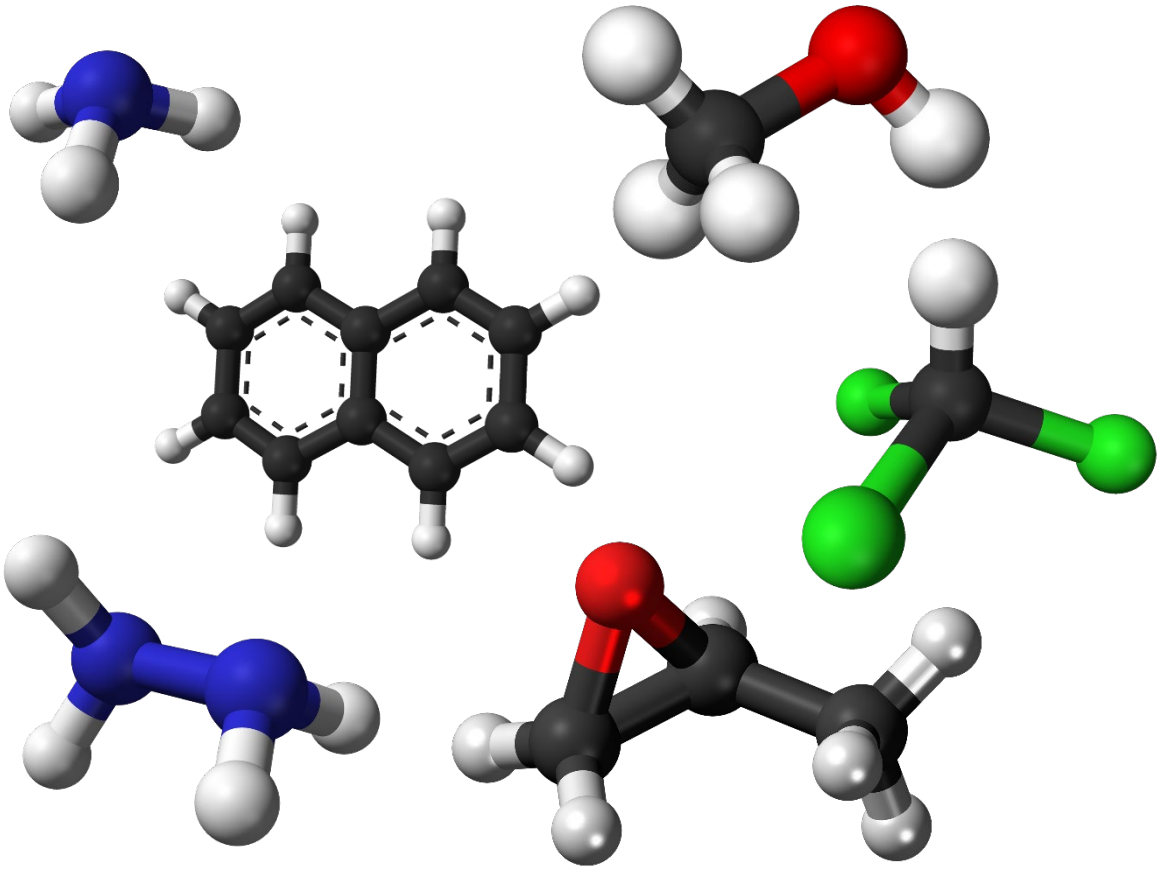
air pollution control district
SANTA BARBARA COUNTY

Approved Emission Factors for Toxic Air Contaminants



December 2023

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1.0 Introduction

This document provides emission factors approved by the Santa Barbara County Air Pollution Control District (District) for calculating emissions of toxic air contaminants (TACs) for health risk assessments (HRAs). Each equipment section of this document includes an equation to calculate average annual and maximum hourly emissions using the approved emission factors. For any method or emission factor not listed in this document, contact the District for approval. **When available, use site-specific emission factors developed from District-approved source tests.**

The District-approved TAC emission factors are available in the spreadsheet titled *SBCAPCD-Approved TAC Emission Factors.xlsx*, noted in the References section of this document, and available on the District's *Toxic Air Contaminant Emission Factors* webpage at: https://www.ourair.org/tac-efs/.

Contact the District to confirm which emission sources should be included in the HRA. Sections 1.1 through 1.3 below explain the requirements for different types of HRAs. Detailed requirements on performing the HRA are included in the District's *Modeling Guidelines for Health Risk Assessments*, Form-15i: https://www.ourair.org/wp-content/uploads/apcd-15i.pdf.

1.1 New Source Review HRA

All emissions from routine and predictable operations (i.e., non-emergency usage) from both permitted and permit-exempt equipment must be included in a New Source Review (NSR) HRA.

1.1.1 NSR HRA with Only New Equipment

An HRA for an NSR project at a new stationary source (i.e., no existing equipment) must include all emitting equipment at its maximum potential to emit (PTE).

1.1.2 NSR HRA with Existing Equipment

For an NSR project at a stationary source with existing equipment, both the new equipment emissions and the existing equipment emissions must be included in the HRA. The new equipment must be modeled at its maximum PTE, and the existing equipment emissions must be modeled based on historical usage. However, if actual emissions for existing equipment will increase over the historical baseline levels as a result of the project, that equipment must be modeled at its maximum PTE.

1.2 CEQA HRA

For CEQA HRAs, all emissions from the NSR HRA must be included. See Sections 1.1.1 and 1.1.2 above for the requirements for NSR HRAs. In addition to routine and predictable emissions, ongoing permit-exempt emissions (not from construction-related activities) from mobile and stationary equipment must be included. For example, combustion emissions from vehicles, fugitive emissions from well workovers and combustion emissions from drill rigs at oil and gas leases must be included in the CEQA HRA. All operational mobile emissions in a 1,000-foot line extending outside the property boundary must be modeled. An HRA for CEQA should *not* include emissions from site grading, welding, or vehicle combustion emissions activities associated with construction. Emissions from oil and gas well drilling must be included in the CEQA analysis; the District does not consider drilling wells on an oil and gas lease to be a construction activity because it occurs over the life of the project.

1.3 AB 2588 Air Toxics "Hot Spots" Program HRA

HRAs performed under AB 2588 are based on an inventory year. Therefore, all emissions calculated for the HRA should reflect actual operations during the inventory year. All emissions from routine and

predictable operations (i.e., non-emergency usage) from both permitted and permit-exempt equipment must be included in the HRA. California Air Resources Board (CARB) clarified that the "Hot Spots" program "addresses all sources within a subject facility that emit listed toxics during routine and predictable operations of the facility. Both permitted and unpermitted sources located within the facility property boundary are included."[1]

All AB 2588 HRAs must be performed after the District has approved the Air Toxics Emission Inventory Plan and Report (ATEIP&R) for the stationary source. Contact the District to confirm the modeling and ATEIP&R requirements for AB 2588 HRAs.

2.0 Internal Combustion

The following section includes internal combustion equipment of different fuel sources, including natural gas, landfill gas, digester gas, gasoline, propane and diesel. In general, the maximum hourly emissions for combustion sources are based on the maximum capacity of the equipment unless the facility records document a lower value.

Table 2.0 is from the District's *Santa Barbara County APCD Piston IC Engine Technical Reference Document* and shows brake-specific fuel consumption (BSFC) values. Emissions must be calculated based on the higher heating value (HHV) of the fuel. For that reason, select the BSFC based on the HHV.

Table 2.0 – Engine Brake-Specific Fuel Consumption

	BSFC (Btu/bhp-hr)	
ENGINE TYPE	LHV basis	HHV basis
Diesel - Naturally Aspirated	7,300	7,800
Diesel - Turbocharged	7,000	7,500
Diesel - TC/Aftercooled	6,600	7,100
Spark Ignited - Nat. Aspirated	9,500	10,500
Spark Ignited - Turbocharged	9,100	10,100
Spark Ignited - TC/Aftercooled	8,700	9,600

2.1 Sulfur Dioxide

Although sulfur dioxide (SO_2) is a criteria pollutant, SO_2 emissions are required to be included in health risk assessments because SO_2 is an Appendix A-1 pollutant[2] and it has an Office of Environmental Health Hazard Assessment (OEHHA)/CARB approved acute reference exposure level. SO_2 emissions should be based on mass balance calculations. Use of manufacturer or AP-42 factors typically will over-estimate potential SO_2 emissions for diesel and gasoline fuel because they are based on higher sulfur contents. Further, these same references may under-estimate SO_2 emissions from natural gas fuel usage. Emission calculations for SO_2 are shown below.

[1] This information was included in an enclosure to a letter sent by Linda C. Murchision (Chief of CARB's Emission Inventory Branch at the time) to Ed Romano (with the Glenn County Air Pollution Control District at the time) on August 18, 1997. This letter is noted in the References section of this document.

[2] Appendix A-1 of CARB's *Emission Inventory Criteria and Guidelines for the Air Toxics "Hot Spots" Program* lists pollutants that must be quantified and reported for AB 2588.

