

EXAMPLE of CONCRETE BATCH PLANT EMISSION CALCULATIONS

This is an example of how the Washoe County Air Quality Management Division's (WCAQMD) permitting database calculates emissions from a typical concrete batch plant.

During the annual permit renewal and inspection process, the source supplied the following:

Type of Plant:	Central Mix w/pneumatic transfer to storage silos
Amount of Material Processed:	200,000 cubic yards/year
Hours of Operation:	3,000 hours/yr
Vehicle Miles Traveled:	2,400 VMT
Storage Piles:	1 acre

Emission factors for concrete batch plants are taken from the EPA guidance document AP-42, Fifth Edition, Section 11.12, Table 11.12-2. The permitting database uses the emission factors in lbs/yd³ which assume that a typical cubic yard of concrete is 1.818 kg or 4,000 lbs (containing 500 lbs of cement 1,240 lbs of sand, 1,900 lbs of coarse aggregate, and 360 lbs of water).

Annual Emissions

Process	Emission Factor (lbs/yd ³)	Material Processed (yd ³ /yr)	Estimated PM ₁₀ Emissions (tons/yr)
Sand and Aggregate Transfer	0.05	200,000	5
Pneumatic Unloading to elevated storage Silo	0.07	200,000	7
Weigh Hopper Loading	0.04	200,000	4
Central Mix - Mixer Loading	0.07	200,000	7
Total	--	--	23

Unpaved Haul Road Emissions

Emission factors and variables were derived from the EPA guidance document AP-42 - Compilation of Air Pollutant Emission Factors, 5th Edition, Section 13.2.2:

$$E = k (5.9) (s/12) (S/30) (W/3)^{0.7} (w/4)^{0.5} (365-p/365) \text{ lb/VMT}$$

Where:

E = Emission factor (lb/VMT)

k = Particle size multiplier (dimensionless); TSP, k = 0.80. PM₁₀, k = 0.36

s = Silt content of road surface (%); 12% average

S = Mean vehicle speed (mph); 20 mph

W = Mean vehicle weight (tons); 20 tons

w = Mean number of wheels; 14 wheels

p = Number of days with greater than, or equal to, 0.01 inches of precipitation per year; 50.7

$$E_{TSP} = 0.8 (5.9) (12/12) (20/30) (20/3)^{0.7} (14/4)^{0.5} (365-50.7/365) \text{ lb/VMT}$$

$$= 19.13 \text{ lbs/VMT}$$

$$E_{PM_{10}} = 6.89 \text{ lbs/VMT}$$

$$(2,400 \text{ VMT/yr}) (6.89 \text{ lbs/VMT}) = 16,536 \text{ lbs/yr uncontrolled}$$

Controlled

$$(16,536 \text{ lbs/yr}) (70\% \text{ control for watering}) = 4,960 \text{ lbs/yr or } 2.5 \text{ tons } PM_{10}/\text{yr}$$

Storage Piles Emissions

Emission factors for storage piles at concrete batch plants are taken from AP-42, Fifth Edition, Section 11.12, Table 11.12-2. Assuming the 3.5 lb/acre/day emission factor is for TSP emissions the wind blown PM_{10} emissions would be approximately 50% or 1.7 lb/acre day.

$$= (1 \text{ acre}) (1.7 \text{ lb/acre/day}) (365 \text{ days/yr})$$

$$= 620.5 \text{ lbs/yr or } 0.31 \text{ tons } PM_{10}/\text{yr}$$

Diesel Equipment Operation Emissions

The WCAQMD permitting database calculates the emissions from the operation of diesel equipment. The amount of particulate emissions from operation of equipment is minimal when compared to other sources, but the WCAQMD permitting database does include those emissions for permit renewal and fee generation reasons. The estimated emissions from Equipment Operation are calculated from emission factors from the mobile source volume of AP-42 (Volume II), Table II of Section 7.1 - Diesel Powered Construction Equipment (wheeled loader). Based on an estimate of 3,000 hours of operation for this plant the emissions for all pollutants would be:

