

SOCIOECONOMIC
ANALYSIS
PROPOSED RULE

REGULATION 9, RULE 6:
NITROGEN OXIDES FROM NATURAL GAS-FIRED
WATER HEATERS

September, 2007

Prepared for
Bay Area Air Quality
Management District

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1. EXECUTIVE SUMMARY

Bay Area Air Quality Management District (“District”) seeks to amend to Regulation 9, Rule 6 to further limit NO_x emissions from residential, commercial and industrial water heaters. The Bay Area Air Quality Management District will not require households and businesses to retrofit or replace existing water heaters during the lifetime of the existing water heater. At the end of their useful life, existing water heaters will be replaced with new water heaters that comply with the proposed amendments. Households and businesses can purchase new water heaters when needed, particularly when their existing units breakdown. Thus, the report analyzes incremental costs associated with proposed amendments to Regulation 9, Rule 6, not the total cost of new compliant water heaters, on the grounds that households and businesses would need to purchase a water heater in any case, and the impact to households and businesses is the incremental increase in cost due to the proposed amendments.

According to District staff, the incremental cost of new water heaters range between \$50 and \$100 for housing of a variety of sizes, from single-family units to small-to-large multi-family units. Impacts to households are less than significant. District staff also places incremental costs of new water heaters for commercial and industrial users between \$100 and \$500. With respect to households, the socioeconomic analysis shows that incremental costs for residential new water heaters are a small fraction of what households typically spend every year on “miscellaneous household equipment and large appliances” and what they spend on retail and services in general. With respect to industries, the analysis concludes that the incremental costs of new commercial and industrial water heaters are less than significant. In addition, the analysis concludes by saying that small businesses are not disproportionately impacted by the proposed amendments to Regulation 9, Rule 6.

2. DESCRIPTION OF THE PROPOSED RULE

CURRENT STATUS OF THE RULE

The Bay Area Air Quality Management District (“District”) regulates NO_x emissions from water heaters under Regulation 9, Rule 6, which imposes a NO_x limit of 40 nanograms NO_x per joule of heat output on water heaters with a rated heat input capacity of 75,000 Btu/hr or less. The regulated water heaters are conventional tank water heaters typically found in single-family residences. This rule was adopted April 1, 1992.

In addition to water heaters with rated heat input capacity of 75,000 Btu/hr or less, there are larger water heaters that are also tank type water heaters, similar in appearance, design, and construction to the smaller water heaters. These larger water heaters range in size from 75,000 to 400,000 Btu/hr and are used in small hotels, apartment buildings, office buildings, and industrial and commercial facilities to supply hot water. Units larger than 400,000 Btu/hr are typically small boilers and are different in appearance, design, and construction from water heaters. These small boilers are generally sold as “package boilers” that are prefabricated, equipped and shipped complete with burners and control systems. Boilers in this size range generally rely on natural draft rather than mechanical draft equipment. They are used in office buildings, hotels, schools, and industrial facilities to supply heat, steam, or hot water. These units are not currently regulated by the District.

Larger water heaters and boilers are regulated under three separate rules. Two rules apply to large industrial boilers at refineries and power plants (Regulation 9, Rules 10 and 11 respectively). The third rule, Regulation 9, Rule 7 (“Regulation 9-7”), imposes a 30 ppm NO_x limit on industrial, institutional, and commercial boilers with a rated heat input of 10 million Btu/hr or more. Regulation 9, Rule 7 was adopted September 15, 1993.

PROPOSED RULE AMENDMENTS

Residential Water Heaters

Regulation 9, Rule is a “point of sale” type rule, requiring new water heaters sold, offered for sale, or installed in the District to meet the NO_x requirements. District staff proposes to amend Regulation 9, Rule 6 to require the following categories of residential water heaters (less than 75,000 Btu/hr heat input) to meet a NO_x emission limit of 10 ng/joule from the current 40 nanograms/joule limit according to the following schedule:

- < 50 gallon storage tank effective January 1, 2009
- > 50 gallon storage tank effective January 1, 2010
- Power assist storage tank effective January 1, 2011

Swimming Pool & Spa Heaters

District staff recommends requiring any new heaters used exclusively for commercial, public, and institutional swimming pools and spas to meet a NO_x emissions standard of 40 ng/joule, (~55 ppm), effective January 1, 2008. This water heater technology is now readily available, and swimming pool and spa heaters should no longer be exempt from this regulation, according to the District. Further, staff recommends that the commercial, public and institutional pool and spa water heaters be required to meet a 14 ng/joule NO_x emission limit by January 1, 2013, consistent with other large commercial water heaters.

Mobile Home Water Heaters

District staff recommends requiring any new heaters used exclusively for mobile homes not to exceed a NO_x emissions standard of 40 ng/joule, effective July 1, 2008, particularly since water heater technology is now readily available to lower emissions.

Commercial Water Heaters

The District does not currently regulate water heaters larger than 75,000 Btu/hr heat input. The District seeks to amend Rule 9-6 by imposing a NO_x limit of 40 nanograms per joule of heat output (~55 ppm) for new water heaters from greater

than 75,000 Btu/hr up to 400,000 Btu/hr heat input, effective January 1, 2008. Instantaneous water heaters are included here because they have similar rated heat input capacity, since they are designed to heat cold water up to normal hot water temperatures (typically 140 – 160°F) for immediate delivery. Water heaters certified to meet these emissions are currently available in southern California. Staff proposes a 14 ng/joule standard become effective in the Bay Area by January 1, 2013.

