

SOCIOECONOMIC
ANALYSIS
PROPOSED RULE

REGULATION 8, RULES 44 & 46:
MARINE VESSEL LOADING OPERATIONS

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Prepared for
Bay Area Air Quality
Management District

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CONTENTS

1. Executive Summary.....	1
2. Description of the Proposed Rule.....	4
3. Impact of Proposed Rule Amendments.....	11
3.1 Methodology	11
3.2 Regional Demographic Trends.....	13
3.3 Regional Economic Trends.....	13
3.4 Description of Affected Industries.....	16
3.5 Compliance Costs.....	20
3.6 Business Response to Compliance Costs.....	22
3.7 Impact Analysis.....	22
3.8 Impact on Small Business.....	25

1. EXECUTIVE SUMMARY

INTRODUCTION

This report describes the socioeconomic impacts of proposed amendments to Regulation 8, Rule 44 and Rule 46 that, if implemented, will allow the Bay Area Air Quality Management District (District) to achieve and maintain state ambient air quality standards for ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide. Following this summary, the report summarizes the proposed rule requirements and describes the methodology for the socioeconomic analysis. The report also describes the economic characteristics of sites affected by the proposed rule amendments along with the socioeconomic impacts of the proposed amendments. The proposed amendments will assist the BAAQMD in meeting its commitments to improving air quality in the region by reducing emissions from Marine Loading-related activities due to enhanced monitoring and prevention measures.

SUMMARY

The proposed rule amendments affect Bay Area businesses engaged in petroleum refining, bulk storage, and marine transport. It is believed that five oil refineries, six terminal facilities, and five marine transportation businesses will experience the greatest proportion of the impact resulting from the proposed rule amendments. The refineries are estimated to generate sales of \$9.8 billion per year and to realize net income of about 7 percent of sales, or \$689 million per year. Total annual sales at the six terminal facilities is estimated at \$488.4 million, of which, 2.7 percent (\$13.2 million) is estimated to be profit. Annual revenue at the impacted water transportation firms is estimated at \$221.6 million with 3.9 percent (\$8.6 million) profit.

Compliance with the proposed rule amendments explicitly would require affected businesses to control emissions from an expanded list of regulated organic liquids, those with a “flash point” of 100 °F or lower. Compliance will also require that businesses monitor emissions from organic

liquids with a “flash point” above 100 °F; however, this testing is expected to be required for a limited period of time and there are expected to be a number of regulator exemptions, as well as a provision for requesting a special exemption. Finally, the proposed amendments will require that affected businesses control emissions from operations related to the venting of vessel cargo tanks.¹

The cost to comply with the proposed expansion of the regulated materials list is expected to cost a total \$448,407 per year. Respectively, this annual compliance cost represents 0.07 percent, 3.4 percent, and 5.2 percent of profits for the oil refineries, terminal facilities, and water transportation firms. However, this assumes that each individual group of businesses bears the full annual compliance cost. It is more likely that the total annual cost will be spread among all sixteen impacted sites, not just five or six of them. Additionally, most of the impacted terminal facilities and water transportation firms are owned by the same corporations that own the oil refineries. Therefore, it is believed that the above percent of profits estimates are conservatively high.

At the upper end, the annual cost to comply with the proposed expansion of the rule to venting operations is expected to be \$720,000. As this requirement pertains to the venting of marine vessel cargo tanks it is believed that only the water transportation businesses will be affected by this proposed amendment. At total profits of \$8.6 million, it is estimated that annual compliance could represent up to 8.3 percent of profits for the five impacted businesses. It is believed that this estimate is also conservatively high. The proposed amendment would only apply within District waters, therefore, a vessel venting outside District waters would not be subject to the regulation. Furthermore, it is believed to be less expensive, even without the added regulatory compliance cost associated with the proposed

¹ The proposed rule amendments will also require that businesses control emissions from marine tanks and connectors emitting more than 1,000 ppmv, a lower standard than is currently in effect. However, this same standard is in effect in other CA air districts. Therefore, it is believed that this amendment will not require affected businesses to significantly alter their overall operating practices.

amendment, to vent outside District waters. In addition, the majority of the five impacted water transportation firms are owned by the same corporations that own the oil refineries. Therefore, the percentage of profits represented by the actual costs to comply with this rule amendment will likely be lower than is estimated here.

The analysis concludes that the compliance costs associated with the compliance will not result in significant economic dislocation or job losses. For the oil refineries and terminal facilities, the total annual cost of compliance is well below the 10 percent of profits threshold for significant impact. Also, while the combined compliance cost of the expanded regulated materials list and the venting requirement could exceed 10 percent of profits for water transportation businesses, it is not believed that this will be the case. For the impact on these firms to exceed 10 percent of profits, it must be assumed that they will bear the full annual compliance cost of both proposed regulatory amendments. Also, it must be assumed that these businesses will choose to vent within District waters, even though it is believed that, even without the cost to comply with the proposed amendments, it is less expensive for vessels to vent outside District waters.

2. DESCRIPTION OF THE PROPOSED RULE

CURRENT STATUS OF THE RULE

Regulation 8, Rule 44 and Rule 46 were both adopted in 1989. These rules address organic compound emissions generated when marine tank vessels are loaded with organic liquids. The emissions occur because the loaded liquid evaporates as it is loaded and the loaded liquid volume forces the gas headspace, including the evaporated organics, out of the tank. Emissions addressed by these rules also result from “venting”² and “ballasting”³ operations.

The proposed amendments to the rules address the following current rule requirements:

- 1) **Regulated materials:** Regulation 8 Rule 44 and Rule 46 apply to the loading of five (5) materials, each of which have a Reid vapor pressure of 2.0 psia or greater: gasoline, gasoline blending stocks, aviation gasoline, JP-4 aviation fuel, and crude oil. Emissions from these materials may not exceed two (2) pounds per thousand barrels (2 lb/1,000 bbl) of material loaded, or be controlled such that emissions are reduced by at least 95 percent by weight.
- 2) **Venting operations:** Emission controls are required for loading of any organic liquid if the prior cargo was one of the five (5) currently regulated liquids. However, emissions from venting operations are not directly addressed.

