

## **APPENDIX D**

### **Socioeconomic Impact Analysis For Proposed Amendments to Rules 4306 and 4320**

**November 25, 2020**

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**POTENTIAL AMENDMENTS TO RULES 4306 & 4320—BOILERS,  
STEAM GENERATORS, AND PROCESS HEATERS - PHASE 3,  
ADVANCED EMISSION REDUCTION OPTIONS FOR BOILERS,  
STEAM GENERATORS, AND PROCESS HEATERS GREATER THAN  
5.0 MMBTU/HR**

**SOCIOECONOMIC IMPACT ANALYSIS**

***Draft***

**November 17, 2020**

*Submitted to:*



**San Joaquin Valley Air Pollution Control District  
1900 East Gettysburg Avenue  
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District Agreement No. CONT-00656

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## 1. EXECUTIVE SUMMARY

This report contains ERG’s analysis of the socioeconomic impacts of potential amendments to the San Joaquin Valley Air Pollution Control District (SJVAPCD or District) Rules 4306 (Boilers, Steam Generators, and Process Heaters - Phase 3) and 4320 (Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr). Potential amendments to Rules 4306 and 4320 would establish more strict NOx limits than in the existing rules. Also, facilities operating boilers, steam generators, or process heaters that do not meet those limits would be required to retrofit or replace the units to meet the specified emissions limits, comply with low use provision (fuel limit of ≤ 1.8 billion Btu/year), and/or pay annual Advanced Emissions Reduction Option (AERO) fees to the District (SJVAPCD, 2020a).

After providing an overview of demographic and economic trends in the District as a whole and describing how the COVID-19 pandemic has impacted the District economically, ERG estimates the impacts of the potential amendments on entities that would incur costs under the potential amendments by comparing compliance costs to profits.

As shown in Table 1, no affected sector would experience a significant adverse socioeconomic impact, defined as costs that amount to 10 percent or more of profits (Berck, 1995). The “Oil Producers” sector would incur both the highest average cost per facility and highest impacts. Note that the government facilities impacted by this rule are operated by local government agencies, which do not seek to maximize profits in the same way that private entities do, and therefore profit values are not shown in the following and subsequent tables. Local governments commonly raise fees to cover the compliance costs of regulations, and will likely plan for incurring these additional costs through their annual budgeting processes. Based on the average annualized cost per facility for the “Government” sector, there does not appear to be a significant impact to these types of facilities.

**Table 1. Summary of Socioeconomic Impacts due to Potential Amendments to Rules 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

Sector	Affected Facilities	Total Annualized Cost [a]	Average Annualized Cost per Facility	Average Profits per Facility	Cost as % Profits
Oil Producers	49	\$17,813,503	\$363,541	\$4,270,931	8.51%
Oil Refineries	4	\$466,421	\$116,605	\$14,188,009	0.82%
Government [b]	7	\$189,269	\$27,038	—	—
Food Processing and Related Industries	137	\$3,198,693	\$23,348	\$1,289,118	1.81%
Other Affected Sources	93	\$1,313,620	\$14,125	\$5,020,940	0.28%
<b>Total/Average</b>	<b>290</b>	<b>\$22,981,507</b>	<b>\$79,247</b>	<b>\$3,136,497</b>	<b>2.53%</b>

Sources: ERG estimates are based on SJVAPCD, 2020b; U.S. Census Bureau, 2015; U.S. Census Bureau, 2020b; U.S. Census Bureau 2020c; NASS, 2019; CA EDD, 2020a; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020d; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; BLS, 2020; IMPLAN, 2020a; OPM, 2017; IRS, 2016; RMA, 2020.

Notes:

- [a] The total annualized cost is calculated by summing annualized one-time costs (annualized over a 10-year period using a 10 percent discount rate) and annual costs.
- [b] Government agencies do not have profits, so profit values are not shown here.

As a secondary measure of impacts, ERG also used the IMPLAN (2020a) input-output model to assess how facilities with costs under the potential amendments might react by reducing employment, as well as a “ripple effect” felt if affected facilities reduce purchases from their suppliers, and their suppliers in turn reduce their own purchases. These impacts make up less than **0.01 percent** of District-wide revenue and employment.

ERG also conducted sensitivity analyses to assess how varying degrees of recovery from the effects of the COVID-19 pandemic might affect the results of the analysis. Impacts would change slightly with a full recovery (in fact increase slightly, as IMPLAN (2020a) data suggests that some of the affected sectors actually have higher revenues under the main analysis (with no recovery from the pandemic) than under full recovery).

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## 2. INTRODUCTION AND BACKGROUND

This report provides economic data and analysis in support of the San Joaquin Valley Air Pollution Control District's (SJVAPCD or District) assessment of the socioeconomic feasibility of potential amendments to its existing rules for boilers, steam generators, and process heaters. This work was performed by ERG under District Agreement No. CONT-00656.

Facilities with boilers, steam generators, and process heaters subject to the District's rules represent a wide range of industries, including manufacturing and industrial processes, electrical utilities, oil and gas production, agricultural processing, and service and commercial facilities.

The potential amendments under consideration would affect two existing District rules:

- Rule 4306 (Boilers, Steam Generators, and Process Heaters - Phase 3)
- Rule 4320 (Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMbtu/hr)

Existing District Rule 4306 (last revised in 2008) is designed "to limit emissions of oxides of nitrogen (NO<sub>x</sub>) and carbon monoxide (CO) from boilers, steam generators, and process heaters" (SJVAPCD, 2008a).

Existing District rule 4320 (adopted in 2008) is designed "to limit emissions of oxides of nitrogen (NO<sub>x</sub>), carbon monoxide (CO), oxides of sulfur (SO<sub>2</sub>), and particulate matter 10 microns or less (PM<sub>10</sub>) from boilers, steam generators, and process heaters" (SJVAPCD, 2008b).

Both Rule 4306 and 4320 apply "to any gaseous fuel or liquid fuel fired boiler, steam generator, or process heater with a total rated heat input greater than 5 million Btu per hour" (SJVAPCD, 2008a; SJVAPCD, 2008b).

The potential amendments to these rules will satisfy commitments included in the *2018 PM<sub>2.5</sub> Plan* to establish stricter NO<sub>x</sub> emission limits and lower the more stringent AERO limit for specific classes and categories of units (SJVAPCD, 2020a).

This analysis was prepared to meet the requirements of California Health and Safety Code §40728.5, which requires an assessment of the socioeconomic impacts of the adoption, amendment, or repeal of air district rules. It begins by providing an overview of demographic and economic trends in the District, and then estimates the economic impacts on specific entities subject to the potential rule amendments (including small entities), and how those economic impacts might affect the surrounding communities, including at-risk populations.

### **3. REGIONAL DEMOGRAPHIC AND ECONOMIC TRENDS**

In this section ERG considers larger demographic and economic trends in the District, which includes eight counties that are home to over 4 million people.<sup>1</sup> These counties have become more populous over the last decade, and the median income (adjusted for inflation) has also increased. Utilities, wholesale and retail trade, and transportation, along with agriculture and oil and gas extraction, are the predominant industries within the District both in terms of establishments and employment.

#### **3.1. REGIONAL DEMOGRAPHIC TRENDS**

This section presents the demographic shifts within the District's jurisdiction over the past decade. The District has experienced greater population growth rate than the state as a whole, but the median income has lagged the state. The poverty rate throughout the district, while decreasing over time, is doing so at a slower pace than California as a whole.

The San Joaquin Valley contains almost 11 percent of the state of California's population. Table 2 shows how this population has changed over the last 10 years. Table 2 also shows the compound annual growth rate (CAGR) between 2010 and 2019. The CAGR is the constant rate the population would have changed annually to go from the 2010 level to the 2019 level.

The region has seen small amounts of population growth, an annual average growth rate marginally higher than the state of California. Kings and Madera counties, the two counties with the smallest population of the counties in the District, saw little growth in their populations from 2010 to 2019, and were the only counties to have population declines in any one year over the last ten years. San Joaquin County saw the most growth, increasing at 1.16 percent annually.

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<sup>1</sup> While only part of Kern County falls into the District's boundaries, all of Kern County is included in the data presented in this section, as the data were only available at the county level.

**Table 2. Population Trends by County**

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	CAGR 2010-2019
Fresno	932,039	939,406	945,045	951,514	960,567	969,488	976,830	985,238	991,950	999,101	0.78%
Kern [a]	840,996	847,970	853,606	862,000	869,176	876,031	880,856	887,356	893,758	900,202	0.76%
Kings	152,370	151,868	150,991	150,337	149,495	150,085	149,382	149,665	151,382	152,940	0.04%
Madera	150,986	151,675	151,527	151,370	153,456	153,576	153,956	155,423	156,882	157,327	0.46%
Merced	256,721	259,297	260,867	262,026	264,419	266,353	267,628	271,096	274,151	277,680	0.88%
San Joaquin	687,127	694,354	699,593	702,046	711,579	722,271	732,809	743,296	752,491	762,148	1.16%
Stanislaus	515,145	517,560	520,424	523,451	528,015	533,211	539,255	544,717	548,126	550,660	0.74%
Tulare	442,969	446,784	449,779	452,460	455,138	457,161	459,235	462,308	464,589	466,195	0.57%
<b>SJVAPCD [a]</b>	<b>3,978,353</b>	<b>4,008,914</b>	<b>4,031,832</b>	<b>4,055,204</b>	<b>4,091,845</b>	<b>4,128,176</b>	<b>4,159,951</b>	<b>4,199,099</b>	<b>4,233,329</b>	<b>4,266,253</b>	<b>0.78%</b>
<b>California</b>	<b>37,319,502</b>	<b>37,638,369</b>	<b>37,948,800</b>	<b>38,260,787</b>	<b>38,596,972</b>	<b>38,918,045</b>	<b>39,167,117</b>	<b>39,358,497</b>	<b>39,461,588</b>	<b>39,512,223</b>	<b>0.64%</b>

Source: U.S. Census Bureau, 2020e.

Notes:

[a] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

Table 3 shows the median income by county for 2010 through 2018 (U.S. Census Bureau, 2019a). Median income growth rates varied across counties from 2010 to 2018, though the counties in the District<sup>2</sup> as a whole had a CAGR of 0.63 percent overall; this is significantly lower than the growth rate of median income for the state of California (1.60 percent). Kern and Tulare Counties experienced declines in median income (-0.17 percent and -0.26 percent respectively) while all other counties experienced some level of growth. Kings and Merced Counties have notably higher growth rates of 2.34 percent and 2.13 percent, respectively. These are the only two counties in the District where median income increased at a rate faster than the state.

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<sup>2</sup> 2018 is the most recent data year currently available in the U.S. Census Bureau (2019a) median income data from the American Community Survey.

**Table 3. Median Income by County [a]**

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2010-2018
Fresno	\$52,859	\$49,014	\$46,766	\$48,496	\$47,071	\$50,369	\$51,728	\$53,987	\$53,547	0.16%
Kern [b]	\$53,213	\$51,781	\$51,578	\$51,758	\$51,647	\$55,082	\$52,990	\$51,959	\$52,478	-0.17%
Kings	\$52,144	\$57,645	\$51,606	\$50,538	\$46,378	\$49,078	\$56,527	\$59,985	\$62,738	2.34%
Madera	\$56,421	\$53,323	\$47,229	\$43,896	\$45,998	\$50,585	\$54,852	\$53,448	\$57,287	0.19%
Merced	\$49,619	\$45,863	\$48,979	\$44,921	\$47,788	\$45,056	\$50,692	\$49,750	\$58,752	2.13%
San Joaquin	\$58,458	\$58,227	\$56,984	\$56,785	\$55,999	\$57,617	\$63,199	\$63,746	\$65,237	1.38%
Stanislaus	\$56,159	\$50,467	\$52,134	\$52,954	\$55,376	\$56,177	\$57,664	\$62,027	\$61,373	1.12%
Tulare	\$50,727	\$47,136	\$45,277	\$43,525	\$46,191	\$45,503	\$48,719	\$48,219	\$49,668	-0.26%
<b>SJVAPCD [b][c]</b>	<b>\$53,990</b>	<b>\$51,459</b>	<b>\$50,426</b>	<b>\$50,318</b>	<b>\$50,550</b>	<b>\$52,467</b>	<b>\$54,674</b>	<b>\$55,614</b>	<b>\$56,791</b>	<b>0.63%</b>
<b>California</b>	<b>\$67,455</b>	<b>\$65,594</b>	<b>\$65,529</b>	<b>\$66,454</b>	<b>\$67,136</b>	<b>\$69,198</b>	<b>\$71,929</b>	<b>\$74,837</b>	<b>\$76,589</b>	<b>1.60%</b>

Source: U.S. Census Bureau, 2019a.

Notes:

[a] Inflated values to 2019\$ using the BEA (2020) GDP deflator.

[b] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

[c] Median income for SJVAPCD is a weighted average by population.

Poverty rates by county for the same nine-year period are shown in Table 4. The poverty rate decreased in every county in the District in that time frame. Poverty rates within the District are higher than state average, and declining at a slower rate overall compared to the state of California's rate of -2.60 percent. Fresno and Tulare Counties consistently had the highest poverty rates while Stanislaus and San Joaquin Counties had the two lowest. San Joaquin and Stanislaus Counties were also the only two counties in the valley with CAGR lower than the states. Despite Merced County's notable CAGR of median household income, its poverty rate has declined at one of the slowest rates (-0.55 percent) in the valley.

Many the District's leading industries, including agriculture, transportation, and manufacturing, typically employ a higher percentage of low income and less educated employees, and have unstable or seasonal employment needs (Abood, 2014), likely leading to the higher rates of poverty seen in the District.

**Table 4. Poverty Rate by County**

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2010-2018
Fresno	26.8%	25.8%	28.4%	28.8%	27.7%	25.3%	25.6%	21.1%	21.5%	-2.72%
Kern [a]	21.2%	24.5%	23.8%	22.8%	24.8%	21.9%	22.7%	21.4%	20.6%	-0.36%
Kings	22.2%	20.5%	21.2%	21.4%	26.6%	23.6%	16.0%	18.2%	19.2%	-1.80%
Madera	21.0%	24.3%	23.6%	23.6%	22.2%	23.4%	20.3%	22.6%	20.9%	-0.06%
Merced	23.0%	27.4%	24.3%	25.2%	25.2%	26.7%	20.3%	23.8%	22.0%	-0.55%
San Joaquin	19.2%	18.1%	18.4%	19.9%	20.9%	17.4%	14.4%	15.5%	14.2%	-3.70%
Stanislaus	19.9%	23.8%	20.3%	22.1%	18.0%	19.7%	14.2%	13.5%	15.6%	-3.00%
Tulare	24.5%	25.7%	30.4%	30.1%	28.6%	27.6%	25.2%	24.6%	22.5%	-1.06%
<b>SJVAPCD [a]</b>	<b>22.5%</b>	<b>23.8%</b>	<b>24.2%</b>	<b>24.6%</b>	<b>24.3%</b>	<b>22.7%</b>	<b>20.6%</b>	<b>19.7%</b>	<b>19.3%</b>	<b>-1.91%</b>
<b>California</b>	<b>15.8%</b>	<b>16.6%</b>	<b>17.0%</b>	<b>16.8%</b>	<b>16.4%</b>	<b>15.3%</b>	<b>14.3%</b>	<b>13.3%</b>	<b>12.8%</b>	<b>-2.60%</b>

Source: U.S. Census Bureau, 2019b.