Average Annual SO_2 Emissions for Gaseous Fuels Using Mass Balance:

$$Em_{SO2\ Annual} = \frac{Conc\ S * BSFC * BHP * H_{Annual} * LF * MR * MW_{SO2}}{MV * HHV * 10^6} \quad \text{(Eq. 1)}$$

$Em_{SO2\ Annual}$ = Average annual emissions of SO_2 (lb SO_2/yr)
$Conc\ S$ = Concentration of sulfur in fuel in ppmv (ppmv S)
$BSFC$ = Engine brake-specific fuel consumption (Btu/bhp-hr)
BHP = Brake horsepower of the engine (bhp)
H_{Annual} = Hours operated per year (hr/yr)
LF = Load factor (Default is 1; Documentation is required for non-default values)
MR = Molar ratio ($S + O_2 \rightarrow SO_2$, i.e., MR = 1)
MW_{SO2} = Molecular weight of sulfur dioxide (64.1 lb/lb-mol)
MV = Molar volume (379 scf S/lb-mol S; assumes standard temp of 60°F)
HHV = Fuel higher heating value (Btu/scf); Natural gas default is 1050 Btu/scf; Digester gas default is 600 Btu/scf
10^6 = Conversion factor for ppmv

Maximum Hourly SO_2 Emissions for Gaseous Fuels Using Mass Balance:

$$Em_{SO2\ Hourly} = \frac{Conc\ S * BSFC * BHP * LF * MR * MW_{SO2}}{MV * HHV * 10^6} \quad \text{(Eq. 2)}$$

$Em_{SO2\ Hourly}$ = Maximum hourly emissions of SO_2 (lb SO_2/hr)
$Conc\ S$ = Concentration of sulfur in fuel in ppmv (ppmv S)
$BSFC$ = Engine brake-specific fuel consumption (Btu/bhp-hr)
BHP = Brake horsepower of the engine (bhp)
LF = Load factor (Full load is required for maximum hourly emission calculations)
MR = Molar ratio ($S + O_2 \rightarrow SO_2$, i.e., MR = 1)
MW_{SO2} = Molecular weight of sulfur dioxide (64.1 lb/lb-mol)
MV = Molar volume (379 scf S/lb-mol S; assumes standard temp of 60°F)
HHV = Fuel higher heating value (Btu/scf); Natural gas default is 1050 Btu/scf; Digester gas default is 600 Btu/scf
10^6 = Conversion factor for ppmv

Average Annual SO_2 Emissions for Liquid Fuels Using Mass Balance:

$$Em_{SO2\ Annual} = \frac{Conc\ S * BSFC * BHP * H_{Annual} * LF * \rho_f * MR * MW_{SO2}}{MW_S * HHV * 100} \quad \text{(Eq. 3)}$$

$Em_{SO2\ Annual}$ = Average annual emissions of SO_2 (lb SO_2/yr)
$Conc\ S$ = Concentration of sulfur in fuel in weight percent (wt % S)
$BSFC$ = Engine brake-specific fuel consumption (Btu/bhp-hr), based on HHV from Table 2.0
BHP = Brake horsepower of the engine (bhp)
H_{Annual} = Hours operated per year (hr/yr)
LF = Load factor (Default is 1; Documentation is required for non-default values)
ρ_f = Density of fuel (lb/gal)
MR = Molar ratio ($S + O_2 \rightarrow SO_2$, i.e., MR = 1)
MW_{SO2} = Molecular weight of sulfur dioxide (64.1 lb/lb-mol)
MW_S = Molecular weight of sulfur (32.1 lb/lb-mole)

HHV = Fuel higher heating value (Btu/gal); Diesel default is 137,000 Btu/gal; Gasoline default is 130,000 Btu/gal
100 = Conversion factor for weight percent

Maximum Hourly SO_2 Emissions for Liquid Fuels Using Mass Balance:

$$Em_{SO2\ Hourly} = \frac{Conc\ S * BSFC * BHP * LF * \rho_f * MR * MW_{SO2}}{MW_S * HHV * 100} \quad \text{(Eq. 4)}$$

$Em_{SO2\ Hourly}$ = Maximum hourly emissions of SO_2 (lb SO_2/hr)
$Conc\ S$ = Concentration of sulfur in fuel in weight percent (wt % S)
$BSFC$ = Engine brake-specific fuel consumption (Btu/bhp-hr), based on HHV from Table 2.0
BHP = Brake horsepower of the engine (bhp)
LF = Load factor (Full load is required for maximum hourly emission calculations)
ρ_f = Density of fuel (lb/gal)
MR = Molar ratio ($S + O_2 \rightarrow SO_2$; i.e., MR = 1)
MW_{SO2} = Molecular weight of sulfur dioxide (64.1 lb/lb-mol)
MW_S = Molecular weight of sulfur (32.1 lb/lb-mole)
HHV = Fuel higher heating value (Btu/gal); Diesel default is 137,000 Btu/gal; Gasoline default is 130,000 Btu/gal
100 = Conversion factor for weight percent

2.2 Natural Gas, Landfill Gas, Digester Gas Fueled Internal Combustion Engines

Emission factors for natural gas, landfill gas, and digester gas fired internal combustion engines (ICEs) are located in the *Engines & Turbines* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. The emission factors for natural gas-fired ICEs are from Table B-1 of South Coast Air Quality Management District's (SCAQMD) *Reporting Procedures for AB2588 Facilities for Reporting their Quadrennial Air Toxics Emissions Inventory*; a link is provided in the References section of this document. The landfill gas-fired ICE emission factors are from a 2013 source test of the landfill gas fired internal combustion cogeneration engine at the Marian Medical Center, operated by J&A Santa Maria, LLC. The source tested values were supplemented with the maximum emission factors from California Air Toxics Emission Factors (CATEF) for any TACs not included in the source test; a link to the source test report is provided in the References section of this document. The emission factors for digester gas-fired ICEs were determined by taking the higher emission factor for each pollutant from Table B-7 of SCAQMD's *Reporting Procedures for AB2588 Facilities for Reporting their Quadrennial Air Toxics Emissions Inventory* and San Joaquin Valley Air Pollution Control District's *Toxic Emission Factors for Digester Gas-Fired Internal Combustion Engines*; links are provided in the References section of this document.

Calculate the average annual and maximum hourly emissions for each TAC using the equations below. For natural gas, use the default value of 1050 Btu/scf, unless the District has approved a different value for use or site-specific data is available. For digester gas, use the default value of 600 Btu/scf per AP-42 Tables 3.1-7 and 3.1-8, unless the District has approved a different value for use or site-specific data is available. Due to the variation of heat content in landfill gas, no default values are available. For that reason, site-specific data is required for landfill gas.

Average Annual Emissions:

$$Em_{C\ Annual} = \frac{BSFC * BHP * H_{Annual} * LF * EF_{lb\ C/MMscf}}{HHV * 10^6} \qquad \text{(Eq. 5)}$$

C	= A specific pollutant
$Em_{C\ Annual}$	= Average annual emissions of pollutant C (lb C/yr)
$BSFC$	= Engine brake-specific fuel consumption (Btu/bhp-hr)
BHP	= Brake horsepower of the engine (bhp)
H_{Annual}	= Hours operated per year (hr/yr)
LF	= Load factor (Default is 1; Documentation is required for non-default values)
$EF_{lb\ C/MMscf}$	= Emission factor (lb C/MMscf)
HHV	= Fuel higher heating value (Btu/scf); Natural gas default is 1050 Btu/scf; Digester gas default is 600 Btu/scf
10^6	= Conversion factor (10^6 scf = 1 MMscf)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{BSFC * BHP * LF * EF_{lb\ C/MMscf}}{HHV * 10^6} \qquad \text{(Eq. 6)}$$

C	= A specific pollutant
$Em_{C\ Hourly}$	= Maximum hourly emissions of pollutant C (lb C/hr)
$BSFC$	= Engine brake-specific fuel consumption (Btu/bhp-hr)
BHP	= Brake horsepower of the engine
LF	= Load factor = 1 (Full load is required for maximum hourly emission calculations)
$EF_{lb\ C/MMscf}$	= Emission factor (lb C/MMscf)
HHV	= Fuel higher heating value (Btu/Scf); Natural gas default is 1050 Btu/scf; Digester gas default is 600 Btu/scf
10^6	= Conversion factor (10^6 scf = 1 MMscf)

2.3 Natural Gas Fueled and Digester Gas Fueled Turbines

Emission factors for natural gas and digester gas fired turbines are located in the *Engines & Turbines* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. The natural gas turbine emission factors are from Table B-1 of SCAQMD's *Reporting Procedures for AB2588 Facilities for Reporting their Quadrennial Air Toxics Emissions Inventory* and AP-42 Table 3.1-3. *Emission Factors for Hazardous Air Pollutants from Natural Gas-Fired Stationary Gas Turbines*[3]; links are provided in the References section of this document. The digester gas turbine emission factors are from AP-42 Table 3.1-7. *Emission Factors for Hazardous Air Pollutants from Digester Gas-Fired Stationary Gas Turbines* and Table 3.1-8. *Emission Factors for Metallic Hazardous Air Pollutants from Digester Gas-Fired Stationary Gas Turbines*; a link is provided in the References section of this document.

Calculate the average annual and maximum hourly emissions for each TAC using the equations below.

[3] For the initial health risk assessment (HRA) for a natural gas-fired turbine or LPG turbine, include both the naphthalene and polycyclic aromatic hydrocarbons (PAHs) emission factor from Table 3.1-3 of AP-42. If the results of the initial HRA indicate a significant cancer risk and the chronic non-cancer risk is less than 0.1, rerun the final HRA with the naphthalene emission factor set to zero. For additional information, see the District's Internal Memorandum dated May 2021 regarding *PAH and Naphthalene Emission Factors for Natural Gas-Fired Turbines*.

Average Annual Emissions:

$$Em_{C\ Annual} = FC_{Annual} * EF_{lb\ C/MMscf} \quad \text{(Eq. 7)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
FC_{Annual} = Annual fuel usage (MMscf/year)
$EF_{lb\ C/MMscf}$ = Emission factor (lb C/MMscf)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{Em_{Capacity} * EF_{lb\ C/MMscf}}{HHV} \quad \text{(Eq. 8)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$Em_{Capacity}$ = Maximum capacity of the unit (MMBtu/hr)
$EF_{lb\ C/MMscf}$ = Emission factor (lb C/MMscf)
HHV = Fuel higher heating value (Btu/scf); Natural gas default is 1050 Btu/scf; Digester gas default is 600 Btu/scf

2.4 Propane Fueled Turbines and Propane Fueled & Gasoline Fueled IC Engines

Emission factors for propane fueled turbines, propane fueled ICE and gasoline fueled ICEs are located in the *Engines & Turbines* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. The emission factors for propane fueled ICE are from Table B-3 of SCAQMD's *Reporting Procedures for AB2588 Facilities for Reporting their Quadrennial Air Toxics Emissions Inventory*; a link is provided in the References section of this document. The emission factors for propane fueled turbines are from Table B-3 of SCAQMD's *Reporting Procedures for AB2588 Facilities for Reporting their Quadrennial Air Toxics Emissions Inventory* and AP-42 Table 3.1-3. *Emission Factors for Hazardous Air Pollutants from Natural Gas-Fired Stationary Gas Turbines*[2]; links are provided in the References section of this document. The gasoline fueled ICE emission factors are from Table B-4 of the same document; a link is provided in the References section of this document.

