APPLIED DEVELOPMENT ECONOMICS, INC.

SOCIO-ECONOMIC ANALYSIS OF PROPOSED REGULATION 12, RULE 15: PETROLEUM REFINING EMISSIONS TRACKING

Prepared for:

Bay Area Air Quality Management District

April 2016

Prepared by:

APPLIED DEVELOPMENT ECONOMICS, INC.
255 Ygnacio Valley Road, #200 ■ Walnut Creek, CA 94596 ■ 925.934.8712
99 Pacific Street, #200-J, Monterey, CA 93940 ■ 831.324.4896
2320 Broadway, Sacramento, CA 95818 ■ 916.454.1537
www.adeusa.com

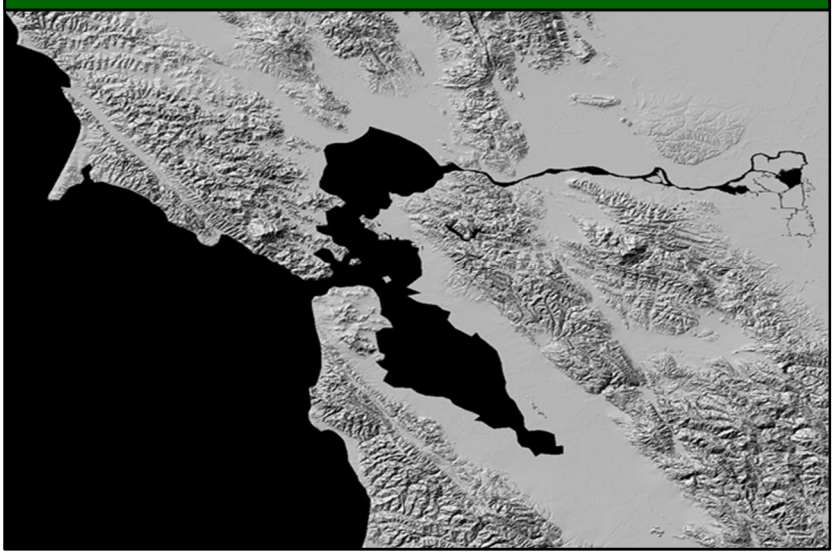
TABLE OF CONTENTS

1. INTRODUCTION

The Bay Area Air Quality Management District ("BAAQMD" or the "Air District") seeks to adopt Regulation 12, Rule 15 ("Petroleum Refining Emissions Tracking" or "Regulation 12-15"). The purpose of Regulation 12-15 is to track air emissions and crude oil quality characteristics from petroleum refineries over time, and to establish monitoring systems to provide detailed air quality data along refinery boundaries. After this introduction, this report discusses in greater detail the elements of Regulation 12-15 with cost impacts to Bay Area refineries (Section Two). A complete discussion of all of the elements of this rule is included in the Final Staff Report. After the discussion of cost impacts, 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 Air District is contemplating adopting Regulation 12-15. Finally, the socioeconomic impacts stemming from the proposed regulation are discussed in Section Five.

The report is prepared pursuant to 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 Air District staff 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



2. BACKGROUND OF BAAQMD'S RULE 12-15

In general, the Air District regulates stationary sources of air pollution, which includes certain petroleum refineries that would be subject to proposed Regulation 12, Rule 15 ("Regulation 12-15"). Bay Area refineries are currently subject to over 20 separate air quality rules, many of which focus on specific equipment in place at refineries, as well as different kinds of pollutants emitted by refineries.

In an effort to further improve air quality, the Air District seeks to adopt Regulation 12, Rule 15. The purpose of Regulation 12-15 is to track air emissions and crude oil quality characteristics from petroleum refineries over time, and to establish monitoring systems to provide detailed air quality data along refinery boundaries. The rule covers three classes of regulated air pollutants, including "criteria pollutants", "toxic air contaminants" (TACs), and greenhouse gases (GHGs).[1]

The Air District proposed Regulation 12-15 because of the possibility of changes to "crude oil slates" at the five petroleum refineries in the Bay Area, which could result in increases in emissions of criteria pollutants, TACs and GHGs. Crude oil slate refers to the characteristics of crude oil and other feedstocks processed at a refinery, including some composition elements and some physical characteristic elements.