$$\text{CO: } [(3,000 \text{ hrs/yr}) (0.572 \text{ lbs/hr})] / (365 \text{ days/yr}) = 4.7 \text{ lbs/day}$$

$$\text{VOC: } [(3,000 \text{ hrs/yr}) (0.25 \text{ lbs/hr})] / (365 \text{ days/yr}) = 2.0 \text{ lbs/day}$$

$$\text{NOx: } [(3,000 \text{ hrs/yr}) (1.89 \text{ lbs/hr})] / (365 \text{ days/yr}) = 15.5 \text{ lbs/day}$$

$$\text{SOx: } [(3,000 \text{ hrs/yr}) (0.182 \text{ lbs/hr})] / (365 \text{ days/yr}) = 1.5 \text{ lbs/day}$$

$$\text{TSP: } [(3,000 \text{ hrs/yr}) (0.172 \text{ lbs/hr})] / (365 \text{ days/yr}) = 1.4 \text{ lbs/day}$$

Total Estimated Emissions for This Facility

<u>Pollutant</u>	<u>lbs/day</u>	<u>tons/yr</u>
CO	4.7	0.86
NOx	15.5	2.83
SOx	1.5	0.27
VOC	2.0	0.37
PM_{10}	142.5	26.0

EXAMPLE of SAND and GRAVEL OPERATION EMISSION CALCULATIONS

This is an example of how the Washoe County Air Quality Management Division's (WCAQMD) permitting database calculates emissions from a typical sand and gravel plant.

During the annual permit renewal and inspection process, the source supplied the WCAQMD with the following:

Tons of Material Processed:	754,066 tons/year
Hours Operated:	1,824 hours

Equipment and estimated throughput through each piece of equipment.

Primary:

- 3-Deck Screen - 754,066 tons/year
- 2-Deck Screen - 754,066 tons/year

Secondary:

- Impact crusher - 754,066 tons/year
- 3-Deck Screen - 754,066 tons/year
- 3-Deck Screen - 282,775 tons/year

Tertiary:

- Impact Crusher - 754,066 tons/year
- 3-Deck Screen - 141,387 tons/year

25 conveyors:

- #1 - #5 - 754,066 tons/year
- #6 - #15 - 282,775 tons/year
- #16 - #25 - 141,387 tons/year

2 Drop Unloading/Loading points at 754,066 tons each - 70% control efficiency

Vehicle Miles = 10,426 miles

Road Dust Control = 4,760 miles - 70% for water and/or palliative

Storage Piles = 20

All other points in the crushing circuit are given 80% control efficiency because they must use controls which achieve at least that control percentage.

The estimated particulate emissions were calculated from emission factors taken from Tables 11.19.2-2 of AP-42 "Compilation of Air Pollutant Emission Factors", 5th Edition:

Source	Throughput (tons/year)	Emission Factors (lbs/ton) TSP / PM ₁₀	% Control Efficiency	Days/Year (for fee calc.)	lbs/day TSP/ PM ₁₀
3-Deck Screen	754,066	0.0315 / 0.015	80%	365	10.3 / 6.2
2-Deck Screen	754,066	0.0315 / 0.015	80%	365	10.3 / 6.2
Impact Crusher	754,066	0.00504 / 0.0024	80%	365	1.6 / 1.0
3-Deck Screen	754,066	0.0315 / 0.015	80%	365	10.3 / 6.2
3-Deck Screen	282,775	0.0315 / 0.015	80%	365	3.9 / 2.3
Impact Crusher	754,066	0.00504 / 0.0024	80%	365	1.6 / 1.0
3-Deck Screen	141,387	0.0315 / 0.015	80%	365	1.9 / 1.2
Conveyor #1	754,066	0.00294 / 0.0014	80%	365	1.0 / 0.6
Conveyor #2	754,066	0.00294 / 0.0014	80%	365	1.0 / 0.6
Conveyor #3	282,775	0.00294 / 0.0014	80%	365	0.4 / 0.2
Conveyor #4	282,775	0.00294 / 0.0014	80%	365	0.4 / 0.2
Conveyor #5	141,387	0.00294 / 0.0014	80%	365	0.2 / 0.1
Conveyor #6	141,387	0.00294 / 0.0014	80%	365	0.2 / 0.1
Drop/Load Point	754,066	0.00021 / 0.00010	70%	365	0.1 / 0.1
Drop/Load Point	754,006	0.00021 / 0.00010	70%	365	0.1 / 0.1
Total =					54.3 / 26.1

