

DRAFT SOCIOECONOMIC ANALYSIS FOR REGULATION 9, RULE 10 NITROGEN OXIDES AND CARBON MONOXIDE FROM BOILERS, STEAM GENERATORS AND PROCESS HEATERS IN PETROLEUM REFINERIES

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Prepared for
BAAQMD

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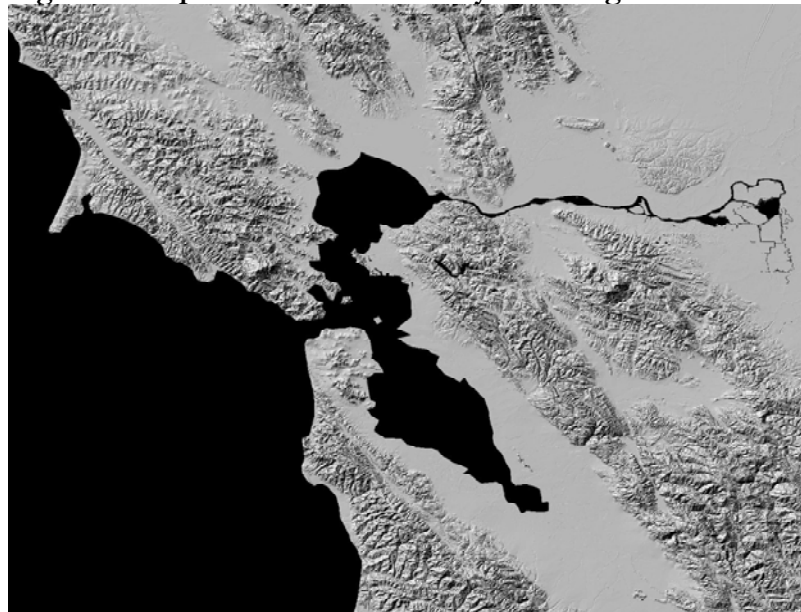
SECTION ONE: INTRODUCTION

The Bay Area Air Quality Management District (“BAAQMD” or the “District”) seeks to amend Regulation 9, Rule 10: Nitrogen Oxides and Carbon Monoxide from Boilers, Steam Generators and Process Heaters in Petroleum Refineries (“Regulation 9-10” or “the rule”). In Further Study Measure 14 of the Bay Area 2005 Ozone Strategy, and subsequently, Control Measure SSM 10 of the Bay Area 2010 Clean Air Plan, the District identified refinery boilers, steam generators, and process heaters as potential sources of further reductions of emissions of nitrogen oxides (NOx), an ozone precursor. By reducing NOx emissions, the District would make progress toward meeting federal and state ozone standards, with respect to which the District currently is in nonattainment.

After this introduction, this report discusses in greater detail how the District proposes to amend Regulation 9-10 (Section Two). After that discussion, the report describes the socioeconomic impact analysis methodology and data sources (Section Three). The report describes population and economic trends in the nine-county San Francisco Bay Area (Section Four), which serves as a backdrop against which the District is contemplating changes to Regulation 9-10. Finally, the socioeconomic impacts stemming from the proposed amendments are discussed in Section Five.

The report is prepared pursuant to the provisions of AB2051 (Section 40728.5 of the California Health and Safety Code), which requires an assessment of socioeconomic impacts of proposed air quality rules. The findings in this report can assist District staff and the Board of Directors in understanding the socioeconomic impacts of the proposed requirements, and can assist staff in preparing a refined version of the rule. Figure 1 is a map of the nine-county region that comprises the San Francisco Bay Area Air Basin.

