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**SOCIOECONOMIC ANALYSIS OF PROPOSED AMENDMENTS TO  
REGULATION 9, RULE 10: NOX AND CO FROM BOILERS,  
STEAM GENERATORS, AND PROCESS HEATERS IN PETROLEUM  
REFINERIES**

Prepared for:

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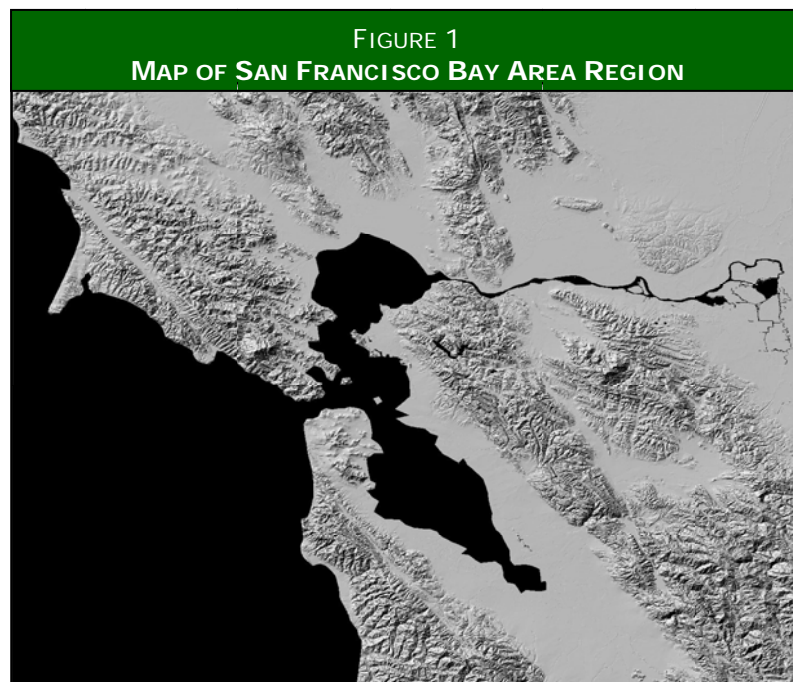
# INTRODUCTION

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The Bay Area Air Quality Management District (“BAAQMD” or the “Air 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”). The Air District is considering amendments to Regulation 9, Rule 10 that would set a voluntary, alternative NOx emission limit that a refinery could elect to use instead of the current emission limit that applies to most refinery heaters that were in service in 1994 (“pre-1994 heaters”). The Air District is also considering amendments that would require more continuous emission monitoring systems (CEMS) to be used on refinery heaters subject to this rule.

After this introduction, this report discusses in greater detail how the District proposes to amend Regulation 9-10 (Proposed Rule Amendment). After that discussion, the report describes the socioeconomic impact analysis methodology and data sources (Methodology). The report describes population and economic trends in the nine-county San Francisco Bay Area (Regional Economic Trends), 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 the final section.

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 Board of Directors in understanding the socioeconomic impacts of the proposed requirements. Figure 1 is a map of the nine-county region that comprises the San Francisco Bay Area Air Basin.



# PROPOSED RULE AMENDMENTS

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The Air District adopted Regulation 9-10 on January 5, 1994 and subsequently amended it on July 17, 2002 and on December 15, 2010. The regulation imposes a refinery-wide average NO<sub>x</sub> 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 NO<sub>x</sub> 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 NO<sub>x</sub> limits as a result of the District’s “best available control technology” (BACT) permit requirements. The rule also imposes a specific (not average) NO<sub>x</sub> emission limit on all CO boilers. The NO<sub>x</sub> limits in Regulation 9-10 for pre-1994 heaters, combined with BACT permit requirements for post-1994 heaters, resulted in significant reductions in NO<sub>x</sub> 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 NO<sub>x</sub> controls of some kind.

The Air District is considering amendments to Regulation 9-10 that would set a voluntary, alternative NO<sub>x</sub> emission limit that a refinery could elect to use instead of the current emission limit that applies to most refinery heaters that were in service in 1994 (“pre-1994 heaters”). The Air District is also considering amendments that would require more continuous emission monitoring systems (CEMS) to be used on refinery heaters subject to this rule.

The current NO<sub>x</sub> emission limit is a daily, average emission rate limit expressed as 0.033 pounds of NO<sub>x</sub> per million BTUs of collective heat input (0.033 lb/MM BTU) at pre-1994 heaters. The proposed alternative limit would set a daily NO<sub>x</sub> emissions limit based on the mass of NO<sub>x</sub> emitted from the pre-1994 heaters (ton/day). Each refinery would need to choose whether to have its entire population of pre-1994 heaters be subject to the existing emission rate limit or instead have them be subject to a mass limit.

