



2019 Area Source Emissions Inventory Methodology

690 – COMMERCIAL COOKING OPERATIONS

I. Purpose

This document describes the Area Source Methodology used to estimate emissions of fine particulate matter less than 10 microns (PM₁₀) and volatile organic compounds (VOC) from commercial cooking operations in the San Joaquin Valley Air Basin and includes: 1) charbroiling - underfired and chain-driven units, 2) deep-fat frying, and 3) other commercial cooking using equipment such as clamshells and flat griddles. An area source category is a collection of similar emission units within a geographic area (i.e., a County). An area source category collectively represent individual sources that are small and numerous, and that may not have been inventoried as specific point, mobile, or biogenic sources. The California Air Resources Board (CARB) has grouped these individual sources with other like sources into area source categories. These source categories are grouped in such a way that they can be estimated collectively using one methodology.

II. Applicability

The emission calculations from this Area Source Methodology apply to facilities that are identified by the following Category of Emission Source (CES) codes and Reconciliation Emission Inventory Codes (REIC):

Table 1. Emission inventory codes.

CES	REIC	Description
60418	690-680-6000-0000	Commercial Charbroiling
66811	690-682-6000-0000	Commercial Deep-Fat Frying
82180	690-684-6000-0000	Other Commercial Cooking

III. Point Source Reconciliation

Emissions from the area source inventory and point source inventory are reconciled against each other to prevent double counting. This is done using relationships created by the California Air Resources Board (CARB) between the area source REIC and the point sources' Standard Industry Classification (SIC) code and emissions process Source Classification Code (SCC) combinations. Currently, only chain-driven charbroilers are subject to District permit, and therefore represented in our point source inventory. These units are reconciled to the area source inventory using the following SIC/SCC combination:

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Table 2. Point source reconciliation relationships for commercial charbroiling.

EIC	SIC	SCC	Point Source Type
690-680-6000-0000	5812	30299998	Commercial Cooking - Eating Places - Miscellaneous

IV. Methodology Description

This document describes PM₁₀ and VOC emissions from three categories of commercial cooking operations in the San Joaquin Valley Air Basin: 1) charbroiling - underfired and chain-driven units, 2) deep-fat frying, and 3) other commercial cooking - clamshell and flat griddles. The VOC and PM₁₀ emissions calculated from this methodology are only from the cooking of the food. Emissions from the combustion processes related to the cooking may be covered in other source categories such as *Commercial Natural Gas Combustion - Other* (EIC 060-995-0110-0000) and *Commercial L.P.G. Combustion* (EIC 060-995-0120-0000).

This methodology uses a study performed for the California Air Resources Board and the number of restaurants in each county as surrogates for determining the number of cooking devices and the amount of food (meats and potatoes) cooked in each county. The amount of food cooked on each device type is multiplied by appropriate emission factors to determine the emissions from each food type on each cooking device. These are then summed for county level emissions.

V. Activity Data

Number of restaurants: The number of restaurants by type for each county in the San Joaquin Valley Air Pollution Control District (“the District”) was obtained from data provided by health departments in each of the eight counties in the San Joaquin Valley. The method for collection and processing of the data provided by each county is presented in Appendix A, entitled “Processing of County Health Department Permit Data”. Restaurants were identified using the same five restaurant types as derived in the original 2006 methodology.

Table 3. Number of restaurants in the District by type (2019).

County	Ethnic	Family	Fast Food	Seafood	Steak & BBQ	Total
Fresno	625	140	283	32	22	1,102
Kern	400	163	320	19	24	926
Kings	55	14	52	2	1	124
Madera	102	24	29	3	3	161
Merced	144	55	74	6	8	287
San Joaquin	380	109	248	20	13	770
Stanislaus	329	121	198	11	17	676
Tulare	264	64	131	16	6	481
Total	2,299	690	1,335	109	94	4,527

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Cooking equipment: The fraction of restaurants using different types of cooking equipment and the average pieces of equipment used in each of these restaurants was derived from a CARB sponsored survey (Potepan, 2001). The following table summarizes this data:

Table 4. Type of cooking equipment used per restaurant category.

Equipment Type	Ethnic	Family	Fast Food	Seafood	Steak and BBQ
Percent of restaurants with equipment					
Chain-Driven charbroilers	3.5	10.1	18.6	0.0	6.9
Underfired charbroilers	47.5	60.9	30.8	52.6	55.2
Deep-fat fryer	81.9	91.4	96.8	100.0	82.8
Flat griddles	62.7	82.9	51.9	36.8	89.7
Clamshell griddles	4.0	1.4	14.7	10.5	0.0
Average number of units per restaurant type¹					
Chain-Driven charbroilers	1.62	1.71	1.07	--	--
Underfired charbroilers	1.54	1.29	1.58	1.10	1.63
Deep-fat fryer	1.63	2.34	3.10	2.47	2.42
Flat griddles	1.88	2.03	1.43	1.11	1.35
Clamshell griddles	1.80	--	2.09	1.50	--

¹Average number of equipment pieces only for restaurants having equipment.

Multiplying the number of each type of restaurant within the District by the percentage with equipment and then the average number of cooking devices gives the total amount of equipment within the District, by restaurant type. This estimate is summarized in the table below:

Table 5. Equipment type by restaurant category within the District (2019).

Equipment Type	Ethnic	Family	Fast Food	Seafood	Steak and BBQ	Total
Chain-Driven charbroilers	130	119	266	0	0	515
Underfired charbroilers	1,682	542	650	63	85	3,021
Deep-fat fryer	3,069	1,476	4,006	269	188	9,008
Flat griddles	2,710	1,161	991	45	114	5,020
Clamshell griddles	166	0	410	17	0	593
Total	7,757	3,298	6,322	394	387	18,158

Process Rates

Emissions estimates are based upon commercial cooking of meats (hamburger, steak, seafood, pork, chicken, and “other” meats) and potatoes. The average weekly pounds of meat cooked by equipment type was described by Potepan (2001), and converted into tons per year.