Figure 1. Map of San Francisco Bay Area Region



SECTION TWO: BACKGROUND OF BAAQMD'S RULE 9-10

The District adopted Regulation 9-10 on January 5, 1994 and subsequently amended it on July 17, 2002. The regulation imposes a refinery-wide average NOx emissions limit on refinery boilers, steam generators and process heaters (excluding CO (carbon monoxide) boilers) that were permitted prior to the adoption of the rule (“pre-1994 heaters”). The NOx limits were not applied to boilers, steam generators and process heaters that would be permitted after the rule was adopted (“post-1994 heaters”) because these devices would be subject to stringent NOx limits as a result of the District’s “best available control technology” (BACT) requirements. The rule also imposes a specific (not average) NOx emission limit on all CO boilers. The NOx limits in Regulation 9-10 for pre-1994 heaters, combined with BACT requirements for post-1994 heaters, resulted in significant reductions in NOx emissions from Bay Area refinery operations beginning in 2002. Currently, 81 percent of the total rated capacity of refinery boilers, steam generators and process heaters in the Bay Area is equipped with NOx controls of some kind.

In the Bay Area 2005 Ozone Strategy (“Further Study Measure FS 14”), and now in the Bay Area 2010 Clean Air Plan (Control Measure SSM 10) the District committed to study ways that the existing Regulation 9-10 emissions limits might be tightened to achieve further NOx emissions reductions. As explained in the Ozone Strategy, however, the District did not commit to continue evaluating measures deemed technically infeasible, cost-ineffective or inappropriate for any other reason, nor did the District commit to move forward with a measure that was deemed feasible as a result of its further study, unless and until the District conducted a rulemaking process.

In carrying out Further Study Measure FS 14, District staff has completed the following:

- Compiled a precise inventory of refinery boilers, steam generators and process heaters
- Determined the type, age, retrofitability of, and the nature of the emissions from, these refinery boilers, steam generators and process heaters
- Evaluated the cost effectiveness of retrofits and replacement technologies
- Evaluated the contribution to emissions of the heaters that are currently exempt from Regulation 9-10
- Compared the NOx emissions limits imposed by other air districts on refinery boilers, steam generators and process heaters
- Compared NOx emissions from and control of non-refinery boilers of similar size that are in use in the District; and
- Consulted extensively with industry representatives regarding these analyses.

At this time, District staff recommends amending Regulation 9-10 in three ways: (1) by making NOx limits on CO boilers more stringent; (2) by expanding the applicability of the rule to smaller natural gas and LPG-fired devices; and (3) by simplifying and clarifying compliance calculation procedures.

First, since 1994 some CO boilers have demonstrated the ability to operate at significantly lower NOx levels than the current Regulation 9-10 limit of 150 ppmv. As a result, District staff recommends amending Regulation 9-10 to impose more stringent NOx limits on CO boilers. The new limits are shown in Table 7 of the staff report. As explained in the staff report, the District anticipates that only one refinery, Shell Oil in Martinez, will incur costs to comply with the proposed new limits.

Second, the District proposes narrowing the exemption in Regulation 9-10-110.1 so that pre-1994 heaters fired with natural gas or LPG fuel with a rated heat input between 10 and 2 MMBTU/hr would be subject to the rule. District staff does not anticipate that the change will require any refinery to add NOx controls since these newly-regulated devices will have other compliance options; however, the change would make refinery heaters regulated in the same size range as non-refinery heaters in Regulation 9-7.

Throughout this rule development process, District staff met this rule development process, District staff met extensively with refinery staff and representatives to evaluate the cost of each control option.

SECTION THREE: METHODOLOGY

Applied Development Economics (ADE) began the analysis by preparing a statistical description of the industry groups of which the affected sources are a part, analyzing data on the number of establishments, jobs, and payroll. We also estimated sales generated by impacted industries, as well as net profits for each affected industry.

This report relies heavily on the most current data available from a variety of sources, particularly the State of California's Employment Development Department (EDD) Labor Market Information Division. In addition, this report relied on data from the State of California's Department of Energy, particularly with respect to measuring throughput capacity of the sole refinery expected to have compliance costs related to the proposed changes to the CO boiler NOx emission limits, i.e. Shell Oil refinery. Another important source of information was the United States Department of Energy/Energy Information Agency, which provides data on retail and wholesale prices of gasoline and other refinery products. For purposes of estimating profits, ADE reviewed industry-specific financial ratios issued by the US Internal Revenue Service.