Like the existing emission rate limit, the proposed mass limit still would be a refinery-wide limit as opposed to a source-specific limit, which will allow refinery operators to retain flexibility over their operations. The mass limit will be different for each refinery choosing this alternative compliance method. To calculate the mass limit for any refinery under the proposal, a refinery operator would determine the “baseline NO<sub>x</sub> daily emissions” from each pre-1994 heater (referred to as a “device” in the proposed rule) using actual emissions data from a “baseline” period, which is discussed in more detail below. All of the devices taken together would then be subject to a daily NO<sub>x</sub> mass limit that is equal to the sum of the baseline NO<sub>x</sub> daily emissions for all of the devices. Provisions in the proposed rule allow for emission reduction credits (ERCs) to be used in place of expiring interchangeable emission reduction credits (IERCs) during the baseline period, or to be used in place of emission reductions that would have been required under the existing rule for any project for which a permit application has been submitted in order to set the baseline NO<sub>x</sub> daily emissions limit. A refinery’s daily NO<sub>x</sub> mass limit (which as mentioned above is equal to the sum of the baseline mass emissions from each device) would be reduced whenever a device is no longer subject to this rule (for example, if the device is modified or taken out of service). The amount of the reduction is the baseline NO<sub>x</sub> daily emissions for that device.

# METHODOLOGY

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Applied Development Economics (ADE) began the analysis by preparing a statistical description of the industry group 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, in this case petroleum refining.

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 CO boiler NOx emission limits. 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 rule amendments. 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 ultimately end-users of goods and services subject to proposed rule amendments, we also analyzed whether costs could be passed to households in the region. However, in this rule, no job losses or consumer impacts are anticipated.

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."

# REGIONAL 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 2002 and 2012, including data for the year 2007. Between 2002 and 2007, the region grew by 0.4 percent a year, which was considerably slower than statewide annual growth rate for the same period of 0.9 percent. Between 2007 and 2012, the region increased its rate of growth to an annual rate of 0.8 percent. Overall, there are 7,327,627 people in the region. At 1,842,254, Santa Clara County has the most people, while Napa has the least, at 138,383.

TABLE 1 POPULATION TRENDS: NINE COUNTY SAN FRANCISCO BAY AREA AND CALIFORNIA: 2002 – 2012					
	2002	2007	2012	02-07 ANN. CHG.	07-12 ANN. CHG.
<b>California</b>	<b>35,163,609</b>	<b>36,704,375</b>	<b>37,966,471</b>	<b>0.9%</b>	<b>0.7%</b>
Bay Area:	<b>6,883,559</b>	<b>7,033,325</b>	<b>7,327,626</b>	<b>0.4%</b>	<b>0.8%</b>
Alameda	1,467,892	1,484,085	1,548,681	0.2%	0.9%
Contra Costa	984,256	1,027,264	1,074,702	0.9%	0.9%
Marin	247,342	249,546	254,007	0.2%	0.4%
Napa	128,683	133,969	138,383	0.8%	0.7%
San Francisco	782,599	795,002	825,111	0.3%	0.7%
San Mateo	704,014	707,820	735,678	0.1%	0.8%
Santa Clara	1,693,752	1,747,912	1,842,254	0.6%	1.1%
Solano	407,882	412,908	418,387	0.2%	0.3%
Sonoma	467,139	474,819	490,423	0.3%	0.6%

Source: California DOF E-4 2000-2010 Final EOC Report with 2000 and 2010 Census, and California DOF E-4 2013

Data in Table 2 describe the larger economic context within which officials are contemplating the proposed updates to the Rule 9-10. Businesses in the region employ over three million workers, or 3,245,491. The number of jobs in the region declined annually by 0.5 percent between 2007 and 2012, after having grown at a low annual pace of 0.1 percent a year between 2002 and 2007.

Relative to the state as a whole, manufacturing, professional/business services, information, and financial services sectors comprise a greater proportion of the region’s employment base. In the region, these sectors comprise 9.4 percent (manufacturing), 11.0 percent (professional/business services), 3.7 percent (information) and 3.7 percent (financial services) respectively of total private and public sector employment. In the state, these sectors comprise 8.3 percent (manufacturing), 7.3 percent (professional/business services), 2.9 percent (information), and 3.5 percent (financial services) 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.