Proposed Regulation 12, Rule 15 includes the following steps that will result in costs to the affected petroleum refineries:

- Submit consistent, **enhanced periodic emissions inventory information**, including information about cargo carriers;
- Make available **historic and periodic crude slate information, including volumes and composition data**, for imported pre-processed feedstocks as well as for crude oil;
- Install and operate new **air monitoring facilities at refinery fence lines**; and

The analysis of the socioeconomic impacts of new Regulation 12-15 in Section Five is based on the costs in Table 1. The basis for these costs is provided after the table.

[1]Criteria pollutants are air pollutants for which there are ambient air quality standards that set levels of concentrations of pollutants designed to be protective of public health. Examples of criteria pollutants include ozone and particulate matter in the air. TACs refer to up to 200 air pollutant compounds that may have health impacts in terms of exposure though there are not yet any air quality standards. GHG refers to air pollutant compounds that affect global warming and climate change.

Table 1 - Regulation 12, Rule 15 Costs		
Section	**Requirement**	**Cost (per refinery)**
12-15-401	Prepare and Submit Annual Petroleum Refinery Emissions Inventory (beginning with year 2016 data)	$90,000 / year (annualized)
12-15-408.2	Prepare Monthly Crude Slate Report (beginning with year 2016 data)	
12-15-408.1	Prepare Historical Monthly Crude Slate Reports for 2012, 2013, 2014 & 2015	
12-15-403	Prepare Air Monitoring Plans (one time submittal)	$250,000 (one-time)
12-15-501	Fenceline Air Monitoring System (construction and operation)	$2,000,000 (one-time construction) $50,000 / year (maintenance & operation)

12-15-401 and 408

These sections require one-time submittals, or one-time document preparations, related to the refinery inventory and crude slate, as well as ongoing reports (monthly crude slate reports and annual inventories) are assumed to constitute one-half of a full-time employee (FTE) with a resulting annualized cost of $90,000 at each of the refineries.

12-15-403

The one-time fenceline monitoring plans are expected to be prepared by an environmental consulting firm at a cost of no more than $250,000 at each of the refineries. Air District staff is familiar with the required elements of this type of document and the resources required to complete them.

12-15-501

The Air Monitoring Guidelines prepared as a companion document to Rule 12-15 suggest that 2 permanent fenceline monitors (upwind and downwind of the refinery) will be required. District staff estimates that monitors will cost up to $1,000,000 each to install. Therefore, total capital cost, including site development, infrastructure development (electricity and communications) and construction is not expected to exceed $2,000,000 per refinery. Assuming $25,000 per year for maintenance and operation at each monitor, and 2 monitors per refinery, the total annual cost is not expected to exceed $50,000 per year per refinery. Air District staff have designed, constructed and operated similar monitoring facilities and are familiar with these costs.

All costs are summarized in Table 6 of Section 5, with costs shown above as occurring one-time converted to annualized costs by applying a capital recovery factor of 0.14 to the one-time cost, as discussed in Table 6.

3. METHODOLOGY

Applied Development Economics (ADE) began this 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 relies on data from the State of California's Energy Commission (CEC), particularly with respect to measuring throughput capacity of the five refineries subject to these new requirements. From the CEC, we also obtained information on retail and wholesale prices of gasoline and other refinery products, as well as industry-specific profitability ratios.

With the above information, ADE was able to estimate net after tax profit ratios for sources affected by the proposed new regulation. 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 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 provided by the affected sources, 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 (ARB) 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 ARB has incorporated the methodologies described in this report in its own assessment of socioeconomic impacts of rules generated by the 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, the 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."