² Venting refers to forcing air or an inert gas into a vessel’s cargo tank to eliminate the risk that vapors from the liquid organic compounds will ignite or explode. Venting is typically performed when a vessel’s tank must be cleaned so that it can be filled with a different cargo than it held previously.

³ Ballasting refers to filling a marine tank, which previously held a cargo of organic liquid, with seawater to improve the vessel’s stability. Modern vessels are typically designed with “segregated” ballast tanks; however, older vessels may not have segregated tanks, and, empty cargo tanks may be used for ballast in especially rough ocean conditions.

While this is the case, in a March 2005 compliance advisory, the District interpreted the rules to apply to these activities when a regulated material is involved.

- 3) **“Gas Tight” standard:** The current “gas tight” standard for marine tanks and connectors is 10,000 ppmv. All marine tanks and connectors emitting more than 10,000 ppmv are subject to control requirements.
- 4) **Separation of Rules:** Both Rule 44 and Rule 46 are largely identical. Between them, the rules apply the same control standards to the loading of marine vessels at terminals (Rule 44) and vessel-to-vessel loading⁴ (Rule 46). Resource limitations in 1989 did not allow rulemaking for both aspects of marine loading to be completed at the same time.

In 2001, the District prepared a 2001 Bay Area Ozone Attainment Plan to attain the national 1-hour ozone standard in the Bay Area. The 2001 Plan included a study measure (FS-11, “Marine Tank Vessel Activities”) that proposed to examine whether significant additional emission reductions were available from further regulation of marine tank vessel operations. The results of this study were published in 2002 in a draft technical assessment document (TAD).

PROPOSED RULE AMENDMENTS

Pursuant to FS-11, District staff examined whether significant emission reductions were available from loading, lightering, ballasting, and “housekeeping” activities. The FS-11 TAD compared Rule 44 to rules from other air districts and found that the current District abatement standard (2 lb/1,000 bbl or 95 percent by weight) is at least as stringent as corresponding standards in the South Coast AQMD, San Luis Obispo APCD, and Santa Barbara County APCD.

⁴ Vessel-to-vessel loading is also referred to as “lightering.” Because the San Francisco Bay is not deep enough to accommodate larger tanker vessels at some of the refinery marine terminals, cargoes are loaded (“lightered”) into smaller vessels for distribution to area refineries and bulk storage facilities.

However, the current “gas tight” standard for tanks and connectors (10,000 ppmv) is less stringent than the standard in the South Coast AQMD and San Luis Obispo County APCD (1,000 ppmv). Also, both the South Coast AQMD and San Luis Obispo County APCD require control of gas venting operations, whereas, Rule 44 and Rule 46 do not.

Based upon FS-11 and the findings of the FS-11 TAD, the District is proposing the following amendments to Regulation 8 Rule 44 and Rule 46:

1) **Expansion of rule requirements to other materials:** The proposed amendments would expand the current list of regulated materials to include all organic liquids with a “flash point” of 100 °F or lower⁵. This amendment has been proposed for the following reasons:

- a. data shows that there is significant traffic these liquids
- b. these liquids can be readily identified prior to loading
- c. liquids with a “flash point” of 100 °F or lower are extremely volatile and therefore produce significant emissions; and,
- d. control of emissions from these liquids has proven both feasible and cost effective

Additionally, in October 2003, the District proposed to modify Rule 44 to require controls on an event-specific parameter for low-volatility liquids.⁶ However, the District has concluded that it cannot, at present, identify low-volatility liquids

⁵ Originally, the District had determined that the regulated “high-volatility” liquids would be those with a Reid Vapor Pressure of 2.0 psia or higher. However, based upon stakeholder comments, it has been determined that Reid Vapor Pressure is not a practical measure for determining which organic compounds are subject to regulation. Flash point has been found to be a more reasonable measure and that regulating liquids with a “flash point” of 100 °F or less sufficiently captures the “high volatility” compounds originally intended to be included as regulated.

⁶ These are liquids with a “flash point” above 100 °F.

that can be cost-effectively controlled. Therefore, rather than make these liquids subject to emission control requirements, the District is proposing to gather more data by requiring that operators measure the organic concentration in cargo tanks during loading operations.⁷ Then, the District may be able to determine whether certain low-volatility organic materials under certain conditions should be subject to control requirements under Rule 44.

- 2) **Controlled venting operations:** The District is proposing to expand emission control requirements to include venting operations. In order to vent within the District waters, vessels will be required to vent to emission control devices.
- 3) **Reduction in “gas tight” standard:** The 1,000 ppmv standard in effect in the South Coast AQMD and San Luis Obispo County APCD is proposed for all marine loading operations. To date, the District has not established that the ultra-low leak standards (100 ppmv for connectors, 500 ppmv for pressure relief devices) in Regulation 8 Rule 18 for equipment at non-marine facilities are feasible for marine service.⁸
- 4) **Consolidation of Rules 44 and 46:** The proposed amendments will eliminate Rule 46 and consolidate all marine loading requirements in

⁷ Operators would be required to measure organic concentration at hourly intervals during loading operations, to record other loading parameters, and to submit this data to the District. District staff expects that this rule amendment will include built-in exemptions and an option to file for a special exemption. Staff also expects that the testing requirement will include a sunset date.

⁸ In October 2003, the District proposed to lower the standard 100 ppmv consistent with the rule for equipment at non-marine facilities. Marine loading operators have indicated that connectors and other fugitive sources in marine service cannot meet the same low level of leakage achieved in non-marine service because of the harshness of the environment and because loading hoses must be connected and disconnected for each loading event, and thus much more frequently than for typical non-marine connectors.

Rule 44. The rules are largely identical and consolidation will simplify District regulations. The rules were originally adopted separately because resource limitations did not allow rulemaking for both aspects of marine loading to be completed at the same time.

EMISSIONS REDUCTIONS

This section details the emissions reductions expected from the proposed amendments to Rule 44 and Rule 46. The District estimates that the proposed rule amendments will reduce emissions by more than 30 tons/day. The reductions would result from the expansion of the rule requirements to other materials, the expansion of the rule requirements to gas venting operations, and the reduction in the “gas tight” standard. The proposed consolidation of Rule 46 into Rule 44 is not expected to result in emission reductions. The remainder of this section details the emission reductions expected from the other three (3) proposed rule amendments.