Notes:

[a] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

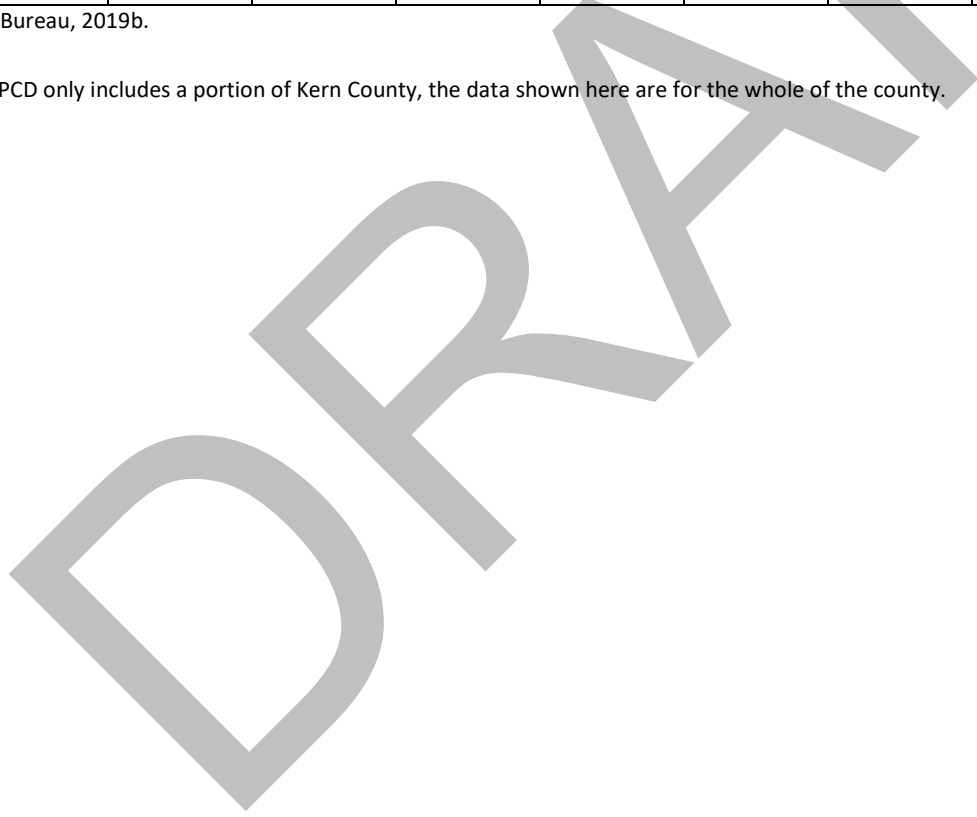


Table 5 shows the population below the poverty line from 2010 to 2018. While there has been a decline in the number of people below the poverty line from 2010 to 2018, the number has fluctuated during this period. The number of people in poverty grew by over 100,000 between 2010 and 2014, but has been in decline since 2014.

The CAGR of population below the poverty line varies across counties. Fresno County has the largest population below the poverty line as of 2018, which coincides with its large population and relatively higher poverty rate. Conversely, San Joaquin County has a notable decline in CAGR at -2.56 percent, one of three counties to see declines in poverty at a rate faster than the state (along with Fresno and Stanislaus Counties). Kern, Madera, and Merced Counties have positive CAGR and have seen an increase in population below the poverty over the nine-year period.



**Table 5. Population Below Poverty Line by County**

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2010-2018
Fresno	246,196	238,706	264,738	270,072	263,220	242,083	247,507	205,291	209,799	-1.98%
Kern [a]	171,950	201,230	196,625	189,484	208,388	186,501	193,133	184,619	178,239	0.45%
Kings	30,425	27,101	27,819	28,473	35,623	31,453	21,565	24,935	26,299	-1.81%
Madera	29,936	34,148	33,936	34,242	32,432	34,227	29,736	33,482	31,191	0.51%
Merced	58,360	70,243	62,448	64,552	65,405	70,118	53,314	63,485	59,283	0.20%
San Joaquin	128,748	123,258	126,610	137,663	146,601	123,817	103,399	113,136	104,622	-2.56%
Stanislaus	101,335	122,212	104,559	114,628	94,586	104,801	76,191	73,254	85,073	-2.16%
Tulare	107,660	113,515	135,194	135,066	129,485	125,728	114,290	112,524	103,711	-0.47%
<b>SJVAPCD [a]</b>	<b>874,610</b>	<b>930,413</b>	<b>951,929</b>	<b>974,180</b>	<b>975,740</b>	<b>918,728</b>	<b>839,135</b>	<b>810,726</b>	<b>798,217</b>	<b>-1.14%</b>
<b>California</b>	<b>5,783,043</b>	<b>6,118,803</b>	<b>6,325,319</b>	<b>6,328,824</b>	<b>6,259,098</b>	<b>5,891,678</b>	<b>5,525,524</b>	<b>5,160,208</b>	<b>4,969,326</b>	<b>-1.88%</b>

Source: U.S. Census Bureau, 2019b.

Notes:

[a] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

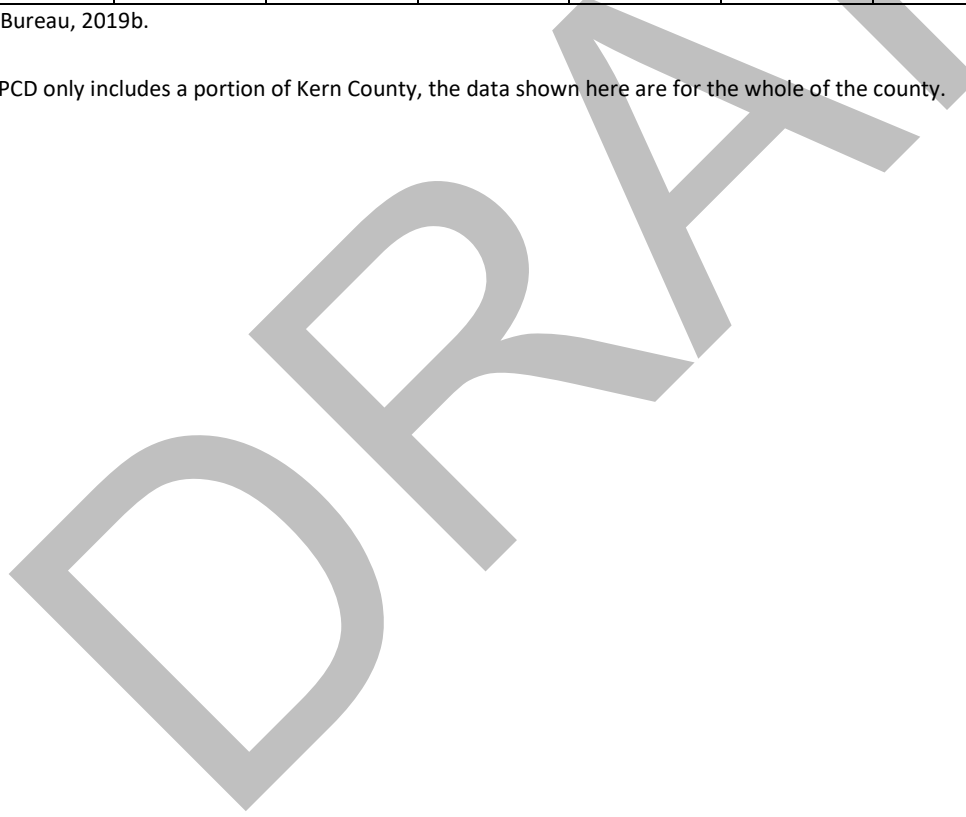


Figure 1 shows where the population in poverty or at risk of poverty lives within the District<sup>3</sup> using CalEnviroScreen 3.0 (OEHHA, 2018) data on the percent of population living below two times the federal poverty limit. CalEnviroScreen poverty data is derived from the US Census Bureau’s American Community Survey 5-year estimates for 2011 to 2015. CalEnviroScreen uses a poverty threshold of two times the poverty level to account for the higher cost of living in California compared to other parts of the country (OEHHA, 2017).

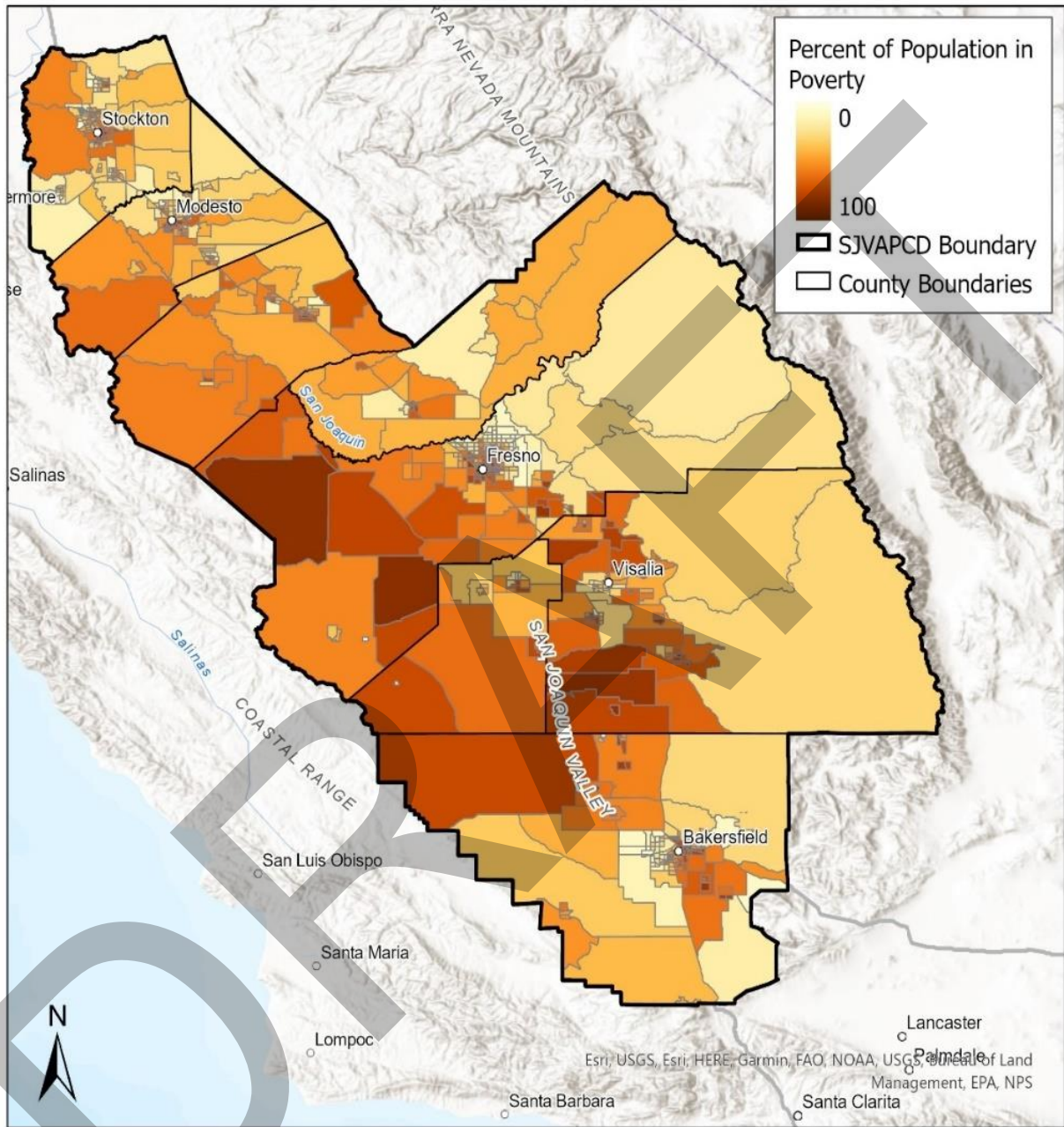
As shown in Table 4 above, roughly 20 percent of the District population is below the federal poverty limit, depending on the year. Using the higher CalEnviroScreen 3.0 threshold, nearly half (48.7 percent) of District residents are below twice the federal poverty limit (OEHHA, 2018), reflected in the high poverty rates in the map in Figure 1 below.

As seen in Figure 1, several large census tracts in the western part of the District have particularly high rates of poverty. Census tracts, on average, have a population of 4,000 people. The larger census tracts include more rural areas, several of which have higher rates of poverty compared to urban areas. Many rural areas depend on the agricultural industry for employment, which likely explains the high rates of poverty in the rural regions, particularly in the southwest of the District, where the percentage of agricultural jobs is higher (Abood, 2014). Areas of lower poverty are clustered near major cities and in the less densely populated areas in the Sierra Nevada mountain range.

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<sup>3</sup> Note that only the part of Kern County included in the SJVAPCD is shown. There are four census tracts on the eastern border of Kern County that are in the Eastern Kern Air Pollution Control District. The portions of these census tracts that fall outside of the SJVAPCD border are not shown.

Figure 1. Percentage of the Population Living below Two Times the Federal Poverty Level by Census Tract (2018)



Source: OEHHA, 2018.

### **3.2. REGIONAL ECONOMIC TRENDS**

This section tracks the economic trends of the District over the past decade. Total employment growth in the District is slightly below that of California. Overall, employment, the number of establishments, and average pay have all increased across the District during that period.

Table 6 presents employment trends over the same 10-year span. During that period, overall employment throughout the District has also increased. The District as a whole saw a CAGR of 1.48 percent in employment over the last decade, slightly below that of the entire state of California (1.64 percent). No individual county experienced a decline in employment, although Kings County has a notably lower growth rate (0.72 percent) than the other counties in the region.

San Joaquin County was the only county in the District to experience an employment growth rate greater than that of California as a whole. This may be in part due to the California Central Valley Economic Development Corporation's (CCVEDC) efforts to encourage companies to locate within the District through tax credits and incentives and grants (CCVEDC, 2020). A few large employers (Amazon, Tesla, etc.) have moved to San Joaquin County in recent years, creating numerous job opportunities within the county. Some people have also moved from the more expensive Bay Area and Los Angeles-San Diego area to the Central Valley, with San Joaquin County being one of the more popular areas to relocate (Lillis, 2019).

**Table 6. Employment Trends by County**

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	CAGR 2010-2019
Fresno	366,200	370,200	373,500	379,800	387,500	395,700	402,700	407,400	412,783	418,092	1.48%
Kern [a]	313,400	325,700	340,400	347,200	351,700	350,500	348,000	349,500	354,892	360,783	1.58%
Kings	49,900	49,700	50,000	50,400	50,600	51,700	51,500	52,300	53,025	53,233	0.72%
Madera	51,400	52,000	53,500	54,400	54,900	53,500	55,400	56,100	56,958	57,642	1.28%
Merced	93,200	94,500	96,200	98,000	99,700	101,200	102,300	104,600	105,650	106,875	1.53%
San Joaquin	260,000	261,000	267,100	274,600	279,200	286,600	292,600	301,100	304,617	307,842	1.89%
Stanislaus	202,200	202,400	205,900	209,800	213,700	218,200	222,000	224,400	227,533	228,750	1.38%
Tulare	168,100	168,700	168,800	172,200	172,100	178,700	180,700	183,500	183,300	184,350	1.03%
<b>SJVAPCD [a]</b>	<b>1,504,400</b>	<b>1,524,200</b>	<b>1,555,400</b>	<b>1,586,400</b>	<b>1,609,400</b>	<b>1,636,100</b>	<b>1,655,200</b>	<b>1,678,900</b>	<b>1,698,758</b>	<b>1,717,567</b>	<b>1.48%</b>
<b>California</b>	<b>16,091,900</b>	<b>16,258,100</b>	<b>16,602,700</b>	<b>16,958,400</b>	<b>17,310,900</b>	<b>17,681,800</b>	<b>18,002,800</b>	<b>18,285,500</b>	<b>18,460,433</b>	<b>18,623,900</b>	<b>1.64%</b>

Source: CA EDD, 2020b.

Notes:

[a] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

Table 7 shows the economic trends by industry in the District by presenting three snapshots from 2009 to 2019 using data from the Bureau of Labor Statistics' (BLS, 2020) Quarterly Census of Employment and Wages (QCEW). The recent influx of new employers explains the continued growth in the utilities, trade and transportation industries. These industries have been the largest employers in the District for the last 11 years, followed closely by agriculture and oil and gas extraction. The education, health and social services industry has seen the greatest increase of establishments in the District over the past decade, although it is the one industry that has experienced a decrease in average pay over that same time frame. The information sector is the smallest industry in the district and has gotten smaller over the last 11 years.