Storage Pile Emissions

During the WCAQMD permit renewal only basic information regarding storage piles is obtained; therefore, the storage pile emission factors are taken from the 4th Edition of AP-42 (Table 8.19.1-1) and are used as a default. These emission factors include emissions from loading into storage piles, equipment traffic in storage pile area, and wind erosion. During initial permitting if there is source specific information the Sections and methodologies listed in Section 13 of the 5th Edition of AP-42 are used (see example calculations completed for a Clay borrow pit). WCAQMD believes the 4th Edition factors are acceptable as a default since the methodology is similar to the 5th Edition methodologies.

For this example, it is estimated there are 20 acres of storage piles.

Active Storage Piles

TSP

$$\frac{(13.2 \text{ lbs/day acre}) (20 \text{ acres}) (1,824 \text{ hours}) (1.00 - 0.70)}{(24 \text{ hrs/day}) (365 \text{ days/yr})}$$

$$= 16.5 \text{ lbs/day}$$

PM₁₀

$$\frac{(6.3 \text{ lbs/day acre}) (20 \text{ acres}) (1,824 \text{ hours}) (1.00 - 0.70)}{(24 \text{ hrs/day}) (365 \text{ days/yr})}$$

$$= 7.9 \text{ lbs/day}$$

Inactive Storage Piles

TSP

$$\frac{(3.5 \text{ lbs/day acre}) (20 \text{ acres}) (6,936 \text{ hours})}{(24 \text{ hrs/day}) (365 \text{ days/yr})}$$

$$= 55.4 \text{ lbs/day}$$

PM₁₀

$$\frac{(1.7 \text{ lbs/day acre}) (20 \text{ acres}) (6,936 \text{ hours})}{(24 \text{ hrs/day}) (365 \text{ days/yr})}$$

$$= 26.9 \text{ lbs/day}$$

Vehicle Road Traffic Emissions

The estimated emission factors from Haul Roads were calculated from the equation and variables derived from AP-42 - Compilation of Air Pollutant Emission Factors, 5th Edition, Section 13.2.2:

$$E = k (5.9) (s/12) (S/30) (W/3)^{0.7} (w/4)^{0.5} (365-p/365) \text{ lb/VMT}$$

Where:

E = Emission factor (lb/VMT)

k = Particle size multiplier (dimensionless); TSP, k = 1.0. PM₁₀, k = 0.36

s = Silt content of road surface (%); 4.8% (mean sand and gravel - Table 13.2.2-1)

S = Mean vehicle speed (mph); 26 mph

W = Mean vehicle weight (tons); 30 tons

w = Mean number of wheels; 8 wheels

p = Number of days with greater than, or equal to, 0.01 inches of precipitation per year; 57 (average)