The per capita farm weight of frozen potatoes sold in 2019 was obtained from the United States Department of Agriculture – Economic Research Service (USDA, 2019). This value (52.4 lb/person-year) was multiplied by the total district population (4,304,283 people) (California Department of Finance, 2019), divided by the total number of deep fat fryers in the District (9,008 deep fat fryers), and finally divided by 2,000 pounds per ton. The result of this calculation was 12.52 tons of potatoes cooked per deep fat fryer within the District for 2019. In 2019, District Rule 4692 imposed a limit on the quantity of meat that can be used at unpermitted facilities of 10.4 tons/year (worst case scenario of 400

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lbs/week) for both Chain and Underfired Charbroilers. Therefore, tonnage limits outlined in District Rule 4692 were incorporated by adjusting the quantity of each food type found in Table 6 for Chain and Underfired Charbroilers only. The consumption of all food types is displayed in the table below:

Table 6. Food cooked per device (tons/yr) in the District (2019).

Food Type	Chain-Driven Charbroilers	Underfired Charbroilers	Deep-Fat Fryers	Flat Griddles	Clamshell Griddles
Steak	1.51	1.69	4.71	4.32	2.44
Hamburger	5.11	2.54	7.12	9.41	34.16
Poultry, with skin	0.94	1.35	9.49	2.29	2.94
Poultry, skinless	1.70	1.68	5.41	2.89	2.81
Pork	0.37	1.39	1.52	2.91	3.07
Seafood	0.76	1.35	4.13	2.39	16.43
Other meat	0.00	0.39	7.12	1.50	0.00
Potatoes	0.00	0.00	14.28	0.00	0.00

Chain-Driven Charbroilers

Because the District permits chain-driven charbroilers, the total amount of food cooked on these devices for the unreconciled area source portion of emissions is determined by adding the process rate reported through the District's point source inventory to the process rate estimated by the methodology.

The total area-wide process rate (tons of meat cooked per year) for chain-driven charbroilers in each county is determined by summing the average use of all meat types and multiplying that by the number of chain-driven charbroilers in each county. The results of these calculations are presented in the tables below:

Table 7. Distribution of meat cooked on chain-driven charbroilers¹.

Meat Type	Meat Cooked (Tons/Year/Charbroiler)	Percentage of Total Meat Consumption
Steak	1.51	14.54
Hamburger	5.11	49.15
Poultry, with skin	0.94	9.05
Poultry, skinless	1.70	16.38
Pork	0.37	3.55
Seafood	0.76	7.33
Total	10.40	100.00

¹ Please see Appendix B for information on the Rule adjusted tons

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Table 8. Total meat cooked on chain-driven charbroilers by County (2019).

County	Chain-Driven Charbroilers (no.)	Total Meat Cooked (tons/year)
Fresno	228	2,396
Kern	201	1,207
Kings	30	321
Madera	26	187
Merced	59	381
San Joaquin	159	1,743
Stanislaus	140	912
Tulare	100	970

The point source process rate (tons of meat cooked per year) is then added to the total area-wide process rate as seen below.

Table 9. Meat cooked on all chain-driven charbroilers (2019, tons)

Meat Type	Total Process Rate	Point Source Process Rate	¹ PEER Source Process Rate	² Area Source Process Rate
Fresno	2,396	1,201	569	626
Kern	1,207	383	205	618
Kings	321	151	84	86
Madera	187	102	0	85
Merced	381	160	46	175
San Joaquin	1,743	839	420	485
Stanislaus	912	366	119	426
Tulare	970	445	244	281

¹Permit Exempt Equipment Registration (PEER). Since PEERs are not surveyed, the process rate was developed assuming that they operate similar to permitted facilities. The ratio between PEER and Permitted sources is multiplied by the county process rate to estimate PEER process rates.

²At this time, the area-wide methodology does not remove permitted or PEER facilities from the total area-wide facility count. Therefore, the process rates for these facilities are being double counted in the area source process rate.

The area source process rate is then redistributed by meat type within each county using the percentages of total meat consumption in Table 7 above.

VI. Emission Factors

Emission factors for commercial cooking processes were obtained from the 2002 National Emissions Inventory (US EPA, 2002b). These emission factors were based on a study performed by Welch and Norbeck (1998).

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Table 10. Emissions factors for commercial cooking processes.

Equipment Type	Emission Factors (lb/ton meat)			
	Meat/Food	PM ₁₀	PM _{2.5}	VOC
Underfired Charbroilers	Steak	34.4	33.6	1.72
	Hamburger	65.4	63.8	7.88
	Poultry (with and without skin)	21	19.8	3.64
	Pork	21	19.8	3.64
	Seafood	6.6	6.4	0.76
	Other	34.4	33.6	1.72
Deep Fat Fryers	Poultry (with and without skin)	-	-	0.24
	Pork	-	-	0.24
	Seafood	-	-	0.28
	Potatoes	-	-	0.42
Flat Griddles	Steak	10	7.6	0.14
	Hamburger	10	7.6	0.14
	Poultry (with and without skin)	-	-	0.8
	Pork	-	-	0.8
	Seafood	-	-	0.22
	Other	10	7.6	0.14
Clamshell Griddles	Steak	1.7	1.44	0.02
	Hamburger	1.7	1.44	0.02
	Poultry (with and without skin)	-	-	0.11
	Pork	-	-	0.11
	Seafood	-	-	0.03
Chain-Driven Charbroilers	Steak	14.8	14.6	4.54
	Hamburger	14.8	14.6	4.54
	Poultry (with and without skin)	21	19.8	3.64
	Pork	21	19.8	3.64
	Seafood	6.6	6.4	0.76

VII. Emissions Calculations

A. Assumptions

- 1) The number and type of restaurants in the San Joaquin Valley Air Pollution Control District are accurately categorized by District staff, based on the information provided by the county health departments.
- 2) The survey data in the CARB sponsored study (Potepan, 2001) are representative of commercial cooking processes in the District.
- 3) The scheme used to distribute per capita consumption of frozen potatoes (for french fries) to District fryers accurately represents activity within the District.
- 4) The commercial cooking emission factors reported by the National Emissions Inventory are accurate.
- 5) The types of restaurants not characterized do not contribute significantly to the emissions inventory.