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Table 7. Economic Trends in the San Joaquin Valley, 2009-2019 [a]

NAICS	Sector	2009			2014			2019		
		Establish-ments	Employ-ment	Average Annual Pay [c]	Establish-ments	Employ-ment	Average Annual Pay [c]	Establish-ments	Employ-ment	Average Annual Pay
11, 21	Agriculture, Oil and Gas Extraction	7,789	189,766	\$29,692	7,438	217,769	\$33,068	7,430	217,649	\$36,568
23	Construction	6,099	50,178	\$55,144	5,377	56,011	\$54,022	6,637	70,498	\$59,475
31-33	Manufacturing	2,640	105,142	\$52,640	2,531	107,702	\$53,749	2,715	110,892	\$55,863
22, 42, 44-45, 48-49	Utilities, Trade and Transportation	14,041	219,813	\$40,871	14,500	246,596	\$41,428	16,026	282,861	\$43,587
51	Information	602	13,482	\$59,608	510	11,035	\$68,525	498	6,127	\$60,315
52-53	Finance Activities	5,747	44,703	\$52,430	5,652	41,123	\$55,695	6,443	42,638	\$59,747
54-56	Profession and Business Services	7,944	97,494	\$45,994	8,391	106,412	\$45,985	9,054	116,895	\$50,424
61-62	Educational, Health and Social Services	7,503	140,416	\$54,050	39,280	184,959	\$47,321	53,489	223,552	\$48,667
71-72	Leisure and Hospitality	5,960	97,885	\$17,407	6,224	111,610	\$16,859	7,424	130,279	\$19,906
81	Other Services	38,938	53,413	\$24,934	5,124	32,856	\$33,084	5,603	24,860	\$35,245
99	Unclassified	1,730	2,112	\$34,651	1,917	3,006	\$31,870	4	4	\$25,752
<b>SJVAPCD Total/Average [b]</b>		<b>98,993</b>	<b>1,014,404</b>	<b>\$40,664</b>	<b>96,944</b>	<b>1,119,079</b>	<b>\$41,095</b>	<b>115,323</b>	<b>1,226,255</b>	<b>\$43,903</b>

Source: BLS, 2020.

Notes:

- [a] Includes all of Kern County.
- [b] Annual average pay is a weighted average of the eight counties in the SJV APCD weighted by employment in sector.
- [c] Annual average pay is adjusted to 2019 dollars using the BEA (2020) GDP deflator.

Table 8 presents the CAGR of the economic data from Table 7. The number of establishments, employment, and average annual pay have all increased over the last 11 years across the District. Health, education, and social services has seen the greatest growth in establishments and employment over that time frame, but it is the one industry that experienced a decrease in average pay (outside of the unclassified businesses). There are fewer establishments in the agriculture, oil, and gas extraction industry today than there were a decade ago, but employment and pay have both increased. The information industry has experienced the greatest decrease in employment across the District.

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**Table 8. Compound Annual Growth Rate of Establishments, Employment, and Annual Pay [a]**

NAICS	Sector	Establishments			Employment			Average Annual Pay		
		2009-2014	2014-2019	2009-2019	2009-2014	2014-2019	2009-2019	2009-2014	2014-2019	2009-2019
11, 21	Agriculture, Oil and Gas Extraction	-0.92%	-0.02%	-0.47%	2.79%	-0.01%	1.38%	2.18%	2.03%	2.10%
23	Construction	-2.49%	4.30%	0.85%	2.22%	4.71%	3.46%	-0.41%	1.94%	0.76%
31-33	Manufacturing	-0.84%	1.41%	0.28%	0.48%	0.59%	0.53%	0.42%	0.77%	0.60%
22, 42, 44-45, 48-49	Utilities, Trade and Transportation	0.65%	2.02%	1.33%	2.33%	2.78%	2.55%	0.27%	1.02%	0.65%
51	Information	-3.26%	-0.48%	-1.88%	-3.93%	-11.10%	-7.58%	2.83%	-2.52%	0.12%
52-53	Finance Activities	-0.33%	2.65%	1.15%	-1.66%	0.73%	-0.47%	1.22%	1.41%	1.32%
54-56	Profession and Business Services	1.10%	1.53%	1.32%	1.77%	1.90%	1.83%	0.00%	1.86%	0.92%
61-62	Educational, Health and Social Services	39.25%	6.37%	21.70%	5.67%	3.86%	4.76%	-2.62%	0.56%	-1.04%
71-72	Leisure and Hospitality	0.87%	3.59%	2.22%	2.66%	3.14%	2.90%	-0.64%	3.38%	1.35%
81	Other Services	-33.34%	1.80%	-17.62%	-9.26%	-5.42%	-7.36%	5.82%	1.27%	3.52%
99	Unclassified	2.07%	-70.90%	-45.50%	7.31%	-73.40%	-46.58%	-1.66%	-4.17%	-2.92%
<b>SJVAPCD Total/Average</b>		<b>-0.42%</b>	<b>3.53%</b>	<b>1.54%</b>	<b>1.98%</b>	<b>1.85%</b>	<b>1.91%</b>	<b>0.21%</b>	<b>1.33%</b>	<b>0.77%</b>

Source: BLS, 2020.

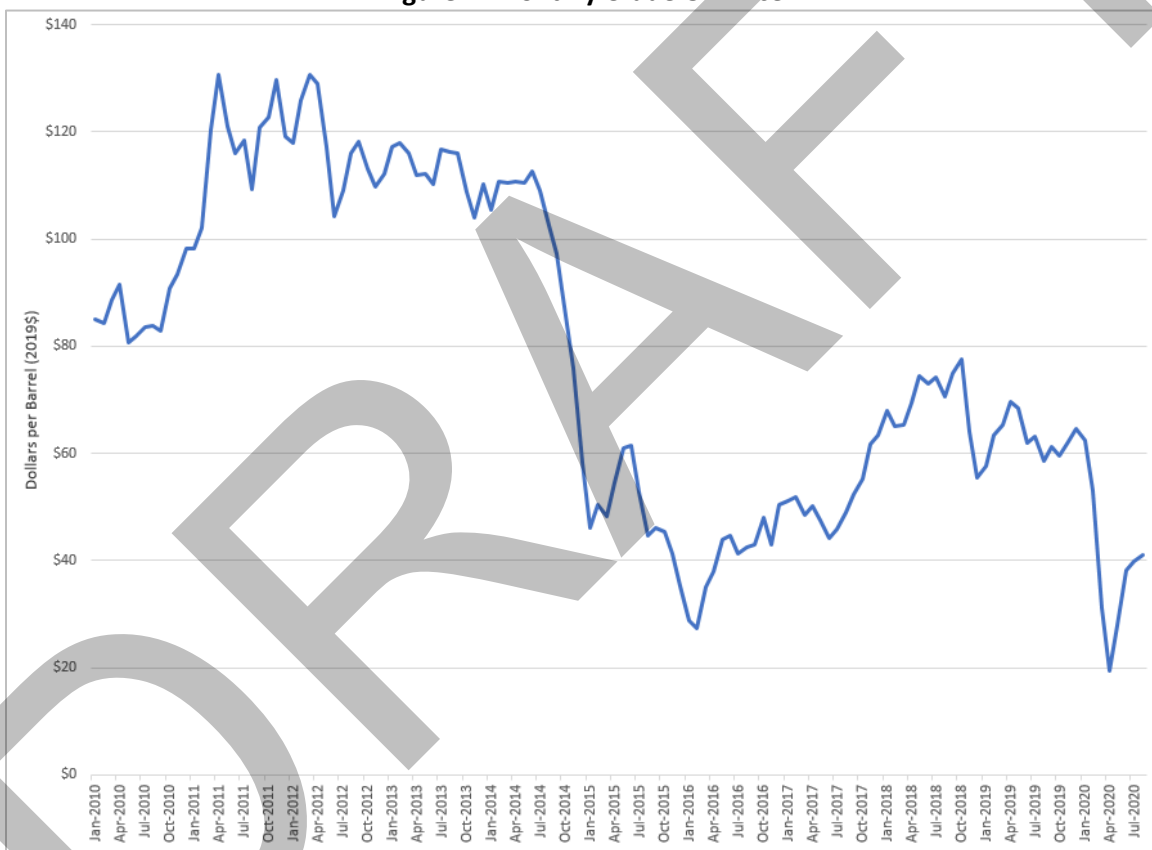
Notes:

[a] Includes all of Kern County.

This proposed rule amendments would in part impact oil and gas producers in the District. Industry-specific trends, including the price of crude oil, number of producing wells, and overall oil production, are provided below.

Based on U.S. Energy Information Administration (EIA) data, crude oil prices across California have generally increased over the last few years since a significant drop-off in prices at the end of 2014 and into 2015 (EIA, 2020a). In December 2019, the price for a barrel of crude oil was \$64.51. This price is below the average monthly price from 2010 to 2019 of \$80.74 but is significantly higher than that of January 2016 (\$28.83), an increase of 124 percent. Monthly prices from 2010 through July 2020 are shown in Figure 2. Prices dipped considerably in the spring of 2020 (with the onset of the COVID-19 pandemic) but have since started to recover.

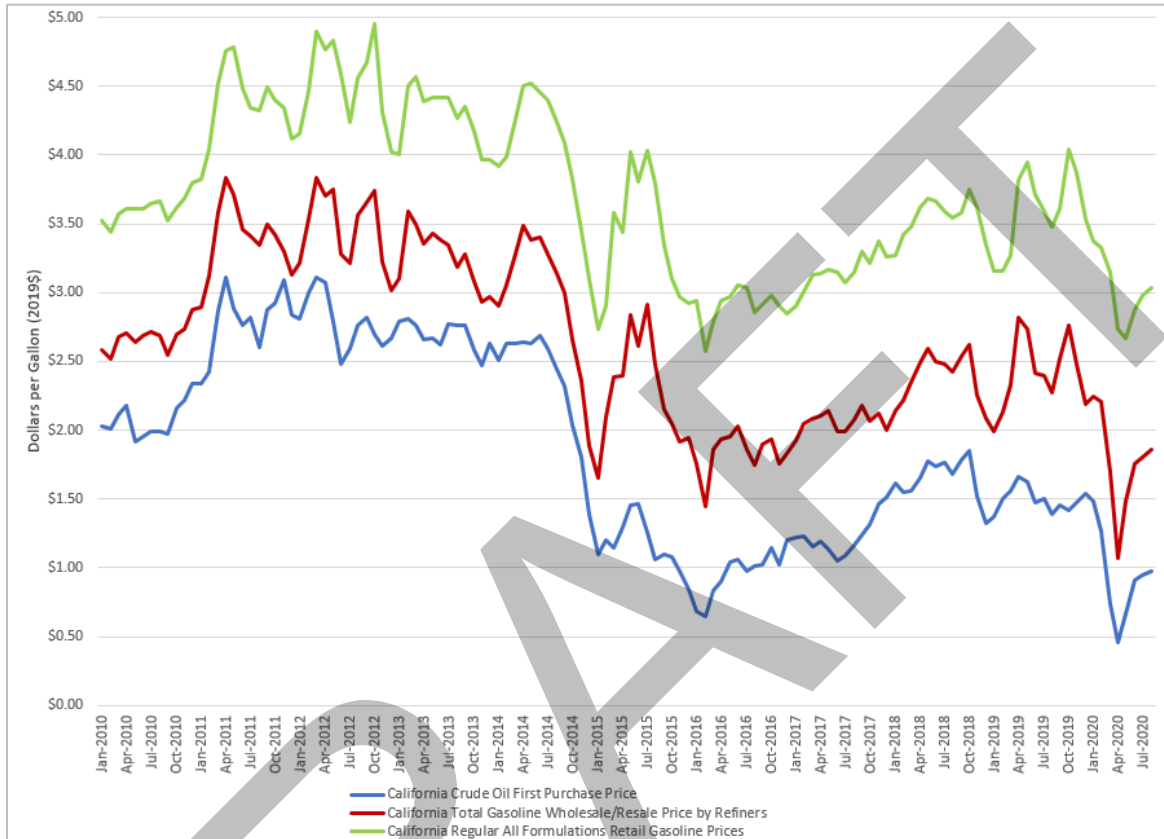
Figure 2. Monthly Crude Oil Price



Source: EIA, 2020a.

Figure 3 shows the same crude oil prices from above converted into dollars per gallon and also compares that price to the wholesale price of refined gasoline and the reformulated gas price from gas stations (in the state of California, all gasoline must be reformulated, so the “All Formulations” price presented in Figure 3 is the same as the reformulated price). The gross margins between the retail price and the wholesale price tend to be greater than those between the wholesale and crude prices. On average over this 10-year time frame, gas stations recognized a gross margin of \$1.08 compared to the refineries’ gross margin of \$0.77 per gallon (EIA, 2020a-c).

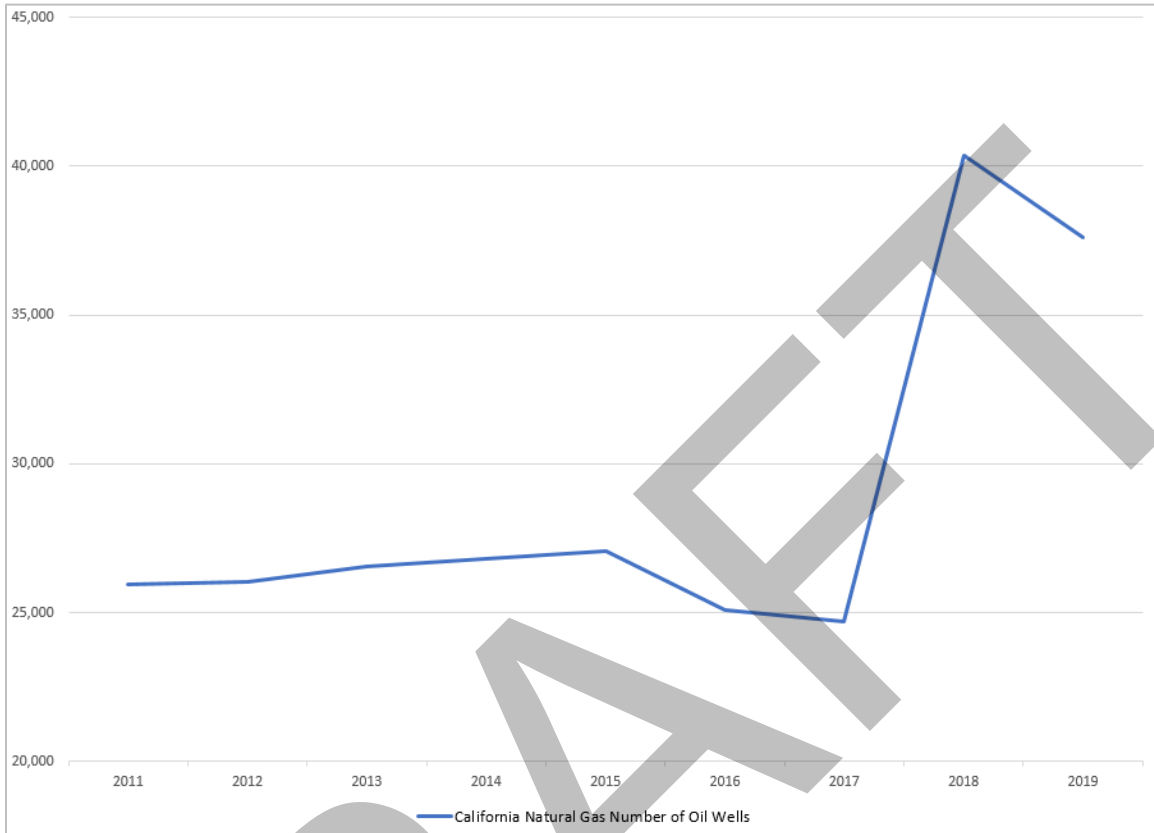
Figure 3. Comparison of California Monthly Price per Gallon of Oil



Source: EIA, 2020a-c.