Uncontrolled VMT

$$= (10,426 \text{ VMT} - 4,760 \text{ controlled VMT}) / (365 \text{ days})$$

$$= 15.5 \text{ VMT/day}$$

Controlled VMT

$$= (4,760 \text{ controlled VMT}) / (365 \text{ days})$$

$$= 13.0 \text{ VMT/day}$$

TSP

$$E_{\text{TSP}} = 1.0 (5.9) (4.8/12) (26/30) (30/3)^{0.7} (8/4)^{0.5} (365-57/365) \text{ lb/VMT}$$

$$= 12.2 \text{ lbs/VMT}$$

Uncontrolled

$$(15.5 \text{ VMT/day}) (12.2 \text{ lb/VMT}) = 189.4 \text{ lbs/day}$$

Controlled

$$(13.0 \text{ VMT/day}) (12.2 \text{ lb/VMT}) (1.00 - 0.70) = 47.6 \text{ lbs/day}$$

$$\text{Total TSP} = 237 \text{ lbs/day}$$

PM₁₀

$$E_{\text{PM}_{10}} = 0.36 (5.9) (4.8/12) (26/30) (30/3)^{0.7} (8/4)^{0.5} (365-57/365) \text{ lb/VMT}$$

$$= 4.4 \text{ lbs/VMT}$$

Uncontrolled

$$(15.5 \text{ VMT/day}) (4.4 \text{ lb/VMT}) = 68.2 \text{ lbs/day}$$

Controlled

$$(13.0 \text{ VMT/day}) (4.4 \text{ lb/VMT}) (1.00 - 0.70) = 17.2 \text{ lbs/day}$$

$$\text{Total PM}_{10} = 85.4 \text{ lbs/day}$$

Diesel Equipment Operation Emissions

The WCAQMD permitting database calculates the emissions from the operation of diesel equipment. The amount of particulate emissions from operation of equipment is minimal when compared to other sources at a sand and gravel pit, but the WCAQMD permitting database does include those emissions for permit renewal and fee generation reasons. The estimated emissions from Equipment Operation are calculated from emission factors from the mobile source volume of AP-42 (Volume II), Table II of Section 7.1 - Diesel Powered Construction Equipment (wheeled loader). Based on an estimate of 1,824 hours of operation for this project the emissions for all pollutants would be:

CO: $[(1,824 \text{ hrs/yr}) (0.572 \text{ lbs/hr})] / (365 \text{ days/yr}) = 2.86 \text{ lbs/day}$
VOC: $[(1,824 \text{ hrs/yr}) (0.25 \text{ lbs/hr})] / (365 \text{ days/yr}) = 1.25 \text{ lbs/day}$
NOx: $[(1,824 \text{ hrs/yr}) (1.89 \text{ lbs/hr})] / (365 \text{ days/yr}) = 9.44 \text{ lbs/day}$
SOx: $[(1,824 \text{ hrs/yr}) (0.182 \text{ lbs/hr})] / (365 \text{ days/yr}) = 0.91 \text{ lbs/day}$
TSP: $[(1,824 \text{ hrs/yr}) (0.172 \text{ lbs/hr})] / (365 \text{ days/yr}) = 0.86 \text{ lbs/day}$

Total Estimated Emissions for This Facility

<u>Pollutant</u>	<u>lbs/day</u>	<u>tons/yr</u>
CO	2.86	0.5
NOx	9.44	1.7
SO ₂	0.91	0.2
VOC	1.25	0.2
TSP	364	66
(PM ₁₀)	147	27)

69 tpy w/TSP
30 tpy w/PM₁₀ only

EXAMPLE of INCINERATOR EMISSION CALCULATIONS

Incinerators are regulated by Washoe County Air Quality Management Division regulations 040.046 and 040.050. These regulations address equipment design requirements and particulate emissions. During the annual renewal of an Air Quality permit for an incinerator our office confirms the equipment specifications, the condition of the equipment, and obtains the following information:

Type:	Industrial Multichamber Incinerator
Maximum Rate:	200 lbs/hr
Hours of Operation:	800 hrs/yr

Emission factors for both pathological and industrial incinerators are found in Volume I of AP-42, Fifth Edition, Section 2. Emission factors used below are for an industrial incinerator and are from Table 2.1-12.