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- 6) CO, NO_x and SO_x emissions are considered to be from the combustion of the fuel used in cooking the food.
- 7) PEER facilities operate similar to those issued permits.

B. Sample Calculation for Underfired Charbroiler Emissions from Fresno County (2019)

Number of Ethnic Restaurants with Underfired Charbroilers: For each restaurant type, multiply the number of facilities by the fraction of each type of cooking equipment:

$$N_{ethnic} \times f_{ethnic,ufc} = N_{ethnic,ufc}$$

where:

N_{ethnic} = Number of ethnic food restaurants in county

f_{ethnic} = Fraction of ethnic food restaurants with underfired charbroilers

$N_{ethnic,ufc}$ = Number of ethnic food restaurants with underfired charbroilers

Example:

Given that, in 2019, Fresno County had 625 ethnic restaurants and that 47.5% used underfired charbroilers:

$$625 \text{ Ethnic Restaurants} \times 0.475 = 297 \text{ ethnic restaurants with underfired charbroilers in Fresno County}$$

Number of Underfired Charbroilers at Restaurants: For each restaurant and equipment type, multiply the number of restaurants by the average number of pieces of equipment expected to be in those restaurants:

$$N_{ethnic,ufc} \times e_{ethnic,ufc} = E_{ethnic,ufc}$$

where:

$N_{ethnic,ufc}$ = Number of ethnic food restaurants with underfired charbroilers

$e_{ethnic,ufc}$ = Number of underfired charbroilers at ethnic food restaurants with at least one underfired charbroiler

$E_{ethnic,ufc}$ = Total number of underfired charbroilers at ethnic food restaurants in Fresno County

Example:

Given that Fresno County has 297 ethnic food restaurants with underfired charbroilers and that there are approximately 1.54 underfired charbroilers per restaurant:

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$$297 \text{ Ethnic Restaurants} \times \frac{1.54 \text{ Underfired Charbroilers}}{\text{Ethnic Restaurant}} = 457 \text{ underfired charbroilers}$$

Number of cooking equipment for all restaurant types: Sum the number of pieces of cooking equipment across all restaurant types:

$$E_{\text{ethnic,ufc}} + E_{\text{family,ufc}} + E_{\text{fast,ufc}} + E_{\text{seafood,ufc}} + E_{\text{S\&B,ufc}} = E_{\text{all,ufc}}$$

where: $E_{\text{ethnic,ufc}}$ = Total number of underfired charbroilers at ethnic food restaurants

$E_{\text{fast,ufc}}$ = Total number of underfired charbroilers at fast food restaurants

$E_{\text{seafood,ufc}}$ = Total number of underfired charbroilers at seafood restaurants

$E_{\text{S\&B,ufc}}$ = Total number of underfired charbroilers at steak & barbecue restaurants

$E_{\text{all,ufc}}$ = Total number of underfired charbroilers at all restaurants

Example:

457 ethnic + 110 family + 138 fast food + 19 seafood + 20 steak and barbecue
= 744 underfired charbroilers in all of Fresno County Restaurants

Amount of Meat Cooked per Restaurant Equipment: For each meat type, multiply the total number of underfired charbroilers by average pounds of meat cooked per year:

$$E_{\text{all,ufc}} \times m_{\text{steak,ufc}} = M_{\text{steak,ufc}}$$

where:

$E_{\text{all,ufc}}$ = Total number of underfired charbroilers at all restaurants

$m_{\text{steak,ufc}}$ = Average tons per year of steak cooked on one underfired charbroiler

$M_{\text{steak,ufc}}$ = Total tons per year of steak cooked on all underfired charbroilers in the county

Example:

$$743 \text{ underfired charbroilers} \times \frac{1.69 \text{ tons of steak}}{\text{underfired charbroiler - year}} = \frac{1,256.0 \text{ tons of steak}}{\text{year}}$$

Therefore, there are 1,256 tons of steak cooked on underfired charbroilers in Fresno County for 2019.

Emissions: Multiply the amount of meat cooked on each device type by the appropriate emission factor and convert emissions to tons per year.

$$\text{Steak Emissions}(E_{\text{steak,ufc}}) = M_{\text{steak,ufc}} \times \text{Emission Factor} \times \left(\frac{1 \text{ ton VOC}}{2000 \text{ lbs VOC}} \right)$$

Example:

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$$\frac{1,256.0 \text{ tons of steak}}{\text{year}} \times \frac{1.72 \text{ lbs VOC}}{\text{ton of steak}} \times \frac{1 \text{ ton VOC}}{2000 \text{ lbs VOC}} = \frac{1.08 \text{ tons VOC}}{\text{year}}$$

Therefore, 1.08 tons of VOC were generated through the cooking of steak on underfired charbroilers in Fresno County for 2019.

Total Emissions per Meat Category per Cooking Device: Sum the emissions from each meat category within each device type to get the total emissions from each device.