4. REGIONAL DEMOGRAPHIC AND ECONOMIC TRENDS

This section of the report tracks economic and demographic contexts within which the Air District is contemplating new Regulation 12-15. Table 2 tracks population growth in the nine-county San Francisco Bay Area between 2003 and 2013, including data for the year 2008. Between 2003 and 2008, the region grew by approximately 1 percent a year. Between 2008 and 2013, the region grew annually at a much slower rate of 0.1 percent per year. Overall, there are 7,420,453 people in the region. At 1,868,558, Santa Clara County has the most people, while Napa has the least, at 139,255.

TABLE 2:
REGIONAL DEMOGRAPHIC TRENDS: 2003-2013
POPULATION GROWTH: SAN FRANCISCO BAY AREA

	Population			Annual Percent Change		
	2003	2008	2013	03 - 08	08 - 13	03 - 13
California	36,199,342	38,292,687	38,340,074	1.1%	0.0%	0.6%
Bay Area	**7,025,575**	**7,375,678**	**7,420,453**	**1.0%**	**0.1%**	**0.5%**
Alameda County	1,495,162	1,556,657	1,573,254	0.8%	0.2%	0.5%
Contra Costa County	1,005,590	1,060,435	1,087,008	1.1%	0.5%	0.8%
Marin County	250,793	258,618	255,846	0.6%	-0.2%	0.2%
Napa County	131,228	137,571	139,255	0.9%	0.2%	0.6%
San Francisco County	795,042	845,559	836,620	1.2%	-0.2%	0.5%
San Mateo County	717,921	745,858	745,193	0.8%	0.0%	0.4%
Santa Clara County	1,739,939	1,857,621	1,868,558	1.3%	0.1%	0.7%
Solano County	416,379	426,729	424,233	0.5%	-0.1%	0.2%
Sonoma County	473,521	486,630	490,486	0.5%	0.2%	0.4%

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

Data in Table 3 describe the larger economic context within which officials are contemplating new Regulation 12-15. Businesses in the region employ over three million workers, or 3,376,819. The number of private and public sector jobs in the region grew annually by 0.5 percent between 2008 and 2013, after having grown somewhat slightly also between 2003 and 2008 by 0.8 percent a year. Of the 3,376,819 workers, 422,634, or 12.5 percent, are in the public sector, meaning 87.5 percent of all employment is in the private sector. In the state, almost 15 percent of all jobs are in the public sector, with 85 percent in the private sector. Relative to the state as a whole, manufacturing, professional/technical services, and education/health service sectors comprise a greater proportion of the regional employment base. In the region, these sectors comprise 9 percent (manufacturing), 11 percent (professional/technical services), and 15 percent (private education/health services) respectively of total employment. In the state, these sectors comprise 8 percent (manufacturing),7

percent (professional/technical services), and 14.6 percent (private education/health 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. Conversely, typically lower-paying sectors such as agriculture and retail represent a higher share of the overall statewide employment base relative to the Bay Area. In the state, 2.7 percent of all jobs are in agriculture, whereas in the region, the figure is 0.4 percent. Almost 10.5 percent of all jobs in the state are in retail, while in the region, 9.8 percent of all jobs are in retail.