Calculate the average annual and maximum hourly emissions for each TAC using the equations below.

Average Annual Emissions:

$$Em_{C\ Annual} = \frac{BSFC * BHP * H_{Annual} * LF * EF_{lb\ C/kgal}}{HHV * 1000} \quad \text{(Eq. 9)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
$BSFC$ = Engine brake-specific fuel consumption (Btu/bhp-hr)
BHP = Brake horsepower of the engine
H_{Annual} = Hours operated per year (hr/yr)
LF = Load factor (Default is 1; Documentation is required for non-default values)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
HHV = Fuel higher heating value (Btu/gal); Propane default is 91,500 Btu/gal; Gasoline default is 130,000 Btu/gal.

1000 = Conversion factor (1000 gal = kgal)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{BSFC * BHP * LF * EF_{lb\ C/kgal}}{HHV * 1000} \qquad \text{(Eq. 10)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$BSFC$ = Engine brake-specific fuel consumption (Btu/bhp-hr)
BHP = Brake horsepower of the engine
LF = Load Factor = 1 (Full load is required for maximum hourly emission calculations)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
HHV = Fuel higher heating value (Btu/gal); Propane default is 91,500 Btu/gal; Gasoline default is 130,000 Btu/gal.
1000 = Conversion factor (1000 gal = kgal)

2.5 Diesel Internal Combustion Engines

In August 1998, CARB identified diesel engine exhaust as a TAC. OEHHA developed chronic non-cancer and cancer health factors based on whole (gas and particulate matter) diesel engine exhaust. The surrogate for whole diesel exhaust is diesel PM. Annual and hourly emissions from diesel internal combustion engines (DICE) must be quantified for diesel PM and total organic gas (TOG) from diesel exhaust. Although there are no OEHHA health factors for TOG from diesel exhaust, and there is no acute health factor for diesel PM, the emissions must be quantified because they are Appendix A-1 pollutants[4].

OEHHA has not developed acute or 8-hour chronic health factors for diesel engine exhaust. For that reason, the individual pollutants from diesel exhaust must be speciated in order to assess acute or 8-hour chronic risk from diesel engines. The calculated 8-hour chronic risk from diesel engines is typically very low, partially due to the limited number of pollutants with OEHHA health factors for 8-hour chronic risk. For this reason, speciated annual emissions are not required to be included in the HRA unless the stationary source-wide 8-hour chronic hazard index is greater than 0.8. If the 8-hour chronic hazard index exceeds 0.8, the speciated annual emissions must be calculated for the diesel engine(s) and added to the HRA run for the 8-hour chronic risk only. Do not add speciated annual emissions to the HRA when calculating cancer risk or chronic non-cancer risk, as this will overestimate health impacts from the diesel exhaust. Contact the District for further assistance or questions.

Speciated pollutants from Tier 3 and Tier 4 engines and Tier 2 engines greater than 750 bhp are not required to be included in the HRA at this time. The available TAC emission factors for DICE are based on source testing performed on Tier 0 engines in the early 1990s. For that reason, these emission factors are not representative of Tier 3 and Tier 4 engines and Tier 2 engines greater than 750 bhp. When available, this document will be updated to reflect representative emission factors for all tiers.

2.5.1 Stationary DICE

The equations for calculating average annual and maximum hourly diesel PM and TOG emissions from stationary DICE are shown below. For existing engines, consult the permit to determine the emission

[4] Appendix A-1 of CARB's *Emission Inventory Criteria and Guidelines for the Air Toxics "Hot Spots" Program* lists pollutants that must be quantified and reported for AB 2588.

factors. For new engines, select the appropriate emission factors from the District's *Emission Factors* webpage: https://www.ourair.org/dice/emission-factors.

Average Annual Emissions:

$$Em_{Annual} = \frac{EF_{g\ /bhp-hr} * BHP * LF * H_{Annual}}{453.6} \qquad \text{(Eq. 11)}$$

Em_{Annual} = Average annual emissions of diesel PM or diesel TOG (lb C/yr)
$EF_{g\ /bhp-hr}$ = PM or TOG emission factor (g/bhp-hr)
BHP = Engine rating brake horsepower of the engine (bhp)
LF = Load factor (Default is 1; Documentation is required for non-default values)
H_{Annual} = Hours operated per year (hr/yr)
453.6 = Conversion factor (453.6 g = lb)

Maximum Hourly Emissions:

$$Em_{Hourly} = \frac{EF_{g\ /bhp-hr} * BHP * LF}{453.6} \qquad \text{(Eq. 12)}$$

Em_{Hourly} = Maximum hourly emissions of diesel PM or diesel TOG (lb C/hr)
$EF_{g\ /bhp-hr}$ = PM or TOG emission factor (g/bhp-hr)
BHP = Engine rating brake horsepower of the engine (bhp)
LF = Load Factor = 1 (Full load is required for maximum hourly emission calculations)
453.6 = Conversion factor (453.6 g = lb)

When applicable, calculate the speciated TAC emissions using the equation for Scenario 1 or Scenario 2 below. The emission factors for stationary diesel engines shown in the *Engines & Turbines* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx* are for the speciated hourly emission calculations only. The DICE factors are from VCAPCD's *AB 2588 Combustion Emission Factors,* supplemented with factors from Table B-2 of SCAQMD's *Reporting Procedures for AB2588 Facilities for Reporting their Quadrennial Air Toxics Emissions Inventory*; links are provided in the References section of this document.

Annual Average Speciated Emissions[5] for Scenario 1: Annual fuel consumption is unknown

$$Em_{C\ Annual} = \frac{EF_{lb\ C/kgal} * BHP * BSFC * LF * H_{Annual}}{1000 * HHV} \qquad \text{(Eq. 13)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Annual emissions of pollutant C (lb C/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
BHP = Brake horsepower of the engine (bhp)
$BSFC$ = Engine brake-specific fuel consumption (Btu/bhp-hr)
LF = Load Factor; Default is 1.0 (Documentation required for values less than 1.0)

[5] Annual speciated emissions are required to be included in the HRA only for Tier 2 engines < 750 bhp, Tier 1 engines or Tier 0 engines when the initial stationary source-wide HRA results show the 8-hour chronic hazard index is greater than 0.8. Annual speciated emissions are not required for Tier 3 and Tier 4 engines and Tier 2 engines greater than 750 bhp.

1000 = Conversion factor (1000 gal = kgal)
HHV = Fuel higher heating value (Btu/gal); Diesel default is 137,000 Btu/gal
H_{Annual} = Hours operated per year (hr/yr)

Maximum Hourly Emissions for Scenario 1: Hourly fuel consumption is unknown

$$Em_{C\ Hourly} = \frac{EF_{lb\ C/kgal} * BHP * BSFC * LF}{1000 * HHV} \qquad \text{(Eq. 14)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
BHP = Brake horsepower of the engine (bhp)
$BSFC$ = Engine brake-specific fuel consumption (Btu/bhp-hr)
LF = Load Factor = 1 (Full load is required for maximum hourly emission calculations)
1000 = Conversion factor (1000 gal = kgal)
HHV = Fuel higher heating value (Btu/gal); Diesel default is 137,000 Btu/gal

Annual Average Speciated Emissions for Scenario 2[6]: Annual fuel consumption is known

$$Em_{C\ Annual} = \frac{EF_{lb\ C/kgal}}{1000} * FC_{Annual} \qquad \text{(Eq. 15)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Annual emissions of pollutant C (lb C/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
FC_{Annual} = Annual Fuel Usage (gal/yr)
1000 = Conversion factor (1000 gal = kgal)

Maximum Hourly Emissions for Scenario 2: Hourly fuel consumption is known

$$Em_{C\ Hourly} = \frac{EF_{lb\ C/kgal} * FC * LF}{1000} \qquad \text{(Eq. 16)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
FC = Equipment's fuel consumption from manufacturer's specifications (gal/hr)
LF = Load Factor = 1 (Full load is required for maximum hourly emission calculations)
1000 = Conversion factor (1000 gal = kgal)

[6] Annual speciated emissions are required to be included in the HRA only for Tier 2 engines < 750 bhp, Tier 1 engines or Tier 0 engines when the initial stationary source-wide HRA results show the 8-hour chronic hazard index is greater than 0.8. Annual speciated emissions are not required for Tier 3 and Tier 4 engines and Tier 2 engines greater than 750 bhp.

2.5.2 Marine Vessels

TAC emission factors for crew and supply boats are located in the *Engines & Turbines* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. These factors are from AP-42 Table 3.3-2. *Speciated Organic Compound Emission Factors for Uncontrolled Diesel Engines*, supplemented with factors from VCAPCD's *AB 2588 Combustion Emission Factors*; links are provided in the References section of this document.

Annual and hourly diesel PM and TOG emissions should be calculated based on the permitted emission calculations when available. Alternatively, diesel PM and TOG emissions may be calculated using EPA's marine vessel engine standards, *Federal Marine Compression-Ignition (CI) Engines: Exhaust Emission Standards*; a link is provided in the References section of this document.