The District also seeks to regulate new package boilers larger than 400,000 Btu/hr to 2 million Btu/hr inclusive, via proposed amendments to Regulation 9, Rule 6. In particular, the District would impose a similar NO_x limit of 20 nanograms per joule (~30 ppm) of heat output for new water heaters from greater than 400,000 Btu/hr up to 2 million Btu/hr heat input, effective January 1, 2008. Staff further proposes to require water heaters with a heat input of 400,000 Btu/hr to 2 million Btu/hr to meet a 14 ng/joule standard effective January 1, 2013.

All of the NO_x emissions limits proposed for Regulation 9, Rule 6 will apply to new units only.

EMISSIONS REDUCTIONS

According to District staff, Regulation 9, Rule 6 draft amendments are similar to the standards and implementation timetable established by SCAQMD for residential water heaters. Emissions reductions are based on lower emissions for each water heater sold starting in 2009 and an estimated 12-year life expectancy for a typical water heater. NO_x reductions are estimated to be 0.2 tpd in mid-2009 and accrue to a total reduction of 2.47 tpd by 2021.

3. IMPACT OF PROPOSED RULE AMENDMENTS

This section of the socioeconomic analysis describes demographic and economic trends in the San Francisco Bay Area (Bay Area) region. Following an overview of the methodology for the socioeconomic analysis, the first part of this section compares the Bay Area against California and provides a context for understanding demographic and economic changes that have occurred within the Bay Area between 1996 and 2006. After an overview of Bay Area industries, we focus on households and industries impacted by the proposed amendments to Regulation 9, Rule 6.

For the purposes of this report, the Bay Area region is defined as Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma Counties.

METHODOLOGY

The socioeconomic analysis of the proposed rule amendments concerning nitrogen oxides from stationary gas turbines involves the use of information provided directly by BAAQMD, as well as secondary data used to describe the industries affected by the proposed rule amendments.

Based on information provided by BAAQMD staff, ADE determined that the impacts would affect households and businesses in a wide set of industries, particularly as affected entities purchase new water heaters. The BAAQMD does not require affected entities to replace existing water heaters with water heaters that meet Regulation 9, Rule 6, as amended, during the lifetime of the existing water heater. Affected entities will purchase compliant water heaters at the point in time they need to replace existing units. For this reason, this report analyzes *incremental* compliance costs associated with amendments to Regulation 9, Rule 9, not the *total* cost of a new heater.

With this information we began to prepare economic descriptions of the industry groups of which the impacted sites are a part, as well as to analyze data on the number of

jobs, sales levels, the typical profit ratios and other economic indicators for the Bay Area businesses. In addition, we collected demographic information of typical households living in various housing settings, from owner-occupied single-family homes to renters living in large apartment complexes.

With the annual reports and data from the US Economic Census and other sources such as US IRS, ADE was able to estimate revenues and profit ratios for many of the sites impacted by the proposed water heater rule amendments. In calculating aggregate revenues generated by Bay Area businesses in wide number of industries, ADE first estimated annual revenue based upon available data. Using annual reports and publicly available data, ADE calculated ratios of profit per dollar of sales for the businesses on which the analysis focused. To estimate employment, ADE used employment data from 2002 Economic Census and the California Employment Development Department.

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

With respect to impacts on households purchasing new water heaters that comply with Regulation 9, Rule 6 as amended, ADE gathered information from US Census, particularly data from 2005 American Community Survey (ACS) on households in the nine-county Bay Area. ADE identified typical households in a variety of housing arrangements, from households in owner-occupied single-family homes to renters living in large apartment complex. ADE identified average household incomes for households in various housing arrangements, and based on this information, calculated annual retail spending in general and spending on appliances-and-miscellaneous household equipment. ADE compared incremental cost of purchasing new water heaters against spending in general and on household equipment and

appliance in particular, and made a determination on the significance of the incremental cost.

REGIONAL DEMOGRAPHIC TRENDS

The Bay Area experienced moderate population growth from 1995 to 2005. Between 1995 and 2000, the nine-county region increased by nearly 6.7 percent, from 6.3 million in 1995 to almost 6.8 million in 2000. From 1995 to 2005, the population increase was from 6.3 million to close to 7.1 million for an increase of approximately 10.4 percent. At the same time, California had population growth of almost 14 percent.

Within the Bay Area, the greatest percentage increase occurred in Contra Costa County. From 1995 to 2005 Contra Costa increased its population by nearly 15 percent. All other Bay Area counties had population increases slower than the State. The smallest percentage increase occurred in Marin County where population grew less than 5.5 percent from 1995 to 2005. Table 1 shows the population changes that have occurred in the Bay Area and California from 1995 to 2005.

