness by attributing half of the costs of the proposed amendments to diesel PM reductions.

Cost-Effectiveness of the Proposed Amendments: All Costs Attributed to Diesel PM Reductions

The estimated cost-effectiveness of the proposed regulation is shown in Table V-9 below. The cost-effectiveness is expressed in terms of dollars per ton of diesel PM,

with the total annual cost attributed to diesel PM alone. As shown, the average cost-effectiveness is estimated at about $16 per pound of PM reduced. The cost-effectiveness values are lower prior to 2014 because of the savings derived from the delay in the implementation of the more expensive Phase 2 fuel to 2014.

Table V-9: Cost-Effectiveness of the Proposed Amendments (Attributes All Costs to Diesel PM Reductions)

Year	Total Annual Cost (millions $)	Emission Reductions* (TPD)	Cost-Effectiveness ($/ton)	Cost-Effectiveness ($/lb)
2012	$10.5	1.7	$17,000	$8.50
2013	$9.4	1.4	$18,000	$9.00
2014	$46.6	2.1	$61,000	$30.50
Average Cost-Effectiveness			$32,000	$16

* The emission reductions are based on the ARB Marine Emissions Model, version 2.3g

Cost-Effectiveness of the Proposed Amendments: Half the Costs Attributed to PM

In Table V-10 below, we calculate the cost-effectiveness by attributing half of the costs of the proposed amendments to PM reductions. This may reflect the overall cost-effectiveness more accurately in that it accounts for the multiple benefits of the proposed regulation. As shown, the average cost-effectiveness is estimated at about $16,000 per ton (or $8.00/lb) of PM reduced.

Table V-10: Cost-Effectiveness of the Proposed Amendments (Attributes Half of the Costs to PM)

Year	Half of Total Annual Cost (millions $)	Emission Reductions* (tons per day)	Cost-Effectiveness ($/ton)	Cost-Effectiveness ($/lb)
2012	$5.2	1.7	$8,400	$4.20
2013	$4.7	1.4	$9,200	$4.50
2014	$23.3	2.1	$30,400	$15.00
Average Cost Effectiveness			$16,000	$8.00

* The emission reductions are based on the ARB Marine Emissions Model, version 2.3g.

As shown in Table V-11 below, the cost-effectiveness of the proposed amendments for PM (as presented in Table V-10) is on the low end compared to other regulations recently adopted by the Board. For comparison purposes, all cost-effectiveness

estimates shown attribute half of the costs to PM, except for the In-Use Off-road Diesel Vehicle Rule, as noted. Also note that the cost-effectiveness of the proposed amendments is significantly lower than that of the original regulation.

Table V-11: PM Cost-Effectiveness of the Proposal and Other Diesel Regulations (Attributes Half of All Costs to PM)

Regulation or Airborne Toxic Control Measure	PM Cost-Effectiveness		Source of Estimate
	Dollars/Ton	Dollars/pound	
Public Fleets Rule	$320,000	$160	ARB, 2005b
In-Use Off-road Diesel Vehicle Rule*	$80,000	$40	ARB, 2007b
Solid Waste Collection Vehicle Rule	$64,000	$32	ARB, 2003a
Cargo Handling ATCM	$42,000	$21	ARB, 2005c
OGV Clean Fuel Regulation (2008)	$31,300	$16	ARB, 2008
Ship Auxiliary Engine Regulation (2005)	$26,000	$13	ARB, 2005
Stationary Diesel Engine ATCM	$15,400	$7.70	ARB, 2003b
Proposed Amendments to OGV Clean Fuel Regulation (2011)	$16,000	$8.00	Staff Report

*Attributes all regulation costs associated with diesel emission controls to PM, and splits other regulation costs equally between PM and NOx.

I. Analysis of Alternatives

In this section, we compare the proposed amendments to four alternative control options: (1) Do nothing; (2) Repeal the existing regulation and rely on existing U.S. EPA and international regulations; (3) Implement the proposed amendments but also allow alternative emission control strategies to the use of the specified cleaner fuels; and (4) Implement the proposed amendments, except keep the requirement to use the Phase 2 fuel in 2012, rather than moving the implementation to 2014. We do not discuss the cost-effectiveness of the first two alternatives because there are no ARB imposed costs associated with them. We also do not discuss the cost-effectiveness of the third alternative because the cost of potential alternatives is unquantifiable, and we do not believe this option would be pursued to any significant extent during the 2012-2014 timeframe of this analysis.

Alternative 1: No Project (Do not amend the existing regulation)

As discussed in detail in Chapter III, the existing regulation is not achieving the emission reductions originally estimated by ARB staff, and the redirection of vessel traffic to stay out of Regulated California Waters has increased traffic through the U.S. Navy's Point Mugu Sea Range operations. The proposed amendments to the original regulation will regain the emission reductions originally expected from the regulation, and we expect it to significantly reduce vessel traffic through the Navy Sea Range. In addition, as discussed in this chapter, the amendments would be more cost-effective than anticipated in the original rule due to the delay of the Phase 2 (0.1% sulfur) fuel to 2014. For these reasons, staff rejected Alternative 1.