Total emissions from underfired charbroilers in Fresno County =

$$E_{\text{steak,ufc}} + E_{\text{hamburger,ufc}} + E_{\text{poultry, with skin,ufc}} + E_{\text{poultry, skinless,ufc}} + E_{\text{pork,ufc}} + E_{\text{seafood,ufc}} + E_{\text{other,ufc}} + E_{\text{potatoes,ufc}}$$

where:

$E_{\text{steak,ufc}}$ = Total emissions from the cooking of steak in underfired charbroilers

$E_{\text{hamburger,ufc}}$ = Total emissions from the cooking of hamburgers in underfired charbroilers

$E_{\text{poultry, with skin,ufc}}$ = Total emissions from the cooking of poultry, with skin in underfired charbroilers

$E_{\text{poultry, skinless,ufc}}$ = Total emissions from the cooking of skinless poultry in underfired charbroilers

$E_{\text{pork,ufc}}$ = Total emissions from the cooking of pork in underfired charbroilers

$E_{\text{seafood,ufc}}$ = Total emissions from the cooking of seafood in underfired charbroilers

$E_{\text{other,ufc}}$ = Total emissions from the cooking of other meats in underfired charbroilers

$E_{\text{potatoes,ufc}}$ = Total emissions from the cooking of potatoes in underfired charbroilers

Table 11. Underfired Charbroiler Emissions, Fresno Co.

Emissions Source	VOC (tons/year)
$E_{\text{steak,ufc}}$	1.08
$E_{\text{hamburger,ufc}}$	7.44
$E_{\text{poultry, with skin,ufc}}$	1.83
$E_{\text{poultry, skinless,ufc}}$	2.27
$E_{\text{pork,ufc}}$	1.88
$E_{\text{seafood,ufc}}$	0.38
$E_{\text{other,ufc}}$	0.25
$E_{\text{potatoes,ufc}}$	0.00
Total Emissions from Underfired Charbroilers in Fresno County	15.13¹

¹ These emissions must be added to the emissions from chain-driven charbroilers in order to obtain the total emissions for the charbroiling category.

VIII. Temporal Variation

- a. Daily: ARB code 38. Activity during meal time hours (i.e. commercial cooking).
- b. Weekly: ARB code 7. 7 days per week - uniform activity every day of the week
- c. Monthly: Uniform activity. 8.33% of yearly activity per month.

IX. Growth Factor

Growth factors are developed by either the District's Planning Department or CARB for each EIC. These factors are used to estimate emissions in future years. The growth factors associated with this emissions category may be obtained from the Air Quality Analysis Section of the District's Planning Department.

X. Control Level

Control levels are developed by either the District's Planning Department or CARB for each EIC. Control levels are used to estimate emissions reductions in future years due to implementation of District rules. These control levels take into account the effect of control technology, compliance and exemptions at full implementation of the rules.

Chain-driven charbroilers are subject to District Rule 4692 (Commercial Charbroiling). Control levels associated with this emissions category may be obtained from the Air Quality Analysis Section of the District's Planning Department.

XI. CARB Chemical Speciation

CARB has developed organic gas profiles in order to calculate reactive organic gasses (ROG), volatile organic compounds (VOC) or total organic gas (TOG) given any one of the three values. For each speciation profile, the fraction of TOG that is ROG and VOC is given. The organic gas profile codes can also be used to look up associated toxics. CARB's speciation profile for commercial cooking is presented in Table 12.

Table 12. CARB chemical speciation profiles for commercial cooking.

Profile Description	CARB Organic Gas Profile#	Fractions	
		ROG	VOC
Species unknown - all category composite	600	0.6986	0.6986

CARB has developed particulate matter speciation profiles in order to calculate particulate matter (PM), particulate matter with a diameter less than or equal to 10 microns (PM₁₀) or particulate matter with a diameter less than or equal to 2.5 microns (PM_{2.5}) given any one of the three values. For each speciation profile, the fraction of PM that is PM₁₀ and PM_{2.5} is given. The particulate matter profile codes can also be used to look up associated toxics. CARB's speciation profile for commercial cooking is presented in Table 13.

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Table 13. CARB chemical speciation profiles for commercial cooking.

Profile Description	CARB PM Profile#	Fractions	
		PM ₁₀	PM _{2.5}
Unspecified	900	0.7	0.42

XII. Assessment Of Methodology

This estimation does not include all commercial cooking emissions. Cooking at institutions (schools, prisons), public events (fairs, sporting events), and non-permanent sources (lunch wagons and other catered events) are not covered by this methodology.

The amount of meat that was cooked per week and the amount of equipment was determined by PRI based on a survey of restaurants in the entire state of California. To improve the accuracy, it is recommended that the District conduct its own survey of restaurants within the District.

The survey conducted by PRI targeted restaurants suspected of having charbroilers. In the future, it is recommended to survey other restaurants as well, to see if their contributions to emissions are significant (Potepan 2001).

In the future, facilities permitted by the District should be linked to facilities from the Health departments to minimize the double counting of units, process rates, and emissions.

Further review on the quantity of frozen potatoes needs to be conducted. Specifically, determine if the farm weight vs retail weight should be used to determine the tons of frozen potatoes cooked in deep fat frying.

XIII. Emissions

Following is the 2019 area source emissions inventory for commercial charbroiling (690-680-6000-0000), commercial deep-fat frying (690-682-6000-0000), and other commercial cooking (690-684-6000-0000) estimated by this methodology. Emissions are reported for each county in the District.

Table 14. Area source emissions for commercial cooking (2019).