TABLE 3 SAN FRANCISCO BAY AREA EMPLOYMENT TRENDS BY SECTOR: 2003-2013								
		Private and Public Sector Employment Trends			Employment Distribution		Ann. Percentage Chg: Bay Area	
		2003	2008	2013	Bay Area '13	State '13	03-08	08-13
Private and Public Sectors		**3,158,570**	**3,285,661**	**3,376,819**			**0.8%**	**0.5%**
Private Sector Only		**2,713,025**	**2,837,090**	**2,954,185**	**87.5%**	**85.2%**	**0.9%**	**0.8%**
11	Agriculture, Forestry, Fishing & Hunting	17,710	18,726	13,315	0.4%	2.7%	1.1%	-6.6%
21	Mining	1,744	982	1,876	0.1%	0.2%	-10.9%	13.8%
22	Utilities	4,639	5,497	5,591	0.2%	0.4%	3.5%	0.3%
23	Construction	177,987	178,171	151,847	4.5%	4.1%	0.0%	-3.1%
31-33	Manufacturing	361,948	343,551	308,961	9.1%	8.1%	-1.0%	-2.1%
42	Wholesale Trade	123,213	116,685	121,274	3.6%	4.5%	-1.1%	0.8%
44-45	Retail Trade	335,893	333,952	329,247	9.8%	10.4%	-0.1%	-0.3%
48-49	Transportation and Warehousing	51,995	54,050	68,846	2.0%	2.8%	0.8%	5.0%
51	Information	117,546	114,889	136,214	4.0%	2.9%	-0.5%	3.5%
52	Finance and Insurance	150,174	136,632	118,304	3.5%	3.4%	-1.9%	-2.8%
53	Real Estate and Rental and Leasing	61,693	58,089	55,222	1.6%	1.7%	-1.2%	-1.0%
54	Professional and Technical Services	277,412	344,560	378,755	11.2%	7.4%	4.4%	1.9%
55	Management of Companies and Enterprises	67,779	60,845	69,367	2.1%	1.4%	-2.1%	2.7%
56	Administrative and Waste Services	177,198	185,013	192,231	5.7%	6.4%	0.9%	0.8%
61	Educational Services	63,905	76,185	88,322	2.6%	2.0%	3.6%	3.0%
62	Health Care and Social Assistance	283,259	305,784	417,312	12.4%	12.6%	1.5%	6.4%
71	Arts, Entertainment, and Recreation	48,740	51,438	57,255	1.7%	1.7%	1.1%	2.2%
72	Accommodation and Food Services	252,693	283,578	314,978	9.3%	9.1%	2.3%	2.1%
81	Other Services, Ex. Public Admin	137,155	156,925	114,764	3.4%	3.1%	2.7%	-6.1%
99	UNCLASSIFIED ESTABLISHMENTS	342	11,538	10,504	0.3%	0.4%	102.1%	-1.9%
Public Sector Only (Federal, State and Local)		**445,545**	**448,571**	**422,634**	**12.5%**	**14.8%**	**0.1%**	**-1.2%**
	Public Sector (excluding public educ.)	299,104	302,052	281,196	8.3%	8.2%	0.2%	-1.4%
6111	Public Education: Elementary and Secondary	112,275	105,053	104,467	3.1%	4.7%	-1.3%	-0.1%
6112	Public Education: Junior College	9,850	16,629	11,910	0.4%	0.6%	11.0%	-6.5%
6113	Public Education: Colleges and Universities	24,316	24,837	25,024	0.7%	1.2%	0.4%	0.2%
611z	Public Education: Other			37	0.0%	0.0%		

Source: Applied Development Economics, based on California EDD LMID

Table 3 also shows the 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 3.1 percent per year between 2008 and 2013, with finance and insurance dropping by 2.8 percent per year, and real estate dropping by 1.0 percent. On a positive note, employment in health care increased annually by 6.4 percent annually between 2008 and 2013, and transportation-warehousing increased annually by five percent.

Proposed Regulation 12-15 affects one particular industry in the Bay Area, namely refineries. While the California EDD LMID reports that there are 23 refineries in the nine-county region, more than likely, this state agency applied a broader definition for refinery operations in the region. Appendix A identifies a number of "refineries" included in the EDD LMID's database; as this shows, many are not full scale refineries but rather are engaged in a variety of petroleum-related operations. Nonetheless, Table 4 shows refinery trends *per* the EDD-LMID. What is striking about Table 4 is the high average pay workers garner in this industry.