With the above information, ADE was able to estimate net after tax profit ratios for sources affected by the proposed control measures. ADE calculated ratios of profit per dollar of revenue for affected industries. The result of the socioeconomic analysis shows what proportion of profits the compliance costs represent. Based on assumed thresholds of significance, ADE discusses in the report whether the affected sources are likely to reduce jobs as a means of recouping the cost of rule compliance or as a result of reducing business operations. To the extent that such job losses appear likely, the indirect multiplier effects of the jobs losses are estimated using a regional IMPLAN input-output model. In some instances, particularly where consumers are the ultimate end-users of goods and services subject to proposed control measures, we also analyzed whether costs could be passed to households in the region.

When analyzing the socioeconomic impacts of proposed new rules and amendments, ADE attempts to work closely within the parameters of accepted methodologies discussed in a 1995 California Air Resources Board report called "Development of a Methodology to Assess the Economic Impact Required by SB513/AB969" (by Peter Berck, PhD, UC Berkeley Department of Agricultural and Resources Economics, Contract No. 93-314, August, 1995). The author of this report reviewed a methodology to assess the impact that California Environmental Protection Agency proposed regulations would have on the ability of California businesses to compete. The California Air Resources Board (ARB) has incorporated the methodologies described in this report in its own assessment of socioeconomic impacts of rules generated by ARB. One methodology relates to determining a level above or below which a rule and its associated costs is deemed to have significant impacts. When analyzing the degree to which its rules are significant or insignificant, ARB employs a threshold of significance that ADE follows. Berck reviewed the threshold in his

analysis and wrote, “The Air Resources Board’s (ARB) use of a 10 percent change in [Return on Equity] ROE (i.e. a change in ROE from 10 percent to a ROE of 9 percent) as a threshold for a finding of no significant, adverse impact on either competitiveness or jobs seems reasonable or even conservative.”

SECTION FOUR: REGIONAL DEMOGRAPHIC AND ECONOMIC TRENDS

This section of the report tracks economic and demographic contexts within which District staff and officials are contemplating changes to Rule 9-10. Table 1 tracks population growth in the nine-county San Francisco Bay Area between 1999 and 2009, including data for the year 2004. Between 1999 and 2004, the region grew by less than one percent a year, at 0.6 percent. Between 2004 and 2009, the region grew annually by slightly over one percent, at 1.1 percent a year. Overall, there are 7,459,858 people in the region. At 1,880,876, Santa Clara County has the most people, while Napa has the least, at 138,917.

**TABLE 1
REGIONAL DEMOGRAPHIC TRENDS: 1999-2009
POPULATION GROWTH: SAN FRANCISCO BAY AREA**

	Population			Percent Change		
	1999	2004	2009	99-04	04-09	99-09
California	34,336,091	36,676,931	38,648,090	1.3%	1.1%	1.2%
Bay Area	6,878,214	7,073,168	7,459,858	0.6%	1.1%	0.8%
Alameda County	1,454,302	1,498,967	1,574,857	0.6%	1.0%	0.8%
Contra Costa County	930,025	1,016,407	1,073,055	1.8%	1.1%	1.4%
Marin County	249,671	251,586	260,651	0.2%	0.7%	0.4%
Napa County	127,005	132,280	138,917	0.8%	1.0%	0.9%
San Francisco Cty.	801,377	806,433	856,095	0.1%	1.2%	0.7%
San Mateo County	730,029	720,042	754,285	0.3%	0.9%	0.3%
Santa Clara County	1,736,722	1,753,041	1,880,876	0.2%	1.4%	0.8%
Solano County	399,026	418,876	427,837	1.0%	0.4%	0.7%
Sonoma County	450,057	475,536	493,285	1.1%	0.7%	0.9%

Source: Applied Development Economics, based on total population estimates from The California Department of Finance (E-5 Report)