As presented in Figure 4, the state of California saw a 63 percent increase in the number of oil wells in 2018 from the decade-low mark in 2017 (EIA, 2020d). The number of producing wells decreased in 2019 by 6 percent but is still much higher than at any other point in the last decade.

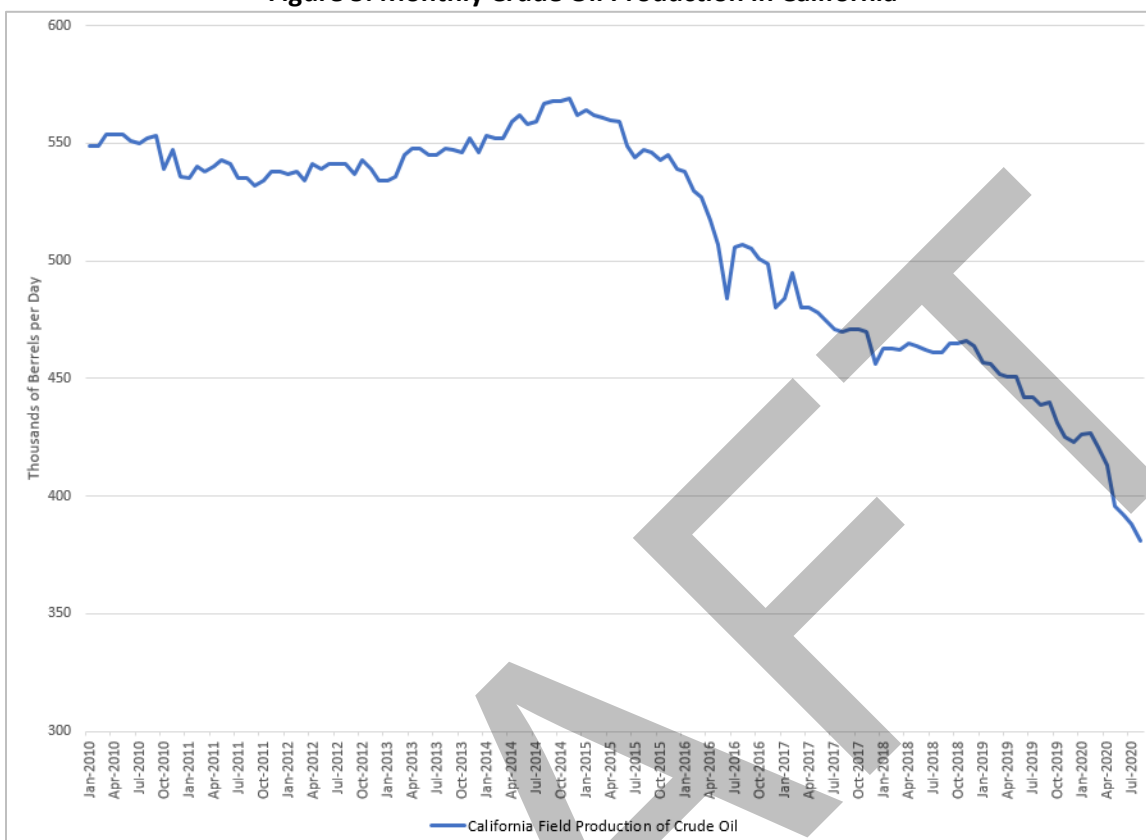
Figure 4. Number of Producing Wells in California



Source: EIA, 2020d.

Oil production has not necessarily coincided with the number of producing wells across California. Monthly crude oil production, as shown in Figure 5, has dropped significantly since a decade-high of 569,000 barrels per day in November 2014 (EIA, 2020e).

Figure 5. Monthly Crude Oil Production in California

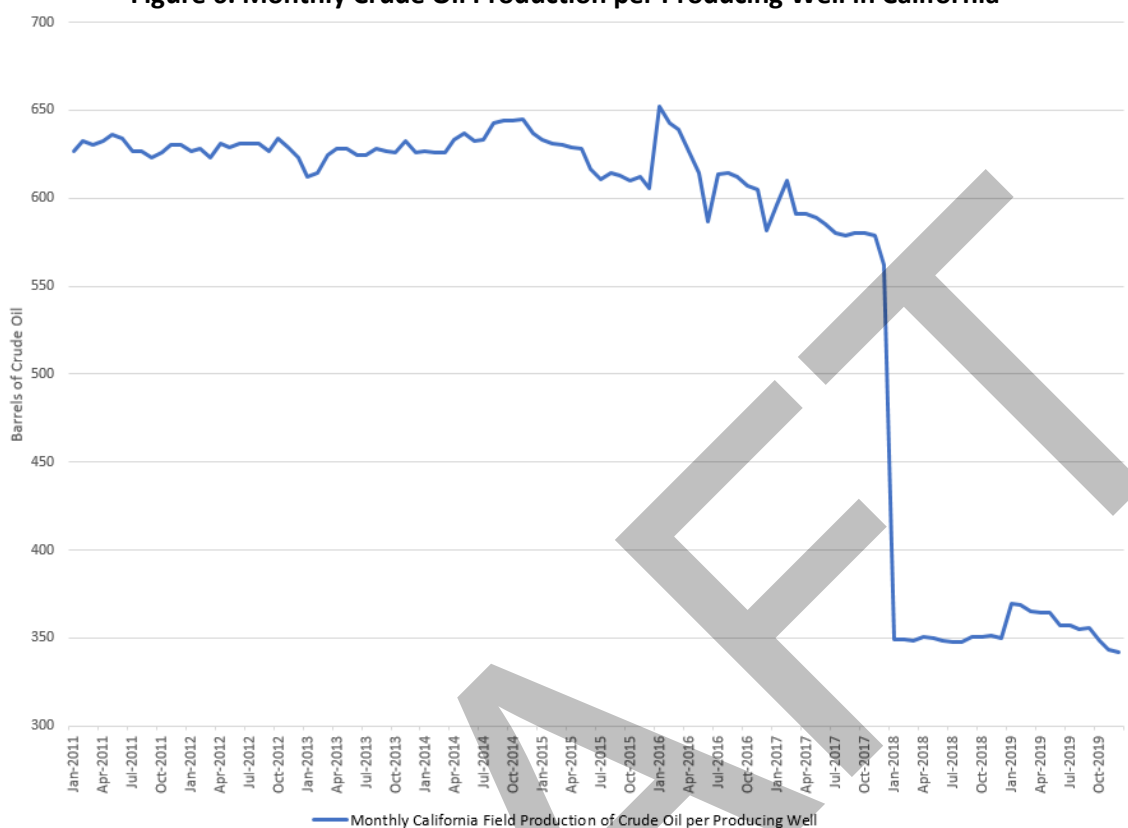


Source: EIA, 2020e.

From 2011 to 2019, oil production per well has generally decreased (EIA, 2020d-e). As shown in Figure 6, 2018 represented a dramatic downturn in per-well production, namely due to the sudden increase in the number of wells producing oil in California that year.

The downward trend since 2016 in both oil production and the number of producing wells seen in Figure 3 through Figure 5 represent the changing dynamics of the oil extraction industry. Fracking has become an increasingly deployed method of oil extraction, especially in top producing states like Texas, North Dakota, and New Mexico. The California state government places more restrictions on this practice than these other states, while some municipalities and counties have outright banned fracking (Nikolewski, 2018). In recent years, state policymakers have also pushed measures that promote renewable energy. California is also a more expensive state for oil companies to operate in. Extraction is more difficult since the oil in California is generally heavier. As a result, many companies have moved to other states such as Texas.

Figure 6. Monthly Crude Oil Production per Producing Well in California

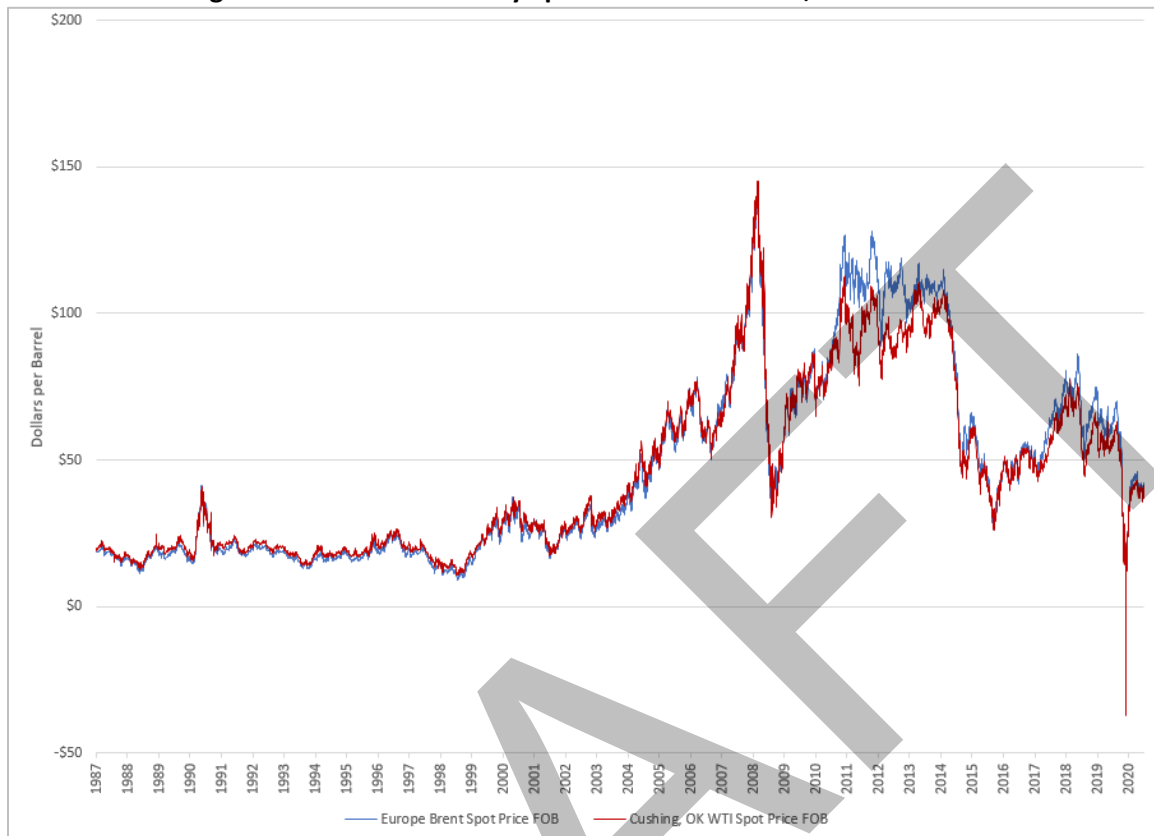


Source: EIA, 2020d-e.

Figure 7 shows daily spot prices for crude oil going back to 1987 (EIA, 2020f-g). There are two main spot price indicators used for crude oil trade: the West Texas Intermediate (WTI) spot price and the Brent Crude spot price. The WTI price is the benchmark in the United States since it refers to oil that is extracted from U.S. wells and sent via pipeline to Cushing, Oklahoma. At the same time, the EIA has determined that the price of Brent crude oil is a better indicator of prices throughout the U.S. than WTI (EIA, 2014). Brent crude oil is extracted from four oil fields in the North Sea and is the price used in nearly two-thirds of contracts globally, making it the global benchmark for crude oil prices (Bradfield, 2018). Of note, both the WTI and Brent spot indicators represent free on board (FOB) prices, which means that the buyer is liable for any damage to the goods while being shipped to them.

As can be seen in Figure 7, the WTI crude oil price dropped below zero for one day in April 2020, the first time this had ever happened. This was determined to be the result of weak demand (likely due to a decrease in travel across the country due to the COVID-19 pandemic), storage capacity reaching its limits, and unconstrained oil production (Wallace, 2020). It has since begun to recover, although not to 2019 levels.

Figure 7. WTI vs Brent Daily Spot Price of Crude Oil, 1987-Present



Source: EIA, 2020f-g.

### 3.3. IMPACTS OF THE COVID-19 PANDEMIC

The COVID-19 pandemic has affected virtually every industry, including those that would have costs under the potential amendments to Rules 4306 and 4320. For instance, the pandemic has changed how the food manufacturing industry operates. Workers in this industry are considered essential workers, requiring them to go to work in the production facilities. Some facilities, particularly meatpacking facilities, have experienced outbreaks resulting in temporary shutdowns of those facilities. Workers' safety in these facilities has become a main issue for the industry, with OSHA and the FDA creating a checklist for food manufacturing operators to adhere to (OSHA & FDA, 2020).

Despite these new safety protocols, food processors and manufacturers increased hiring in the early stages of the pandemic. This hiring spree was an effort to meet increased demand for food sold at retail establishments, since consumers were "panic buying" in the face of uncertainty about stay at home orders and the potential need to quarantine (Demetrakakes, 2020). These two developments in concert have given smaller manufacturers an advantage in maintaining social distancing protocols while still producing food for the country.

The early stages of the pandemic also saw the third oil price collapse that the oil and gas extraction industry has seen in just the last 12 years. This price shock, unlike the previous two, was swift, resulting in wide-ranging changes across the industry in a short period of time. Stay at home orders in California and around the world resulted in depressed demand for gas. Even as some of these

restrictions have eased, a combination of job losses and remote work means that far fewer people are commuting. Travel for recreational activities is reduced as well, whether because facilities are closed or have restrictions in place or because people are reluctant to expose themselves to illness. Those who have lost their jobs as a result of the coronavirus are conscious of their expenses, including on travel.

The coronavirus-driven lack of demand coincided with a massive oversupply of oil that left the industry with very little storage space (Kasler, 2020). This combination of supply and demand mismatches resulted in an 87 percent drop in the Brent per-barrel price of oil from January to April of 2020 (McCarthy, 2020). Gas prices have also dropped nationwide. For instance, over a one month period from late February to late March 2020, the price of gas dropped significantly across California, going from \$3.49 to \$3.20 statewide, while the prices in the metro areas of Fresno and Madera-Chowchilla both dropped from about \$3.33 to just under \$3.00 over that same timeframe (Sheehan, 2020). The average price of regular unleaded gasoline in California in late September 2020 (\$3.22) was about 70 cents cheaper than a year prior (\$3.95) (AAA, 2020). Fresno and Merced have seen similar changes to their average gas prices, albeit with slightly lower prices than the statewide average.

Oil and gas companies started to slow down production in response to demand changes. The number of rigs operating across the country has dropped by more than 70 percent since the end of August 2019 (Flores, 2020). California has seen a similar drop in rigs within the state, going from 18 rigs in operation in late August of 2019 to just four at the end of August 2020 (Baker Hughes, 2020). California's oil and gas production is primarily centered in the San Joaquin Valley, in Kern County specifically. Before the pandemic began, nearly 10,000 people were employed in the oil and gas extraction industry in Kern County (Kasler, 2020). Each rig is associated with about 100 jobs, which means that the reduction in oil rigs operating in California over the past year could have resulted in the loss of approximately 1,400 jobs.

The pandemic also halted maintenance projects at refineries and pumps across the globe. With companies either shutdown or at limited working capacity, the supply of spare parts for repairs dwindled. Maintenance workers were unable to conduct reviews of equipment. There were anticipated to be a backlog of maintenance projects to complete as stay at home orders were lifted (Yagova, George, and Sharafedin, 2020). Typically, companies perform maintenance inspections during lulls in production, but they will need to conduct these inspections when production should be picking up. This could further delay crude production, slowing the industry's recovery.

Unlike previous economic hits to the industry, oil and gas extraction may not recover quickly from this downturn. Where some industries are hoping for a "V-shaped" recovery, oil and gas extraction is more likely to recover in a "U-shape," with a protracted downturn before recovery begins (Flores, 2020). The industry will likely be looking at flat or even decreased demand post-pandemic, as practices such as remote working continue (Barbosa et al, 2020).