Average Annual Emissions:

$$Em_{Annual} = \frac{EF_{g\ /bhp-hr} * BHP * LF * H_{Annual}}{453.6} \qquad \text{(Eq. 17)}$$

Em_{Annual} = Average annual emissions of diesel PM or diesel TOG (lb C/yr)
$EF_{g\ /bhp-hr}$ = PM or TOG emission factor (g/bhp-hr)
BHP = Engine rating brake horsepower of the engine (bhp)
LF = Load factor (Default is 1; Documentation is required for non-default values)
H_{Annual} = Hours operated per year (hr/yr)
453.6 = Conversion factor (453.6 g = lb)

Maximum Hourly Emissions:

$$Em_{Hourly} = \frac{EF_{g\ /bhp-hr} * BHP * LF}{453.6} \qquad \text{(Eq. 18)}$$

Em_{Hourly} = Maximum hourly emissions of diesel PM or diesel TOG (lb C/hr)
$EF_{g\ /bhp-hr}$ = PM or TOG emission factor (g/bhp-hr)
BHP = Engine rating brake horsepower of the engine (bhp)
LF = Load Factor = 1 (Full load is required for maximum hourly emission calculations)
453.6 = Conversion factor (453.6 g = lb)

Calculate the speciated emissions for each TAC using the equation for Scenario 1 or Scenario 2 below.

Annual Average Speciated Emissions[7] for Scenario 1: Annual fuel consumption is unknown

$$Em_{C\ Annual} = \frac{EF_{lb\ C/kgal} * BHP * BSFC * LF * H_{Annual}}{1000 * HHV} \qquad \text{(Eq. 19)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Annual emissions of pollutant C (lb C/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)

[7] Annual speciated emissions are required to be included in the HRA only when the initial stationary source-wide HRA results show the 8-hour chronic hazard index is greater than 0.8.

BHP = Brake horsepower of the engine (bhp)
$BSFC$ = Engine brake-specific fuel consumption (Btu/bhp-hr)
LF = Load Factor; Default is 1.0 (Documentation required for values less than 1.0)
1000 = Conversion factor (1000 gal = kgal)
HHV = Fuel higher heating value (Btu/gal); Diesel default is 137,000 Btu/gal
H_{Annual} = Hours operated per year (hr/yr)

Maximum Hourly Emissions for Scenario 1: Hourly fuel consumption is unknown

$$Em_{C\ Hourly} = \frac{EF_{lb\ C/kgal} * BHP * BSFC * LF}{1000 * HHV} \qquad \text{(Eq. 20)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
BHP = Brake horsepower of the engine (bhp)
$BSFC$ = Engine brake-specific fuel consumption (Btu/bhp-hr)
LF = Load Factor = 1 (Full load is required for maximum hourly emission calculations)
1000 = Conversion factor (1000 gal = kgal)
HHV = Fuel higher heating value (Btu/gal); Diesel default is 137,000 Btu/gal

Annual Average Speciated Emissions for Scenario 2[8]: Annual fuel consumption is known

$$Em_{C\ Annual} = \frac{EF_{lb\ C/kgal}}{1000} * FC_{Annual} \qquad \text{(Eq. 21)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Annual emissions of pollutant C (lb C/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
FC_{Annual} = Annual Fuel Usage (gal/yr)
1000 = Conversion factor (1000 gal = kgal)

Maximum Hourly Emissions for Scenario 2: Hourly fuel consumption is known

$$Em_{C\ Hourly} = \frac{EF_{lb\ C/kgal} * FC * LF}{1000} \qquad \text{(Eq. 22)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
FC = Fuel consumption from manufacturer's specifications (gal/hr) or maximum from recordkeeping if fuel usage is recorded on an hourly basis
LF = Load Factor = 1 (Full load is required for maximum hourly emission calculations)
1000 = Conversion factor (1000 gal = kgal)

[8] Annual speciated emissions are required to be included in the HRA only when the initial stationary source-wide HRA results show the 8-hour chronic hazard index is greater than 0.8.

2.6 Diesel-Fired Turbines

TAC emission factors for diesel-fired turbines are located on the *Engines & Turbines* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. These factors are from VCAPCD's *AB 2588 Combustion Emission Factors*, supplemented with factors from Table B-2 of SCAQMD's *Reporting Procedures for AB2588 Facilities for Reporting their Quadrennial Air Toxics Emissions Inventory*; links are provided in the References section of this document.

Calculate the average annual and maximum hourly emissions for each TAC using the equation for Scenario 1 or Scenario 2 below.

Annual Average Emissions for Scenario 1: Annual fuel consumption is unknown

$$Em_{C\ Annual} = \frac{EF_{lb\ C/kgal} * BHP * BSFC * LF * H_{Annual}}{1000 * HHV} \qquad \text{(Eq. 23)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Annual emissions of pollutant C (lb C/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
BHP = Brake horsepower of the engine (bhp)
$BSFC$ = Engine brake-specific fuel consumption (Btu/bhp-hr)
LF = Load Factor; Default is 1.0 (Documentation required for values less than 1.0)
1000 = Conversion factor (1000 gal = kgal)
HHV = Fuel higher heating value (Btu/gal); Diesel default is 137,000 Btu/gal
H_{Annual} = Hours operated per year (hr/yr)

Maximum Hourly Emissions for Scenario 1: Hourly fuel consumption is unknown

$$Em_{C\ Hourly} = \frac{EF_{lb\ C/kgal} * BHP * BSFC * LF}{1000 * HHV} \qquad \text{(Eq. 24)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
BHP = Brake horsepower of the engine (bhp)
$BSFC$ = Engine brake-specific fuel consumption (Btu/bhp-hr)
LF = Load Factor = 1 (Full load is required for maximum hourly emission calculations)
1000 = Conversion factor (1000 gal = kgal)
HHV = Fuel higher heating value (Btu/gal); Diesel default is 137,000 Btu/gal

Annual Average Emissions for Scenario 2: Annual fuel consumption is known

$$Em_{C\ Annual} = \frac{EF_{lb\ C/kgal}}{1000} * FC_{Annual} \qquad \text{(Eq. 25)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Annual emissions of pollutant C (lb C/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
FC_{Annual} = Annual Fuel Usage (gal/yr)
1000 = Conversion factor (1000 gal = kgal)

Maximum Hourly Emissions for Scenario 2: Hourly fuel consumption is known

$$Em_{C\ Hourly} = \frac{EF_{lb\ C/kgal} * FC * LF}{1000} \qquad \text{(Eq. 26)}$$

C	= A specific pollutant
$Em_{C\ Hourly}$	= Maximum hourly emissions of pollutant C (lb C/hr)
$EF_{lb\ C/kgal}$	= Emission factor (lb C/kgal)
FC	= Fuel consumption from manufacturer's specifications (gal/hr) or maximum from recordkeeping if fuel usage is recorded on an hourly basis
LF	= Load Factor = 1 (Full load is required for maximum hourly emission calculations)
1000	= Conversion factor (1000 gal = kgal)

3.0 External Combustion

The following sub-sections address TAC emission calculations for external combustion equipment, including flares, boilers, ovens, dryers, furnaces, heaters and crematories.

3.1 Sulfur Dioxide

Although SO_2 is a criteria pollutant, SO_2 emissions are required to be included in health risk assessments because SO_2 is an Appendix A-1 pollutant[9] and it has an OEHHA/CARB approved acute reference exposure level. SO_2 emissions should be based on mass balance calculations. Use of manufacturer or AP-42 factors typically will over-estimate potential SO_2 emissions for diesel and gasoline fuel because they are based on higher sulfur contents. Further, these same references may under-estimate SO_2 emissions from natural gas fuel usage. Emission calculations for SO_2 are shown below.

Average Annual SO_2 Emissions for Gaseous Fuels Using Mass Balance: [10]

$$Em_{SO2\ Annual} = \frac{Conc\ S * Em_{Capacity} * H_{Annual} * MR * MW_{SO2}}{MV * HHV} \qquad \text{(Eq. 27)}$$

$Em_{SO2\ Annual}$	= Average annual emissions of SO_2 (lb SO_2/yr)
$Em_{Capacity}$	= Maximum capacity of the unit (MMBtu/hr)
$Conc\ S$	= Concentration of sulfur in fuel in ppmvd (scf S/10^6 scf fuel)
H_{Annual}	= Hours operated per year (hr/yr)
MR	= Molar ratio ($S + O_2 \rightarrow SO_2$; i.e., MR = 1)
MW_{SO2}	= Molecular weight of sulfur dioxide (64.1 lb/lb-mol)
MV	= Molar volume (379 scf S/lb-mol S; assumes standard temp of 60°F)
HHV	= Fuel higher heating value (Btu/scf); Natural gas default is 1050 Btu/scf; Digester gas default is 600 Btu/scf

[9] Appendix A-1 of CARB's *Emission Inventory Criteria and Guidelines for the Air Toxics "Hot Spots" Program* lists pollutants that must be quantified and reported for AB 2588.

[10] The conversion factors of 10^6 for ppmvd and MMBtu to Btu cancel out.