TABLE 4:
SF BAY AREA EDD-LMID REFINERY TRENDS, 1999-2009

	2003	2008	2013	03-08 CAGR	08-13 CAGR
Establishments	35	23	23	-8.05%	0.00%
Employment	6,738	7,816	5,323	3.01%	-7.39%
Payroll	$768,112,469	$1,326,728,738	$986,117,494	11.55%	-5.76%
Average Pay	$114,006	$169,756	$185,250	8.29%	1.76%

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

Table 5 identifies the businesses in the Bay Area that are full-scale refineries. The list comes from the CEC, which also included each refinery's throughput capacity. Of the five operating refineries in the region, Chevron is the largest, with the capacity to refine 245,271 42-gallon barrels of crude oil per day. At 78,400, Phillips 66 has the lowest throughput capacity.

TABLE 5
BAY AREA REFINERIES (CALIFORNIA ENERGY COMMISSION) AND CRUDE OIL CAPACITY

Refinery	Barrels Per Day
Chevron U.S.A. Inc., Richmond Refinery	245,271
Tesoro Refining & Marketing Company, Golden Eagle (Avon/Rodeo) Refinery	166,000
Shell Oil Products US, Martinez Refinery	156,400
Valero Benicia Refinery	132,000
Phillips 66, Rodeo San Francisco Refinery	78,400

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

5. SOCIOECONOMIC IMPACT ANALYSIS

This section of the report analyzes socioeconomic impacts stemming from new Regulation 12-15. If the proposed new regulation is adopted, the District estimates that the five impacted refineries would each incur total annualized costs of $455,000 for ten years, the period over which costs associated with capital equipment and one-time air monitoring plans would be amortized. After the amortization period, ongoing costs of $140,000 per year per refinery would continue for additional inventories, reports and operation and maintenance of air monitoring systems.

The five affected sources' combined throughput capacity is approximately 674,582 42-gallon barrels per day, which takes into consideration periods when refineries may be off-line. While the affected sources refine 674,582 barrels of crude oil per day, they generate an estimated 693,044 gallons of refined products a day. Assuming a 87 percent utilization rate, and further estimating the price of refined product at $120 per barrel[2], we estimate the affected refineries generate $30.3 billion in revenues a year, from which is generated $2.1 billion in after-tax net profits. When comparing these figures with the annualized costs stemming from the proposed new regulation, we obtain cost-to-net profit ratio ranging from 0.2 percent to 0.5 percent. **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 regulation.

[2] $119.80 per barrel of gasoline =
((436,600*$124.26)$_{\text{GASOLINE}}$+(124,748*$112.35)$_{\text{JET FUEL}}$+(131,748*$112.35)$_{\text{KEROSENE, OTHERS}}$) / (693,044) $_{\text{TOTAT REFINED PRODUCTS}}$

TABLE 6 SOCIOECONOMIC IMPACT ANALYSIS: PROPOSED NEW REGULATION 12, RULE 15						
	All Sources	**Chevron**	**Tesoro**	**Shell**	**Valero**	**Phillips 66**
Effective Barrels of Crude Per Day	674,582	212,648	143,921	135,598	114,443	67,972
Estimated Revenues	$30.3 billion	$9.6 billion	$6.5 billion	$6.1 billion	$5.1 billion	$3.1 billion
Estimated Net Profits	$2.1 billion	$653 million	$442 million	$416 million	$351 million	$208 million
Annual Costs for Regulation 12-15 with one-time costs annualized by applying a capital recovery factor (CRF) factor of 0.14. This CRF is derived using BAAQMD's cost-effectiveness methodology in the BACT-TBACT Workbook and assuming an interest rate of 6% and "project horizon" of 10 years.						
Reg 12-15-401, 408: Inventories and Crude Reports (Initial & Annual - annualized)	$450,000	$90,000	$90,000	$90,000	$90,000	$90,000
Reg 12-15-403: Fenceline Air Monitoring Plans (annualized)	$175,000	$35,000	$35,000	$35,000	$35,000	$35,000
Reg 12-15-501: Fenceline Monitoring Construction (annualized)	$1,400,000	$280,000	$280,000	$280,000	$280,000	$280,000
Reg 12-15-501: Air Monitoring Operation & Maintenance (Annual - annualized)	$250,000	$50,000	$50,000	$50,000	$50,000	$50,000
Total Annualized Costs	$2,275,000	$455,000	$455,000	$455,000	$455,000	$455,000
Cost to Net Profits	0.11%	0.07%	0.10%	0.11%	0.13%	0.22%
Significant?	No, in all cases	No, in all cases	No, in all cases	No, in all cases	No, in all cases	No, in all cases