County	Emissions (tons/year)					
	NO _x	CO	SO _x	VOC	PM ₁₀	PM _{2.5}
Commercial Charbroiling						
Fresno	0.00	0.00	0.00	17.56	135.89	131.39
Kern ⁽¹⁾	0.00	0.00	0.00	14.79	112.97	109.23
Kings	0.00	0.00	0.00	1.93	14.67	14.19
Madera	0.00	0.00	0.00	2.61	20.33	19.66
Merced	0.00	0.00	0.00	4.65	35.86	34.67
San Joaquin	0.00	0.00	0.00	12.21	93.68	90.58
Stanislaus	0.00	0.00	0.00	10.89	83.64	80.88
Tulare	0.00	0.00	0.00	7.64	59.00	57.04
TOTAL	0.00	0.00	0.00	72.28	556.05	537.64
Commercial Deep-Fat Frying						
Fresno	0.00	0.00	0.00	11.68	0.00	0.00
Kern ⁽¹⁾	0.00	0.00	0.00	10.75	0.00	0.00
Kings	0.00	0.00	0.00	1.48	0.00	0.00
Madera	0.00	0.00	0.00	1.60	0.00	0.00
Merced	0.00	0.00	0.00	3.12	0.00	0.00
San Joaquin	0.00	0.00	0.00	8.65	0.00	0.00
Stanislaus	0.00	0.00	0.00	7.51	0.00	0.00
Tulare	0.00	0.00	0.00	5.18	0.00	0.00
TOTAL	0.00	0.00	0.00	49.97	0.00	0.00
Other Commercial Cooking						
Fresno	0.00	0.00	0.00	5.63	97.32	74.34
Kern ⁽¹⁾	0.00	0.00	0.00	4.71	81.73	62.47
Kings	0.00	0.00	0.00	0.60	10.45	8.00
Madera	0.00	0.00	0.00	0.86	14.76	11.26
Merced	0.00	0.00	0.00	1.52	26.14	19.96
San Joaquin	0.00	0.00	0.00	3.87	67.24	51.39
Stanislaus	0.00	0.00	0.00	3.52	60.82	46.46
Tulare	0.00	0.00	0.00	2.44	42.28	32.30
TOTAL	0.00	0.00	0.00	23.14	400.74	306.17

(1) Includes both the Valley and non-Valley portions of Kern County.

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Following is the 2019 point / PEER source emissions inventory for commercial charbroiling (690-680-6000-0000), commercial deep-fat frying (690-682-6000-0000), and other commercial cooking (690-684-6000-0000) as reported to the District by our permit holders. Emissions are reported for each county in the District.

Table 15. Point / PEER source emissions for commercial cooking (2019).

County	Emissions (tons/year)					
	NOx	CO	SOx	VOC	PM ₁₀	PM _{2.5} ⁽²⁾
Commercial Charbroiling						
Fresno	0.00	0.00	0.00	0.57	2.23	2.23
Kern ⁽¹⁾	0.00	0.00	0.00	0.19	0.74	0.74
Kings	0.00	0.00	0.00	0.09	0.34	0.34
Madera	0.00	0.00	0.00	0.03	0.13	0.13
Merced	0.00	0.00	0.00	0.07	0.26	0.26
San Joaquin	0.00	0.00	0.00	0.48	1.87	1.87
Stanislaus	0.00	0.00	0.00	0.16	0.61	0.61
Tulare	0.00	0.00	0.00	0.22	0.87	0.87
TOTAL	0.00	0.00	0.00	1.79	7.05	7.05
Commercial Deep-Fat Frying						
Fresno	0.00	0.00	0.00	0.00	0.00	N/A
Kern ⁽¹⁾	0.00	0.00	0.00	0.00	0.00	N/A
Kings	0.00	0.00	0.00	0.00	0.00	N/A
Madera	0.00	0.00	0.00	0.00	0.00	N/A
Merced	0.00	0.00	0.00	0.00	0.00	N/A
San Joaquin	0.00	0.00	0.00	0.00	0.00	N/A
Stanislaus	0.00	0.00	0.00	0.00	0.00	N/A
Tulare	0.00	0.00	0.00	0.00	0.00	N/A
TOTAL	0.00	0.00	0.00	0.00	0.00	N/A
Other Commercial Cooking						
Fresno	0.00	0.00	0.00	0.00	0.00	N/A
Kern ⁽¹⁾	0.00	0.00	0.00	0.00	0.00	N/A
Kings	0.00	0.00	0.00	0.00	0.00	N/A
Madera	0.00	0.00	0.00	0.00	0.00	N/A
Merced	0.00	0.00	0.00	0.00	0.00	N/A
San Joaquin	0.00	0.00	0.00	0.00	0.00	N/A
Stanislaus	0.00	0.00	0.00	0.00	0.00	N/A
Tulare	0.00	0.00	0.00	0.00	0.00	N/A
TOTAL	0.00	0.00	0.00	0.00	0.00	N/A

(1) Includes only the Valley portion of Kern County.

(2) District assumes all PM₁₀ is PM_{2.5}.

690-Commercial Cooking Operations

Following is the 2019 total unreconciled (point source plus area source) emissions inventory for commercial charbroiling (690-680-6000-0000), commercial deep-fat frying (690-682-6000-0000), and other commercial cooking (690-684-6000-0000). Emissions are reported for each county in the District.

Table 16. Total emissions for commercial cooking (2019).