EXPANSION OF RULE REQUIREMENTS TO OTHER MATERIALS

Expansion of the control requirements of Rule 44 to all organic chemicals with a Reid vapor pressure exceeding 2.0 psia is expected to reduce emissions by a much more significant amount than the “gas tight” standard reduction. This proposed amendment is expected to result in control of up to 8,500,000 bbl/yr of additional volatile organic cargo, such as benzene and toluene, with high unabated loading emission factors. Assuming a conservative average factor of 10 lb/1,000 bbl, the resulting emission reduction would be:

$$(8,500,000 \text{ bbl/yr}) ((10 - 2) \text{ lb} / 1,000 \text{ bbl}) (\text{ton}/2,000 \text{ lb}) = 34 \text{ ton/yr}$$

Some cargos included in this category may already be subject to control requirements if they are used as gasoline blending stocks. To the extent this is the case, the emission reduction would be less.

EXPANSION OF RULE REQUIREMENTS TO GAS VENTING OPERATIONS

Emissions reductions from this amendment are expected to be the highest of all proposed, about 170 ton. FS-11 found evidence that crude oil tankers performed approximately two (2) to four (4) venting events per month (total) in the San Francisco Bay, and estimated that the resulting emissions could be as high as 720 tons per year if a typical venting event resulted in 15 tons of emissions. Crude oil tankers are the most likely vessels to undergo venting because they occasionally take on a different cargo after unloading crude, which may require that the cargo tanks be cleaned and vented. Even if only one (1) 100,000 barrel tanker were cleaned per month, emissions could be as high as 180 ton/yr. If emission controls achieved a 95 percent emission reduction, the resulting overall emission reduction would be about 170 ton/yr.

REDUCTION IN "GAS TIGHT" STANDARD

Reduction of the current "gas tight" standard for marine tanks and connectors subject to control requirements from 10,000 ppmv to 1,000 ppmv is expected to reduce emissions by a minimal amount (approximately 0.05 tons per day). Assuming that annual throughput of materials with a Reid vapor pressure exceeding 2.0 psia, that the materials are shipped in 500,000 barrel tankers,⁹ and that each vessel remains in the Bay Area five (5) days, then there would be about 419 trips per year, with approximately six (6) vessels in the Bay Area on the average day. Further, assuming that each vessel will have 20 connectors, one (1) pressure relief valve (gas service), and one (1) pump seal (light liquid service), and that each vessel spend half the time in the Bay Area actively loading material, the emissions may be estimated using the screening value method for fugitive emissions using the factors in Table IV-2a of the CAPCOA/CARB guidelines.¹⁰

⁹ This is the largest size in use in the Bay Area.

¹⁰ California Implementation Guidelines for Estimating Emissions of Fugitive Hydrocarbon Leaks at Petroleum Facilities, February 1999, CAPCOA/CARB

At the current limit of 10,000 ppmv, the emissions would be:

$$(1/2) (6) (24 \text{ hr/day}) (\text{kg}/2.2 \text{ lb}) (\text{ton}/2,000 \text{ lb}) [(20)(0.0375 \text{ kg/hr})+(1.691 \text{ kg/hr})+(0.437 \text{ kg/hr})] = 0.05 \text{ ton/day}$$

At the proposed limit of 1,000 ppmv, the emissions would be:

$$(1/2) (6) (2.20 \text{ kg/lb}) (\text{ton}/2,000 \text{ lb}) [(20)(0.00006 \text{ kg/hr})+(0.0447 \text{ kg/hr})+(0.012 \text{ kg/hr})] = 0.001 \text{ ton/day}$$

Therefore, an emission reduction of approximately 0.05 ton/day may be achieved by reducing the “gas tight” standard as proposed. It is not expected that improved equipment or maintenance practices will be necessary to achieve compliance with the new standard. The following assumption have been made

3. IMPACT OF PROPOSED RULE AMENDMENTS

This section of the socioeconomic analysis describes demographic and economic trends in the San Francisco Bay Area (Bay Area) region. Following an overview of the methodology for the socioeconomic analysis, the first part of this section compares the Bay Area against California and provides a context for understanding demographic and economic changes that have occurred within the Bay Area between 1994 and 2004. After an overview of Bay Area industries, we focus on the following industries:

- SIC 2911, Oil Refining (NAICS 32411 – oil refineries)
- SIC 5171, Petroleum Bulk Stations and Terminals (NAICS 42471 – Petroleum Bulk Stations and Terminals)
- SIC 4449/4499, Water Transportation of Freight/Services¹¹ (NAICS 483113 – Coastal and Great Lakes Freight Transport)
- SIC 4412/4424, Deep Sea Foreign/Domestic Transportation of Freight (NAICS 483111 – Deep Sea Freight Transportation)

Then the impacts on businesses within these industries of the proposed changes to Rule 8-44/46 concerning Marine Loading are analyzed. For the purposes of this report, the Bay Area region is defined as Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma Counties.

3.1 METHODOLOGY

The socioeconomic analysis of the proposed rule amendments concerning marine loading involves the use of information provided directly by BAAQMD, as well as secondary data used to describe the industries affected by the proposed rule amendments.

¹¹ SIC 4499 is Water Transportation Services; SIC 4449 is Water Transportation of Freight.

Based on conversations with BAAQMD staff, ADE determined that the impacts would affect oil refineries, terminal facilities, and water transportation firms located and operating in the BAAQMD region. In relation to the refineries, we further focused attention on Chevron, Shell, Conoco Phillips, Valero, and Tesoro refineries. Also, for the terminal facilities we focused on those operated by Shore Terminals (2), IMTT, BP, Tesoro, and Conoco Phillips. Finally, for the water transportation firms, we focused on Foss Maritime, SeaRiver Maritime, Crowley Maritime, Polar Tanker, and Sause Brothers¹².

With this information we began to prepare an economic description of the industry groups of which the affected sites are a part, as well as to analyze data on the number of jobs, sales levels, the typical profit ratios and other economic indicators for the Bay Area businesses. ADE also reviewed and summarized documents available to the public such as annual reports for publicly traded companies.