The public sector's outlook has also drastically changed. State and local governments across the country are now experiencing significantly altered fiscal budgets. With the private sector struggling to attract business, the public sector has seen their projected budgets move into shortfall territory (McNichol & Leachman, 2020). The coronavirus-induced recession is estimated to cause greater budgetary shortfalls than the Great Recession of 2008. While the Coronavirus Aid, Relief, and Economic Security (CARES) Act granted state and local government federal aid to help offset these budgetary constraints, it is a fraction of their lost revenues. States in total also have about \$75 billion in "rainy day" funds, but this also may not be enough to weather the shortage of government revenues.



Tax revenues are expected to diminish as a result of the pandemic. Income taxes will decrease with greater unemployment (Sheiner & Campbell, 2020). Revenues from sales taxes have also decreased because of reduced spending on entertainment and travel. As a result, state and local officials have started cutting funding for numerous programs. According to analysis from the League of California Cities, no matter their size, the vast majority of cities will have to cut spending on their public services. Even spending on core services will be cut, with between 78 and 90 percent of cities cutting public safety budgets and 71 to 90 percent cutting housing budgets (League of California Cities, 2020).

Public sector employment was also cut, particularly in the early stages of the pandemic. While most public sector job loss in education, local government workers lost approximately 523,000 jobs in non-education related areas from March through May of 2020 (NACo, 2020).

Because the COVID-19 pandemic has dramatically altered metrics used to estimate socioeconomic impacts, such as revenue and employment, ERG uses a “COVID-adjusted baseline” for these metrics, as discussed further in Section 4.1.2 below.

## 4. SOCIOECONOMIC IMPACT ANALYSIS

ERG calculated the direct impacts of the proposed rule amendments by comparing the costs of compliance to profits of affected facilities. ERG estimated potential employment impacts using IMPLAN's (2020a) input-output model. Additionally, ERG used the IMPLAN model to capture indirect and induced impacts (i.e., impacts that might arise if directly impacted entities reduce purchases from their suppliers and households adjust their spending as a result of changes in earnings).

### 4.1. DATA SOURCES AND METHODOLOGY

To estimate socioeconomic impacts, ERG compares the costs of compliance with the potential amendments with profits per facility. ERG sought to create a profile for each affected sector, including employment, revenue, profits, and average pay per employee. The process of estimating each of these endpoints also requires other data to be used (e.g., facility name, address).

This section describes the data sources used to create the baseline industry profile, how this profile was adjusted to capture the impacts of the COVID-19 pandemic, and how socioeconomic impacts were estimated.

The sections that follow detail the resulting profile of affected entities and the socioeconomic impacts of compliance with the potential rule amendments.

#### 4.1.1. Baseline Industry Profile Estimates

SJVAPCD (2020b) provided ERG with an initial list of affected facilities, including fields for facility ID, facility description, Standard Industrial Classification (SIC) code, number of emissions sources, and unit location.

ERG identified additional data points for use in the analysis. For instance, SJVAPCD's (2020b) facility data includes a SIC code, and ERG converted these to the North American Industry Classification System (NAICS) codes that are used with other sources of economic data used in the analysis using a combination of U.S. Census Bureau (2020b) concordances.<sup>4</sup> Where a SIC code could map to multiple NAICS codes, ERG used information on companies' websites or other search tools about what type of industry they are engaged in to assign a NAICS code. (See Table A-2 for a list of the NAICS code(s) that mapped to each SIC code.)

Employment and revenue data for most private industries were drawn from the U.S. Census Bureau's (2020b) Economic Census, using 2017 data for California. Where data for certain industries

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<sup>4</sup> SIC codes were last updated in 1987, and NAICS codes were first issued in 1997. The U.S. Census Bureau's (2020b) concordances map 1987 SIC codes to 1997 NAICS codes, and from there to the NAICS codes that are revised every five years (thus far in 2002, 2007, 2012, and 2017). SIC and NAICS codes are available at different levels of granularity. The SIC codes used in SJVAPCD's (2020a) data are 4-digit SIC codes, and ERG mapped these to 4-digit NAICS codes.

were not available,<sup>5</sup> ERG instead used estimates from the U.S. Census Bureau’s (2015) Statistics of U.S. Businesses for 2012 for California or, if that was not available, the U.S. Census Bureau’s (2020c) estimates for 2017 for the U.S.<sup>6</sup>

For the agricultural sector, revenue data are available in the United States Department of Agriculture (USDA) National Agricultural Statistics Service (NASS, 2019) Census of Agriculture for California for 2017, using the “market value of agricultural products sold.” Employment data are drawn from the California Employment Development Department (CA EDD, 2020b) and are for California for 2017.

For state and local government entities, employment and revenue data are drawn from the U.S. Census Bureau’s (2020d) Annual Survey of State and Local Government Finances, U.S. Census Bureau’s (2017a) State and Local Government Employment and Payroll, and U.S. Census Bureau’s (2017b) Government Units Survey, all using data for California for 2017. For federal entities, ERG used publicly-available estimates for the specific facilities included in the District’s facility list (VA, 2019; IRS, 2020; ABC 30, 2016).

To estimate average payroll per employee, data for private entities by sector come from BLS’ (2020) QCEW. For state and local government entities, data are from the U.S. Census Bureau’s (2017a) State and Local Government Employment and Payroll and U.S. Census Bureau’s (2017b) Government Units Survey. For federal entities, data are an Office of Personnel Management (OPM, 2017) estimate of the average base salary for full-time permanent employees.

ERG estimated profits for private industries by multiplying revenue figures by the average profit rate for each NAICS for 2010 through 2013 using data from the Internal Revenue Service (IRS, 2016) “SOI Tax Stats - Corporation Source Book.” The profit rate was calculated as “Net Income (less deficit)” divided by “Total Receipts.”<sup>7</sup> (See Appendix B for profit rates by NAICS code.) For agricultural industries (which are not included in the IRS data at a granular level) ERG used data from the Risk Management Association’s (RMA, 2020 Annual Statement Studies, which are prepared standardized income statements from data submitted by individual enterprise to assess risk and evaluate financial performance relative to other enterprises in the same industry). For state and local government entities, although they are not profit-seeking, ERG calculates a “profit” rate as revenue minus expenditures divided by revenue, using data from the U.S. Census Bureau’s (2020d) Annual Survey of State and Local Government Finances for 2017 for California.

#### **4.1.2. COVID-19-Adjusted Baseline Industry Profile Estimates**

To reflect the impact of the COVID-19 pandemic, ERG estimates “**COVID-adjusted**” baseline, which alters employment, revenue, and payroll figures for each facility using IMPLAN (2020a) data. IMPLAN’s “Evolving Economy” data use economic data points from the second quarter of 2020 to reflect the impacts on the pandemic, taking into account industry losses, shifts in household spending and

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<sup>5</sup> U.S. Census (2020b) Economic Census data were not available for California for NAICS 1151 Support Activities for Crop Production, 2212 Natural Gas Distribution, 2213 Water, Sewage and Other Systems, and 5324 Commercial and Industrial Machinery and Equipment Rental and Leasing.

<sup>6</sup> U.S. Census Bureau (2020c) Statistics of U.S. Businesses estimates for 2017 that include state-level revenue data will not be released until January 2021.

<sup>7</sup> 2013 is the most recent year for which profit rate data are available.

behavior, stimulus checks and unemployment benefits, and Paycheck Protection Program (PPP) loans (Demski, 2020). IMPLAN uses only the second quarter 2020 data, adjusts it for seasonality, and annualizes the single quarter of data to an entire year. This annualization approach means that IMPLAN models 2020 as if the entire year had an economy like in the early stages of the pandemic, without the relatively normal first quarter of 2020 and without any level of recovery later in the year (Clouse, 2020).

While the IMPLAN data for 2020 reflect the impacts of the COVID-19 pandemic and government response, it is important to note that it does not *only* capture the impacts of the pandemic, as other trends may also be captured in the changes between 2018 and 2020 (Clouse, 2020).

Using outputs of the IMPLAN model, ERG estimates the percentage change in employment, revenue, and payroll by NAICS between 2018 (the second-most recent year for which data are available) and 2020 (the “Evolving Economy” dataset, the most recent estimate). District-wide, this approach suggests that revenue contracted by 8 percent, and employment contracted by 9.9 percent (see Table 9). This likely underestimates the impacts of COVID because of continued economic growth through 2019 into the start of 2020. The impact of COVID is more appropriately against a baseline that incorporates this additional growth. Such a baseline would be higher than it was in 2018, and the economic decline in the second quarter of 2020 due to COVID shown in Table 9 would likely be even larger when compared against the later baseline (were such data available).

**Table 9. District-Wide COVID-19 Impacts**

	2018	2020 Q2 [a]	% Change
Revenue	\$333.1 billion	\$306.5 billion	-8.0%
Employment	2.0 million	1.8 million	-9.8%

Source: IMPLAN, 2020a.

Note:

[a] Data are modeled for an entire year as if it were like the second quarter of 2020 (i.e., the early stage of the pandemic.)

To estimate the impacts of the COVID-19 pandemic on individual industries, ERG multiplied the percentage change from 2018 to the second quarter of 2020 in the IMPLAN model by the baseline data to produce “COVID-adjusted” estimates for each NAICS code (which was then mapped onto SIC codes for use in conjunction with the cost data provided by SJVAPCD (2020c) on a SIC code basis).

In most industries, this results in a decrease in revenue and employment, but an *increase* in average payroll per employee, reflecting the fact that more workers in lower-paid occupations have been laid off than workers in higher-paid administrative and executive occupations (Clouse, 2020).

The industries with the largest decrease in revenue and employment between 2018 and the second quarter of 2020 include restaurants (a 46.7 percent decrease in revenue and 49.6 percent decrease in employment), support activities for crop production (a 32.2 percent decrease in revenue and 13.9 percent decrease in employment), and dry cleaning and laundry services (a 30.0 percent decrease in revenue and a 34.8 percent decrease in employment).

Notably, some sectors saw substantial revenue growth in 2019 through the first quarter of 2020, and thus appear to show less substantial impacts using the COVID-19-adjusted baseline. These sectors include oil and gas extraction (a 33.6 percent increase in revenue, state and local governments (a 15.0 and 9.6 percent increase in revenue, respectively), hospitals (a 7.4 increase in revenue), and the

administrative and support and waste management and remediation service sector (between a 5 and 10 percent increase in revenue, depending on the specific industry).

This increase in revenue in the oil and gas industry and state and local governments is primarily the result of the forces driving economic growth prior to COVID-19. To account for this, IMPLAN's estimated the effect of growth in employment and increased labor productivity in these sectors between 2018 and 2020 prior to COVID-19, which, combined, suggest an increase in output (IMPLAN, 2020c). While IMPLAN's "Evolving Economy" dataset represents their best available estimate of the economy in 2020 based on the economic data that are currently released, the modeling approach has limitations. For instance, it is not possible to separate trends in an industry sector between 2018 and the second quarter of 2020 from the specific impacts of COVID-19 on the economy between the first and the second quarter of 2020. Using second quarter of 2020 data and applying it to the entire year also does not capture any lagging impacts of the COVID-19 pandemic that may take time to be seen in the data. Given the shortcomings of the dataset, IMPLAN suggests using both the 2018 and 2020 models to compare the results (Clouse, 2020). ERG has done this in the sensitivity analysis in Section 4.4.3 below.

While the pattern recovery from the COVID-19 pandemic will take is unknown, many sectors may have fully or partially recovered by the time compliance is required with the potential rule amendments. To capture this, while the primary analysis includes the worst-case scenario of no recovery, ERG also performed three sensitivity analyses assuming 30 percent, 70 percent, or 100 percent recovery (i.e., return to the 2018 baseline) (with the results presented in Section 4.4.3).

Note that the industries with lower revenue in 2018 than the second quarter of 2020 in the IMPLAN (2020a) data actually fare worse in terms of economic impacts under the COVID-19 recovery sensitivity analyses, because they are modeled as gradually returning to their (lower) 2018 revenue levels. This includes oil and gas extraction, one of the main industries affected by the potential amendments.

See Appendix C for detail on the revenue, employment, and payroll adjustments for the sectors affected by the potential amendments.

#### **4.1.3. Estimating Impacts on Affected Entities**

Cost estimates (i.e., the direct cost of the potential rule amendments by SIC code) were provided by SJVAPCD (2020b). Total costs were calculated by summing the one-time capital costs (annualized over a 10-year period using a 10 percent discount rate) and ongoing annual costs. (Note that this approach does not account for the fact that costs will not be incurred for several years, and thus resulting in greater cost and impacts estimates than an approach that takes into account the time value of money would.)

To estimate impacts, the direct costs of the rule (i.e., the cost of compliance with the rule) are compared to profits for each SIC code. Because each SIC code can include multiple NAICS codes, and because it is unknown which facilities are those with costs, ERG compared the costs of compliance with the proposed amendments to profits.

To estimate both direct employment impacts of the potential rule amendments and indirect and induced effects, ERG used IMPLAN's (2020a) input-output model. IMPLAN "is a regional economic analysis software application that is designed to estimate the impact or ripple effect (specifically

backward linkages) of a given economic activity within a specific geographic area through the implementation of its Input-Output model” (IMPLAN Group LLC, 2020b).

Based on the costs to affected facilities, the IMPLAN model estimates how many jobs might be lost in reaction to the costs to affected firms. It also estimates indirect costs (i.e., the impact to affected firms’ suppliers when the direct cost of rule compliance causes affected firms to reduce their purchases from those companies) and induced impacts (i.e., how households that have lost income in turn adjust their purchases).

#### **4.1.4. Aggregating to the Sector Level**

While the inputs to the analysis are estimated on a NAICS code or SIC code basis, the results are presented with those more granular industries aggregated into a smaller number of sectors:

- Oil Producers
- Oil Refineries
- Government<sup>8</sup>
- Food Processing and Related Industries
- Other Affected Sources
- Other Industries (those not directly affected by the rule, but that may see indirect or induced impacts).

These SIC code to sector mappings were developed by SJVAPCD (2020d). See Appendix A for a concordance between SIC codes and sectors.