County	Emissions (tons/year)					
	NOx	CO	SOx	VOC	PM ₁₀	PM _{2.5}
Commercial Charbroiling						
Fresno	0.00	0.00	0.00	18.12	138.12	133.62
Kern ⁽¹⁾	0.00	0.00	0.00	14.98	113.71	109.97
Kings	0.00	0.00	0.00	2.02	15.01	14.53
Madera	0.00	0.00	0.00	2.64	20.46	19.79
Merced	0.00	0.00	0.00	4.72	36.12	34.93
San Joaquin	0.00	0.00	0.00	12.68	95.56	92.45
Stanislaus	0.00	0.00	0.00	11.04	84.26	81.49
Tulare	0.00	0.00	0.00	7.86	59.87	57.91
TOTAL	0.00	0.00	0.00	74.07	563.10	544.69
Commercial Deep-Fat Frying						
Fresno	0.00	0.00	0.00	11.68	0.00	0.00
Kern ⁽¹⁾	0.00	0.00	0.00	10.75	0.00	0.00
Kings	0.00	0.00	0.00	1.48	0.00	0.00
Madera	0.00	0.00	0.00	1.60	0.00	0.00
Merced	0.00	0.00	0.00	3.12	0.00	0.00
San Joaquin	0.00	0.00	0.00	8.65	0.00	0.00
Stanislaus	0.00	0.00	0.00	7.51	0.00	0.00
Tulare	0.00	0.00	0.00	5.18	0.00	0.00
TOTAL	0.00	0.00	0.00	49.97	0.00	0.00
Other Commercial Cooking						
Fresno	0.00	0.00	0.00	5.63	97.32	74.34
Kern ⁽¹⁾	0.00	0.00	0.00	4.70	81.73	62.47
Kings	0.00	0.00	0.00	0.60	10.45	8.00
Madera	0.00	0.00	0.00	0.86	14.76	11.26
Merced	0.00	0.00	0.00	1.52	26.14	19.96
San Joaquin	0.00	0.00	0.00	3.87	67.23	51.39
Stanislaus	0.00	0.00	0.00	3.52	60.82	46.46
Tulare	0.00	0.00	0.00	2.44	42.28	32.30
TOTAL	0.00	0.00	0.00	23.13	400.74	306.17

(1) Includes both the Valley and non-Valley portions of Kern County.

690-Commercial Cooking Operations

Following is the net change in total unreconciled emissions between this update (2019 inventory year) and the previous update (2007 inventory year) for commercial charbroiling (690-680-6000-0000), commercial deep-fat frying (690-682-6000-0000), and other commercial cooking (690-684-6000-0000). The change in emissions are reported for each county in the District.

Table 17. Net emissions change for commercial cooking.

County	Emissions (tons/year)					
	NO _x	CO	SO _x	VOC	PM ₁₀	PM _{2.5}
Commercial Charbroiling						
Fresno	0.00	0.00	0.00	-25.18	-180.21	N/A
Kern ⁽¹⁾	0.00	0.00	0.00	-17.77	-123.58	N/A
Kings	0.00	0.00	0.00	-2.88	-20.15	N/A
Madera	0.00	0.00	0.00	-1.89	-12.40	N/A
Merced	0.00	0.00	0.00	-3.52	-24.46	N/A
San Joaquin	0.00	0.00	0.00	-14.17	-100.29	N/A
Stanislaus	0.00	0.00	0.00	-11.53	-81.67	N/A
Tulare	0.00	0.00	0.00	-9.04	-63.79	N/A
TOTAL	0.00	0.00	0.00	-85.98	-606.56	N/A
Commercial Deep-Fat Frying						
Fresno	0.00	0.00	0.00	-0.29	0.00	N/A
Kern ⁽¹⁾	0.00	0.00	0.00	0.96	0.00	N/A
Kings	0.00	0.00	0.00	-0.03	0.00	N/A
Madera	0.00	0.00	0.00	0.33	0.00	N/A
Merced	0.00	0.00	0.00	0.84	0.00	N/A
San Joaquin	0.00	0.00	0.00	0.94	0.00	N/A
Stanislaus	0.00	0.00	0.00	0.90	0.00	N/A
Tulare	0.00	0.00	0.00	0.47	0.00	N/A
TOTAL	0.00	0.00	0.00	4.12	0.00	N/A
Other Commercial Cooking						
Fresno	0.00	0.00	0.00	1.08	19.43	N/A
Kern ⁽¹⁾	0.00	0.00	0.00	1.38	24.55	N/A
Kings	0.00	0.00	0.00	0.11	1.99	N/A
Madera	0.00	0.00	0.00	0.39	6.77	N/A
Merced	0.00	0.00	0.00	0.64	11.21	N/A
San Joaquin	0.00	0.00	0.00	1.10	19.67	N/A
Stanislaus	0.00	0.00	0.00	1.15	20.15	N/A
Tulare	0.00	0.00	0.00	0.68	12.16	N/A
TOTAL	0.00	0.00	0.00	6.52	115.93	N/A

(1) Includes both the Valley and non-Valley portions of Kern County.

XIV. Revision History

2019. The methodology was updated to

- 1) Incorporate the District Rule 4692 limits for commercial chain-driven and under-fired charbroiling devices
- 2) Account for the increase in restaurants since the last inventory in 2007 with 2019 data
- 3) Replace the use of Dun & Bradstreet with more accurate data from the county health departments

690-Commercial Cooking Operations

- 4) Account for facilities that require PEER permits
- 2006. The methodology was reformatted to the new District standard. Process rates were updated. An error was corrected in the emission factor table (table 10). The units should have been lb/ton meat and not lb/1000lb meat.
- 2005. This is a new District methodology based on one prepared by E.H. Pechan & Associates for the US EPA.

XV. References

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Appendix A
Processing of County Health Department Permit Data

Background:

The original methodology was developed using data provided by Dun & Bradstreet. A review of that data noted several deficiencies: 1) Not all commercial cooking operations were included in their data set and 2) some of the facilities returned by Dun & Bradstreet were not commercial cooking operations at all such as Starbucks coffee shops. Based on the errors noted using Dun & Bradstreet, the District needed to identify another source of data that could be used. The District found that each county health department issued permits to all cooking operations under their jurisdiction. Unfortunately, the data also included facilities that handled food goods from gas stations to commercial cooking operations.