Annual Emission Calculations

Throughput
(200 lbs/hr) (800 hrs/yr) (1 ton/2,000 lbs) = 80 tons/yr

Particulate Matter
(80 tons/yr) (7 lb/ton) = 560 lbs/yr or 0.28 ton PM/yr

SO_x
(80 tons/yr) (2.5 lb/ton) = 200 lbs/yr or 0.10 ton SO_x/yr

NO_x
(80 tons/yr) (3 lb/ton) = 240 lbs/yr or 0.12 ton NO_x/yr

CO
(80 tons/yr) (10 lb/ton) = 800 lbs/yr or 0.40 ton CO/yr

VOC
(80 tons/yr) (3 lb/ton) = 240 lbs/yr or 0.12 ton VOC/yr

Peak Season Emission Calculations

The reported activity level for incinerators is assumed to be constant throughout the year; therefore, no seasonal adjustment factor was applied (SAF = 1.00).

$$E_s = \frac{(0.28 \text{ tons/yr}) (2,000 \text{ lb/ton}) (1.00)}{(7 \text{ days/week}) (52 \text{ weeks/yr})}$$

$E_s = 1.5 \text{ lbs PM/PM day}$

EXAMPLE of ASPHALT PLANT EMISSION CALCULATIONS

This example illustrates how the Washoe County Air Quality Management Division (WCAQMD) permitting database calculates emissions from Asphalt Plants. Upon renewal of A-1 Asphalt Plant's Washoe County air quality permit, A-1 submits the following information as requested by the WCAQMD during the annual compliance inspection:

Type:	Conventional
Total Production:	100,000 tons/yr
Hours Operated:	2,240 hours/yr
Control Equipment:	Baghouse w/ 99.8% control efficiency
Acres of Storage Piles:	5 acres

Primary emissions consist of particulate matter and amounts of gaseous volatile organics which result from the heating and mixing of the asphalt cement. Criteria pollutants are also emitted from the various types of diesel equipment which are run in conjunction with the asphalt plant such as loaders or generators. This source is subject to an NSPS regulation for particulate emissions.

Emission factors for asphalt batching are from section 11.1 of AP-42 Volume I, Fifth Edition, emissions from diesel equipment are from Section 7.2 of AP-42 Volume II.

Asphalt Mixing Emissions

Emission factors from Section 11.1 of AP-42, Fifth Edition, Conventional Asphalt Plant uncontrolled emission factors.

Total Suspended Particulate (TSP)
 $(100,000 \text{ tons/yr}) (32 \text{ lbs/ton}) (1.000 - 0.998) = 6,400 \text{ lbs/yr}$ or = 3.2 tons/yr

PM₁₀
 $(100,000 \text{ tons/yr}) (4.5 \text{ lbs/ton}) (1.000 - 0.998) = 900 \text{ lbs/yr}$ or = 0.45 ton/yr

SO_x
0.056 lb/ton (average between clean and dirty fuel)
 $(100,000 \text{ tons/yr}) (0.056 \text{ lb/ton}) = 5,600 \text{ lbs/yr}$ or = 2.8 tons/yr

NO_x
 $(100,000 \text{ tons/yr}) (0.075 \text{ lb/ton}) = 7,500 \text{ lbs/yr}$ or = 3.8 tons/yr

VOC
 $(100,000 \text{ tons/yr}) (0.0082 \text{ lb/ton}) = 820 \text{ lbs/yr}$ or = 0.4 ton/yr

CO
 $(100,000 \text{ tons/yr}) (0.036 \text{ lb/ton}) = 3,600 \text{ lbs/yr}$ or = 1.8 tons/yr

Toxics
 $(100,000 \text{ tons/yr}) (0.066 \text{ lb/ton}) = 660 \text{ lbs/yr}$ or 0.33 ton/yr

Fugitive Emissions

TSP emission factors are from Section 8.19.1-1 of AP-42, Fourth Edition, with 70% control efficiency for water application

Active Storage Piles

$$(13.2 \text{ lb/acre day}) (5 \text{ acres}) (2,240/24 \text{ hrs}) (1.00 - 0.70) = 1,848 \text{ lbs/yr} \\ \text{or } 0.92 \text{ ton/yr}$$

Inactive Storage Piles

$$(3.5 \text{ lb/day}) (5 \text{ acres}) [(8,760 - 2,240)/24 \text{ hrs}] = 4,745.2 \text{ lbs/yr or } 2.38 \text{ tons/yr}$$

Diesel Equipment Emissions

Emission factors are from Section 7.2 of AP-42 Volume II for a loader.