Data in Table 2 describe the larger economic context within which officials are contemplating the proposed updates to Rule 9-10. Businesses in the region employ over three million workers, or 3,193,427. The number of jobs in the region grew annually by 1.2 percent between 2004 and 2009, after having declined dramatically between 1999 and 2004 by 2.4 percent a year. Of the 3,193,427 positions, almost 14 percent are in the public sector. In the state, slightly over 16 percent of all jobs are in the public sector. Relative to the state as a whole, manufacturing, professional/business services, and education/health service sectors comprise a greater proportion of the employment base in the Bay Area. In the region, these sectors comprise 10.1 percent (manufacturing), 17.4 percent (professional/business services), and 12.1 percent (private education/health services) respectively of total employment. In the state, these sectors comprise 8.8 percent, 14.1 percent, and 11.5 percent of the statewide job base. In other words, as a percent of total workforce, the region employs more people in sectors with occupations that presumptively require more skills and are higher-paying.

**TABLE 2
SAN FRANCISCO BAY AREA EMPLOYMENT TRENDS, 1999-2009**

	SF Bay Area Employment			Distribution		1999-2004		2004-2009	
	1999	2004	2009	SFBA 2009	California '09	Change	CAGR	Change	CAGR
Private and Public	3,391,178	3,003,433	3,193,427	100.0%	100.0%	-387,745	-2.4%	189,994	1.2%
Total, all industries (private sector)	2,960,921	2,588,826	2,748,225	86.1%	83.6%	-372,095	-2.7%	159,399	1.2%
Goods-Producing	662,086	515,650	493,895	15.5%	16.0%	-146,436	-4.9%	-21,755	-0.9%
Natural Resources and Mining	29,454	17,599	21,799	0.7%	2.7%	-11,855	-9.8%	4,200	4.4%
Construction	171,832	169,409	150,514	4.7%	4.4%	-2,423	-0.3%	-18,895	-2.3%
Manufacturing	460,800	328,642	321,582	10.1%	8.8%	-132,158	-6.5%	-7,060	-0.4%
Service-Providing	2,298,835	2,073,176	2,254,329	70.6%	67.6%	-225,659	-2.0%	181,153	1.7%
Trade, Transportation, and Utilities	602,544	521,223	526,983	16.5%	18.0%	-81,321	-2.9%	5,760	0.2%
Information	121,893	110,639	112,229	3.5%	3.0%	-11,254	-1.9%	1,590	0.3%
Financial Activities	198,588	197,996	183,446	5.7%	5.4%	-592	-0.1%	-14,550	-1.5%
Professional and Business Services	629,658	502,453	556,256	17.4%	14.1%	-127,205	-4.4%	53,803	2.1%
Education and Health Services	326,645	323,039	385,503	12.1%	11.5%	-3,606	-0.2%	62,464	3.6%
Leisure and Hospitality	290,783	284,461	324,850	10.2%	10.2%	-6,322	-0.4%	40,389	2.7%
Other Services	128,724	133,027	157,909	4.9%	5.0%	4,303	0.7%	24,882	3.5%
Unclassified	0	338	7,155	0.2%	0.4%				
Government Ownership:	430,257	414,607	445,202	13.9%	16.4%	-15,650	-0.7%	30,595	1.4%
Federal Government	60,971	52,493	51,320	1.6%	1.7%	-8,478	-2.9%	-1,173	-0.5%
State Government	77,744	81,082	86,757	2.7%	3.1%	3,338	0.8%	5,675	1.4%
Local Government	291,542	281,032	307,125	9.6%	11.6%	-10,510	-0.7%	26,093	1.8%

Source: Applied Development Economics, Inc., based on California EDD LMID

Table 2 above also shows precipitous decline in employment in industries most-affected by the downturn in the economy that began in late 2007, namely housing. Construction employment declined by 2.3 percent per year between 2004 and 2009, with financial activities (which includes real estate) declining by 1.5 percent annually over the same period.