Of the 3,245,491 positions, 187,750 (5.8 percent) are public sector positions, excluding education. Including education, the public sector employed 341,546 or 10.5 percent of all public and private sector jobs in 2012, meaning that public education alone comprises 4.7 percent of all Bay Area jobs. It is important to note that the 10.5 percent figure somewhat understates public sector employment because the EDD has not issued public sector elementary/secondary school employment data for San Francisco County for 2012. In the state, slightly over 15 percent of all public and private sector jobs are in the public sector. Excluding education, the public sector comprises 8.5 percent of all statewide jobs, meaning public sector employment in education alone comprises 6.8 percent of all jobs.

**TABLE 2  
SECTORAL EMPLOYMENT TRENDS: NINE COUNTY SAN FRANCISCO BAY AREA AND CALIFORNIA: 2002 - 2012**

	San Francisco Bay Area: Employment Trends			SF Bay Area: Employment Distribution and Change			California: Employment Distribution and Change		
	2002	2007	2012	2012 Dist.	02-07 Ann. Chg.	07-12 Ann. Chg.	2012 Dist.	02-07 Ann. Chg.	07-12 Ann. Chg.
Total, all industries and sectors	3,312,546	3,323,630	3,245,491	100%	0.1%	-0.5%	100%	1.0%	-1.0%
Goods-Producing	602,766	550,838	459,874	14.2%	-1.8%	-3.5%	14.9%	-0.4%	-4.1%
Agriculture and Natural Resources	23,485	20,413	18,621	0.6%	-2.8%	-1.8%	2.7%	0.5%	1.0%
Mining (less oil and gas)	538	195	386	0.0%	-	14.6%	0.0%	-0.2%	-4.1%
Construction	182,399	192,082	136,237	4.2%	1.0%	-6.6%	3.9%	2.9%	-8.4%
Manufacturing (less refineries)	396,344	338,148	304,631	9.4%	-3.1%	-2.1%	8.3%	-2.3%	-3.1%
Service-Providing Sectors: Consumer and Business	1,493,658	1,511,434	1,501,617	46.3%	0.2%	-0.1%	43.1%	1.7%	-1.1%
Retail (less gas stations)	330,949	331,284	308,252	9.5%	0.0%	-1.4%	10.0%	1.4%	-1.8%
Wholesale	129,192	126,894	115,500	3.6%	-0.4%	-1.9%	4.5%	2.1%	-1.4%
Transportation and Warehousing (less pipeline services)	104,437	72,375	78,458	2.4%	-7.1%	1.6%	2.7%	0.4%	-1.1%
Information	124,190	113,084	121,447	3.7%	-1.9%	1.4%	2.9%	-1.2%	-2.0%
Financial Activities	147,833	146,927	120,673	3.7%	-0.1%	-3.9%	3.5%	1.3%	-3.4%
Real Estate and Leasing	61,793	59,335	53,531	1.6%	-0.8%	-2.0%	1.7%	1.0%	-2.6%
Professional and Business Services	294,762	330,858	356,076	11.0%	2.3%	1.5%	7.3%	3.2%	0.5%
Leisure and Hospitality (i.e. lodgings, food, entertainment)	300,502	330,677	347,681	10.7%	1.9%	1.0%	10.5%	2.5%	0.2%
Service-Providing Sectors: Institution-based Services	504,113	516,943	566,368	17.5%	0.5%	1.8%	19.4%	1.4%	1.0%
Education (public and private)	218,887	219,683	237,894	7.3%	0.1%	1.6%	9.1%	0.9%	-0.2%
Health Services	285,226	297,260	328,474	10.1%	0.8%	2.0%	10.2%	1.9%	2.1%
Service-Providing Sectors: Other Services	389,584	398,608	416,543	12.8%	0.5%	0.9%	13.1%	1.0%	-0.2%
Others (i.e. mgt. of companies, admin., waste, & other)	388,924	396,652	402,933	12.4%	0.4%	0.3%	12.6%	1.0%	-0.5%
Unclassified*	660	1,956	13,610	0.4%	24.3%	47.4%	0.5%	2.0%	7.2%
Energy and Utilities	22,792	21,614	24,800	0.8%	-1.1%	2.8%	1.0%	0.6%	0.4%
Utilities**	4,846	3,500	7,664	0.2%	-6.3%	17.0%	0.4%	1.0%	0.3%
Energy (i.e. oil/gas, refineries, gas stations, pipelines)	17,946	18,114	17,136	0.5%	0.2%	-1.1%	0.6%	0.3%	0.4%
Public Sector (less education)	213,027	210,884	187,750	5.8%	-0.2%	-2.3%	8.5%	0.3%	-0.5%
Federal Government	56,886	52,283	48,413	1.5%	-1.7%	-1.5%	1.7%	-0.6%	0.5%
State Government	31,730	28,324	29,617	0.9%	-2.2%	0.9%	1.7%	-1.1%	-0.1%
Local Government	124,411	130,277	109,721	3.4%	0.9%	-3.4%	5.2%	1.1%	-0.9%