TSP

$$(2,240 \text{ hrs/yr}) (0.172 \text{ lbs/hr}) = 385.3 \text{ lbs/yr or } 0.19 \text{ ton/yr}$$

SOx

$$(2,240 \text{ hrs/yr}) (0.182 \text{ lbs/hr}) = 407.7 \text{ lbs/yr or } 0.20 \text{ ton/yr}$$

NOx

$$(2,240 \text{ hrs/yr}) (1.89 \text{ lbs/hr}) = 4,233.6 \text{ lbs/yr or } 2.12 \text{ tons/yr}$$

VOC

$$(2,240 \text{ hrs/yr}) (0.25 \text{ lbs/hr}) = 560.0 \text{ lbs/yr or } 0.28 \text{ ton/yr}$$

CO

$$(2,240 \text{ hrs/yr}) (0.57 \text{ lbs/hr}) = 1,276.8 \text{ lbs/yr or } 0.64 \text{ ton/yr}$$

Total Estimated Emissions for This Facility

Summary of Emissions Computed in Permitting Data Base

Pollutant	Total Emissions (tons/yr)
PM ₁₀ *	3.75*
SOx	3.0
NOx	5.9
VOC	0.68
CO	2.4
Toxics	0.3

*The calculated TSP fugitive emissions were treated as PM₁₀ emissions for the total, and the mobile TSP emissions were subtracted from the total particulate emissions for each asphalt plant inventoried to avoid double counting.

Peak Season Emission Calculations

Because ambient temperatures during the peak PM₁₀ season were below the acceptable operating range for a facility in this category, one hundred percent of the activity was assumed to occur outside the peak season; therefore, the seasonal adjustment factor 0 (SAF = 0.00).

$$E_s = \frac{(3.75 \text{ tons/yr}) (2,000 \text{ lb/ton}) (0.00)}{(6 \text{ days/week}) (52 \text{ weeks/yr})}$$

$$E_s = 0.0 \text{ lb PM/PM day}$$

CONSTRUCTION SITE EMISSION FACTOR CALCULATION ASSUMPTIONS

Construction Activity

The Washoe County Air Quality Management Division (WCAQMD) used an emission factor from a report on a study conducted by Midwest Research Institute (MRI) entitled Improvement of Specific Emission Factors. The report and study was funded by EPA through a grant to the Serious PM₁₀ Non-attainment Areas BACM Working Group. WCAQMD determined to use the arithmetic mean of the various emission factors MRI derived which is 0.23 tons/acre-month.

Wind Erosion

The methodology found in the EPA guidance document number 450/3-88-008, Control of Open E fugitive Dust Sources, was used to estimate emissions from wind erosion of construction sites. The document contains the following emission factor (EF) equation.

$$EF_{tsp} = 1.7 (s/1.5) (365-p/235) (f/15) \text{ lb/day-acre}$$

Where in 1995:

p = Number of days with greater than, or equal to, 0.01 inches of precipitation; 64 days

f = Percentage of time wind exceeds 12 mph; 20%

s = Silt content; 2% average for all areas

$$\begin{aligned} EF_{tsp} &= 1.7 (2/1.5) (365-64/235) (20/15) \text{ lb/day-acre} \\ &= 3.87 \text{ lb/day-acre} \end{aligned}$$

$$\begin{aligned} EF_{pm10} &= (EF_{tsp}) (0.5) \\ &= (3.87) (0.5) \\ &= 1.94 \text{ lb/day-acre} \end{aligned}$$