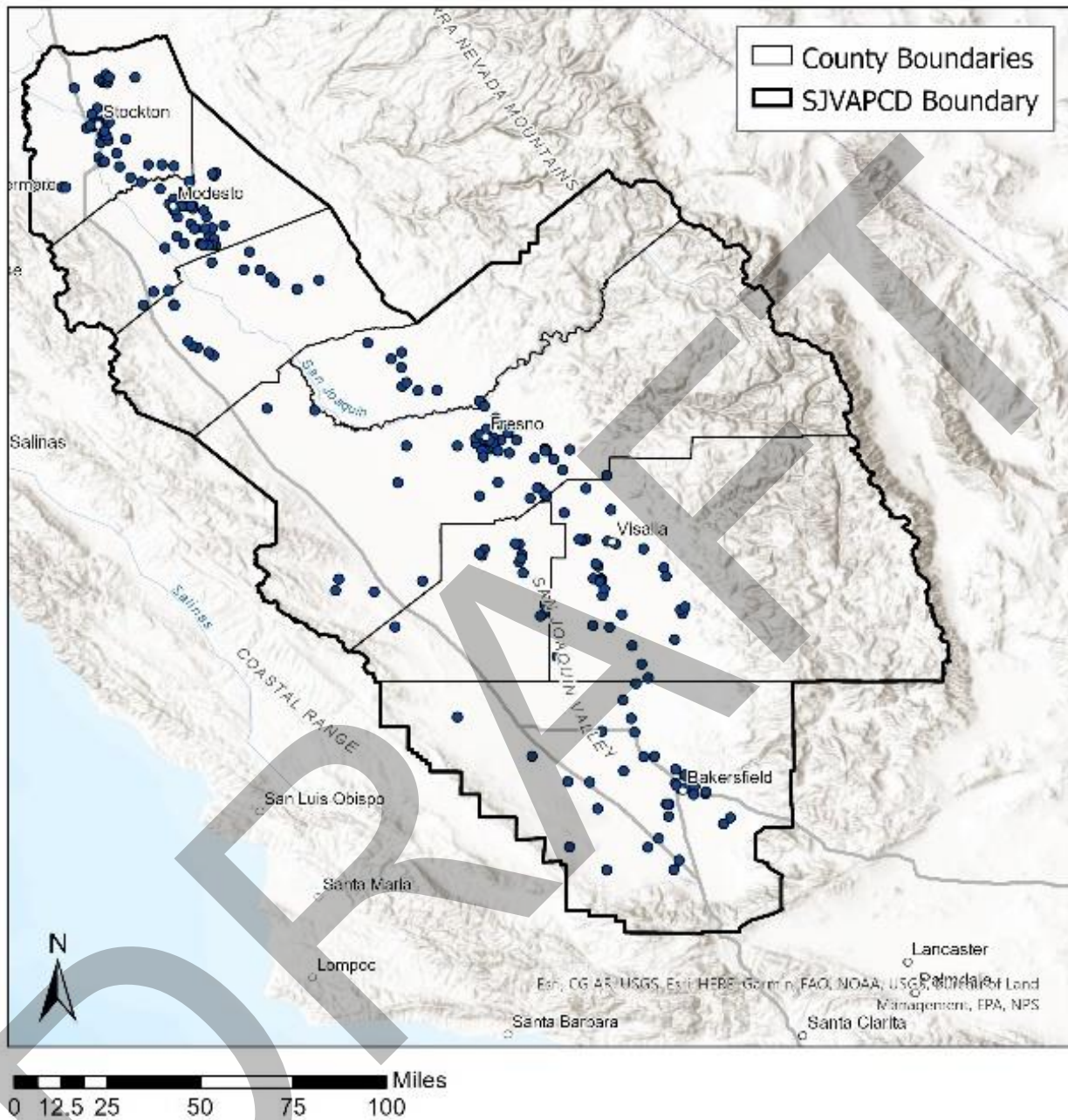
## **4.2. PROFILE OF AFFECTED ENTITIES**

Figure 8 presents the facilities operating boilers, steam generators, and process heaters (whether affected by potential rule changes or not). Facilities were mapped using the geocoding function in ArcGIS Pro 2.6.0. Out of the 335 affected facilities, 271 were mapped while the remaining facilities did not have sufficient information to be displayed. Many of the unmapped facilities are likely in more rural areas where there was less information available for the address locator. However, the majority of facilities are concentrated in major metropolitan areas of the District. Madera County contains the least number of affected facilities (10) while the portion of Kern County within in the Districts contains the highest amount of affected facilities (68).

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<sup>8</sup> Note that this sector does not include all government-operated facilities, as there are two local government facilities assigned SIC 4952 Sewerage Systems in the SJV APCD (2020b) data, and SIC 4952 is assigned to the “Other Affected Sources” sector in the SJV APCD (2020d) SIC to sector concordance. One of these two facilities is affected by the potential amendments.

Figure 8. Map of Facilities Operating Boilers, Steam Generators, and Process Heaters



Source data: SJVAPCD, 2020b; CARB, 2020; ERG estimates.  
Map created by ERG using ArcGIS® software by Esri.

Table 10 includes a profile of facilities affected by the potential amendments to Rules 4306 and 4320 (i.e., those that will incur compliance costs). A total of 290 facilities will incur retrofit and/or AERO fee costs.

**Table 10. Profile of Facilities Affected by Potential Amendments to Rules 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

Sector	Total Facilities	Affected Facilities	% Affected	Total		
				Employees	Revenue	Profits
Oil Producers	55	49	89.1%	1,806	\$2,840,741,675	\$209,275,625
Oil Refineries	4	4	100.0%	212	\$840,428,115	\$56,752,035
Government [a]	9	7	77.8%	1,437	\$6,943,144,058	—
Food Processing and Related Industries	148	137	92.6%	7,502	\$4,237,786,768	\$176,609,213
Other Affected Sources	101	93	92.1%	32,295	\$10,104,515,144	\$466,947,385
Other Industries	18	0	0.0%	N/A	N/A	N/A
<b>Total</b>	<b>335</b>	<b>290</b>	<b>86.6%</b>	<b>43,251</b>	<b>\$24,966,615,761</b>	<b>\$909,584,258</b>

Sources: ERG estimates based on SJVAPCD, 2020b; U.S. Census Bureau, 2015; U.S. Census Bureau, 2020b; U.S. Census Bureau 2020c; NASS, 2019; CA EDD, 2020a; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020d; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; BLS, 2020; IMPLAN, 2020a; OPM, 2017; IRS, 2016; RMA, 2020.

Note:

[a] Government agencies do not have profits, so profit values are not shown here.

Table 11 shows the characteristics of the average facility affected by the potential amendments to Rules 4306 and 4320. (The exact characteristics of individual facilities could be either higher or lower than these average estimates.)

**Table 11. Characteristics of Average Facilities Affected by Potential Amendments to Rules 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

Sector	Average per Facility			Average Annual Pay per Employee
	Employees	Revenue	Profits	
Oil Producers	37	\$57,974,320	\$4,270,931	\$39,729
Oil Refineries	53	\$210,107,029	\$14,188,009	\$58,992
Government [a]	205	\$991,877,723	—	\$58,259
Food Processing and Related Industries	55	\$30,932,750	\$1,289,118	\$58,494
Other Affected Sources	347	\$108,650,700	\$5,020,940	\$52,620
<b>Average</b>	<b>149</b>	<b>\$86,091,778</b>	<b>\$3,136,497</b>	<b>\$53,319</b>

Sources: ERG estimates based on SJVAPCD, 2020b; U.S. Census Bureau, 2015; U.S. Census Bureau, 2020b; U.S. Census Bureau 2020c; NASS, 2019; CA EDD, 2020a; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020d; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; BLS, 2020; IMPLAN, 2020a; OPM, 2017; IRS, 2016; RMA, 2020.

Note:

[a] Government agencies do not have profits, so profit values are not shown here.

### 4.3. COMPLIANCE COST ESTIMATES

Compliance costs were estimated by SJVAPCD (2020c), and include:

- One-time costs for units retrofit by December 31, 2023.
- One-time costs for units retrofit by December 31, 2029.



- Annual operating and maintenance (O&M) costs for the units retrofit in 2023, beginning in 2023 and continuing indefinitely. (Note that for some facilities these costs may actually be cost savings, as the more efficient units result in decreased electricity and fuel usage.)
- Annual O&M costs (or cost savings) for the units retrofit in 2029, beginning in 2029 and continuing indefinitely.
- AERO fees paid annually to the District, beginning in 2025 on the basis of 2024 emissions.

Total costs are calculated by annualizing the one-time retrofit costs that will be incurred in either 2023 or 2029 over a 10-year period using a 10 percent interest rate, and then summing annualized one-time costs and annualized costs to yield the total.<sup>9</sup>

Table 12 shows the one-time, annual, and total annualized costs incurred by sector. Costs would total **\$23.0 million**, with the majority of these incurred by the “Oil Producers” sector.

**Table 12. Costs of Compliance with Potential Amendments to Rules 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

Sector	Retrofit Capital Costs [a]		Retrofit O&M Costs [b]		AERO Fees [c]	Total Annualized Costs [d]
	One-Time		Annual		Annual	Annualized One-Time + Annual
	2023	2029	2023+	2029+	2025+	—
Oil Producers	\$53,498,510	\$22,800	\$2,088,349	\$2,798	\$7,012,010	\$17,813,503
Oil Refineries	\$217,440	\$0	\$12,257	\$0	\$418,777	\$466,421
Government	\$0	\$525,960	\$0	\$82,888	\$20,783	\$189,269
Food Processing and Related Industries	\$2,215,900	\$38,409,984	-\$51,328	-\$4,243,880	\$882,225	\$3,198,693
Other Affected Sources	\$957,600	\$8,762,144	\$175,056	-\$680,207	\$236,928	\$1,313,620
<b>Total</b>	<b>\$56,889,450</b>	<b>\$47,720,888</b>	<b>\$2,224,334</b>	<b>-\$4,838,401</b>	<b>\$8,570,724</b>	<b>\$22,981,507</b>

Source: SJVAPCD, 2020c.

Notes:

- [a] Includes one-time capital costs for retrofit in either 2023 or 2029 (depending on NOx emissions)
- [b] Includes the costs to operate and maintain the retrofit unit (which for some facilities will be a cost savings due to decreased electricity and fuel usage).
- [c] Includes AERO fees that are paid annually beginning in 2025 based on the previous year's emissions.
- [d] The total annualized cost is calculated by summing annualized one-time costs (annualized over a 10-year period using a 10 percent discount rate) and annual costs.

#### 4.4. IMPACTS ON AFFECTED ENTITIES

This section first discusses our primary impacts test, which compares compliance costs to profits for affected facilities. ERG then discusses indirect and induced impacts to related industries, and the results of sensitivity analyses that examine results under varying degrees of economic recovery from the COVID-19 pandemic.

<sup>9</sup> Note that this is a conservative cost estimate in the sense that costs that will not be incurred until 2023, 2025, or 2029 are not discounted to account for the time value of money.

#### 4.4.1. Direct Impacts

One possible measure of determining economic feasibility is a comparison of total annualized costs to profits for affected facilities, with a threshold of 10 percent of profits indicating a finding of a finding of significant adverse impact (Berck, 1995). Therefore, ERG uses this comparison to aid in the District’s determination of economic feasibility of the rule amendments.

As shown in Table 13, overall rule impacts are approximately **2.5 percent of profits**. The “Oil Producers” sector would face the highest impacts, at **8.5 percent** of profits, but no sector would be affected at a significant level.

**Table 13. Economic Impacts for Entities Affected by Potential Amendments to Rule 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

Sector	Average Annualized Cost per Facility	Average Profits per Facility	Cost as % Profits
Oil Producers	\$363,541	\$4,270,931	8.51%
Oil Refineries	\$116,605	\$14,188,009	0.82%
Government [a]	\$27,038	—	—
Food Processing and Related Industries	\$23,348	\$1,289,118	1.81%
Other Affected Sources	\$14,125	\$5,020,940	0.28%
<b>Average</b>	<b>\$79,247</b>	<b>\$3,136,497</b>	<b>2.53%</b>

Sources: ERG estimates are based on SJVAPCD, 2020b; SJVAPCD, 2020c; U.S. Census Bureau, 2015; U.S. Census Bureau, 2020b; U.S. Census Bureau 2020c; NASS, 2019; CA EDD, 2020a; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020d; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; BLS, 2020; IMPLAN, 2020a; OPM, 2017; IRS, 2016; RMA, 2020.

Note:

[a] Government agencies do not have profits, so profit values are not shown here.

#### 4.4.2. Employment, Indirect, and Induced Impacts

In addition to the primary test of direct impacts on revenue (i.e., costs), ERG also assessed potential direct impacts on employment, indirect impacts, and induced impacts using IMPLAN’s (2020a) input-output model. The IMPLAN model uses the direct costs of the rule to estimate “ripple effect (specifically backward linkages) of a given economic activity within a specific geographic area through the implementation of its Input-Output model” (IMPLAN, 2020b).

Outputs from the IMPLAN model include:

- **Direct employment impacts**, if facilities with compliance costs under the potential amendments were to attempt to offset these costs by reducing the number of employees.
- **Indirect revenue and employment impacts** that capture how directly affected firms might react to the direct cost of rule compliance by reducing purchases from their suppliers, and how those suppliers might in turn reduce employees.
- **Induced revenue and employment impacts** that capture how households will adjust their spending as a result of any changes in earnings.

Table 14 summarizes these impacts, which, taken together, could have a total impact on the District economy of **\$25.4 million and 44 jobs**.

**Table 14. Direct, Indirect, and Induced Impacts of Potential Amendments to Rules 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

Sector	Direct		Indirect		Induced		Total	
	Revenue (Costs)	Employment	Revenue	Employment	Revenue	Employment	Revenue	Employment
Oil Producers	\$17,813,503	22	\$396,071	1	\$6,651	0	\$18,216,225	23
Oil Refineries	\$466,421	0	\$76,437	0	\$9,721	0	\$552,580	0
Government	\$189,269	1	\$1,429	0	\$2,155	0	\$192,853	1
Food Processing and Related Industries	\$3,198,693	7	\$470,018	2	\$62,086	0	\$3,730,796	9
Other Affected Sources	\$1,313,620	5	\$185,818	1	\$132,151	1	\$1,631,590	7
Other Industries	\$0	0	\$784,261	2	\$277,480	2	\$1,061,741	4
<b>Total</b>	<b>\$22,981,507</b>	<b>36</b>	<b>\$1,914,034</b>	<b>5</b>	<b>\$490,243</b>	<b>3</b>	<b>\$25,385,784</b>	<b>44</b>

Sources: ERG estimates are based on SJVAPCD, 2020b; SJVAPCD, 2020c; U.S. Census Bureau, 2015; U.S. Census Bureau, 2020b; U.S. Census Bureau 2020c; NASS, 2019; CA EDD, 2020a; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020d; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; BLS, 2020; IMPLAN, 2020a; OPM, 2017; IRS, 2016; RMA, 2020.

Table 15 compares these impacts to the total size of the District’s economy (as estimated in the IMPLAN model). These impacts represent **less than 0.01 percent** of revenue and employment District-wide.

**Table 15. Comparison of Total Impacts against the District-Wide Economy for Potential Amendments to Rules 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

	Total Rule Impacts	Size of District Economy [a]	% of District Economy
Revenue	\$25,385,784	\$306,518,988,618	0.008%
Employment	44	1,806,161	0.002%

Source: ERG estimates based on IMPLAN, 2020a.

Note:

[a] While the SJVAPCD only includes a portion of Kern County, the data shown here include the whole of the county.

#### 4.4.3. COVID-19 Sensitivity Analysis

As discussed in Section 4.1.2, the primary estimates used in this analysis reflect a “COVID-19-adjusted baseline” where the baseline economic indicators are adjusted using the percentage change between IMPLAN’s (2020a) 2018 and second quarter of 2020 “Evolving Economy” model. ERG also conducted three sensitivity analyses that capture varying degrees of economic recovery from the pandemic (i.e., 30 percent, 70 percent, 100 percent).

Table 16 shows how the results of the analysis would vary under these three degrees of economic recovery. Counter-intuitively, costs as a percentage of profits would actually *increase* under the recovery scenarios. This is because the sector most heavily impacted by the rule, “Oil Producers,” has higher revenue in IMPLAN’s (2020a) model under the 2018-based 100 percent recovery scenario than under the second quarter of 2020 model used for the primary estimate.

Induced impacts also increase slightly with greater COVID-19 recovery, likely because IMPLAN’s (2020a) 2020 model takes into account changes in household income and spending patterns (including stimulus checks, unemployment checks, and increased saving) that is removed in the recovery scenarios.

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**Table 16. Results of COVID-19 Sensitivity Analyses for the Impacts of Rules 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

Analysis	Recovery from COVID-19 Baseline	Direct			Indirect		Induced		Total	
		Revenue (Costs)	Costs % Profits	Employment	Revenue	Employment	Revenue	Employment	Revenue	Employment
Primary Estimate	0%	\$22,981,507	2.527%	40	\$2,058,502	5	\$557,300	3	\$29,141,975	49
Sensitivity Analysis 1	30%	\$22,981,507	2.529%	39	\$2,012,914	5	\$580,194	4	\$29,119,282	47
Sensitivity Analysis 2	70%	\$22,981,507	2.532%	37	\$1,952,130	5	\$610,720	4	\$29,089,023	46
Sensitivity Analysis 3	100%	\$22,981,507	2.534%	36	\$1,906,542	5	\$633,614	4	\$29,066,330	45

Sources: ERG estimates based on SJVAPCD, 2020b; SJVAPCD, 2020c; U.S. Census Bureau, 2015; U.S. Census Bureau, 2020b; U.S. Census Bureau 2020c; NASS, 2019; CA EDD, 2020a; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020d; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; BLS, 2020; IMPLAN, 2020a; OPM, 2017; IRS, 2016; RMA, 2020.