TABLE 1
Population Growth: San Francisco Bay Area

	Population			Percent Change		
	1995	2000	2005	95-00	00-05	95-05
California	31,617,000	33,871,648	36,728,196	6.7%	7.8%	13.9%
Bay Area	6,329,800	6,783,760	7,067,403	6.7%	4.0%	10.4%
Alameda County	1,332,900	1,443,741	1,500,228	7.7%	3.8%	11.2%
Contra Costa County	869,200	948,816	1,019,101	8.4%	6.9%	14.7%
Marin County	238,100	247,289	251,820	3.7%	1.8%	5.4%
Napa County	116,800	124,279	132,990	6.0%	6.6%	12.2%
San Francisco County	741,600	776,733	792,952	4.5%	2.0%	6.5%
San Mateo County	673,300	707,161	719,655	4.8%	1.7%	6.4%
Santa Clara County	1,568,200	1,682,585	1,752,653	6.8%	4.0%	10.5%
Solano County	368,000	394,542	420,307	6.7%	6.1%	12.4%
Sonoma County	421,700	458,614	477,697	8.0%	4.0%	11.7%

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

REGIONAL ECONOMIC TRENDS

The Bay Area is one of the world's greatest regional economies. It benefits from pre-eminent knowledge-based industries, with competitive strength flowing from an unmatched culture of entrepreneurship, world-leading research institutions, and some of the nation's best educated and most highly skilled workforce. With these remarkable advantages, it has led through innovation in a wide range of research and industrial fields.

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

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

As of 2005, the professional and business services sector was the largest employer in the region, at 529,100 jobs or 17 percent of all private and public sector jobs. This is a change from 1995 when professional and business services accounted for 16 percent of all Bay Area employment. During the same period, professional and business services increased 14 percent. The next largest industry in the Bay Area is public service, or government, with 468,100 jobs. In 2005, government accounted for 15 percent of all Bay Area employment. From 1995 to 2005, government had one of the lowest growth rates of all industries at less than 6 percent. Two other industries came close to manufacturing in total employment. Retail trade and education & health care both made up 11 percent of total employment and had only a few

thousand jobs less than manufacturing. Unlike manufacturing, both retail trade and education & health care had significant job gains from 1995 to 2005. All other industries made up less than manufacturing in total employment in 2005. Table 2 shows Bay Area industry sectors and their trends from 1995 to 2005.

TABLE 2
Employment Profile of the San Francisco Bay Area, 1995-2005

Industry	1995	2000	2005	% of Total Employment in 2005	% Change 1995 - 2000	% Change 2000 - 2005
Farm	21,100	25,800	20,000	1%	4%	-5%
Natural Resources & Mining	1,261	1,986	4,560	0.1%	10%	18.1%
Construction	105,200	165,700	164,100	5%	10%	0%
Manufacturing	428,800	484,500	351,300	11%	2%	-6%
Wholesale Trade	121,700	138,800	122,900	4%	3%	-2%
Retail Trade	304,900	350,600	336,600	11%	3%	-1%
Transportation, Warehousing and Utilities	116,600	125,600	100,400	3%	1%	-4%
Information	92,100	151,600	112,300	4%	10%	-6%
Financial Activities	189,300	198,500	213,000	7%	1%	1%
Professional and Business Services	464,400	670,300	529,100	17%	8%	-5%
Educational and Health Services	299,300	334,300	361,600	11%	2%	2%
Leisure and Hospitality	260,400	297,700	311,000	10%	3%	1%
Other Services	100,700	110,800	109,900	3%	2%	0%
Government	442,100	465,200	468,100	15%	1%	0%
Total	2,947,861	3,521,386	3,204,860	100%	4%	-2%

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

DESCRIPTION OF AFFECTED HOUSEHOLDS AND INDUSTRIES

Proposed amendments to Regulation 9, Rule 6 potentially affect almost all industries and households in the Bay Area, in so far as affected businesses and households occupy buildings that utilize a water heater in one capacity or another. Many businesses will share a building with other businesses in small to large building complex, meaning incremental costs would be distributed on a pro rata basis. Likewise, households living in single-family units to multi-family structures, from duplexes to large apartment buildings, are also potentially subject to the rule, at the point in time they need a new water heater.

The discussion below analyzes household and economic trends in greater detail. The discussion first examines household trends, including analysis on what proportion of household spending incremental costs associated with rule amendments represents. After this discussion, the report examines economic trends, including detailed discussion on businesses by size categories in terms of number of workers. This discussion also analyzes incremental costs in relation to economic indicators, particularly estimated aggregate industry net profits.

Household Trends and Impacts

As Table 3 shows, there are 2.5 million households in the nine-county Bay Area. Of these households, 1.1 million live in owner-occupied housing in which households maintain a mortgage. Over 348,000 households live in owner-occupied units with no mortgage payments. Table 3 also shows that there are over 1 million renting households in the Bay Area.

TABLE 3
Households By Housing Units in Structure and Tenure

	Total	San Francisco Bay Area Region		
		Owner-Occupied Mortgage	Owner-Occupied No Mortgage	Renter-Occupied No Mortgage
Housing Units in Structure:	2,502,669	1,140,563	348,213	1,013,893
1, detached or attached	1,613,073	1,016,640	310,380	286,053
2 to 4	233,856	33,705	10,290	189,861
5 to 9 (small apartment\condo\townhouse)	153,136	17,297	5,281	130,558
10 to 19 (medium apartments\condo\townhouse)	135,897	10,496	3,204	122,197
20 or more (large apartments\condo\townhouse)	311,256	27,840	8,499	274,917
Mobile home	52,654	33,418	10,202	9,034
Boat, RV, van, etc.	2,797	1,168	356	1,273

Source: Applied Development Economics, based on US Census American Community Survey 2005

Data is broken into three broad categories of “mortgage,” “no mortgage,” and “renters” as incomes for households in each of these broad categories typically differ even when adjusted for housing unit type (i.e. single-family units, duplex, small apartment, mid-sized apartment, and large apartment). Thus, the average household income for households in owner-occupied living situations with a mortgage is \$127,250 versus \$81,845 for households without a mortgage. Because spending on a wide variety of goods, including household equipment and large appliances, varies with income, it is

important to characterize average household incomes as accurately as possible.