\* Note: Employment and employment change between 2002, 2007 and 2012 may be overstated because what is "unclassified" in one year may not be so in another

\*\* Note: Utilities employment data for 2002 and 2007 (relative to 2012) undercounted due to masking

Source: ADE, Inc., based on California EDD LMID



The table 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 in the Bay Area declined by 6.6 percent per year between 2007 and 2012, with financial services (-3.9 percent a year) and real estate (-2.0 percent a year) declining significantly 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 21 refineries in the nine-county region (see Table 3 below), 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, the table 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 estimated at \$168,252.

TABLE 3 TRENDS IN REFINERIES BASED ON CALIFORNIA EDD LMID: SAN FRANCISCO BAY AREA AND CALIFORNIA					
Bay Area	2002	2007	2012	02-07 Ann. Chg.	07-12 Ann. Chg.
Establishments	33	17	21	-12%	4%
Employment	6,551	6,843	6,758	1%	0%
Avg. Pay	\$113,015	\$179,472	\$168,252	10%	-1%
California	2002	2007	2012	02-07 Ann. Chg.	07-12 Ann. Chg.
Establishments	172	148	127	-3%	-3%
Employment	12,884	12,932	12,611	0%	-1%
Avg. Pay	\$89,721	\$148,619	\$170,217	11%	3%

Source: ADE, 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. There are five refineries. 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 245,271 42-gallon barrels per day.

TABLE 4 SAN FRANCISCO REFINERIES SUBJECT TO PROPOSED RULE AMENDMENTS	
	Daily Throughput Capacity (barrels per day)
1 Chevron U.S.A. Inc., Richmond Refinery	245,271
2 Tesoro Refining & Marketing Company, Golden Eagle (Avon/Rodeo) Refinery	166,000
3 Shell Oil Products US, Martinez Refinery	156,400
4 Valero Benicia Refinery	132,000
5 ConocoPhillips, Rodeo San Francisco Refinery	78,400
	<b>778,071</b>

Source: BAAQMD and California Energy Commission

# SOCIO-ECONOMIC IMPACTS

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This section of the report analyzes socioeconomic impacts stemming from changes to the Rule 9-10. District staff estimates that CEMS cost from \$100,000 to \$500,000 to install and estimates \$25,000 per year in operating costs, including maintenance and performance testing. Utilizing the highest cost, if the proposed amendments are adopted, the impacted sources will incur \$1.725 million in annual costs over a ten year period. This section of the report compares these annual costs against estimated revenues and net profits generated by the affected sources.

**TABLE 5  
ESTIMATED CAPITAL AND OPERATIONAL COST OF CEMS: TEN YEAR TOTAL AND ANNUAL ESTIMATE**

Est. Capital and Operational Cost of CEMS over Ten Years	\$17,250,000
Est. Annual Capital and Operational Cost of CEMS Over Ten Yr. Period	\$1,725,000

Source: BAAQMD

The throughput capacity of the five affected refineries is approximately 778,071 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 \$1.876 per gallon, wholesale diesel at \$1.858, and other products at \$1.579 , we estimate the affected refineries generate \$16.0 billion in revenues a year, from which is generated \$1.1 billion in net profits. When the annual cost of \$1.725 million is compared against estimated annual net profits, we obtain a cost-to-net profit ratio of less than one percent, or 0.15 percent. As a result, impacts are less than significant. Moreover, because affected establishments are not small businesses, small businesses are not disproportionately impacted by the proposed amendments.

**TABLE 6  
SOCIOECONOMIC ANALYSIS OF PROPOSED AMENDMENTS TO REGULATION 9, RULE 10**

<b>SF Bay Area Refineries</b>	
Establishments	5
Est. Annual Revenues	\$16,047,223,249
Est. Annual Profits	\$1,123,305,627
Annual Rule Cost	\$1,725,000
Annual Cost to Profit Ratio	0.15%
Significant	no

Source: ADE, Inc.