With the annual reports and data from the US Economic Census, ADE was able to estimate revenues and profit ratios for many of the sites affected by the proposed Marine Loading rule amendments. In calculating aggregate revenues generated by Bay Area refineries, terminals, and water transporters, ADE first estimated annual revenue based upon available data. Using annual reports and publicly available data, ADE calculated ratios of profit per dollar of sales for the businesses on which the analysis focused. To estimate employment, ADE used employment data from Dun & Bradstreet.

The result of the socioeconomic analysis shows what proportion of profit the compliance costs represent. Based on a given threshold of significance, ADE discusses in the report whether the affected sites are likely to reduce jobs as a means of recouping the cost of compliance or as a result of reducing business operations. To the extent that such job losses appear likely, the indirect multiplier effects of the job

¹² SeaRiver Maritime is a subsidiary of Exxon. Polar Tankers is a subsidiary of Conoco Phillips. Foss Maritime, Crowley Maritime, and Sause Brothers are independent.

losses area estimated using a regional IMPLAN input-output model.

3.2 REGIONAL DEMOGRAPHIC TRENDS

The Bay Area experienced moderate population growth from 1994 to 2004. Between 1994 and 1999, the nine-county region increased by 7 percent, from 6.2 million in 1994 to 6.6 million in 1999. From 1994 to 2004, the population increase was from 6.2 million to 6.8 million for an increase of 11 percent. At the same time, California had population growth of 14 percent.

Within the Bay Area, the greatest percentage increase occurred in Contra Costa County. From 1994 to 2004 Contra Costa increased its population by 18 percent. All other Bay Area counties had population increases equal to, or slower than, the State. The smallest percentage increase occurred in Marin and San Mateo Counties where population grew 5 percent from 1994 to 2004. Table 1 shows the population changes that have occurred in the Bay Area and California from 1994 to 2004.

	Population			Percent Change		
	1994	1999	2004	94 - 99	99 - 04	94 - 04
California	30,889,182	32,971,834	35,300,654	7%	7%	14%
Bay Area	6,189,000	6,646,167	6,865,370	7%	3%	11%
Alameda County	1,302,462	1,406,046	1,470,456	8%	5%	13%
Contra Costa County	844,076	914,645	992,608	8%	9%	18%
Marin County	228,718	236,955	239,209	4%	1%	5%
Napa County	111,083	118,088	126,283	6%	7%	14%
San Francisco County	729,024	771,122	772,985	6%	0%	6%
San Mateo County	667,218	712,376	702,017	7%	-1%	5%
Santa Clara County	1,544,523	1,672,977	1,701,831	8%	2%	10%
Solano County	356,652	377,601	399,826	6%	6%	12%
Sonoma County	405,244	436,357	460,155	8%	5%	14%

Source: Applied Development Economics, based on household population estimates from The California Department of Finance

3.3 REGIONAL ECONOMIC TRENDS

The Bay Area is one of the world's greatest regional economies. It benefits from pre-eminent knowledge-based industries, with competitive strength flowing from an unmatched culture of entrepreneurship, world-leading

research institutions, and some of the nation's best educated and most highly skilled workforce. With these remarkable advantages, it has led through innovation in a wide range of research and industrial fields.

Many of the Bay Area's most prominent industries are manufacturing related. From Intel to PowerBar, Bay Area manufacturers are often high profile companies with world-renowned recognition. From small to large, Bay Area industry has been dynamic, creating wealth and jobs in both the export sector and local serving industries.

The economic base is typically comprised of export industries within the manufacturing, minerals-resource extraction, and agricultural sectors. There are also the "local support industries" such as retail or service sectors, the progress of which is a function of the economic base and demographic changes, and more so the latter than the former. As population increases in a given area, demand for services – such as realtors, teachers, healthcare – increases, as does demand for basic retail items like groceries, gas for commuting, or clothing at the local apparel shops.

The industries affected by the proposed PRD rule amendments are a prominent part of the region's economic base. Mainly engaged in export related business, the oil refineries are classified as manufacturers. In the Bay Area, manufacturing jobs have decreased over the last decade. In 1994, manufacturing accounted for 14 percent of all Bay Area employment. By 2004, manufacturing declined 11 percent to account for 11 percent of all Bay Area employment.

As of 2004, the professional and business services sector was the largest employer in the region, at 520,200 jobs or 16 percent of all private and public sector jobs. This is a change from 1994 when professional and business services accounted for 15 percent of all Bay Area employment. During the same period, professional and business services increased 17 percent. The next largest industry in the Bay Area is public service, or government, with 460,300 jobs. In 2004, government accounted for 14 percent of all Bay Area employment. From 1994 to 2004, government had one of the lowest growth rates of all industries at 4 percent. Two other industries came close to manufacturing in total

employment. Retail trade and education & health care both made up 11 percent of total employment and had only a few hundred or few thousand jobs less than manufacturing. Unlike manufacturing, both retail trade and education & health care had significant job gains from 1994 to 2004. All other industries made up less than manufacturing in total employment in 2004. Table 2 shows Bay Area industry sectors and their trends from 1994 to 2004.

Table 2
Employment Profile of the San Francisco Bay Area, 1994 - 2004

Industry	1994	1999	2004	% of Total Employment in 2004
Farm	25,800	28,600	21,300	1%
Natural Resources & Mining	4,300	3,600	2,300	0%
Construction	109,300	171,400	181,000	6%
Manufacturing	405,400	459,400	359,700	11%
Wholesale Trade	118,500	107,100	121,900	4%
Retail Trade	300,200	339,000	337,900	11%
Transportation & Warehousing & Utilities	115,500	124,700	102,900	3%
Information	89,200	122,100	111,600	3%
Financial Activities	193,300	197,400	209,800	7%
Professional and Business Services	445,400	626,100	520,200	16%
Education & Health Care	293,800	335,000	359,200	11%
Leisure and Hospitality	250,000	289,500	304,400	10%
Other Services	100,100	108,800	109,700	3%
Government	444,500	449,800	460,300	14%
Total	2,895,300	3,362,500	3,202,200	100%

Source: Applied Development Economics from data supplied by the Labor Market Information Division of the California Employment Development Department

3.4 DESCRIPTION OF AFFECTED INDUSTRIES

The proposed Marine Loading rule amendments affect industries in the following SIC's:

- SIC 2911, Oil Refining (NAICS 32411 – oil refineries)
- SIC 5171, Petroleum Bulk Stations and Terminals (NAICS 42471 – Petroleum Bulk Stations and Terminals)
- SIC 4449/4499, Water Transportation of Freight/Services¹³ (NAICS 483113 – Coastal and Great Lakes Freight Transport)
- SIC 4412/4424, Deep Sea Foreign/Domestic Transportation of Freight¹⁴ (NAICS 483111 – Deep Sea Freight Transportation)

What follows is a description of this industry, along with economic trends for oil refineries in the Bay Area, and it provides a comparison between 2001 and 2004. Data in Table 3 are for all sources, not just the major sites that have been focused on in the Bay Area. As shown in Table 3, employment in oil refineries increased by 2 percent in the four years from 2001 to 2004. This is at the same time that Bay Area manufacturing jobs decreased 22 percent. In California, oil refineries declined 5 percent during the same period and manufacturing jobs declined 14 percent.

¹³ SIC 4499 is Water Transportation Services; SIC 4449 is Water Transportation of Freight.

¹⁴ SIC 4424 is Deep Sea Domestic Transportation of Freight; SIC 4412 is Deep Sea Foreign Transportation of Freight.

Table 3
Employment Trends: Industries Affected by Proposed Amendments, 2001 - 2004

	2001	2004	Change from 2001 to 2004	% Change from 2001 to 2004
San Francisco Bay Area				
Manufacturing	460,992	357,385	-103,607	-22%
Petroleum refineries	7,086	7,196	110	2%
Petroleum bulk stations and terminals	175	59	-116	-66%
Trade, Transportation, and Utilities	608,519	555,081	-53,438	-9%
Deep sea freight transportation	745	668	-77	-10%
Coastal and Great Lakes freight transport	165	73	-92	-56%
California				
Manufacturing	1,780,544	1,536,787	-243,757	-14%
Petroleum refineries	13,447	12,776	-671	-5%
Petroleum bulk stations and terminals	1,589	1,794	205	13%
Trade, Transportation, and Utilities	2,719,610	2,729,841	10,231	0.38%
Deep sea freight transportation	2,550	2,367	-183	-7%
Coastal and Great Lakes freight transport	563	346	-217	-39%

Source: Applied Development Economics from data supplied by the Labor Market Information Division of the California Employment Development Department

According to the data in Table 3¹⁵, that employment at Bay Area terminal facilities (also in the Manufacturing sector) declined 66 percent between 2001 and 2004. This particular data set reports Bay terminals employed only 59 workers in 2004. A separate data set (Dun and Bradstreet’s “Zapdata.com”), used later in this report to estimate employment at the specific sites on which this analysis focuses, indicates that employment at these sites alone totals 260. During the same period (2001 – 2004), statewide employment in the Petroleum Bulk Stations and Terminals industry grew by 13 percent.

The data from the Quarterly Census of Employment and Wages indicates that the Deep Sea Freight Transportation and Coastal and Great Lakes Freight Transport industries employed zero people in the Bay Area in 2001; but, that by 2004 these industries employed nearly 750 people combined. Given the historical port operations in the Bay Area and the

¹⁵ Data in Table 3 was obtained from the “Quarterly Census of Employment and Wages,” published by the CA Employment Development Department’s Labor Market Information Division.

statewide employment trends in these industries, it is unlikely that there were zero people employed in occupations related to these industries in 2001. In fact, Occupational Employment Data from the Labor Market Information Division of the Employment Development Department indicates that there were over 900 people employed in the “Captains, Mates, and Pilots of Water Vessels” and “Sailors and Marine Oilers” occupations in 2001¹⁶. In light of this data, it should be assumed that Bay Area employment in the Deep Sea Freight Transportation and Coastal and Great Lakes Freight Transport industries were similar to the State between 2001 and 2004.

Table 4 identifies the economic characteristics of the specific sites affected by the proposed Marine Loading rule amendments. This table shows that the refineries, terminal facilities, and water transportation providers are estimated to employ 1,935 workers, 260 workers, and 365 workers respectively. These sites have an estimated aggregate payroll of \$219.6 million, and estimated revenues of \$10.5 billion. In calculating aggregate revenues generated by Bay Area refineries, the consultant estimated an average revenue figure per refinery based on revenues generated by that refinery in 2004 using annual reports. Then, the consultant summed the refineries’ estimated revenue to arrive at the aggregate amount of \$9.8 billion.

Because not all of the sites in the terminal facilities and water transportation groups are owned/operated by publicly-held companies, the consultant relied on a combination of Dun and Bradstreet business and industry data, as well as data from the 2002 Economic Census to estimate annual revenues per Bay Area site. Wherever possible, revenue data for the specific site was used. Where specific site data was not available, a site’s annual revenue was assumed to be equal to the annual revenue for the “average” Bay Area site in its industry.

¹⁶ This data has been used in Table 3 to approximate the 2001 Bay Area employment in the Deep Sea Freight Transportation” and “Coastal and Great Lakes Freight Transport” industries.

Table 4
Economic Characteristics of Impacted Businesses in the San Francisco Bay Area

	No. of Businesses	Estimated Sales	Estimated Employment	Estimated Payroll
Petroleum Refineries	5	\$9,837,598,944	1,935	\$172,194,300
Terminal Facilities	6	\$488,400,000	260	\$12,855,766
Water Transportation	5	\$221,628,381	365	\$34,522,563
Total	16	\$10,547,627,325	2,560	\$219,572,629

Source: U.S. Economic Census 2002; California Employment Development Department Quarterly Census of Employment and Wages

As Table 5 shows, the affected refinery sites represent 27 percent of all employment within their respective industry in the Bay Area. Overall, there are an estimated 7,196 petroleum refining employees in the Bay Area. Of the 7,196 workers, 1,935 work in the affected refineries, or 27 percent. In all of California, there were 12,776 workers in SIC 2911 (NAICS 32411), meaning that the affected Bay Area refineries equal 15 percent of the state oil refinery workforce.