Table 4 identifies average household incomes for households living in various housing arrangements. At \$127,250, the typical household living in single-family units with mortgage payments has a higher income than households living in other situations, on average. At \$31,029, the typical household that rents in apartment complexes with at least 20 units has the lowest incomes, on average.

TABLE 4
Avg. Household Income By Housing Units in Structure and Tenure

	San Francisco Bay Area Region			
	All Households	Owner-Occupied		Renter-Occupied
		Mortgage	No Mortgage	No Mortgage
Housing Units in Structure:	\$90,046	\$122,566	\$78,832	\$57,315
1, detached or attached	\$108,868	\$127,250	\$81,845	\$72,862
2 to 4	\$62,876	\$90,590	\$58,266	\$58,205
5 to 9 (small apartment\condo\townhouse)	\$66,577	\$80,449	\$51,743	\$65,339
10 to 19 (medium apartments, etc)	\$49,352	\$65,217	\$41,946	\$48,184
20 or more (large apartments, etc)	\$32,755	\$49,984	\$32,149	\$31,029
Mobile home	\$81,053	\$92,911	\$59,759	\$61,236

Source: Applied Development Economics, based on US Census American Community Survey 2005

Tables 5 and 6 identify estimated annual spending on “miscellaneous household equipment” and “large appliances” by households living in the different housing arrangements. Spending amounts in Tables 5 and 6 are directly related to average household incomes found in Table 4 above. Spending data comes from the US Bureau of Labor Statistics (BLS), which annually surveys over 100,000 consumers of various incomes and their respective spending habits.

The tables below show that the typical household living in a single-family unit with mortgage payments spends an estimated \$2,384 on “miscellaneous household equipment/large appliances” (Table 5), and, in general, spends \$59,490 on retail and services (Table 6). Thus, the typical household that lives in single-family unit with a mortgage spends over 46 percent of household income on retail and services (i.e. \$59,490/\$127,250). In contrast, the typical renter in an apartment complex with at least 20 units spends \$777 and \$9,507 on “miscellaneous household

equipment/large appliances” and retail and services respectively. Thus, this household spends 36 percent of its household income on retail and services (i.e. \$9,507/\$31,029).

TABLE 5
Miscellaneous Household Equipment and Major Appliances: Annual Expenditures By Type of Units and Tenure, 2005

	San Francisco Bay Area Region		
	Owner-Occupied		Renter-Occupied
	Mortgage	No Mortgage	No Mortgage
Units in Structure By Avg. Household	\$1,354	\$855	\$331
1, detached or attached	\$2,384	\$1,212	\$367
2 to 4	\$1,577	\$800	\$312
5 to 9 (small apartment, etc)	\$1,449	\$960	\$960
10 to 19 (medium apartments, etc)	\$960	\$835	\$835
20 or more (large apartments, etc)	\$835	\$777	\$777
Mobile home	\$1,577	\$800	\$312

Source: Applied Development Economics, based on US Bureau of Labor Statistics Consumer Expenditures Annual Survey

TABLE 6
Average Annual Household Consumer Retail and Services Expenditures By Housing Units in Structure and Tenure, 2005*

	San Francisco Bay Area Region		
	Owner-Occupied		Renter-Occupied
	Mortgage	No Mortgage	No Mortgage
Housing Units in Structure:	\$48,386	\$31,067	\$21,653
1, detached or attached	\$59,490	\$38,196	\$26,622
2 to 4	\$36,922	\$23,706	\$16,523
5 to 9 (small apartment, etc)	\$39,095	\$25,102	\$17,496
10 to 19 (medium apartments, etc)	\$29,895	\$19,194	\$13,378
20 or more (large apartments, etc)	\$21,245	\$13,641	\$9,507
Mobile home	\$36,922	\$23,706	\$16,523

Source: Applied Development Economics, based on US Bureau of Labor Statistics Consumer Expenditures Annual Survey (*note: Total consumer spending excludes housing-shelter payment, food, utilities, and healthcare)

Incremental Cost and Impact Analysis:

Residential Water Heaters

Table 7 below identifies total and incremental costs of new water heaters that comply with Regulation 9, Rule 6 as amended. The Bay Area Air Quality Management District does not require households to replace existing water heaters with new compliant water heaters. In other words, households and owners of rental properties can purchase new water heaters when needed, particularly when their existing

water heaters breakdown. Thus, the report analyzes incremental costs associated with proposed amendments to Regulation 9, Rule 6 and not on the total cost of new compliant water heaters. As Table 7 shows, the District estimates incremental cost at \$50 for a new water heater for a typical single-family unit and \$100 for a new water heater for small to large apartment building.

**TABLE 7
Incremental Cost of Residential Water Heaters (Proposed)**

	Total Cost Before Rule Adoption	Incremental Cost
Conventional water heaters (75,000 Btu/hr or less): single-family dwellings	\$400 - \$500	\$50
Large water heaters (75K - 400K Btu/hr or less): apartment bldgs. (small to large)	\$2,500 - \$10,000	\$100

Source: Bay Area Air Quality Management District

Tables 8 and 9 express incremental cost as a share of spending for “miscellaneous household equipment/large appliances” in particular, and as a share of overall retail and services spending. These tables shows that incremental costs are a small share of the amount of dollars typical households spend on “miscellaneous household equipment/large appliances,” meaning that incremental cost due to the proposed amendments to Regulation 9, Rule 6 are less than significant.