Maximum Hourly SO_2 Emissions for Gaseous Fuels Using Mass Balance: [11]

$$Em_{SO2\ Hourly} = \frac{Conc\ S * Em_{Capacity} * MR * MW_{SO2}}{MV * HHV} \quad \text{(Eq. 28)}$$

$Em_{SO2\ Hourly}$ = Maximum hourly emissions of SO_2 (lb SO_2/hr)
$Em_{Capacity}$ = Maximum capacity of the unit (MMBtu/hr)
$Conc\ S$ = Concentration of sulfur in fuel in ppmvd (ppmvd S)
MR = Molar ratio ($S + O_2 \rightarrow SO_2$; i.e., MR = 1)
MW_{SO2} = Molecular weight of sulfur dioxide (64.1 lb/lb-mol)
MV = Molar volume (379 scf S/lb-mol S; assumes standard temp of 60°F)
HHV = Fuel higher heating value (Btu/scf); Natural gas default is 1050 Btu/scf; Digester gas default is 600 Btu/scf

Average Annual SO_2 Emissions for Liquid Fuels Using Mass Balance:

$$Em_{SO2\ Annual} = \frac{Conc\ S * \rho_f * FC_{Annual} * MR * MW_{SO2}}{MW_S * 100} \quad \text{(Eq. 29)}$$

$Em_{SO2\ Annual}$ = Average annual emissions of SO_2 (lb SO_2/yr)
$Conc\ S$ = Concentration of sulfur in fuel in weight percent (wt % S)
ρ_f = Density of fuel (lb/gal)
FC_{Annual} = Annual fuel usage (gal/year)
MR = Molar ratio ($S + O_2 \rightarrow SO_2$; i.e., MR = 1)
MW_{SO2} = Molecular weight of sulfur dioxide (64.1 lb/lb-mol)
MW_S = Molecular weight of sulfur (32.1 lb/lb-mole)
100 = Conversion factor for weight percent

Maximum Hourly SO_2 Emissions for Liquid Fuels Using Mass Balance:

$$Em_{SO2\ Hourly} = \frac{Conc\ S * \rho_f * Em_{Capacity} * MR * MW_{SO2} * 10^6}{MW_S * HHV * 100} \quad \text{(Eq. 30)}$$

$Em_{SO2\ Hourly}$ = Maximum hourly emissions of SO_2 (lb SO_2/hr)
$Conc\ S$ = Concentration of sulfur in fuel in weight percent (wt % S)
ρ_f = Density of fuel (lb/gal)
$Em_{Capacity}$ = Maximum capacity of the unit (MMBtu/hr)
MR = Molar ratio ($S + O_2 \rightarrow SO_2$; i.e., MR = 1)
MW_{SO2} = Molecular weight of sulfur dioxide (64.1 lb/lb-mol)
10^6 = Conversion factor (10^6 Btu = 1 MMBtu)
MW_S = Molecular weight of sulfur (32.1 lb/lb-mole)
HHV = Fuel higher heating value (Btu/gal); Diesel default is 137,000 Btu/gal; Propane default is 91,500 Btu/gal
100 = Conversion factor for weight percent

[11] The conversion factors of 10^6 for ppmv and MMBtu to Btu cancel out.

3.2 Natural Gas, Process Gas, Digester Gas, Landfill Gas Fueled External Combustion

The calculations used to determine the average annual and maximum hourly TAC emissions for external combustion of natural gas, process gas, digester gas and landfill gas use the same equations (shown below). The TAC emission factors are discussed below in Sections 3.1.1 and 3.1.2. Emissions must be calculated based on the higher heating value (HHV) of the fuel. For natural gas, use the default value of 1050 Btu/scf, unless the District has approved a different value for use or site-specific data is available. For digester gas, use the default value of 600 Btu/scf per AP-42 Tables 3.1-7 and 3.1-8, unless the District has approved a different value for use or site-specific data is available. Due to the variation of heat content in process gas and landfill gas, no default values are available. For that reason, site-specific data is required for process gas and landfill gas.

Average Annual Emissions:

$$Em_{C\ Annual} = FC_{Annual} * EF_{lb\ C/MMscf} \qquad \text{(Eq. 31)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
FC_{Annual} = Annual fuel usage (MMscf/year)
$EF_{lb\ C/MMcf}$ = Emission factor (lb C/MMscf)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{Em_{Capacity} * EF_{lb\ C/MMscf}}{HHV} \qquad \text{(Eq. 32)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$Em_{Capacity}$ = Maximum capacity of the unit (MMBtu/hr)
$EF_{lb\ C/MMcf}$ = Emission factor (lb C/MMscf)
HHV = Fuel higher heating value (Btu/scf); Natural gas default is 1050 Btu/scf; Digester gas default is 600 Btu/scf

3.2.1 Boilers and Heaters

Emission factors for natural gas, process gas and digester gas fueled boilers and heaters are located in the *Boilers & Heaters* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. The emission factors for natural gas and process gas fueled boilers and heaters are from VCAPCD's *AB 2588 Combustion Emission Factors*, supplemented with metal emission factors from AP-42 Table 1.4-4. *Emission Factors for Metals from Natural Gas Combustion*; links are provided in the References section of this document. The emission factors for digester gas-fired boilers and heaters are from Table B-7 of SCAQMD's *Reporting Procedures for AB2588 Facilities for Reporting their Quadrennial Air Toxics Emissions Inventory*; a link is provided in the References section of this document.

3.2.2 Flares

Emission factors for flares are located in the *Flares & Crematories* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. The emission factors for natural gas flares and process gas flares are from VCAPCD's *AB 2588 Combustion Emission Factors*, supplemented with metal emission factors from AP-42 Table 1.4-4. *Emission Factors for Metals from Natural Gas Combustion*; links are provided in the References section of this document. The landfill gas flare emission factors are from a 2010 source

test of the Santa Maria Landfill flare, supplemented with the maximum emission factors from California Air Toxics Emission Factors (CATEF) for any TACs not included in the source test; a link is provided in the References section of this document. The emission factors for digester gas flares are from San Diego County Air Pollution Control District's (SDCAPCD) *F02 - Flares, Digester Gas Fired, Enclosed* table (Point Loma WWTP-only) and supplemented with VCAPCD's *AB 2588 Combustion Emission Factors* and metal emission factors from AP-42 Table 1.4-4. *Emission Factors for Metals from Natural Gas Combustion*; links are provided in the References section of this document. The AP-42 factors and VCAPCD factors are used to account for emissions from typical combustion in a flare. SDCAPCD's Point Loma WWTP factors account for the additional pollutants/concentrations that are found in digester gas.

3.3 Propane Fueled External Combustion

Emission factors for propane fueled external combustion are located in the *Boilers & Heaters* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. These emission factors are from Table B-3 of SCAQMD's *Reporting Procedures for AB2588 Facilities for Reporting their Quadrennial Air Toxics Emissions Inventory*; a link is provided in the References section of this document.

Calculate the average annual and maximum hourly emissions for each TAC using the equations below.

Average Annual Emissions:

$$Em_{C\ Annual} = \frac{FC_{Annual} * EF_{lb\ C/kgal}}{1000} \qquad \text{(Eq. 33)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
FC_{Annual} = Annual fuel usage (gal/yr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
1000 = Conversion factor (1000 gal = kgal)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{Em_{Capacity} * EF_{lb\ C/kgal} * 1000}{HHV} \qquad \text{(Eq. 34)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$Em_{Capacity}$ = Maximum capacity of the unit (MMBtu/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
1000 = Conversion factor; 1000 = (kgal/1000 gal) * (10^6 Btu/MMBtu)
HHV = Fuel higher heating value (Btu/gal); Propane default is 91,500 Btu/gal

3.4 Diesel External Combustion

Emission factors for external combustion of diesel fuel are located in the *Boilers & Heaters* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. These emission factors are from VCAPCD's *AB 2588 Combustion Emission Factors*; a link is provided in the References section of this document.

Calculate the average annual and maximum hourly emissions for each TAC using the equations below.

Average Annual Emissions:

$$Em_{C\ Annual} = \frac{FC_{Annual} * EF_{lb\ C/kgal}}{1000} \qquad \text{(Eq. 35)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
FC_{Annual} = Annual fuel usage (gal/yr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
1000 = Conversion factor (1000 gal = kgal)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{FC * EF_{lb\ C/kgal}}{1000} \qquad \text{(Eq. 36)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
FC = Equipment's fuel consumption from manufacturer's specifications (gal/hr)
$EF_{lb\ C/kgal}$ = Emission factor (lb C/kgal)
1000 = Conversion factor (1000 gal = kgal)

3.5 Crematories

Emission factors for crematories are located in the *Flares & Crematories* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. The emission factors for crematories that combust human remains are from SDCAPCD's *C01 - Crematory, Natural Gas Fired, Human Remains, Controlled Air*. The emission factors for crematories that combust animal remains are from SCDAPCD's *C02 - Crematory, Natural Gas Fired, Animal Remains, Controlled Air*. Links for the crematory emission factor documents are provided in the References section of this document.

Calculate the average annual and maximum hourly emissions for each TAC using the equations below. If the charge weight is unknown, assume 150 pounds per charge for human remains.

Average Annual Emissions:

$$Em_{C\ Annual} = EF_{lb\ C/ton} * CW_{Annual} \qquad \text{(Eq. 37)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
$EF_{lb\ C/ton}$ = Emission factor (lb C/ton of charge)
CW_{Annual} = Annual charge weight (ton of charge/yr)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{EF_{lb\ C/lb} * CW_{Hourly}}{2000} \qquad \text{(Eq. 38)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$EF_{lb\ C/lb}$ = Emission factor (lb C/lb of charge)

CW_{Hourly} = Maximum hourly charge weight (lb of charge/hr)
2000 = Conversion factor (2000 lb = ton)

4.0 Solvents and Coatings

Emissions from solvents and coatings are generally based on usage, assuming that all usage is emitted to the atmosphere. In some cases, coating control equipment is used to capture the emissions. In those cases, the permitted control efficiency may be used in the emission calculations. Documentation of the weight fractions (e.g., Material Safety Data Sheet) must be provided to the District. If the Material Safety Data Sheet (or other documentation) shows a range for the TAC weight fraction, the maximum of the range must be used for emission calculations. In some cases, this will result in reporting emissions greater than 100 percent of the product. Alternatively, the applicant may contact the product's manufacturer to request written documentation of the exact TAC weight fractions in the product.

Calculate the average annual and maximum hourly emissions for each TAC using the equations below.