Table 5
Employment at Impacted Sites Relative to the Bay Area as a Whole

	No. of Businesses	Estimated Employment	Affected Businesses as a % of Bay Area Total	Affected Businesses as a % of California Total
Petroleum Refineries	5	1,935	27%	15%
Terminal Facilities	6	260	34%	14%
Water Transportation	5	365	49%	13%
Total	16	2,560	29%	15%

Source: Calculations by Applied Development Economics

Based upon the Dun and Bradstreet data used in Table 4, Bay Area Terminal Facilities employ approximately 758 people. Of this amount, 260 (34 percent) are employed by the affected facilities represents 34 percent of the Bay Area's total employment in this industry. These affected sites also account for 14 percent of the statewide employment in the Petroleum Bulk Stations and Terminals industry. This is comparable to the affected oil refinery's share of statewide employment in their industry.

Within the Bay Area, the affected water transportation firms account for 49 percent of the total employment in their

combined industries. This is the largest proportion of all of the affected groups within their respective industries. Statewide, however, water transportation firms account for only 13 percent of the total employment in their combined industries. This is comparable to the proportions for both the refineries and the terminal facilities when compared to the statewide industry employment.

3.5 COMPLIANCE COSTS

In addition to consolidating Rule 46 into Rule 44, the proposed rule amendments will reduce the “gas tight” standard for marine tanks and connectors subject to control requirements; expand emission control requirements to include venting operations; and, expand the current list of regulated materials to include all organic liquids with a “flash point” of 100 °F or lower. The remainder of this section discusses the District’s estimates of the annual costs for firms to comply with these proposed regulatory amendments. The estimates discussed below are based upon District staff’s independent research, as well as conversations with industry professionals engaged in operating the equipment and systems that would be utilized to comply with the proposed amendments.

Since the proposed standard of 1,000 ppmv is already in effect in other California ports, no new equipment or maintenance practices are expected to be necessary for compliance. While there could be some cost increases associated with the proposed new monitoring and recordkeeping requirements, these costs are expected to be minimal; most of this monitoring is already required by Coast Guard and other regulations. Additionally, the consolidation of Rule 46 into Rule 44 is intended to streamline the District’s Regulations; and, therefore, is not expected to increase compliance costs. The two (2) proposed amendments that are expected to result in some compliance cost increases are the expansion of the current regulated materials list and the expansion of control requirements to venting operations.

EXPANSION OF CONTROLLED MATERIALS LIST

The annual cost to comply with the proposed amendment to expand the list of controlled materials to include all organic

materials with a “flash point” of 100 °F or lower is expected to be \$448,407 according to District staff calculations. In 2003, 8,500,000 bbl of these materials moved through the Bay Area. The District estimates that the following line item costs will be involved in complying with this proposed amendment:

- Natural Gas = \$113,392/year¹⁷
- Electrical Cost = \$8,297/year¹⁸
- Operational Labor Cost = \$261,375¹⁹
- Maintenance Labor Cost = \$65,344²⁰

The sum of these line item costs is \$448,407.

EXPANSION OF VENTING CONTROL REQUIREMENTS

The total annual cost of compliance with this proposed amendment is estimated at between \$360,000 and \$720,000. While the precise volume of venting activity in District waters is unknown, it is estimated that as many as two to four ventings of large crude oil tankers occur in the San Francisco Bay each month. At an estimated cost of \$15,000 per event, existing abatement facilities are expected to have the capacity to accommodate the additional controlled venting events resulting from this proposed amendment; therefore, no new facilities will be necessary. With 24 events per year, compliance will cost \$360,000; 48 events per year will cost \$760,000.

¹⁷ Assuming usage of 15,749,000 scf/year at \$7.2/1,000 scf based upon the US DOE *Natural Gas Price Summary for Industrial Customers* (July 2005). Natural gas usage is assumed to be 30 percent of the loaded liquid volume (displaced gas volume) + 10 percent.

¹⁸ Assuming usage of 79,231 KW-hr/yr at \$0.10472/kWh average total rate for primary firm power for industrial customers from PG&E 10/1/05 rate schedule. Electrical usage assumes 100 hp load, with operating time based on 8,000 bbl/hr loading rate.

¹⁹ Assuming 1,743 operating hours per year at \$75/hr/person for 2 persons. The estimate of operating hours assumes 50,000 bbl/load, 8,000 bbl/hr loading rate, 2 hours before and after each load for startup/shutdown.

²⁰ Assumed to be equal to ¼ of the operating labor cost.

Table 6					
Estimated Cost of Venting Control Compliance					
	Per Event Compliance Cost	No. of Annual Events		Total Compliance Cost	
		Lower End	Upper End	Lower End	Upper End
Venting Control Requirements	\$15,000.00	24	48	\$360,000	\$720,000

Source: Estimates by Bay Area Air Quality Management District Staff.

3.6 BUSINESS RESPONSE TO COMPLIANCE COSTS

Sites impacted by the proposed Marine Loading rule amendments may respond in a variety of ways when faced with new regulatory costs. These responses may range from simply absorbing the costs and accepting a lower rate of return to shutting down the business operation all together. Businesses may also seek to pass the costs on to their customers in the form of higher prices, although, in general, throughout the oil industry prices are set in global markets and individual producers or refineries are not in a position to affect prices. More likely, they may renew efforts to increase productivity and reduce costs elsewhere in their operation in order to recoup the regulatory costs and maintain profit levels.

3.7 IMPACT ANALYSIS

The businesses' responses to increased compliance costs hinge on the effect of the costs on the profits generated at the affected sites. An impact on estimated profits greater than 10 percent implies that the source would experience serious economic effects because of the compliance cost. When compliance costs are greater than 10 percent of estimated profits, companies typically respond to the impact by laying off some workers, closing parts of manufacturing facilities or, in the most drastic case, possibly closing the manufacturing facility.

Using the cost estimates developed for the proposed Marine loading rule amendments (where those costs are expected to be greater than negligible), ADE calculated the socioeconomic impacts of the proposed actions. In

calculating impacts on profits, ADE used return on sales ratios identified by media reports and in annual reports of companies directly affected by the proposal. Based on this information, we estimate that the affected refineries generated a combined profit of \$688 million on \$9.8 billion in revenues.