Alternative 2: Suspend the original regulation and rely on international and federal regulations

Prior to 2015, relying only on international and federal regulations would result in substantial increases in PM and SOx emissions. This is because under IMO/U.S. EPA regulations (i.e. an ECA zone), ship operators would be able to use higher 1% sulfur fuel (likely HFO). This compares to the Phase I and Phase II distillate fuel specified in the amended regulation. The Phase I fuel is currently averaging below 0.3% sulfur, and the Phase II fuel would be at or below 0.1% sulfur. In addition, the ARB rule specifies distillate fuels that burn cleaner than the HFO likely to be used to meet the 1% sulfur fuel, independent of sulfur levels. An emissions analysis prepared in the original staff report that compares the original regulation to the then pending ECA requirements shows the dramatic difference in emission reductions between these two options. This analysis would be very similar to the difference between the proposed amended regulation and the currently adopted North American ECA (ARB, 2008).

The emission reductions that would be achieved under the proposed regulation are critical to reducing the cancer and non-cancer health risks to the public. They are also necessary to make progress toward compliance with State and federal air quality standards for ozone and PM in nonattainment areas throughout the State. Finally, these reductions are an important element of California's Diesel Risk Reduction Plan, the California Goods Movement Emission Reduction Plan, and marine port clean air plans. For the above reasons, staff rejected Alternative 2.

Alternative 3: Implement the proposed amendments but also allow alternative emission control strategies to the use of the specified cleaner fuels

Under this alternative, the proposed amendments would be implemented, except that OGVs visiting California would also be allowed to use alternative emission control strategies to the use of the marine distillate fuels specified in the regulation. However, ARB staff does not believe that vessel operators would utilize alternative emission control strategies to any significant degree, meaning that the option would not significantly alter the cost-effectiveness of the proposed amendments (as estimated earlier in this chapter).

A similar OGV fuel regulation adopted by the Board in 2005 included the option to use alternatives to the distillate fuel. The regulation was implemented in 2007 and was in effect for 14 months until invalidated by a court ruling. During the 14 months the rule was in place, not a single ship operator opted to comply by alternative emission controls, despite a guidance document prepared by ARB staff to aid ship operators interested in using the option (ARB, 2006b). ARB staff believes that alternatives to the distillate fuel were not utilized due to uncertainty in their cost-effectiveness and technical feasibility on oceangoing vessels. In addition, the use of the cleaner fuels specified in the regulation results in dramatic reductions in diesel PM and SOx, as well as NOx reductions. It is difficult for any one technology to reduce all of these pollutants

combined to the same levels as the use of the cleaner fuels. This would likely result in the necessity to consider multiple alternative control strategies

In addition, even if we expected alternatives (or combinations of alternatives) to be utilized, it would be extremely difficult to accurately estimate their cost due to the emerging nature of these technologies, the array of possible alternatives, and the unique nature of OGVs, where retrofit installation costs of the same technology would vary significantly between two vessels based on available space, and other design features.

Finally, there are significant legal challenges to including an option to use alternative emission control options that achieve equivalent emission reductions. These challenges are discussed in detail in the staff report for the original regulation (ARB, 2008).

For the above reasons, staff rejected Alternative 3.

Alternative 4: Implement the proposed amendments, except keep the requirement to use the Phase 2 fuel in 2012

Under this alternative, the proposed amendments would be implemented as proposed, except that the Phase 2 (0.1% sulfur) fuel would be implemented in 2012 rather than 2014. As shown in Table V-12, this option would result in additional reductions in PM emissions in 2012 and 2013 compared to the proposal. However, the cost of Alternative 4 is also higher in 2012 and 2013 due to the added cost of the Phase 2 (0.1% sulfur fuel). Due to these added costs, Alternative 4 would have a significantly higher cost-effectiveness ratio in years 2012-2013. For this reason, as well as the other reasons discussed in Chapter II for extending the Phase II fuel requirement to 2014, staff rejected Alternative 4.

Table V-12: Diesel PM Cost-Effectiveness Comparison for Alternative 4 and the Proposed Amendments (Attributes All Costs to PM Reductions)

	Estimated Cost (millions $)		Estimated Reductions (tons/year)		Cost-Effectiveness ($/ton)	
Year	Alternative 4	Proposal	Alternative 4	Proposal	Alternative 4	Proposal
2012	43.3	10.5	2.4	1.7	$49,000	$17,000
2013	44.0	9.4	2.0	1.4	$60,000	$18,000
2014	46.6	46.6	2.1	2.1	$61,000	$61,000

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(ARB, 2005) California Air Resources Board, Staff Report: Initial Statement of Reasons for Proposed Rulemaking: Proposed Regulation for Auxiliary Diesel Engines and Diesel-Electric Engines Operated on Ocean-Going Vessels Within California Waters and 24 Nautical Miles of the California Baseline, October, 2005

(ARB, 2005b) California Air Resources Board, Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Proposed Diesel Particulate Matter Control Measure for On-Road Heavy-Duty Diesel-Fueled Vehicles Owned or Operated by Public Agencies and Utilities, October, 2005

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