Data Processing Procedure:

Step 1. Data Request:

Request a copy of permits issued to food handling facilities from each county in the San Joaquin Valley.

Step 2. Aggregation:

Since data received by the health departments are received in different formats it needs to be aggregated into a single format.

Step 3. Categorize Each Food establishment:

District Staff categorized each food establishment provided by each county health department. The categorization was done using the codes found in the table below, Table 18. Classification for restaurants. Please note: not all codes are associated with Commercial Cooking operations as defined by CARB and this methodology. District Staff has made a concerted effort to ensure that all food establishments associated with this methodology have been identified and coded.

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Table 18. Classifications for Restaurants

Original Code	Original Description	Code	Type of Establishment	Description	Category	Steak	Hamburger	Poultry, with skin	Poultry, skinless	Pork	Seafood	Other meat	Potatoes
		BA	Bars/Pubs	No Cooking Onsite	Other	0	0	0	0	0	0	0	0
		BK-F	Frying - Bakery/ Donuts/ Bagels/ Pastries/ Coffee	No Cooking Onsite	Other	0	0	0	0	0	0	0	0
		BK-NF	Non Frying - Bakery/ Donuts/ Bagels/ Pastries/ Coffee	No Cooking Onsite	Other	0	0	0	0	0	0	0	0
		C	Caterers	Non Commercial Cooking Activities (Events Only)	Other	0	0	0	0	0	0	0	0
		EV	Event/Temporary	Non Commercial Cooking Activities	Other	0	0	0	0	0	0	0	0
		FC-GB	Bar & Grills	Restaurants emphasize speed of service. Does offer non-disposable plates and cutlery. (Chipotle Mexican Grill and Panera Bread)	Other	-1	-1	-1	-1	-1	0	0	-1
		FF-NF	Non Frying - Fast Food	Restaurants emphasize speed of service and have drive thrus, but do not use have CC equipment evaluated under this methodology (KFC).	Other	0	0	0	0	0	0	0	0
		H	Hotel/Bed & Breakfast	Non Commercial Cooking Activities	Other	0	0	0	0	0	0	0	0
		HO	Hospital/Medical	Non Commercial Cooking Activities	Other	0	0	0	0	0	0	0	0
		IY	Ice cream and yogurt	No Cooking Onsite (Not including waffles/cones)	Other	0	0	0	0	0	0	0	0
		M	Market (e.g. grocery store)	Non Commercial Cooking Activities	Other	0	0	0	0	0	0	0	0

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Original Code	Original Description	Code	Type of Establishment	Description	Category	Steak	Hamburger	Poultry, with skin	Poultry, skinless	Pork	Seafood	Other meat	Potatoes
		MM	Mini Mart	Non Commercial Cooking Activities	Other	0	0	0	0	0	0	0	0
		MR	Mobile Restaurants	Not considered Part of CC category	Other	-1	-1	-1	-1	-1	-1	-1	-1
		O	Other	Non Commercial Cooking Activities	Other	0	0	0	0	0	0	0	0
		P	Pizza	Not considered Part of CC category	Other	0	0	0	0	0	0	0	0
		PR	Prison	Non Commercial Cooking Activities	Other	0	0	0	0	0	0	0	0
		SC	School	Non Commercial Cooking Activities	Other	0	0	0	0	0	0	0	0
		SS	Sandwich Shop - Sandwiches only	Sandwich shop that don't cook onsite (Subway)	Other	0	0	0	0	0	0	0	0
		SSO	Sandwich Shop Other - Sandwiches and other items	Sandwich shop that don't cook onsite	Other	0	0	0	0	0	0	0	0
		TBD	Commercial Cooking - TBD	Commercial cooking operation that needs to be classified later	CC	0	0	0	0	0	0	0	0
E	Ethnic	E	Ethnic	Ethnic restaurants specialize in ethnic or national cuisines	CC	-1	-1	-1	-1	-1	-1	-1	-1
E	Ethnic	E-A	Ethnic - Asian Cuisine	Specialize in Asian Cuisine	CC	-1	0	-1	-1	-1	-1	-1	-1
E	Ethnic	E-I	Ethnic - Italian Cuisine	Specialize in Italian Cuisine	CC	-1	0	-1	-1	0	-1	-1	-1
E	Ethnic	E-M	Ethnic - Mexican Cuisine	Specialize in Mexican Cuisine	CC	-1	0	-1	-1	-1	-1	-1	-1
E	Ethnic	E-ME	Ethnic - Middle Eastern Cuisine	Specialize in Middle Eastern Cuisine	CC	-1	0	-1	-1	-1	-1	-1	-1
F	Family	F	Family	American Style Cooking - Family style restaurants are a type of casual dining restaurants where food is often served	CC	-1	-1	-1	-1	-1	-1	-1	-1

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Original Code	Original Description	Code	Type of Establishment	Description	Category	Steak	Hamburger	Poultry, with skin	Poultry, skinless	Pork	Seafood	Other meat	Potatoes
				on platters and the diners serve themselves.									
F	Family	FC-G	Grills	Restaurants emphasize speed of service. Does offer non-disposable plates and cutlery. (Chipotle Mexican Grill and Panera Bread)	CC	-1	-1	-1	-1	-1	-1	-1	-1
F	Family	FC-GM	Grills - Mexican	Restaurants emphasize speed of service. Does offer non-disposable plates and cutlery. (Chipotle Mexican Grill and Panera Bread)	CC	-1	0	-1	-1	-1	-1	-1	0
F	Family	FC-GME	Grills - Middle Eastern	Restaurants emphasize speed of service. Does offer non-disposable plates and cutlery. (Chipotle Mexican Grill and Panera Bread)	CC	-1	0	-1	-1	0	-1	-1	0
F	Family	FC-GS	Grills - Sea Food	Restaurants emphasize speed of service. Does offer non-disposable plates and cutlery. (Chipotle Mexican Grill and Panera Bread)	CC	-1	0	0	0	0	-1	0	-1
F	Family	FD	Fine dining	Fine dining restaurants are full-service restaurants with specific dedicated meal courses.	CC	-1	-1	-1	-1	-1	-1	-1	-1