Because not all of the sites in the terminal facilities and water transportation groups are owned/operated by publicly-held companies a combination of Dun and Bradstreet business and industry data, as well as data from the 2002 Economic Census was used to estimate annual revenues per Bay Area site. Wherever possible, revenue data for the specific site was used. Where specific site data was not available, a site's annual revenue was assumed to be equal to the annual revenue for the "average" Bay Area site in its industry. Based upon this data, we estimate that affected terminal facilities generate a combined profit of \$13.2 million on \$488.4 million in revenues. Affected water transportation firm profits are estimated at \$8.6 million on \$221.6 million in revenues.

The remainder of this section discusses the impacts compliance with the proposed rule amendment is expected to have on the estimated profits of affected sites. The estimated profit impacts have been calculated where annual compliance costs are expected to be greater than negligible. This is the case with two of the proposed amendments: the expansion of the regulated materials list to include organic compounds with a "flash point of 100 °F or lower, and, the expansion of the venting control requirement.

EXPANSION OF REGULATED MATERIALS LIST

Table 7 details the projected impacts of compliance with this proposed rule amendment on affected site profits. The estimated annual compliance cost of \$448,407 represents less than one percent of profits for affected Bay Area petroleum refineries. The impact on the profits of affected terminal facilities and water transportation firms, at 3.4 percent and 5.2 percent respectively, is higher than that for the petroleum refineries. However, the impacts for all three sets of affected facilities are below the 10 percent threshold for a significant impact.

Table 7
Impact of Proposed Expanded Controlled Materials List on Estimated Profits at Bay Area Businesses

	Impacted Businesses	Estimated Profits Generated	Annual Abatement Cost	Cost as a % of profits
Petroleum Refineries	5	\$688,631,926	\$448,407	0.07%
Terminal Facilities	6	\$13,186,800	\$448,407	3.40%
Water Transportation	5	\$8,643,507	\$448,407	5.19%
Total	16	\$710,462,233	\$448,407	0.06%

Source: Calculations by ADE, based on a 7 percent profit margin for oil refiners, 3.9 percent for Water Transportation Businesses, and 2.7 percent for Terminal Facilities

It is believed that the profit impacts shown in Table 7 are conservative (i.e. higher than will actually be realized). The estimates of profit impacts assume that each industry bears the full cost of compliance. It is more likely that the total \$448,407 annual compliance cost will be spread between sites in all three affected industries. Therefore, it is most likely that no one set of affected sites will carry the full cost of compliance with this proposed amendment. Also, the majority of the impacted sites are operated by the same companies that own and operate the oil refineries. Therefore, the annual compliance cost may actually be a much smaller percentage of overall corporate profits.

EXPANSION OF VENTING CONTROL REQUIREMENT

It is assumed that only the profits of businesses providing water transportation services will be impacted by this proposed rule amendment. Table 8 details the project profit impacts. At the low end, assuming twelve (12) venting events per year and an annual compliance cost of \$360,000, compliance with this proposed amendment represents 4.2 percent of the affected water transportation firms combined profits. At the high end, assuming 48 events per year, the \$760,000 annual compliance cost represents 8.3 percent of the businesses' combined profits. The impacts in both cases are below the 10 percent threshold for a significant impact.

Table 8
Impact of Proposed Venting Control Requirements on Estimated Profits at Bay Area Businesses

	Impacted Businesses	Estimated Profits Generated	Cost of Prevention Measure		Cost as a % of profits	
			Lower End	Upper End	Lower End	Upper End
Water Transportation	5	\$8,643,507	\$360,000	\$720,000	4.16%	8.33%

Source: Calculations by ADE, based on a 7 percent profit margin for oil refiners, 3.9 percent for Water Transportation Businesses, and 2.7 percent for Terminal Facilities

It is believed that these profit impact estimates are conservative in that they are higher than what will actually be the case. Vessels will only be subject to this rule amendment if they vent within District waters. If a vessel sails out of District waters to vent, it will not be subject to this amendment. Because other costs, such as demurrage can be avoided by sailing off the coast, outside District waters, it is believed that some vessels will choose to do this; thereby, reducing the actual annual compliance cost and impact on overall profits. Additionally, the majority of the impacted businesses are operated by the same companies that own and operate the oil refineries. Therefore, the annual compliance cost may actually be a much smaller percentage of overall corporate profits.

3.8 IMPACT ON SMALL BUSINESS

In addition to analyzing the employment impacts of the proposed Marine Loading rule amendments, state legislation requires that the socioeconomic analysis assess whether small businesses are disproportionately affected by air quality rules. First, this section begins with a definition of small business per California Statute. It then goes on to profile oil refineries in the Bay Area region by employment size categories, and, in so doing, shows that most of these manufacturers are relatively large employers. This portion of the section discusses the average size of the five refineries affected by the proposed changes; and, shows how the five refineries affected by the proposed Marine Loading rule amendments fail to qualify as small businesses as defined by the State of California.

Next, this section analyzes the proportion of small to large businesses in the Petroleum Bulk Stations and Terminals industry. The per employee cost of compliance with the proposed expansion of regulated materials for these facilities is calculated and used to estimate the proportion of the total annual compliance cost that will be incurred by small businesses in this sector. The analysis shows that small businesses are not disproportionately affected by this proposed amendment.

This section closes with the application of the above methodology employed for analyzing the small businesses in the Petroleum Bulk Stations and Terminals to the Bay Area businesses engaged in the marine transportation of freight. The proportion of the annual costs for complying with the expansion of the regulations to both other materials and venting operations. As with the Petroleum Bulk Stations and Terminals, the analysis finds that small businesses are not disproportionately impacted the proposed amendments to the Marine Loading rule.

DEFINITION OF SMALL BUSINESS PER CALIFORNIA STATUTE

For purposes of qualifying small businesses for bid preferences on state contracts and other benefits, the State of California defines small businesses in the following manner:

- Must be independently owned and operated;
- Cannot be dominant in its field of operation;
- Must have its principal office located in California
- Must have its owners (or officers in the case of a corporation) domiciled in California; and,
- Together with its affiliates, be either:
 - A business with 100 or fewer employees, and an average gross receipts of \$10 million or less over the previous tax years, or
 - A manufacturer with 100 or fewer employees

OIL REFINERIES BY EMPLOYMENT SIZE CATEGORY

Fifty percent of all businesses in California and 46 percent of United States businesses employ less than fifty people. Data in Table 9 are for all of the oil refinery sites identified by the BAAQMD, and it includes data on sites affected by the proposed Marine Loading rule amendments. The data in the table comes from Dun & Bradstreet and is current as of the second quarter of 2005. As a group, establishments in the affected petroleum refining industry are significantly larger than state and national industries as a whole.