Table 8 shows that in most instances a typical household will spend no more than five percent of its respective “miscellaneous household equipment/large appliances” spending on the incremental cost of new water heaters. For example, for a typical mortgage-paying homeowner of a single-family unit, the \$50 incremental cost amounts to 2.1 percent of annual spending on “miscellaneous household equipment\large appliances.” For a typical renter of a single-family unit, the \$50 incremental cost represents 13.6 percent of annual spending household equipment and large appliances, assuming the landlord bills the tenant for the cost of a new water heater. For a typical mortgage-paying homeowner who lives in a building consisting of 2 to 4 units, the \$50 incremental cost amounts to, on average, 1.1 percent of annual spending on “miscellaneous household equipment\large appliances.” In general, for households

living in multi-family buildings, the incremental cost of a new water heater relative to typical “miscellaneous household equipment/large appliances” spending is less than 1.5 percent. This is so because incremental costs are distributed among the number of units in a multi-family building. For example, assuming property owners pass costs to tenants, apartment buildings with more than 20 units contain, on average, 53 units, meaning that the \$100 incremental cost translates to \$1.89 *per unit*, which, in turn, is 0.2 percent of \$777, i.e. the estimated spent every year on “miscellaneous household equipment/large appliances” by the typical renter living in an apartment building with more than 20 units. Table 9 shows smaller incremental cost-to-spending ratios than cost-to-spending ratios found in Table 8.

TABLE 8
Incremental Cost As Percent of Miscellaneous Household Equipment and Major Appliances Spending

	San Francisco Bay Area Region		
	Owner-Occupied		Renter-Occupied
	Mortgage	No Mortgage	No Mortgage
Units in Structure By Avg. Household			
1, detached or attached	2.1%	4.1%	13.6%
2 to 4	1.1%	2.1%	5.3%
5 to 9 (small apartment, etc)	1.0%	1.5%	1.5%
10 to 19 (medium apartments, etc)	0.7%	0.8%	0.8%
20 or more (large apartments, etc)	0.2%	0.2%	0.2%
Mobile home	1.1%	2.1%	5.3%

Source: Applied Development Economics

TABLE 9
Incremental Cost As Percent of Total Annual Household Consumer Retail and Services Spending*

	San Francisco Bay Area Region		
	Owner-Occupied		Renter-Occupied
	Mortgage	No Mortgage	No Mortgage
Units in Structure By Avg. Household			
1, detached or attached	0.08%	0.13%	0.19%
2 to 4	0.05%	0.07%	0.10%
5 to 9 (small apartment, etc)	0.04%	0.06%	0.08%
10 to 19 (medium apartments, etc)	0.02%	0.03%	0.05%
20 or more (large apartments, etc)	0.01%	0.01%	0.02%
Mobile home	0.05%	0.07%	0.10%

Source: Applied Development Economics (*note: Total consumer spending excludes housing-shelter payment, food, utilities, and healthcare)

Economic Trends and Impacts

Table 10 is similar to Table 2 except data is organized by general land use and building types. In addition, data is segregated by private and public sectors.

TABLE 10
Economic Profile: San Francisco Bay Area, 2005

SECTOR	NAICS	REGION	Type of Use	Establishments	Employment
Private	11	Agriculture, forestry, fishing and hunting	Other	1,885	20,863
Local Government	11	Agriculture, forestry, fishing and hunting	Other	1	11
Private	21	Mining	Industrial	79	2,046
Private	22	Utilities	Industrial	119	6,262
Local Government	22	Utilities	Industrial	76	6,781
Private	23	Construction	Other Industrial	16,167	195,805
Local Government	23	Construction	Other Industrial	23	2,524
Private	31-33	Manufacturing	Industrial	9,335	364,614
Private	42	Wholesale trade	Other	9,846	129,229
Private	44-45	Retail	Commercial	20,325	348,804
Private-Govt	48-49	Transportation Warehousing	Other Industrial	3,540	120,084
Private	51	Information	Office	3,791	117,074
Local Government	51	Information	Office	44	3,477
Federal Government	51	Information	Office	1	11
Private	52	Finance and insurance	Office	10,478	153,465
Local Government	52	Finance and insurance	Office	10	4,104
Federal Government	52	Finance and insurance	Office	2	6
Private	53	Real estate and rental and leasing	Office	9,491	63,791
Local Government	53	Real estate and rental and leasing	Office	6	33
Private	54	Professional and technical services	Office	27,100	304,670
Local Government	54	Professional and technical services	Office	5	50
State Government	54	Professional and technical services	Office	2	20
Federal Government	54	Professional and technical services	Office	16	538
Private	55	Management of companies and enterprises	Office	985	56,990
Private	56	Administrative and waste services	Industrial	9,290	188,104
Local Government	56	Administrative and waste services	Industrial	12	109
Private	61	Educational services	Institutional	2,563	68,554
Local Government	61	Educational services	Institutional	2,188	84,712
State Government	61	Educational services	Institutional	668	32,093
Private	62	Health care and social assistance	Institutional	17,993	294,227
Local Government	62	Health care and social assistance	Institutional	31	4,893
State Government	62	Health care and social assistance	Institutional	256	6,727
Federal Government	62	Health care and social assistance	Institutional	4	6,896
Private	71	Arts, entertainment, and recreation	Other	2,519	51,500
Local Government	71	Arts, entertainment, and recreation	Other	57	6,403
Federal Government	71	Arts, entertainment, and recreation	Other	10	764
Private	72	Accommodation and food services	Commercial	14,846	270,423
Local Government	72	Accommodation and food services	Commercial	4	72
Federal Government	72	Accommodation and food services	Commercial	6	59
	721	<i>Traveler Accommodation</i>	Commercial	889	47,377
Private	81	Other services, except public administration	Commercial	68,568	145,611
Local Government	81	Other services, except public administration	Commercial	21	417
Federal Government	81	Other services, except public administration	Commercial	2	44
Local Government	92	Public administration	Office	394	97,032
State Government	92	Public administration	Office	700	21,846
Federal Government	92	Public administration	Office	291	22,686
Private	99	Unclassified	Other	160	436
				233,910	3,204,860