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Original Code	Original Description	Code	Type of Establishment	Description	Category	Steak	Hamburger	Poultry, with skin	Poultry, skinless	Pork	Seafood	Other meat	Potatoes
F	Family	FD-A	Fine dining - Asian	Fine dining restaurants are full-service restaurants with specific dedicated meal courses.(PF Chang)	CC	-1	0	-1	-1	0	-1	0	0
F	Family	FD-S	Fine dining - Steak	Fine dining restaurants are full-service restaurants with specific dedicated meal courses.(Ruth Chris)	CC	-1	0	-1	-1	0	-1	0	0
FF	Fast food	FC	Fast Casual	Restaurants emphasize speed of service. Does offer non-disposable plates and cutlery. (Chipotle Mexican Grill and Panera Bread)	CC	-1	-1	-1	-1	-1	-1	-1	-1
FF	Fast food	FC-AO	Fast Casual - Asian Only	Restaurants emphasize speed of service. Does offer non-disposable plates and cutlery. (Chipotle Mexican Grill and Panera Bread)	CC	-1	0	-1	-1	0	-1	-1	0
FF	Fast food	FC-MO	Fast Casual - Mexican Only	Restaurants emphasize speed of service. Does offer non-disposable plates and cutlery. (Chipotle Mexican Grill and Panera Bread)	CC	-1	0	-1	-1	-1	-1	-1	0
FF	Fast food	FF	Fast Food	Restaurants emphasize speed of service and have drive thrus. Does not primarily offer non-disposable plates and	CC	-1	-1	-1	-1	-1	-1	-1	-1

690-Commercial Cooking Operations

Original Code	Original Description	Code	Type of Establishment	Description	Category	Steak	Hamburger	Poultry, with skin	Poultry, skinless	Pork	Seafood	Other meat	Potatoes
				cutlery. (McDonald's and Burger King)									
FF	Fast food	FF-BO	Fast Food - Burger Only	Restaurants emphasize speed of service and have drive thrus. Does not offer non-disposable plates and cutlery. (In & Out)	CC	0	-1	0	0	0	0	0	-1
FF	Fast food	FF-CO	Fast Food - Chicken Only	Restaurants emphasize speed of service and have drive thrus. Does not primarily offer non-disposable plates and cutlery. (Pollo Loco)	CC	0	0	-1	-1	0	0	0	-1
FF	Fast food	SSC	Sandwich Shop with Cooking	Sandwich shop that also does hamburgers or french fries	CC	0	-1	-1	-1	0	0	0	-1
S	Seafood	S	Seafood	Primarily cooking Seafood	CC	-1	-1	0	0	0	-1	0	-1
SB	Steak & BBQ	SB	Steak and BBQ	Primarily cooking Steak and BBQ	CC	-1	-1	-1	-1	-1	-1	-1	-1

Note: CC indicates an actual commercial cooking operation.

Appendix B
Chain-Driven \ Underfired Charbroiler
Rule Adjustment

690-Commercial Cooking Operations

Original Chain-Driven Charbroilers	
Food Type	Original (tons/yr)
Steak & BBQ	6.14
Hamburger	20.75
Poultry, With Skin	3.82
Poultry, Skinless	6.92
Pork	1.5
Seafood	3.09
Other Meat	0
Potatoes	0
Total	42.22

Original Underfired Charbroilers	
Food Type	Original (tons/yr)
Steak & BBQ	4.68
Hamburger	7.02
Poultry, With Skin	3.74
Poultry, Skinless	4.65
Pork	3.85
Seafood	3.72
Other Meat	1.08
Potatoes	0
Total	28.74

Original Chain-Driven Charbroilers Percent of Primary Meats	
Food Type	
Steak & BBQ	15%
Hamburger	49%
Poultry, With Skin	9%
Poultry, Skinless	16%
Pork	4%
Seafood	7%
Other Meat	0%
Potatoes	0%
Total	100%

Original Underfired Charbroilers Percent of Primary Meats	
Food Type	
Steak & BBQ	16%
Hamburger	24%
Poultry, With Skin	13%
Poultry, Skinless	16%
Pork	13%
Seafood	13%
Other Meat	4%
Potatoes	0%
Total	100%

Original Chain-Driven Charbroilers Rule Adjustment	
Tons of Meat	10.4
Food Type	Adjusted Tons
Steak & BBQ	1.51
Hamburger	5.11
Poultry, With Skin	0.94
Poultry, Skinless	1.70
Pork	0.37
Seafood	0.76
Other Meat	0.00
Potatoes	0.00
Total	10.40

Original Underfired Charbroilers Rule Adjustment	
Tons of Meat	10.4
Food Type	Adjusted Tons
Steak & BBQ	1.69
Hamburger	2.54
Poultry, With Skin	1.35
Poultry, Skinless	1.68
Pork	1.39
Seafood	1.35
Other Meat	0.39
Potatoes	0.00
Total	10.40

Example Calculation (Steak & BBQ):

- 1) Food Type (Percent of Meat)
Original Food Type Tons / Total Tons
 $6.14 / 42.22 = 14.54\%$

- 2) Adjusted Tons
Rule Limit Tons of Meat X Food Type (Percent of Meat)
 $10.4 \times 14.54\% = 1.51$ Adjusted Tons