Table 9
Distribution of Oil Refineries by Employment Size in the San Francisco Bay Area

	Employment Size Categories*							
	1 thru 4	5 thru 9	10 thru 24	25 thru 49	50 thru 99	100 thru 249	250 thru 499	500 or more
Bay Area Petroleum refineries	0%	1%	1%	3%	5%	0%	30%	60%
California (all industries)	16%	8%	14%	12%	13%	14%	8%	15%
U.S. (all industries)	12%	8%	14%	12%	13%	15%	8%	18%

Source: Applied Development Economics, based on data supplied by Zapdata.com (a Dun & Bradstreet Company)

*Note: Employment size based on number of employees located at individual company/business sites

Establishments with more than 100 workers represent 37 percent of all establishments in all industries in California and 41 percent in the United States. In contrast, 90 percent of Bay Area oil refineries employ at least 100 people. We estimate that the sites directly affected by the proposed rule amendments employ, on average, 387 workers, placing these facilities as mid- to large-sized employers.

The refineries that are affected by the proposed Marine Loading rule amendments are not independently-owned and operated businesses. These refineries are owned by publicly-traded global corporations whose headquarters are generally outside of California. In addition, each of the refineries that are affected by the proposed Marine Loading rule amendments employ, on average, 387 workers, and their average revenue is approximately \$1.9 billion. Thus, by the standards established by the State of California, these sources are not small businesses. Based on this discussion, it is determined that the proposed Marine Loading rule amendments do not disproportionately affect small businesses because the sources impacted by the proposed changes do not meet California's definition of small business.

TERMINAL FACILITIES

According to Dun and Bradstreet, there are twelve Bay Area businesses operating in the Petroleum Bulk Stations and Terminals industry. Combined these firms employ 758 people. Eight (67 percent) of the twelve firms employ less than 100 workers and have gross receipts (sales) of less than \$10 million annually. These eight firms qualify as small businesses and employ a combined 117 workers. Table 10 illustrates the expected distribution of the annual cost to comply with the proposed expansion of the regulated materials list between small and medium-large businesses in this sector.

Table 10**Share of Annual Cost to Comply with Proposed Expanded Regulated Materials List, by Business Size Category**

Business Size Category	No. of Businesses	% of Total Businesses	No. of Employees	Per Employee Compliance Cost	Annual Compliance Cost	% of Total Compliance Cost
Small Businesses	8	67%	117	\$592	\$69,213	15%
Mid - Large Businesses	4	33%	641	\$592	\$379,194	85%
Total	12	100%	758	\$592	\$448,407	100%

Source: Dun and Bradstreet's "Zapdata.com," calculations by Applied Development Economics

Since all twelve 12 terminal facilities in the Bay Area employ a combined 758 workers, compliance with the proposed expansion of rule requirements to other materials, with a total annual cost of \$448,407, is expected to cost Bay Area firms in this sector \$592 per employee on an annual basis. On a per employee basis, compliance will cost small businesses in this sector, which employ 117 people, a combined \$69,213 annually. Since small businesses account for 67 percent of the Bay Area firms in this sector and are only expected to incur 15 percent of the total estimated annual compliance cost, it is determined that small businesses will not be disproportionately affected by this proposed amendment.

WATER TRANSPORTATION FIRMS

Utilizing the same Dun and Bradstreet data set employed for the terminal facilities, there are approximately 124 businesses in the Bay Area that are engaged in transporting freight by marine routes. Of these, 116 firms, or 94 percent, qualify as small businesses based on the criteria used above. These 116 firms employ a total of 606 people. Table 10 illustrates the expected distribution of the annual cost to comply with the proposed venting control requirements between small and medium-large businesses in this sector.

Table 11
Share of Cost to Comply With Proposed Venting Requirement, by Business Size Category

Business Size Category	No. of Businesses	% of Total Businesses	No. of Employees	Per Employee Compliance Cost	Annual Compliance Cost	% of Total Compliance Cost
Small Businesses	116	94%	606	\$225	\$136,606	19%
Mid - Large Businesses	8	6%	2,588	\$225	\$583,394	81%
Total	124	100%	3,194	\$225	\$720,000	100%

Source: Dun and Bradstreet's "Zapdata.com;" calculations by Applied Development Economics

Because all 124 water freight transportation firms in the Bay Area employ 3,194 workers, compliance with the proposed expansion of rule requirements to gas venting operations is expected to cost Bay Area firms in this sector up to \$760,000, or, \$225 per employee on an annual basis. On a per employee basis, compliance will cost small businesses in this sector, which employ 606 people, a combined \$136,606 annually. Since small businesses account for 94 percent of the Bay Area firms in this sector and are only expected to incur 19 percent of the total estimated annual compliance cost, it is determined that small businesses will not be disproportionately affected by this proposed amendment.

Likewise, Bay Area small businesses in the water freight transportation sector are not expected to be disproportionately affected by the proposed expansion of rule requirements to organic compounds with a "flash point" of 100 °F or less. Employing the same methodology as above, compliance with this proposed amendment will cost \$140 per employee. The total annual compliance cost to Bay Area small businesses will be \$85,077; 19 percent of the total annual compliance cost. Detail is provided in Table 12 below.

Table 12
Share of Annual Cost to Comply with Proposed Expanded Regulated Materials List, by Business Size Category

Business Size Category	No. of Businesses	% of Total Businesses	No. of Employees	Per Employee Compliance Cost	Annual Compliance Cost	% of Total Compliance Cost
Small Businesses	116	94%	606	\$140	\$85,077	19%
Mid - Large Businesses	8	6%	2588	\$140	\$363,330	81%
Total	124	100%	3194	\$140	\$448,407	100%

Source: Dun and Bradstreet's "Zapdata.com;" calculations by Applied Development Economics