Average Annual Emissions:

$$Em_{C\ Annual} = Solv_{Annual} * \rho_{Solv} * Wt_{lb\ C/lb\ Solv} \qquad \text{(Eq. 39)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
$Solv_{Annual}$ = Annual solvent usage (gal/yr)
ρ_{Solv} = Density of the solvent (lb/gal)
$Wt_{lb\ C/lb\ Solv}$ = Weight fraction of pollutant C in solvent (lb C/lb Solvent)

Maximum hourly emissions from solvents and coatings must be calculated on a case-by-case basis. The general equations used to calculate the maximum hourly emissions are shown below. For Scenario 1, only monthly records are kept. For Scenario 2, daily records are kept. For both Scenario 1 and 2, it is assumed that the maximum hourly emissions are equal to the daily emissions (i.e., daily solvent usage occurs in one hour). If solvent usage is recorded on an hourly basis, use the calculation shown for Scenario 3, using the maximum solvent usage over a one hour time period throughout the entire year.

Maximum Hourly Emissions for Scenario 1: Only monthly records are kept

$$Em_{C\ Hourly} = Em_{C\ Daily} = \frac{Solv_{Monthly} * \rho_{Solv} * Wt_{lb\ C/lb\ Solv}}{21.7} \qquad \text{(Eq. 40)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$Em_{C\ Daily}$ = Maximum daily emissions of pollutant C (lb C/day)
$Solv_{Monthly}$ = Maximum monthly usage of solvent (gal/month)
ρ_{Solv} = Density of the solvent (lb/gal)
$Wt_{lb\ C/lb\ Solv}$ = Weight fraction of pollutant C in solvent (lb C/lb Solvent)
21.7 = Default operating days per month (day/month)

Maximum Hourly Emissions for Scenario 2: Daily records are kept

$$Em_{C\ Hourly} = Em_{C\ Daily} = Solv_{MaxDaily} * \rho_{Solv} * Wt_{lb\ C/lb\ Solv} \quad \text{(Eq. 41)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$Em_{C\ Daily}$ = Maximum daily emissions of pollutant C (lb C/day)
$Solv_{MaxDaily}$ = Maximum daily usage of solvent (gal/day)
ρ_{Solv} = Density of the solvent (lb/gal)
$Wt_{lb\ C/lb\ Solv}$ = Weight fraction of pollutant C in solvent (lb C/lb Solvent)

Maximum Hourly Emissions for Scenario 3: Hourly records are kept

$$Em_{C\ Hourly} = Solv_{MaxHourly} * \rho_{Solv} * Wt_{lb\ C/lb\ Solv} \quad \text{(Eq. 42)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$Solv_{MaxHourly}$ = Maximum hourly usage of solvent (gal/hr)
ρ_{Solv} = Density of the solvent (lb/gal)
$Wt_{lb\ C/lb\ Solv}$ = Weight fraction of pollutant C in solvent (lb C/lb Solvent)

5.0 Oil and Gas Fugitives

TAC emission factors from fugitives are based on the weight fraction of TAC in the Total Organic Gas (TOG or TOC). The District's emission limits for fugitive components are for Reactive Organic Compounds (ROC). In order to convert ROC to TOG, the appropriate ROC/TOG ratio must be chosen based on the facility and emission source. ROC/TOG ratios are found in the District's Policy & Procedure No. 6100.060.2016, *Calculation of Fugitive Hydrocarbon Emissions at Oil and Gas Facilities by the CARB/KVB Method - Modified for the Revised ROC Definition* available at: https://www.ourair.org/wp-content/uploads/6100-060-1.pdf and District's Policy & Procedure No. 6100.061.2016, *Determination of Fugitive Hydrocarbon Emissions at Oil and Gas Facilities Through the Use of Facility Component Leak Path Counts - Modified for Revised ROC Definition* available at: https://www.ourair.org/wp-content/uploads/6100-061-1.pdf.

Weight fractions of TACs for emission calculations for fugitives are located in the *O&G Fugitives tab* of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. These weight fractions are from CARB's *Identification of Volatile Organic Compound Species Profiles*; a link is provided in the References section of this document. **Hydrogen sulfide is site-specific and must be quantified.** No default hydrogen sulfide emission factors are available.

5.1 Fugitive Components

There are two District approved methods to calculate ROC emissions from fugitive components: the component leak path method and the CARB/KVB method. Effective August 25, 2016, the District no longer allows the use of the correlation equation method. However, those projects that previously used this calculation methodology are grandfathered and may continue to use the methodology for current and future permitting, compliance, toxics, inventory and/or planning purposes.

A calculation spreadsheet for the CARB/KVB method is available on the District's website under the *CARB/KVB Fugitive Hydrocarbons* bullet for *Santa Barbara County APCD Emission Calculation Spreadsheets* at: https://www.ourair.org/eng/tech/. Additional direction on using CARB/KVB method is provided in the District's Policy & Procedure No. 6100.060.2016, *Calculation of Fugitive Hydrocarbon Emissions at Oil and Gas Facilities by the CARB/KVB Method - Modified for the Revised ROC Definition* available at: https://www.ourair.org/wp-content/uploads/6100-060-1.pdf.

A spreadsheet for the component leak path method is available on the District's website under the *Fugitive Hydrocarbon Component Leakpath Method* bullet for *Santa Barbara County APCD Emission Calculation Spreadsheets* at: https://www.ourair.org/eng/tech/. Additional direction on using the component leak path method is provided in the District's Policy & Procedure No. 6100.061.2016, *Determination of Fugitive Hydrocarbon Emissions at Oil and Gas Facilities Through the Use of Facility Component Leak Path Counts - Modified for Revised ROC Definition* available at: https://www.ourair.org/wp-content/uploads/6100-061-1.pdf.

For fugitive components in heavy liquid service, use CARB's *Identification of Volatile Organic Compound Species Profiles* profile number 756, *Oil & Gas Production Fugitives – Liquid Service*. For fugitive components in gas or light liquid service, use CARB's profile number 757, *Oil & Gas Production Fugitives – Gas Service*.

Calculate the average annual and maximum hourly emissions for each TAC using the equations below.

Average Annual Emissions:

$$Em_{C\ Annual} = \frac{ROC_{Annual} * Wt_{lb\ C/lb\ TOG}}{FROG} \qquad \text{(Eq. 43)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
ROC_{Annual} = Annual ROC emissions from fugitive components (lb ROC/yr)
$Wt_{lb\ C/lb\ TOG}$ = Weight fraction of pollutant C (lb C/lb TOG)
$FROG$ = Fraction Reactive Organic Compound factor (lb ROC/lb TOG)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{Em_{C\ Annual}}{8760} \qquad \text{(Eq. 44)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
8760 = Number of hours in a year (8760 hr = 1 yr)

5.2 Tanks

The District calculates ROC emissions from tanks in accordance with AP-42 November 2006 Edition of Chapter 7.1, *Organic Liquid Storage Tanks*; a link is provided in in the References section of this document. A spreadsheet for fixed roof tank calculations is available on the District's website under the *Fixed Roof Tanks* bullet for *Santa Barbara County APCD Emission Calculation Spreadsheets* at: https://www.ourair.org/eng/tech/.

The TAC weight fractions are based on the contents of the tank. The default weight fractions for crude oil are from CARB's *Identification of Volatile Organic Compound Species Profiles* profile number 297, *Crude Oil Evaporation – Vapor Composite from Fixed Roof Tanks*.

Calculate the average annual and maximum hourly emissions for each TAC using the equations below.

Average Annual Emissions:

$$Em_{C\ Annual} = \frac{ROC_{Annual} * Wt_{lb\ C/lb\ TOG}}{FROG} \qquad \text{(Eq. 45)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
ROC_{Annual} = Annual ROC emissions from tank (lb ROC/yr)
$Wt_{lb\ C/lb\ TOG}$ = Weight fraction of pollutant C (lb C/lb TOG)
$FROG$ = Fraction Reactive Organic Compound factor (lb ROC/lb TOG)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{Em_{C\ Annual}}{8760} \qquad \text{(Eq. 46)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
8760 = Number of hours in a year (8760 hr = 1 yr)

5.3 Sumps, Pits, Well Cellars and Wastewater Tanks

Sumps, pits, well cellars and wastewater tanks are considered continuous processes and release TAC emissions throughout the year based on the surface area. The District calculates ROC emissions from sumps, pits, well cellars and wastewater tanks in accordance with the CARB/KVB Method. A spreadsheet for the ROC emission calculations is available on the District's website under the *CARB/KVB Fugitive Hydrocarbons* bullet for *Santa Barbara County APCD Emission Calculation Spreadsheets* at: https://www.ourair.org/eng/tech/. Additional direction on using CARB/KVB method is provided in the District's Policy & Procedure No. 6100.060.2016, *Calculation of Fugitive Hydrocarbon Emissions at Oil and Gas Facilities by the CARB/KVB Method - Modified for the Revised ROC Definition* available at: https://www.ourair.org/wp-content/uploads/6100-060-1.pdf.

The weight fractions for sumps, pits, well cellars and wastewater tanks are from CARB's *Identification of Volatile Organic Compound Species Profiles* profile number 532, *Oil & Gas Extraction – Well Heads & Cellars/Oil&Water Separators*.

Calculate the average annual and maximum hourly emissions for each TAC using the equations below.

Average Annual Emissions:

$$Em_{C\ Annual} = \frac{EF_{lb\ ROC/ft^2-day} * 365 * SA}{FROG} * (1 - CE) * Wt_{lb\ C/lb\ TOG} \quad \text{(Eq. 47)}$$

C	= A specific pollutant
$Em_{C\ Annual}$	= Average annual emissions of pollutant C (lb C/yr)
$EF_{lb\ ROC\ /ft^2-day}$	= ROC emission factor (lb ROC/ft^2-day)
365	= Conversion factor (365 days = 1 yr)
SA	= Surface area of the equipment (ft^2)
$FROG$	= Fraction Reactive Organic Compound factor (lb ROC/lb TOG)
CE	= Control efficiency of the unit
$Wt_{lb\ C/lb\ TOG}$	= Weight fraction of pollutant C (lb C/lb TOG)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{Em_{C\ Annual}}{8760} \quad \text{(Eq. 48)}$$

C	= A specific pollutant
$Em_{C\ Hourly}$	= Maximum hourly emissions of pollutant C (lb C/hr)
$Em_{C\ Annual}$	= Average annual emissions of pollutant C (lb C/yr)
8760	= Number of hours in a year (8760 hr = 1 yr)

5.4 Pigging Equipment

Pigging equipment is used in pipelines for cleaning or for the purpose of leak prevention. TACs from pigging are emitted during the launching or receiving of the pigging equipment. For pigs in an oil pipeline, use CARB's *Identification of Volatile Organic Compound Species Profiles* profile number 756, *Oil & Gas Production Fugitives – Liquid Service*. For pigs in a gas pipeline, use CARB's profile number 757, *Oil & Gas Production Fugitives – Gas Service*.