Source: Applied Development Economics, based on California EDD LMID

In Tables 11 and 12, we re-organize Table 10 data in terms of size of businesses by employment. Of the 233,910 public and private establishments in the region, 132,442 employ between one and four workers (see Table 11). Similarly, Table 12 shows that, of the 3.2 million workers in the region, 173,531 are employed in businesses with one to four workers.

TABLE 11
Establishments By Land Use Types and By Size of Business: SF Bay Area, 2005

Type of Use	Establishments	Number of Employees								
		1-4	5-9	10-19	20-49	50-99	100-249	250-499	500-999	1000 or more
Commercial	103,772	58,184	21,392	12,414	8,063	2,443	1,065	153	47	12
Office	53,316	33,626	7,788	5,433	3,665	1,535	825	250	130	64
Industrial	18,911	8,836	3,201	2,548	2,311	1,096	641	181	56	41
Other industrial	19,730	11,509	3,366	2,330	1,479	585	332	81	32	16
Accommodations	889	284	137	172	158	45	55	27	7	2
Institutional	23,703	12,178	5,021	3,272	1,882	727	415	100	59	50
Other	14,478	8,109	2,580	1,766	1,257	459	228	53	19	7
	233,910	132,442	43,348	27,764	18,658	6,843	3,506	817	342	190

Source: Applied Development Economics, based on California EDD LMID

TABLE 12
Employment By Land Use Types and By Size of Business: SF Bay Area, 2005

Type of Use	Employment	Number of Employees								
		1-4	5-9	10-19	20-49	50-99	100-249	250-499	500-999	1000 or more
Commercial	765,431	58,494	83,742	113,545	180,653	131,396	132,688	46,368	20,352	13,192
Office	845,793	50,910	53,169	75,635	116,102	114,583	131,651	88,991	95,871	111,381
Industrial	567,916	10,191	25,274	41,721	83,453	90,078	114,436	72,207	42,083	80,971
Other industrial	318,413	20,234	24,212	34,574	49,614	45,578	55,897	30,851	24,492	32,961
Accommodations	47,377	416	1,147	2,933	5,975	3,951	10,296	11,794	6,227	4,639
Institutional	498,101	16,716	39,125	53,049	68,692	62,351	76,504	42,961	48,868	89,837
Other	209,206	16,985	20,443	26,418	38,519	30,387	33,317	18,265	13,902	10,969
	3,204,860	173,531	245,966	344,943	537,034	474,373	544,493	299,643	245,567	339,310

Source: Applied Development Economics, based on California EDD LMID

Tables 13 and 14 estimate amount of revenues generated by businesses, including public sector entities, based on a revenue per workers formula, data for which comes from the Economic Census 2002. To estimate public sector allocations, the analysis employed a per capita rate based on typical average wages, benefits, and capital outlays at the local, state and federal levels. On average, the public sector per capita rate ranged from \$120,000 to \$160,000. Averages were then multiplied against aggregate number of workers organized by size of business (see Table 13). Table 14 translates aggregate revenues in Table 13 into average revenues per business by size of business category.

TABLE 13
Aggregate Value By Land Use Types and By Size of Business: SF Bay Area, 2005

Type of Use	Aggregate Value ('000)	Number of Employees								
		1-4	5-9	10-19	20-49	50-99	100-249	250-499	500-999	1000 or more
Commercial	\$108,405,884	\$6,826,150	\$12,120,620	\$15,029,589	\$22,719,389	\$19,092,623	\$21,427,610	\$7,546,510	\$2,277,585	\$1,365,808
Office	\$158,984,604	\$10,473,451	\$9,658,257	\$13,957,136	\$21,829,575	\$21,260,660	\$25,926,770	\$17,962,059	\$18,533,599	\$19,383,097
Industrial	\$148,455,055	\$4,107,048	\$6,396,438	\$10,845,523	\$21,740,358	\$22,968,039	\$27,982,415	\$18,000,466	\$11,452,645	\$24,962,122
Other industrial	\$47,832,325	\$3,207,519	\$3,796,657	\$5,322,140	\$7,573,277	\$6,801,482	\$8,394,998	\$4,604,164	\$3,673,897	\$4,458,191
Accommodations	\$3,779,838	\$33,225	\$91,473	\$233,980	\$476,663	\$315,222	\$821,410	\$940,970	\$496,777	\$370,117
Institutional	\$48,852,267	\$1,641,915	\$3,843,776	\$5,206,284	\$6,736,640	\$6,107,154	\$7,494,024	\$4,203,439	\$4,793,677	\$8,825,359
Other	\$109,159,385	\$7,406,945	\$9,909,066	\$13,587,568	\$21,339,902	\$16,222,423	\$16,878,930	\$8,312,288	\$6,854,002	\$8,648,261
	\$621,689,520	\$33,663,027	\$45,724,813	\$63,948,239	\$101,939,141	\$92,452,381	\$108,104,748	\$60,628,926	\$47,585,405	\$67,642,839