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#### **4.5. IMPACTS ON SMALL ENTITIES**

The entities affected by the potential amendments may include small entities (i.e., small businesses and/or small government entities).

For private entities, small businesses are defined in the California Small Business Procurement and Contract Act (Cal. Gov't Code § 14837) as an independently owned and operated, non-dominant business with principal office located in California with fewer than 100 employees and earning less than \$15 million in revenues.

For government entities, the Regulatory Flexibility Act definition is that "a small governmental jurisdiction is a government of a city, county, town, township, village, school district, or special district with a population of less than 50,000."

Because ERG did not estimate costs on a facility-specific basis, it is not possible to identify whether any small entities are among the facilities that will incur costs under the potential rule. To the extent that small entities face similar costs to large entities but have lower profits, compliance costs will make up a greater proportion of their profits. However, since many of the facilities that are anticipated to incur costs to comply with the rule are located at either oil and gas producing or food processing facilities, many of which are large employers, the impact of this rule on small businesses as defined above may not be significant.

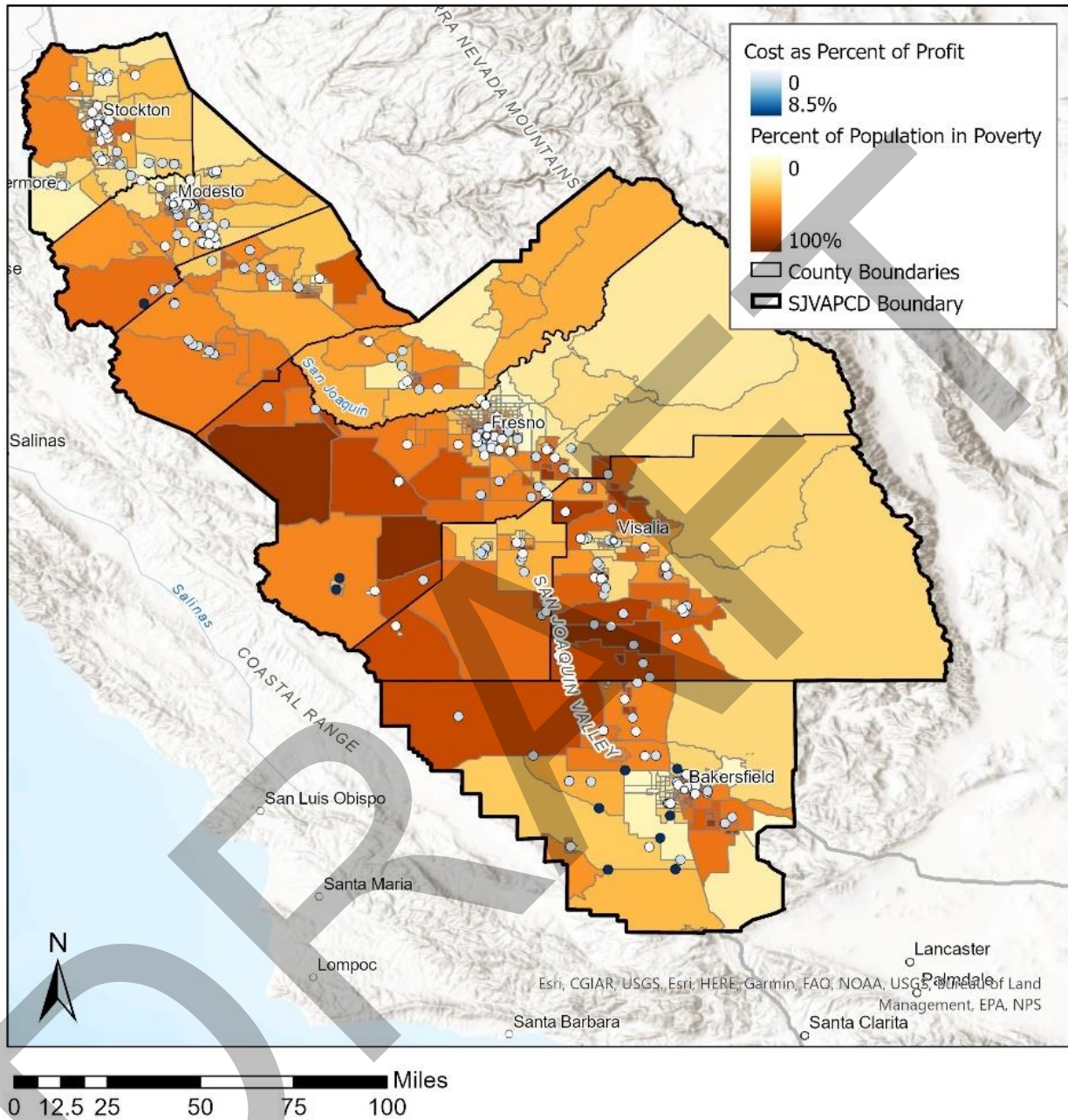
#### **4.6. IMPACTS ON AT-RISK POPULATIONS**

Cal. Gov't Code § 65040.12 defines environmental justice as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies."

The entities affected by the potential amendments may operate facilities in areas with a high number of at-risk populations. To help further the District's environmental justice goals, ERG overlaid data on the impacts of the rule with data on poverty using data from CalEnviroScreen 3.0 (OEHHA, 2018). (Note that not every facility in a given industry will necessarily be impacted by the rule, but this analysis does not include an assessment of impacts on individual facilities.)

Figure 9 presents a map of the potentially affected facilities overlying the percent of population living two times the federal poverty level. The facilities are colored in blue based on the estimated cost of compliance as a percent of profit. There is no correlation between the location of facilities and percent of the population living in poverty. However, the overall percentage of population living in poverty in the District is higher than the percentage for the state of California overall, and many potentially impacted facilities are located in areas with high poverty rates. The majority of facilities would likely face compliance costs of less than two percent of their profits. Impacts are highest for the "Oil Producers" sector, which are primarily facilities located in Kern County. This could impact vulnerable populations in Kern County, which is one of two counties that has experienced a decline in median income from 2010 to 2018 and experienced a smaller decline in poverty rate compared to the other counties in the district (see Table 5 above).

Figure 9. Map of Facilities in Relation to Population Living in Poverty



Source data: SJVAPCD, 2020b; CARB, 2020; ERG estimates; OEHHA, 2018  
 Map created by ERG using ArcGIS® software by Esri

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## APPENDIX A. SECTOR, SIC CODE, AND NAICS CODE CONCORDANCES

Table A-1 shows the concordance between SIC codes and sectors developed by SJV APCD (SJVAPCD, 2020d). (SIC codes that were not in the original concordance but that might have indirect and induced impacts were assigned the sector “Other Industries.”)

**Table A-1. SIC Code to Sector Concordance used to Analyze the Impacts of 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

SIC Code	SIC Industry	Sector
0161	Vegetables and Melons	Food Processing and Related Industries
0191	General Farms, Primarily Crop	Food Processing and Related Industries
0723	Crop Preparation Services For Market, except Cotton Ginning - Other	Food Processing and Related Industries
1311	Crude Petroleum and Natural Gas	Oil Producers
1321	Natural Gas Liquids	Oil Producers
2011	Meat Packing Plants	Food Processing and Related Industries
2015	Poultry Slaughtering and Processing - Poultry Processing	Food Processing and Related Industries
2022	Natural, Processed, and Imitation Cheese	Food Processing and Related Industries
2023	Dry, Condensed, and Evaporated Dairy Products	Food Processing and Related Industries
2024	Ice Cream and Frozen Desserts	Food Processing and Related Industries
2026	Fluid Milk - Ultra-High Temperature	Food Processing and Related Industries
2032	Canned Specialties - Canned Specialties	Food Processing and Related Industries
2033	Canned Fruits, Vegetables, Preserves, Jams, and Jellies	Food Processing and Related Industries
2034	Dried and Dehydrated Fruits, Vegetables, and Soup Mixes - Dried and Dehydrated Fruits and Vegetables	Food Processing and Related Industries
2037	Frozen Fruits, Fruit Juices, and Vegetables	Food Processing and Related Industries
2041	Flour and Other Grain Mill Products	Food Processing and Related Industries
2043	Cereal Breakfast Foods - Coffee Substitute	Food Processing and Related Industries
2044	Rice Milling	Food Processing and Related Industries
2047	Dog and Cat Food	Other Affected Sources
2048	Prepared Feed and Feed Ingredients for Animals and Fowls, Except Dogs and Cats - Animal Slaughtering for Pet Food	Other Affected Sources
2062	Cane Sugar Refining	Food Processing and Related Industries
2064	Candy and Other Confectionery Products - Chocolate Confectionery	Food Processing and Related Industries
2068	Salted and Roasted Nuts and Seeds	Food Processing and Related Industries
2076	Vegetable Oil Mills, Except Corn, Cottonseed, and Soybeans - Vegetable Oilseed Processing, except Corn, Cottonseed, and Soybeans	Food Processing and Related Industries
2077	Animal and Marine Fats and Oils - Animal Fats and Oils	Other Affected Sources
2084	Wines, Brandy, and Brandy Spirits	Food Processing and Related Industries
2086	Bottled and Canned Soft Drinks and Carbonated Waters - Soft Drinks	Food Processing and Related Industries
2096	Potato Chips, Corn Chips, and Similar Snacks	Food Processing and Related Industries
2099	Food Preparations, NEC - Reducing Maple Sap to Maple Syrup	Food Processing and Related Industries
2273	Carpets and Rugs	Other Affected Sources

**Table A-1. SIC Code to Sector Concordance used to Analyze the Impacts of 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

SIC Code	SIC Industry	Sector
2421	Sawmills and Planing Mills, General - Lumber Manufacturing from Purchased Lumber, Softwood Cut Stock, Wood Lath and Planing Mill Products	Other Affected Sources
2491	Wood Preserving	Other Affected Sources
2499	Wood Products, NEC - Mirror and Picture Frames	Other Affected Sources
2541	Wood Office and Store Fixtures, Partitions, Shelving, and Lockers - Wood Lunchroom Tables and Chairs	Other Affected Sources
2652	Setup Paperboard Boxes	Other Affected Sources
2653	Corrugated and Solid Fiber Boxes	Other Affected Sources
2656	Sanitary Food Containers, Except Folding	Other Affected Sources
2759	Commercial Printing, NEC - Screen Printing	Other Affected Sources
2869	Industrial Organic Chemicals, NEC - Aliphatics	Other Affected Sources
2875	Fertilizers, Mixing Only	Other Affected Sources
2879	Pesticides and Agricultural Chemicals, NEC	Other Affected Sources
2911	Petroleum Refining	Oil Refineries
2951	Asphalt Paving Mixtures and Blocks	Other Affected Sources
2952	Asphalt Felts and Coatings	Other Affected Sources
3086	Plastics Foam Products - Urethane and Other Foam Products	Other Affected Sources
3672	Printed Circuit Boards	Other Affected Sources
4221	Farm Product Warehousing and Storage	Other Affected Sources
4612	Crude Petroleum Pipelines	Oil Producers
4911	Electric Services - Hydroelectric Power Generation	Other Affected Sources
4931	Electric and Other Services Combined - Hydroelectric Power Generation When Combined with Other Services	Other Affected Sources
4952	Sewerage Systems	Other Affected Sources
4961	Steam and Air-Conditioning Supply	Other Affected Sources
5093	Scrap and Waste Materials	Food Processing and Related Industries
5141	Groceries, General Line	Food Processing and Related Industries
5142	Packaged Frozen Foods	Food Processing and Related Industries
5143	Dairy Products, Except Dried or Canned	Food Processing and Related Industries
5149	Groceries and Related Products, NEC - Bottling Mineral or Spring Water	Food Processing and Related Industries
5153	Grain and Field Beans	Food Processing and Related Industries
5169	Chemicals and Allied Products, NEC	Other Affected Sources
7216	Drycleaning Plants, Except Rug Cleaning	Other Affected Sources
7217	Carpet and Upholstery Cleaning	Other Affected Sources
7218	Industrial Launderers	Other Affected Sources
8062	General Medical and Surgical Hospitals	Other Affected Sources
9199	General Government, NEC	Government
9223	Correctional Institutions	Government
9999	Nonclassifiable	Government

Source: SJVAPCD, 2020d.

Table A-2 shows the NAICS codes that map to the SIC codes used in the analysis (limited to the NAICS codes assigned to the facilities in the District that may be affected by the potential amendments). This concordance was primarily developed using the U.S. Census Bureau’s (2020a) SIC to NAICS concordances. Where multiple NAICS codes map to one SIC code, ERG used information on companies’ websites or other search tools about what type of industry they are engaged in to assign a NAICS code.

**Table A-2. SIC to NAICS Concordance for Facilities that may be Affected by Potential Amendments to Rule 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

SIC Code	SIC Industry	Corresponding NAICS
0161	Vegetables and Melons	1112 (Vegetable and Melon Farming)
0191	General Farms, Primarily Crop	1119 (Other Crop Farming)
0723	Crop Preparation Services For Market, except Cotton Ginning - Other	1151 (Support Activities for Crop Production), 3119 (Other Food Manufacturing)
1311	Crude Petroleum and Natural Gas	2111 (Oil and Gas Extraction)
1321	Natural Gas Liquids	2111 (Oil and Gas Extraction)
2011	Meat Packing Plants	3116 (Animal Slaughtering and Processing)
2015	Poultry Slaughtering and Processing - Poultry Processing	3116 (Animal Slaughtering and Processing)
2022	Natural, Processed, and Imitation Cheese	3115 (Dairy Product Manufacturing)
2023	Dry, Condensed, and Evaporated Dairy Products	3115 (Dairy Product Manufacturing)
2024	Ice Cream and Frozen Desserts	3115 (Dairy Product Manufacturing)
2026	Fluid Milk - Ultra-High Temperature	3115 (Dairy Product Manufacturing)
2032	Canned Specialties - Canned Specialties	3119 (Other Food Manufacturing)
2033	Canned Fruits, Vegetables, Preserves, Jams, and Jellies	3114 (Fruit and Vegetable Preserving and Specialty Food Manufacturing)
2034	Dried and Dehydrated Fruits, Vegetables, and Soup Mixes - Dried and Dehydrated Fruits and Vegetables	3114 (Fruit and Vegetable Preserving and Specialty Food Manufacturing)
2037	Frozen Fruits, Fruit Juices, and Vegetables	3114 (Fruit and Vegetable Preserving and Specialty Food Manufacturing)
2041	Flour and Other Grain Mill Products	3112 (Grain and Oilseed Milling)
2043	Cereal Breakfast Foods - Coffee Substitute	3112 (Grain and Oilseed Milling)
2044	Rice Milling	3112 (Grain and Oilseed Milling)
2047	Dog and Cat Food	3111 (Animal Food Manufacturing)
2048	Prepared Feed and Feed Ingredients for Animals and Fowls, Except Dogs and Cats - Animal Slaughtering for Pet Food	3111 (Animal Food Manufacturing)
2062	Cane Sugar Refining	3113 (Sugar and Confectionery Product Manufacturing)
2064	Candy and Other Confectionery Products - Chocolate Confectionery	3113 (Sugar and Confectionery Product Manufacturing)
2068	Salted and Roasted Nuts and Seeds	3119 (Other Food Manufacturing)
2076	Vegetable Oil Mills, Except Corn, Cottonseed, and Soybeans - Vegetable Oilseed Processing, except Corn, Cottonseed, and Soybeans	3112 (Grain and Oilseed Milling)
2077	Animal and Marine Fats and Oils - Animal Fats and Oils	3116 (Animal Slaughtering and Processing)
2084	Wines, Brandy, and Brandy Spirits	3121 (Beverage Manufacturing)
2086	Bottled and Canned Soft Drinks and Carbonated Waters - Soft Drinks	3121 (Beverage Manufacturing)
2096	Potato Chips, Corn Chips, and Similar Snacks	3119 (Other Food Manufacturing)