Calculate the average annual and maximum hourly TAC emissions using the equations below.

TOG Emission Factor:

$$EF_{lb\ TOG/Event} = \frac{P * MW}{R * T} \quad \text{(Eq. 49)}$$

$EF_{lb\ TOG/Event}$	= TOG emission factor per pigging event-volume (lb TOG/acf-event)
P	= Pressure of vessel (psi)
MW	= Molecular weight of vapor in vessel (lb TOG/lb-mol TOG)
R	= Universal gas constant $= 10.73\ \frac{psi\ acf}{°R\ lb-mol}$
T	= Temperature of remaining vapor in vessel (°R)

Average Annual Emissions:

$$Em_{C\ Annual} = EF_{lb\ TOG/Event} * PE * Vol_{Pig} * Wt_{lb\ C/lb\ TOG} \quad \text{(Eq. 50)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
$EF_{lb\ TOG/Event}$ = TOG emission factor per pigging event (lb TOG/acf-event)
PE = Number of pigging events per year
Vol_{Pig} = Volume of pig (acf)
$Wt_{lb\ C/lb\ TOG}$ = Weight fraction of pollutant C (lb C/lb TOG)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = EF_{lb\ TOG/Event} * Vol_{Pig} * Wt_{lb\ C/lb\ TOG} \quad \text{(Eq. 51)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/yr)
$EF_{lb\ TOG/Event}$ = TOG emission factor per pigging event (lb TOG/acf-event); Assume 1 pigging event/hr
Vol_{Pig} = Volume of pig (acf)
$Wt_{lb\ C/lb\ TOG}$ = Weight fraction of pollutant C (lb C/lb TOG)

5.5 Loading Racks

The District calculates ROC emissions from loading racks in accordance with AP-42 Chapter 5.2, *Transportation And Marketing Of Petroleum Liquids*; a link is provided in the References section of this document. A spreadsheet for loading rack calculations is available on the District's website under the *Loading Rack* bullet for *Santa Barbara County APCD Emission Calculation Spreadsheets* at: https://www.ourair.org/eng/tech/.

The TAC weight fractions are based on the product being loaded. The default weight fractions for crude oil are from CARB's *Identification of Volatile Organic Compound Species Profiles* profile number 756, *Oil & Gas Production Fugitives – Liquid Service*. Sampling analysis are required for liquefied petroleum gas (LPG), natural gas liquids (NGL) and diluent, as no default weight fractions are available.

Calculate the average annual and maximum hourly emissions for each TAC using the equations below.

Average Annual Emissions:

$$Em_{C\ Annual} = \frac{EF_{lbs\ ROC/load} * NL * Wt_{lb\ C/lb\ TOG}}{FROG} \quad \text{(Eq. 52)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
$EF_{lbs\ ROC\ /\ load}$ = Emission factor (lb ROC/load); from permit or loading rack spreadsheet
NL = Number of loading events per year
$Wt_{lb\ C/lb\ TOG}$ = Weight fraction of pollutant C (lb C/lb TOG)
$FROG$ = Fraction Reactive Organic Compound factor (lb ROC/lb TOG)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{EF_{lbs\ ROC/load} * Wt_{lb\ C/lb\ TOG}}{FROG} \qquad \text{(Eq. 53)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$EF_{lbs\ ROC\ /\ load}$ = Emission factor (lb ROC/load); Assume 1 load/hr
$Wt_{lb\ C/lb\ TOG}$ = Weight fraction of pollutant C (lb C/lb TOG)
$FROG$ = Fraction Reactive Organic Compound factor (lb ROC/lb TOG)

6.0 Minerals Industry Emissions and Miscellaneous Fugitive Dust

The following sub-sections address TAC emission calculations for minerals industry processes and miscellaneous fugitive dust sources.

6.1 Concrete Batch Plants and Aggregate Materials

Particulate matter is emitted from storage piles, conveyors, loading operations, weigh batchers, silos, storage in hoppers and bins, crushing, screening, transfer points, and trucks driving on haul roads (See Section 6.2 for haul roads). The District calculates particulate matter emissions for concrete batch plants (CBPs) in accordance with AP-42 Chapter 11.12, *Concrete Batching* (June 2006); a link is provided in the References section of this document. The District calculates particulate matter emissions for crushing, screening and transfer of aggregate materials in accordance with AP-42 Chapters 11.19.1, *Sand & Gravel Processing*, and 11.19.2, *Crushed Stone Processing and Pulverized Mineral Processing*; links are provided in the References section of this document. The District calculates particulate matter emissions for aggregate storage piles in accordance with Section G of Mojave Desert Air Quality Management District's and Antelope Valley Air Pollution Control District's *Emissions Inventory Guidance Mineral Handling and Processing Industries* document.

Default weight fractions for storage silos at CBPs are located in the *Minerals* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. The crystalline silica (respirable) emission factors are from SDCAPCD's *C01 - Concrete Batch Plant, Transit Mix Operation, Section 11.12 AP-42 (1/95) W/ Baghouse Controls*. The remaining weight fractions for the cement storage silo are from SDCAPCD's *S01 - Cement Storage Silo, Pneumatic Loading, Section 11.12 AP-42 (1/95), w/ Vent Sock Controls*. The remaining weight fractions for the fly ash storage silo are from SDCAPCD's *S03 - Fly Ash Storage Silo, Pneumatic Loading, Section 11.12 AP-42 (1/95), w/ Vent Sock Controls*. Links for the CBP storage silos emission factor documents are provided in the References section of this document.

Default weight fractions for the remaining CBP device types are located in the *Minerals* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. With the exception of the crystalline silica (respirable) emission factors for aggregate transfer and storage, the weight fractions for CBPs are from CARB's *PM Size and Chemical Speciation Profile for Concrete Batching—PM3431*, supplemented with SDCAPCD's *C01 - Concrete Batch Plant, Transit Mix Operation, Section 11.12 AP-42 (1/95) W/ Baghouse Controls*. The weight fractions of crystalline silica (respirable) for aggregate transfer and storage are from the 2009 article titled *PM4 Crystalline Silica Emission Factors and Ambient Concentrations at Aggregate-Producing Sources in California*. Links for all CBP emission factor documents are provided in the References section of this document.

Default weight fractions for aggregate materials are located in the *Minerals* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. The weight fractions for crushing, screening, and transfer of aggregate materials for all pollutants except crystalline silica (respirable) are identical and are from three of SDCAPCD's webpages: *C01 - Primary Crushing, Primary Material, Uncontrolled*; *S01 - Screening Operation, Process Material, Dry, Uncontrolled, AWR / MPI / District 4/9/96 Methodology* and *T01 - Transfer Point, Process Material, Dry, Uncontrolled, AWR / MPI / District 4/9/96 Methodology*. The weight fractions for aggregate storage piles for all pollutants except crystalline silica (respirable) are from SDCAPCD's *O01 - Open Material Storage Areas, General, District Engineering Estimate, Includes 'Natural Moisture Content of Soils'* emission factor table. The weight fractions of crystalline silica (respirable) for aggregate crushing, screening, transfer and storage are from the 2009 article titled *PM4 Crystalline Silica Emission Factors and Ambient Concentrations at Aggregate-Producing Sources in California*. Links for all aggregate materials emission factor documents are provided in the References section of this document.

Calculate the average annual and maximum hourly TAC emissions using the equations below.

Average Annual Emissions:

$$Em_{C\ Annual} = Em_{PM\ Annual} * Wt_{lb\ C/lb\ PM} \qquad \text{(Eq. 54)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
$Em_{PM\ Annual}$ = Annual emissions of Total Particulate Matter (lb PM/yr)
$Wt_{lb\ C/lb\ PM}$ = Weight fraction of pollutant C (lb C/lb PM)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{Em_{PM\ Daily}}{H_{Day}} * Wt_{lb\ C/lb\ PM} \qquad \text{(Eq. 55)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$Em_{PM\ Daily}$ = Maximum daily emissions of Total Particulate Matter (lb PM/day)
H_{Day} = Hours operated per day (hr/day)
$Wt_{lb\ C/lb\ PM}$ = Weight fraction of pollutant C (lb C/lb PM)

6.2 Haul Roads and Roadways

The District recommends that particulate matter emissions for on-site haul roads are calculated in accordance with AP-42 Chapters 13.2.1, *Paved Roads*, and 13.2.2, *Unpaved Roads*. The District will allow the use of a control efficiency for sweeping or watering paved roads if the silt loading is measured before and after application of controls in accordance with AP-42 Appendices C.1 and C.2 and a District-approved sampling plan/source test plan. For unpaved roads, the District will allow the use of a control efficiency for watering if the moisture content and the silt content are measured in accordance with AP-42 Appendices C.1 and C.2 and a District-approved sampling plan/source test plan; contact the District for sampling requirements. In addition, watering records must be submitted if using a control efficiency for watering paved or unpaved roads. For off-site travel, the District accepts the AP-42 methodology or the methodology outlined in CARB's *Miscellaneous Process Methodology 7.9: Entrained Road Travel, Paved Road Dust*; a link is provided in the References section of this document.