Source: Applied Development Economics, based on California EDD LMID and US Economic Census

TABLE 14
Average Value By Land Use Types and By Size of Business: SF Bay Area, 2005

Type of Use	Average Value	Number of Employees								
		1-4	5-9	10-19	20-49	50-99	100-249	250-499	500-999	1000 or more
Commercial	\$1,044,654	\$117,321	\$566,604	\$1,210,674	\$2,817,807	\$7,816,769	\$20,123,709	\$49,183,279	\$48,955,903	\$110,823,050
Office	\$2,981,917	\$311,470	\$1,240,112	\$2,569,099	\$5,955,664	\$13,851,662	\$31,414,988	\$71,951,477	\$142,512,242	\$301,956,790
Industrial	\$7,850,382	\$464,820	\$1,998,379	\$4,256,040	\$9,405,737	\$20,962,125	\$43,626,016	\$99,581,867	\$205,788,952	\$612,032,032
Other industrial	\$2,424,345	\$278,686	\$1,128,019	\$2,284,259	\$5,118,907	\$11,628,970	\$25,299,557	\$57,138,034	\$116,216,497	\$270,291,154
Accommodations	\$4,251,786	\$116,832	\$665,685	\$1,359,837	\$3,022,100	\$6,942,318	\$14,944,218	\$34,238,862	\$69,291,776	\$154,874,516
Institutional	\$2,061,016	\$134,827	\$765,539	\$1,590,941	\$3,579,410	\$8,401,825	\$18,059,266	\$42,224,160	\$81,730,770	\$178,258,989
Other	\$7,539,673	\$913,391	\$3,840,265	\$7,694,023	\$16,977,315	\$35,374,558	\$74,147,265	\$157,056,859	\$352,135,550	\$1,265,530,672
	\$2,657,817	\$254,172	\$1,054,835	\$2,303,315	\$5,463,555	\$13,509,629	\$30,834,719	\$74,218,856	\$139,157,561	\$355,756,803

Source: Applied Development Economics

Tables 15 and 16 are similar to the previous tables except that these tables track aggregate net profits and average net profits. Net profit rates are industry-specific and were multiplied against Table 13 revenues. Net profit rates come from Dun and Bradstreet, and rates are based on a ten-year period to adjust for periods when profits were either unusually high or unusually low.

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TABLE 15
Aggregate Net Profits By Land Use Types and By Size of Business: SF Bay Area, 2005

Type of Use	Aggregate Profits ('000)	Number of Employees								
		1-4	5-9	10-19	20-49	50-99	100-249	250-499	500-999	1000 or more
Commercial	\$3,091,733	\$200,458	\$361,001	\$451,098	\$684,241	\$527,273	\$553,713	\$190,469	\$76,398	\$47,082
Office	\$26,391,117	\$651,420	\$773,769	\$1,245,760	\$2,746,872	\$3,769,092	\$3,567,836	\$2,380,499	\$2,645,177	\$8,610,693
Industrial	\$9,056,619	\$169,709	\$258,615	\$448,355	\$868,087	\$865,227	\$1,140,823	\$620,512	\$782,488	\$3,902,804
Other industrial	\$1,823,809	\$134,366	\$156,214	\$212,145	\$297,393	\$256,081	\$319,960	\$173,379	\$139,706	\$134,565
Accommodations	\$224,270	\$1,971	\$5,427	\$13,883	\$28,282	\$18,703	\$48,737	\$55,831	\$29,475	\$21,960
Institutional	\$16,759,956	\$411,852	\$913,705	\$1,571,643	\$2,337,894	\$2,595,557	\$3,145,323	\$2,066,692	\$1,590,907	\$2,126,382
Other	\$2,821,380	\$178,473	\$237,765	\$329,900	\$538,916	\$437,129	\$474,809	\$255,669	\$197,196	\$171,524
	\$59,944,615	\$1,746,278	\$2,701,069	\$4,258,901	\$7,473,403	\$8,450,359	\$9,202,464	\$5,687,219	\$5,431,872	\$14,993,050

Source: Applied Development Economics, based on California EDD LMID, US Economic Census and Dun and Bradstreet

TABLE 16
Average Net Profits By Land Use Types and By Size of Business: SF Bay Area, 2005