The proposed amendments to Rule 9-10 affect one particular industry in the Bay Area, namely refineries. While the California EDD LMID reports that there are 28 refineries in the nine-county region, more than likely, this state agency applied a broader definition for refinery operations in the region. Rule 9-10 defines refineries as facilities engaged in the production of gasoline, etc. through the distillation of petroleum or through redistillation, cracking or reforming of unfinished petroleum derivatives. The EDD data includes facilities classified under BAAQMD rules as distribution facilities. Nonetheless, Table 3 below shows refinery trends per the EDD-LMID. What is striking about the table below is the high average pay workers garner in this industry. Average annual pay is \$134,393. It is worth noting that Table 3 shows that employment grew by 5.7 percent a year, according to the EDD LMID.

TABLE 3
SF BAY AREA EDD-LMID REFINERY TRENDS, 1999-2009

	1999	2004	2009	99-04 CAGR	04-09 CAGR
Establishments	28	35	28	4.6%	-4.2%
Employment	6,779	6,335	8,352	-1.3%	5.7%
Payroll	\$686,031,847	\$754,700,581	\$1,122,391,845	1.9%	8.3%
Average Pay	\$101,200	\$119,132	\$134,393	3.3%	2.4%

Source: Applied Development Economics, Inc., based on California EDD LMID

Table 4 below identifies the businesses in the Bay Area that are refineries that would be subject to the rule. The list comes from the California Energy Commission, which also included each refinery's respective throughput capacity. Of the five operating refineries in the region, Chevron is the largest, refining 242,900 42-gallon barrels per day. The sole entity expected to have compliance costs related to the proposed CO boiler NOx emission limits is Shell Oil in Martinez, which refines 155,600 barrels per day.

TABLE 4
BAY AREA REFINERIES (CALIFORNIA ENERGY COMMISSION) AND CRUDE OIL CAPACITY

Refinery	Barrels Per Day
Chevron U.S.A. Inc., Richmond Refinery	242,901
Tesoro Refining & Marketing Company, Golden Eagle (Avon/Rodeo) Refinery	166,000
Shell Oil Products US, Martinez Refinery	155,600
Valero Benicia Refinery	144,000
ConocoPhillips, Rodeo San Francisco Refinery	76,000

Source: Applied Development Economics, Inc., based on California Energy Commission

SECTION FIVE: SOCIOECONOMIC IMPACT ANALYSIS

This section of the report analyzes socioeconomic impacts stemming from changes to the Rule 9-10. If the proposed amendments are adopted, the District estimates that the impacted source will incur less than \$3 million in annual costs. This section of the report compares these annual costs against estimated revenues and net profits generated by the affected source, which is the Shell Oil Refinery in Martinez. The results are summarized in Table 5 below.

The Shell Oil Refinery's throughput capacity is approximately 155,600 42-gallon barrels a day, according to the State of California. Assuming a 90 percent utilization rate, and further estimating the price of wholesale gasoline at \$1.812 per gallon, wholesale diesel at \$2.569, and other products at \$1.655¹, we estimate the affected refinery generates \$3.5 billion in revenues a year, from which is generated \$246.1 million in net profits. When the annual cost stemming from the proposed amendments of \$3 million is compared against typical annual net profits, we obtain a cost-to-net profit ratio of less than one percent, or 1.2 percent.² As a result, impacts are less than significant. Moreover, because this establishment is not a small business, small businesses are not disproportionately impacted by the proposed amendments.

TABLE 5
SOCIOECONOMIC IMPACT ANALYSIS: PROPOSED
CHANGES TO REGULATION 9, RULE 10

Shell Oil Refinery	
Barrels Per Day	155,600
Est. Revenues	\$3.5 billion
Est. Net Profits	\$246.1 million
Annual Cost (Reg 9, Rule 10 change)	\$3 million
Cost to Net Profits	1.2%
Significant?	No

Source: Applied Development Economics, Inc.

¹Source: ADE, Inc., based on US Department of Energy, Energy Information Agency annual wholesale price for gas and diesel (2000-2009) in California.

² Source: net profit rate: ADE, Inc., based on US Internal Revenue Service ("SOI Tax Stats" 1994-2009): the long-term average annual after-tax net profit rate for oil refineries is approximately 7.0 percent, according to US IRS SOI data.