**Table A-2. SIC to NAICS Concordance for Facilities that may be Affected by Potential Amendments to Rule 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

SIC Code	SIC Industry	Corresponding NAICS
2099	Food Preparations, NEC - Reducing Maple Sap to Maple Syrup	3119 (Other Food Manufacturing)
2273	Carpets and Rugs	3141 (Textile Furnishings Mills)
2421	Sawmills and Planing Mills, General - Lumber Manufacturing from Purchased Lumber, Softwood Cut Stock, Wood Lath and Planing Mill Products	3211 (Sawmills and Wood Preservation)
2491	Wood Preserving	3211 (Sawmills and Wood Preservation)
2499	Wood Products, NEC - Mirror and Picture Frames	3219 (Other Wood Product Manufacturing)
2541	Wood Office and Store Fixtures, Partitions, Shelving, and Lockers - Wood Lunchroom Tables and Chairs	3222 (Converted Paper Product Manufacturing)
2631	Paperboard Mills	3222 (Converted Paper Product Manufacturing)
2652	Setup Paperboard Boxes	3222 (Converted Paper Product Manufacturing)
2653	Corrugated and Solid Fiber Boxes	3222 (Converted Paper Product Manufacturing)
2656	Sanitary Food Containers, Except Folding	3222 (Converted Paper Product Manufacturing)
2759	Commercial Printing, NEC - Screen Printing	3231 (Printing and Related Support Activities)
2869	Industrial Organic Chemicals, NEC - Aliphatics	3251 (Basic Chemical Manufacturing)
2875	Fertilizers, Mixing Only	3253 (Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing)
2879	Pesticides and Agricultural Chemicals, NEC	3253 (Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing)
2911	Petroleum Refining	3241 (Petroleum and Coal Products Manufacturing), 3261 (Plastics Product Manufacturing)
2951	Asphalt Paving Mixtures and Blocks	3241 (Petroleum and Coal Products Manufacturing)
2952	Asphalt Felts and Coatings	3241 (Petroleum and Coal Products Manufacturing)
3086	Plastics Foam Products - Urethane and Other Foam Products	3261 (Plastics Product Manufacturing)
3672	Printed Circuit Boards	3329 (Other Fabricated Metal Product Manufacturing)
4221	Farm Product Warehousing and Storage	3111 (Animal Food Manufacturing), 3112 (Grain and Oilseed Milling)
4612	Crude Petroleum Pipelines	4861 (Pipeline Transportation of Crude Oil)
4911	Electric Services - Hydroelectric Power Generation	2211 (Electric Power Generation, Transmission and Distribution)
4931	Electric and Other Services Combined - Hydroelectric Power Generation When Combined with Other Services	2211 (Electric Power Generation, Transmission and Distribution)
4952	Sewerage Systems	9993 (Local Government)
4961	Steam and Air-Conditioning Supply	2213 (Water, Sewage and Other Systems)
5093	Scrap and Waste Materials	5629 (Remediation and Other Waste Management Services)

**Table A-2. SIC to NAICS Concordance for Facilities that may be Affected by Potential Amendments to Rule 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

SIC Code	SIC Industry	Corresponding NAICS
5141	Groceries, General Line	3114 (Fruit and Vegetable Preserving and Specialty Food Manufacturing)
5142	Packaged Frozen Foods	4244 (Grocery and Related Product Merchant Wholesalers)
5143	Dairy Products, Except Dried or Canned	4244 (Grocery and Related Product Merchant Wholesalers)
5149	Groceries and Related Products, NEC - Bottling Mineral or Spring Water	3114 (Fruit and Vegetable Preserving and Specialty Food Manufacturing), 3121 (Beverage Manufacturing)
5153	Grain and Field Beans	4245 (Farm Product Raw Material Merchant Wholesalers)
5169	Chemicals and Allied Products, NEC	4249 (Miscellaneous Nondurable Goods Merchant Wholesalers)
7216	Drycleaning Plants, Except Rug Cleaning	8123 (Drycleaning and Laundry Services)
7217	Carpet and Upholstery Cleaning	8123 (Drycleaning and Laundry Services)
7218	Industrial Launderers	8123 (Drycleaning and Laundry Services)
8062	General Medical and Surgical Hospitals	6221 (General Medical and Surgical Hospitals)
9199	General Government, NEC	9991 (Federal Government), 9993 (Local Government)
9223	Correctional Institutions	5612 (Facilities Support Services), 9992 (State Government), 9993 (Local Government)
9999	Nonclassifiable	3115 (Dairy Product Manufacturing)

Source: ERG estimates based on SJVAPCD, 2020b; U.S. Census Bureau, 2020a.

## APPENDIX B. PROFIT RATES BY NAICS INDUSTRY

Table B-1 shows the profit rates used for private industry, which were estimated using the average rate for 2000 through 2013 data from the Internal Revenue Service (IRS, 2016) “SOI Tax Stats - Corporation Source Book.”

**Table B-1. Profit Rate by NAICS Industry for Facilities Affected by Rule 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

NAICS	Industry	Average	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1112	Vegetable and Melon Farming	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1119	Other Crop Farming	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1151	Support Activities for Crop Production	2.00%	1.04%	0.92%	-0.49%	1.06%	1.89%	3.36%	2.06%	2.84%	0.48%	0.87%	2.64%	2.33%	4.76%	4.31%
2111	Oil and Gas Extraction	7.33%	6.53%	5.55%	0.85%	5.50%	8.04%	14.89%	16.06%	11.11%	10.31%	2.50%	8.29%	5.99%	3.50%	3.50%
2211	Electric Power Generation, Transmission and Distribution	0.45%	7.39%	2.31%	2.53%	-1.37%	-0.14%	0.83%	4.84%	7.36%	0.54%	-2.62%	0.18%	-6.02%	-7.16%	-2.38%
2213	Water, Sewage and Other Systems	0.62%	4.82%	3.57%	-8.79%	-0.83%	0.43%	6.40%	4.36%	6.25%	-6.72%	-0.97%	-1.81%	-0.17%	-0.19%	2.38%
3111	Animal Food Manufacturing	4.06%	4.85%	2.75%	3.53%	2.10%	2.77%	5.38%	4.83%	5.11%	3.67%	4.37%	5.13%	3.47%	4.21%	4.66%
3112	Grain and Oilseed Milling	4.62%	3.36%	3.03%	3.33%	4.45%	4.40%	9.30%	7.06%	4.31%	3.66%	4.37%	5.13%	3.47%	4.21%	4.66%
3113	Sugar and Confectionery Product Manufacturing	8.23%	5.65%	7.03%	9.37%	6.34%	4.85%	7.97%	8.95%	6.89%	8.99%	6.98%	11.55%	8.24%	10.61%	11.74%
3114	Fruit and Vegetable Preserving and Specialty Food Manufacturing	5.97%	5.09%	6.15%	5.84%	4.75%	4.31%	7.36%	9.77%	5.17%	6.02%	6.23%	5.55%	5.55%	6.10%	5.71%
3115	Dairy Product Manufacturing	2.10%	2.64%	1.49%	1.89%	0.81%	0.78%	0.48%	2.61%	2.29%	2.52%	1.55%	2.60%	1.97%	4.35%	3.45%
3116	Animal Slaughtering and Processing	2.72%	1.69%	1.82%	1.69%	2.28%	2.05%	2.79%	1.43%	1.66%	0.84%	4.37%	5.13%	3.47%	4.21%	4.66%
3119	Other Food Manufacturing	4.61%	2.86%	2.47%	2.42%	3.20%	2.93%	13.21%	4.91%	5.28%	3.25%	5.00%	6.48%	3.16%	3.79%	5.50%
3121	Beverage Manufacturing	11.35%	9.13%	8.71%	7.57%	11.16%	8.99%	22.37%	10.84%	9.05%	8.36%	13.09%	11.80%	12.61%	11.59%	13.66%
3141	Textile Furnishings Mills	1.70%	1.19%	-1.02%	-0.84%	11.10%	0.56%	1.85%	1.90%	1.47%	-0.30%	-1.05%	1.46%	1.10%	2.78%	3.63%
3211	Sawmills and Wood Preservation	1.37%	1.88%	1.49%	0.66%	2.43%	4.25%	5.26%	2.27%	-0.43%	-2.35%	-4.63%	0.08%	0.55%	2.47%	5.28%
3219	Other Wood Product Manufacturing	1.37%	1.88%	1.49%	0.66%	2.43%	4.25%	5.26%	2.27%	-0.43%	-2.35%	-4.63%	0.08%	0.55%	2.47%	5.28%
3222	Converted Paper Product Manufacturing	7.09%	7.25%	4.44%	5.30%	4.22%	5.40%	12.53%	10.18%	7.60%	4.79%	7.83%	7.65%	5.27%	7.35%	9.47%
3231	Printing and Related Support Activities	2.82%	2.67%	1.69%	1.96%	2.26%	2.80%	4.10%	4.27%	3.77%	1.52%	0.64%	3.44%	1.84%	3.93%	4.55%

**Table B-1. Profit Rate by NAICS Industry for Facilities Affected by Rule 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

NAICS	Industry	Average	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
3241	Petroleum and Coal Products Manufacturing	6.81%	8.77%	7.99%	3.83%	6.49%	7.96%	8.57%	7.99%	7.35%	6.22%	6.59%	6.95%	5.20%	6.05%	5.39%
3251	Basic Chemical Manufacturing	3.41%	1.93%	-1.88%	-0.92%	3.08%	1.16%	6.94%	5.82%	4.63%	2.18%	2.25%	5.76%	4.31%	5.71%	6.82%
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	9.71%	7.17%	6.83%	7.20%	8.32%	7.44%	20.64%	9.91%	9.08%	8.59%	13.43%	9.93%	8.63%	9.32%	9.51%
3261	Plastics Product Manufacturing	2.57%	2.49%	1.24%	1.57%	1.50%	2.51%	3.62%	2.17%	2.74%	1.24%	2.32%	2.84%	3.00%	4.68%	4.01%
3329	Other Fabricated Metal Product Manufacturing	6.09%	6.20%	3.31%	4.19%	4.07%	6.49%	9.50%	6.71%	7.38%	5.85%	3.71%	5.79%	6.81%	7.37%	7.84%
4244	Grocery and Related Product Merchant Wholesalers	2.66%	0.94%	0.92%	0.77%	0.89%	3.24%	2.64%	3.88%	4.15%	2.99%	2.47%	3.24%	3.12%	3.99%	3.98%
4245	Farm Product Raw Material Merchant Wholesalers	1.60%	1.22%	1.07%	0.78%	2.44%	2.08%	2.36%	2.17%	1.52%	0.76%	2.31%	2.33%	0.74%	1.64%	0.91%
4249	Miscellaneous Nondurable Goods Merchant Wholesalers	2.32%	1.52%	1.36%	1.68%	2.63%	2.74%	2.98%	2.31%	1.99%	2.12%	2.47%	2.78%	2.23%	2.94%	2.76%
4861	Pipeline Transportation of Crude Oil	8.89%	4.27%	2.45%	16.03%	10.39%	13.16%	11.98%	3.65%	12.16%	6.97%	7.85%	7.69%	3.74%	13.84%	10.25%
5612	Facilities Support Services	2.80%	0.45%	0.38%	1.43%	2.33%	2.47%	5.02%	3.70%	3.60%	3.03%	2.08%	3.61%	3.35%	3.85%	3.89%
5629	Remediation and Other Waste Management Services	3.47%	1.83%	2.78%	1.49%	-0.78%	3.05%	5.19%	-1.57%	6.69%	4.14%	6.25%	6.27%	4.23%	4.92%	4.13%
6221	General Medical and Surgical Hospitals	4.43%	1.68%	2.78%	3.59%	3.70%	4.00%	5.04%	4.89%	4.80%	4.68%	5.59%	5.37%	4.88%	5.70%	5.34%
8123	Drycleaning and Laundry Services	2.60%	-0.16%	-4.66%	2.16%	2.87%	1.85%	3.20%	4.09%	3.92%	2.41%	2.81%	3.71%	4.59%	4.85%	4.77%
9991	Federal Government	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9992	State Government	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9993	Local Government	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Source: ERG estimates based on IMPLAN, 2020a.

Note: Profit rate calculated as "Net Income (less deficit)" divided by "Total Receipts."

## APPENDIX C. COVID-19 BASELINE ADJUSTMENTS BY NAICS INDUSTRY

Table C-1 shows the percentage change in revenue, employment, and average pay per employee by NAICS code, derived by comparing IMPLAN’s (2020) datasets for 2018 and the “Evolving Economy” dataset developed using data for the second quarter of 2020.

**Table C-1. COVID-19 Adjustments by NAICS Industry for Facilities Affected by Rule 4306 and 4320—Boilers, Steam Generators, and Process Heaters - Phase 3, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr**

NAICS	Industry	COVID-19-Adjusted Change in Baseline		
		Revenue	Employment	Average Pay
1112	Vegetable and Melon Farming	-17.46%	-13.79%	13.98%
1119	Other Crop Farming	-17.46%	-14.86%	13.76%
1151	Support Activities for Crop Production	-32.19%	-13.91%	13.78%
2111	Oil and Gas Extraction	33.55%	29.86%	6.47%
2211	Electric Power Generation, Transmission and Distribution	-3.97%	-7.25%	12.55%
2213	Water, Sewage and Other Systems	1.77%	-3.40%	9.68%
3111	Animal Food Manufacturing	-13.01%	-9.81%	4.41%
3112	Grain and Oilseed Milling	-17.68%	-14.07%	3.99%
3113	Sugar and Confectionery Product Manufacturing	-18.90%	-16.68%	12.61%
3114	Fruit and Vegetable Preserving and Specialty Food Mfg.	-19.07%	-14.99%	4.03%
3115	Dairy Product Manufacturing	-14.11%	-10.32%	8.13%
3116	Animal Slaughtering and Processing	-13.46%	-8.38%	13.85%
3119	Other Food Manufacturing	-7.81%	-2.06%	7.71%
3121	Beverage Manufacturing	-13.48%	-10.19%	4.23%
3141	Textile Furnishings Mills	-28.94%	-25.07%	4.14%
3211	Sawmills and Wood Preservation	-7.83%	-2.90%	6.76%
3219	Other Wood Product Manufacturing	-6.24%	-2.65%	-6.43%
3222	Converted Paper Product Manufacturing	-16.00%	-12.51%	4.47%
3231	Printing and Related Support Activities	-27.69%	-24.98%	3.50%
3241	Petroleum and Coal Products Manufacturing	-18.84%	-15.49%	4.32%
3251	Basic Chemical Manufacturing	-15.25%	-11.23%	3.86%
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Mfg.	-12.36%	3.67%	3.67%
3261	Plastics Product Manufacturing	-10.37%	-6.75%	9.43%
3329	Other Fabricated Metal Product Manufacturing	-17.49%	-4.27%	1.42%
4244	Grocery and Related Product Merchant Wholesalers	-6.17%	-10.33%	8.49%
4245	Farm Product Raw Material Merchant Wholesalers	-5.56%	-10.43%	6.83%
4249	Miscellaneous Nondurable Goods Merchant Wholesalers	-5.56%	-10.43%	6.83%
4861	Pipeline Transportation of Crude Oil	2.40%	0.15%	7.62%
5612	Facilities Support Services	4.69%	-2.34%	12.32%
5629	Remediation and Other Waste Management Services	9.90%	3.37%	7.41%
6221	General Medical and Surgical Hospitals	7.42%	0.14%	8.11%
8123	Drycleaning and Laundry Services	-30.05%	-34.82%	13.54%
9991	Federal Government	1.78%	0.58%	0.21%
9992	State Government	15.00%	9.87%	5.96%
9993	Local Government	9.59%	4.86%	5.84%

Source: ERG estimates based on IMPLAN, 2020a.