Mud and Dirt Trackout

The methodology found in the EPA guidance document number 450/3-88-008, Control of Open E fugitive Dust Sources, was used to estimate emissions from mud/dirt trackout of construction sites. The document contains the following equation to obtain an uncontrolled emission factor (EF).

$$EF_{pm10} = (e) (M)$$

Where:

e = Unit emission increase use which is: 5.5 g/vehicle for <= 25 vehicles per day entering and exiting, OR 13 g/vehicle for > 25 vehicles per day entering and exiting. WCAQMD assumed most projects had less than 25 vehicles per day entering and exiting to 5.5 g/vehicle or 0.012 lbs/vehicle was used.

M = Number of vehicles that pass by the site a day. WCAQMD assumed that most projects are done on local or collector streets so an average number of vehicles passing by was estimated at 2,500 vehicles.

$$\begin{aligned} EF_{pm10} &= (0.012 \text{ lbs/vehicle}) (2,500 \text{ vehicles/day}) \\ &= 30 \text{ lbs/day per project} \end{aligned}$$

EXAMPLE of CHARBROILER / RESTAURANT EMISSION CALCULATIONS

This is an example of how the Washoe County Air Quality Management Division's (WCAQMD) permitting database calculates emissions from a typical permitted restaurant.

During the permit renewal process, a large Hotel Casino supplied the following:

Frying:	200,000 lbs of meat/year
Broiling:	80,000 lbs of meat/year
Wood Oven:	170,000 lbs-wood/year
	40,000 lbs-charcoal/year

WCAQMD assumes the facility can operate 24 hrs/day, 7 days a week, 52 weeks a year.

Emissions result from the cooking of meat in addition to the combustion of wood and/or charcoal if used. New facilities are subject to Washoe County Regulation Section 040.033 which requires BACT for any source with emissions exceeding 10 lbs/day. However, none of the facilities addressed in this inventory are subject to this regulation, and are uncontrolled; therefore, rule effectiveness was not applied.

Emission factors for the frying and broiling of meat were obtained from information gathered the South Coast Air Quality Management District during the development of their Rule 1138 for Restaurant Operations.

<u>Pollutant</u>	Emission Factors (lb/lb meat)	
	<u>Frying</u>	<u>Broiling</u>
PM ₁₀	0.004	0.008
NO _x	0.001	0.001
CO	0.0	0.0
SO _x	0.0	0.0
VOC	0.004	0.008

Emission factors for the wood and charcoal use were obtained from AP-42, Fifth Edition, Section 1.9 Residential Fireplaces, Table 1.9-2.

<u>Pollutant</u>	Emission Factors Wood and Charcoal	
	<u>(lb/ton)</u>	<u>(lb/cord)*</u>
PM ₁₀	34.6	43.24
NO _x	2.6	3.25
CO	252.6	315.75
SO _x	0.4	0.5
VOC	229.0	286.25
Toxics	2.4	3.0

* Assume 2,500 lbs wood / cord.

Annual PM₁₀ Emission Calculation

Frying

$$(200,000 \text{ lbs/yr}) (0.004 \text{ lb/lb meat}) = 800 \text{ lbs/yr or } 0.4 \text{ tpy}$$

Broiling

$$(80,000 \text{ lbs/yr}) (0.008 \text{ lb/lb meat}) = 640 \text{ lbs/yr or } 0.32 \text{ tpy}$$

Wood Use

$$(68 \text{ cords/yr}) (43.25 \text{ lb/cord}) = 2,941 \text{ lbs/yr or } 1.47 \text{ tpy}$$

Charcoal

$$(20 \text{ tons/yr}) (34.6 \text{ lb/ton}) = 692 \text{ lbs/yr or } 0.35 \text{ tpy}$$