Type of Use	Average Net Profits	Number of Employees								
		1-4	5-9	10-19	20-49	50-99	100-249	250-499	500-999	1000 or more
Commercial	\$29,794	\$3,445	\$16,876	\$36,337	\$84,864	\$215,872	\$520,019	\$1,241,355	\$1,642,144	\$3,820,314
Office	\$494,992	\$19,373	\$99,351	\$229,308	\$749,416	\$2,455,624	\$4,323,080	\$9,535,680	\$20,339,819	\$134,140,441
Industrial	\$478,919	\$19,207	\$80,797	\$175,945	\$375,569	\$789,662	\$1,778,601	\$3,432,783	\$14,060,272	\$95,690,624
Other industrial	\$92,438	\$11,674	\$46,413	\$91,053	\$201,013	\$437,840	\$964,245	\$2,151,645	\$4,419,330	\$8,158,377
Accommodations	\$252,273	\$6,932	\$39,497	\$80,684	\$179,311	\$411,911	\$886,690	\$2,031,506	\$4,111,312	\$9,189,221
Institutional	\$707,082	\$33,820	\$181,976	\$480,264	\$1,242,204	\$3,570,798	\$7,579,670	\$20,760,220	\$27,124,495	\$42,949,723
Other	\$194,874	\$22,008	\$92,146	\$186,807	\$428,743	\$953,202	\$2,085,784	\$4,830,740	\$10,131,275	\$25,099,692
	\$256,272	\$13,185	\$62,312	\$153,399	\$400,546	\$1,234,811	\$2,624,819	\$6,962,005	\$15,884,828	\$78,853,572

Source: Applied Development Economics

Incremental Cost and Impact Analysis: Commercial and Industrial Water Heaters

Table 17 below identifies total and incremental costs of new water heaters that comply with Regulation 9, Rule 6 as amended. Costs are for commercial and industrial water heaters. For the most part, the analysis assumes that businesses employing less than 50 workers utilize new water heaters between 75,000 Btu/hr up and 400,000 Btu/hr heat input. In addition, the analysis assumes that businesses employing more than 50 workers utilize water heaters greater than \$400,000 Btu/hr.

TABLE 17
Incremental Cost of Proposed Rule Borne By Business Organized By Land Use and Size of Business

Type of Use	Incremental Cost	Number of Employees								
		1-4	5-9	10-19	20-49	50-99	100-249	250-499	500-999	1000 or more
Commercial	\$100 - \$500	\$100	\$100	\$100	\$100	\$500	\$500	\$500	\$500	\$500
Office	\$100 - \$500	\$100	\$100	\$100	\$100	\$500	\$500	\$500	\$500	\$500
Industrial	\$100 - \$500	\$100	\$100	\$100	\$500	\$500	\$500	\$500	\$500	\$500
Other industrial	\$100 - \$500	\$100	\$100	\$100	\$100	\$500	\$500	\$500	\$500	\$500
Accommodations	\$100 - \$500	\$100	\$100	\$100	\$100	\$500	\$500	\$500	\$500	\$500
Institutional	\$100 - \$500	\$100	\$100	\$100	\$100	\$500	\$500	\$500	\$500	\$500
Other	\$100 - \$500	\$100	\$100	\$100	\$100	\$500	\$500	\$500	\$500	\$500

Source: Applied Development Economics, based on BAAQMD

Table 18 compares incremental cost per business (as organized by land-use\building type and number of workers) versus estimated net profits per business. Across the board, incremental net costs are far below the ten-percent threshold of significance employed for the purposes of evaluating socioeconomic impacts of proposed amendments or new rules. It is important to note that in analyzing incremental annual compliance costs versus net profits, the analysis assumes each individual business and public sector entity bears all of the incremental costs. Since many businesses occupy a single building, in reality, businesses impacted by incremental costs resulting from proposed amendments to Regulation 9, Rule 6 will not bear either \$100 or \$500 in incremental costs. Instead, they will bear a share of incremental costs, meaning that cost-to-net profit ratios are actually less than what is indicated in Table 18.

TABLE 18
Incremental Cost of Proposed Rule As Percent of Net Profits of Business Organized By Land Use and Size of Business

Type of Use	Incremental Cost	Number of Employees								
		1-4	5-9	10-19	20-49	50-99	100-249	250-499	500-999	1000 or more
Commercial	\$100 - \$500	2.9%	0.6%	0.3%	0.1%	0.2%	0.1%	0.0%	0.0%	0.0%
Office	\$100 - \$500	0.5%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Industrial	\$100 - \$500	0.5%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Other industrial	\$100 - \$500	0.9%	0.2%	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
Accommodations	\$100 - \$500	1.4%	0.3%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
Institutional	\$100 - \$500	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other	\$100 - \$500	0.5%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%

Source: Applied Development Economics,

IMPACT ON SMALL BUSINESS

DEFINITION OF SMALL BUSINESS PER CALIFORNIA STATUTE

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

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

SMALL BUSINESS IMPACT ANALYSIS

Table 14 above showed that most businesses that employ less than 100 workers generate less than \$10 million in revenue, on average, meaning that most businesses in these categories are small businesses, with the exception of office, industrial and other industrial businesses. Office, industrial, and other industrial that employ between 50 and 99 workers generate more than \$10 million, so the typical business in these categories is not a small business.

Because Table 14 showed that most businesses employing less than 100 workers fit the profile of a small business, proposed amendments to Regulation 9, Rule 6 *could* impact small businesses disproportionately. However, Table 18 showed that, across the board, the incremental cost-to-net profit ratios were well below the ten-percent significance threshold employed for purposes of evaluating new rules and proposed amendments. Thus, the proposed amendments to Regulation 9, Rule 6 do not disproportionately impact small businesses.