6. APPENDIX A: LIST OF EDD-LMID BAY AREA "REFINERIES"

County	Name of Establishments	City	Number of Workers
Alameda	DASSEL'S PETROLEUM INC	FREMONT	1-4 employees
Alameda	RCA OIL RECOVERY	NEWARK	1-4 employees
Contra Costa	BAY AREA DIABLO PETROLEUM CO	CONCORD	1-4 employees
Contra Costa	CHEVRON CORP	RICHMOND	1-4 employees
Contra Costa	CHEVRON CORP	PACHECO	20-49 employees
Contra Costa	CHEVRON CORPORATION	SAN RAMON	5,000-9,999
Contra Costa	PHILLIPS 66 RODEO REFINERY	RODEO	500-999 employees
Contra Costa	GENERAL PETROLEUM	RICHMOND	10-19 employees
Contra Costa	GOLDEN GATE PETROLEUM	RICHMOND	1-4 employees
Contra Costa	GOLDEN GATE PETROLEUM	RICHMOND	1-4 employees
Contra Costa	GOLDEN GATE PETROLEUM	CONCORD	1-4 employees
Contra Costa	NU STAR	MARTINEZ	20-49 employees
Contra Costa	PITCOCK PETROLEUM INC	PLEASANT HILL	10-19 employees
Contra Costa	SHELL MARTINEZ REFINERY	MARTINEZ	500-999 employees
Contra Costa	TESORO GOLDEN EAGLE REFINERY	PACHECO	500-999 employees
Contra Costa	UOP	DANVILLE	1-4 employees
Marin	GRAND PETROLEUM	SAN RAFAEL	1-4 employees
Marin	GREENLINE INDUSTRIES LLC	LARKSPUR	20-49 employees
San Francisco	DOUBLE AA CORP	SAN FRANCISCO	1-4 employees
San Francisco	R B PETROLEUM SVC	SAN FRANCISCO	5-9 employees
San Francisco	SEAYU ENTERPRISES INC	SAN FRANCISCO	5-9 employees
San Mateo	DOUBLE AA CORP	SOUTH SAN FRANCISCO	5-9 employees
San Mateo	SABEK INC	SOUTH SAN FRANCISCO	5-9 employees
San Mateo	SEAPORT REFINING & ENVRNMNTL	REDWOOD CITY	5-9 employees
Santa Clara	COAST OIL CO LLC	SAN JOSE	20-49 employees
Santa Clara	SHELL OIL PRODUCTS US	SAN JOSE	1-4 employees
Solano	BAY AREA DIABLO PETROLEUM CO	BENICIA	1-4 employees
Solano	CAT TECH INC	DIXON	1-4 employees
Solano	DANVILLE PETROLEUM	VALLEJO	5-9 employees
Solano	GOLDEN GATE PETROLEUM	BENICIA	1-4 employees
Solano	RUBICON OIL	BENICIA	1-4 employees
Solano	TIMEC CO INC	VALLEJO	20-49 employees
Solano	VALERO BENICIA REFINERY	BENICIA	250-499 employees
Solano	VALERO REFINING CO	BENICIA	1-4 employees
Solano	VALERO REFINING CO	BENICIA	1-4 employees
Sonoma	BAY AREA DIABLO PETROLEUM CO	CLOVERDALE	1-4 employees
Sonoma	ROYAL PETROLEUM CO INC	PETALUMA	5-9 employees

Source: ADE, Inc., based on California EDD LMID "Employers By Industry" Database