Total PM₁₀ Emissions = 2.54 tpy

Peak Season Emission Calculations

The reported activity level for restaurants is assumed to be constant throughout the year; therefore, no seasonal adjustment factor was applied (SAF = 1.00).

$$E_s = \frac{(2.54 \text{ ton/yr}) (2,000 \text{ lb/ton}) (1.00)}{(7 \text{ days/week}) (52 \text{ weeks/yr})}$$

$$E_s = 13.96 \text{ lbs PM/PM day}$$

EXAMPLE of EMISSION CALCULATIONS for a FIRE TRAINING ACADEMY

A-1 Fire Training

General Facility Information

A-1 Fire Training is located outside of the CO/PM₁₀ non-attainment areas, but is located in the O₃ non-attainment area. The fires are generated through open burning of "transmix" - gasoline and diesel fuel. The fires are set for training purposes for professional fire fighters from all over the country. In 1990, approximately 150,000 gallons of fuel were burned. The total fuel consumption was 50% diesel, 50% gasoline. The facility operates on a contract basis so fire scheduling is based on demand.

This source is not subject to any Washoe County emission regulations and is uncontrolled; therefore, rule effectiveness was not applied. The following EPA emission factors for open burning of JP-4 and JP-5 are used to determine total emissions. (The document origin of these emission factors is unknown):

Pollutant	Emission Factor (lb/lb fuel)
Particulates	0.162
Carbon Monoxide	0.204
Oxides of Nitrogen	0.00036
VOC	0.167

Annual Emission Calculations

Average weight of diesel and gasoline = 6.0 lb / gal

(150,000 gal/yr) (6.0 lb/gal) = 900,000 lb/yr

Particulate Matter

(900,000 lb fuel/yr) (0.162 lb/lb fuel) = 399.5 lb/day = 72.9 ton/yr

CO

(900,000 lb fuel/yr) (0.204 lb/lb fuel) = 503.0 lb/day = 91.8 ton/yr

NOx

(900,000 lb fuel/yr) (0.00036 lb/lb fuel) = 0.9 lb/day = 0.2 ton/yr

VOC

(900,000 lb fuel/yr) (0.167 lb/lb fuel) = 411.5 lb/day = 75.10 ton/yr

Peak Season Emission Calculations

The reported activity level for this facility was essentially constant throughout the year. Therefore, no seasonal adjustment factor was applied ($T = 0.25$).

Particulate Matter

$$E_s = \frac{(72.9 \text{ tons/year}) (2,000 \text{ lb/ton}) (0.25)}{(5 \text{ days/week}) (13 \text{ weeks/year})}$$

$$E_s = 560.77 \text{ lbs PM/PM day}$$

CO

$$E_s = \frac{(91.8 \text{ tons/year}) (2,000 \text{ lb/ton}) (0.25)}{(5 \text{ days/week}) (13 \text{ weeks/yr})}$$

$$E_s = 706.1 \text{ lbs / PM day}$$

NOx

$$E_s = \frac{(0.16 \text{ tons/year}) (2,000 \text{ lb/ton}) (0.25)}{(5 \text{ days/week}) (13 \text{ weeks/yr})}$$

$$E_s = 1.23 \text{ lbs / PM day}$$

VOC

$$E_s = \frac{(75.1 \text{ tons/year}) (2,000 \text{ lb/ton}) (0.25)}{(5 \text{ days/week}) (13 \text{ weeks/yr})}$$

$$E_s = 577.69 \text{ lbs / PM day}$$

AIR QUALITY ENGINEERING EVALUATION of EMISSIONS from a CLAY BORROW PIT

Analysis completed by Linda O'Brien; 10-16-96

A clay borrow pit operates in Washoe County, Nevada. Using the most recent emission factors for the 1999 PM10 Emission Inventory, emissions would be calculated as follows.

Operating Assumptions

1. Tons of material processed in 1995: 52,394 tons.
2. Hours of operation: 8:00 am to 5:00 pm, Monday through Friday.
3. Process consists of