TAC emissions are calculated based on the total particulate matter (PM) emissions with the TAC weight fractions. The weight fractions for mineral operation haul roads are from SDCAPCD's *R03 - Haul Roads, Mineral Industry Sites, Paved & Unpaved, Default Trace Metal Composition* table. The weight fractions for general unpaved and paved roadway dust are from CARB's *Speciation Profiles Used in ARB Modeling* (Profiles #470 and #471, respectively), supplemented with SDCAPCD's *R03 - Haul Roads, Mineral Industry Sites, Paved & Unpaved, Default Trace Metal Composition* table for crystalline silica. Links for all roadway dust emission factor documents are provided in the References section of this document.

6.3 Landfill Dust

Active landfills conduct many activities that produce particulate emissions, including, but not limited to: cover material quarrying, soil screening, rock crushing, open cover material storage piles, haul roads, solid waste compaction, wind erosion, cover application, composting, and green waste recycling. AP-42, Section 11.9, Western Surface Coal Mining, Table 11.9-1 / Table 11.9-4 and AP-42, Section 13.2.3, Heavy Construction Operations, Table 13.2.3-1 should be used for earthmoving equipment and construction, including, but not limited to, bulldozing (overburden), compacting, scrapers unloading topsoil, scrapers removing topsoil, drilling, overburden replacement, bottom dump truck unloading (overburden), batch scraper unloading (topsoil), and grading. AP-42, Section 13.2.4, Aggregate Handling and Storage Piles, Equation 1 should be used for storage piles, municipal solid waste handling, unloading topsoil and overburden. The District will allow the use of a control efficiency for watering if the moisture content and the silt content (if needed) are measured in accordance with AP-42 Appendices C.1 and C.2 and a District-approved sampling plan/source test plan; contact the District for sampling requirements. In addition, watering records must be submitted. For equations with moisture content in the equation, a reduction in emissions due to watering is accounted for by sampling the moisture content (i.e., no additional control efficiency is applied) in accordance with AP-42 Appendices C.1 and C.2 and a District-approved sampling plan/source test plan; contact the District for sampling requirements. Particulate emissions from inactive landfills are usually limited to short term cover maintenance projects. The weight fractions for landfill dust from on-site haul roads is the same as for other onsite landfill dust and is from CARB's *Speciation Profiles Used in ARB Modeling* (Profile #421), supplemented with SDCAPCD's *N02 - Landfill Gas Default Composition (No Co-Disposal)* table for crystalline silica. Links for all landfill dust emission factor documents are provided in the References section of this document.

Calculate the average annual and maximum hourly TAC emissions using the equations below.

Average Annual Emissions:

$$Em_{C\ Annual} = Em_{PM\ Annual} * Wt_{lb\ C/lb\ PM} \qquad \text{(Eq. 56)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
$Em_{PM\ Annual}$ = Annual emissions of Total Particulate Matter (lb PM/yr)
$Wt_{lb\ C/lb\ PM}$ = Weight fraction of pollutant C (lb C/lb PM)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = Em_{PM\ Hourly} * Wt_{lb\ C/lb\ PM} \qquad \text{(Eq. 57)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)

$Em_{PM\ Hourly}$ = Maximum hourly emissions of Total Particulate Matter (lb PM/hr)
$Wt_{lb\ C/lb\ PM}$ = Weight fraction of pollutant C (lb C/lb PM)

6.4 Hot Mix Asphalt Plants

Default emission factors for hot mix asphalt plants are located in the *Minerals* tab of the spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*. Sections 6.4.1 and 6.4.2 describe how the emissions are calculated for dryers at batch mix and drum mix plants, load-out, yard, silo filling and asphalt storage tanks. Emission factors for hot oil systems are not included in the District's spreadsheet because the TAC emissions are already included in the emission factors for external combustion. The emission factors for aggregate screening, aggregate transfer and haul roads at hot mix asphalt plants are the same as the aggregate material emission factors discussed in Section 6.1.

6.4.1 Dryers at Batch Mix and Drum Mix Plants

The emission factors for dryers at batch mix plants are from AP-42 Table 11.1-9. *Emission Factors for Organic Pollutant Emissions from Batch Mix Hot Mix Asphalt Plants* and Table 11.1-11. *Emission Factors for Metal Emissions from Batch Mix Hot Mix Asphalt Plants*; links are provided in the References section of this document. The emission factors for dryers at drum mix plants are from AP-42 Table 11.1-10. *Emission Factors for Organic Pollutant Emissions from Drum Mix Hot Mix Asphalt Plants* and Table 11.1-12. *Emission Factors for Metal Emission from Drum Mix Hot Mix Asphalt Plants*; links are provided in the References section of this document.

Calculate the average annual and maximum hourly TAC emissions using the equations below. Furthermore, refer to Section 3.1 for an explanation of how to calculate sulfur dioxide emissions from dryers.

Average Annual Emissions

$$Em_{C\ Annual} = AP_{Annual} * EF_{lb\ C/ton\ AP} \qquad \text{(Eq. 58)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
AP_{Annual} = Annual asphalt production (tons of asphalt produced/yr)
$EF_{lb\ C/ton\ AP}$ = Emission factor (lb C/ton of asphalt produced)

Maximum Hourly Emissions

$$Em_{C\ Hourly} = \frac{AP_{Daily}}{H_{Day}} * EF_{lb\ C/ton\ AP} \qquad \text{(Eq. 59)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
AP_{Daily} = Maximum daily asphalt production (tons of asphalt produced/day)
H_{Day} = Hours operated per day (hr/day)
$EF_{lb\ C/ton\ AP}$ = Emission factor (lb C/ton of asphalt produced)

6.4.2 Load-Out, Yard, Silo Filling and Asphalt Storage Tanks

The emission factors for load-out and silo filling at hot mix asphalt plants are from AP-42 Table 11.1-15. *Speciation Profiles for Load-Out, Silo Filling, and Asphalt Storage Emissions – Organic Particulate-*

Based Compounds and Table 11.1-16. *Speciation Profiles for Load-Out, Silo Filling, and Asphalt Storage Emissions – Organic Volatile-Based Compounds*; links are provided in the References section of this document. These emission factors are in units of lb/lb-Total Organic Compound (TOC), except for phenol and the speciated polycyclic aromatic hydrocarbons (PAHs), which are in units of lb/lb organic PM. Calculate the emissions of TOC and organic PM for load-out and silo filling in accordance with AP-42 Table 11.1-14. *Predictive Emission Factor Equations for Load-Out and Silo Filling Operations*.

The emission factors for yard emissions (fugitive emissions from loaded trucks sitting in yard immediately following load-out) and asphalt storage tanks at hot mix asphalt plants are from AP-42 Table 11.1-16. *Speciation Profiles for Load-Out, Silo Filling, and Asphalt Storage Emissions – Organic Volatile-Based Compounds.* These emission factors are in units of lb/lb-TOC. The TOC emission factor for yard emissions is 0.0011 lb/ton of asphalt loaded, from AP-42 Chapter 11.1.2.5 *Fugitive Emissions from Production Operations*. EPA's December 2000 *Hot Mix Asphalt Plants Emission Assessment Report* (HMA Plants EA Report) shows that there is no organic PM (i.e., no phenol or PAHs) in the yard emissions. For that reason, AP-42 Table 11.1-15 should not be used to calculate yard emissions of phenol or PAHs. Calculate TOC emissions from asphalt storage tanks in accordance with AP-42 November 2006 Edition of Chapter 7.1, *Organic Liquid Storage Tanks*, as described in AP-42 Chapter 11.1.2.5, *Fugitive Emissions from Production Operations*. Do not use Table 11.1-15 to calculate emissions of phenol or PAHs from the asphalt storage tanks, as these are combustion emissions from the oil heater, as noted in Footnote "a" from Table 7 and Footnote "a" from Table 11 of EPA's HMA Plants EA Report. Furthermore, the formaldehyde emission factor in Table 11.1-16 should not be used for asphalt storage tanks, as almost all of the formaldehyde emissions in this table are from the oil heater, as noted in footnote "a" from Table 7 and footnote "a" from Table 11 of EPA's HMA Plants EA Report. The TAC emissions from the oil heater are included in the emission factors for external combustion.

Calculate the average annual and maximum hourly TAC emissions for pollutants that are not phenol or PAHs using the equations below.

Average Annual Emissions:

$$Em_{C\ Annual} = Em_{TOC\ Annual} * Wt_{lb\ C/lb\ TOC} \qquad \text{(Eq. 60)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
$Em_{TOC\ Annual}$ = Annual emissions of Total Organic Compounds (lb TOC/yr)
$Wt_{lb\ C/lb\ TOC}$ = Weight fraction of pollutant C (lb C/lb TOC)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{Em_{TOC\ Daily}}{H_{Day}} * Wt_{lb\ C/lb\ TOC} \qquad \text{(Eq. 61)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$Em_{TOC\ Daily}$ = Maximum daily emissions of Total Organic Compounds (lb TOC/day)
H_{Day} = Hours operated per day (hr/day)
$Wt_{lb\ C/lb\ TOC}$ = Weight fraction of pollutant C (lb C/lb TOC)

Calculate the average annual and maximum hourly TAC emissions for phenol and speciated PAHs from load-out and silo filling using the equations below.

Average Annual Emissions:

$$Em_{C\ Annual} = Em_{Organic\ PM\ Annual} * Wt_{lb\ C/lb\ Organic\ PM} \quad \text{(Eq. 62)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
$Em_{Organic\ PM\ Annual}$ = Annual emissions Organic Particulate Matter (lb Organic PM/yr)
$Wt_{lb\ C/lb\ Organic\ PM}$ = Weight fraction of pollutant C (lb C/lb PM)

Maximum Hourly Emissions:

$$Em_{C\ Hourly} = \frac{Em_{Organic\ PM\ Daily}}{H_{Day}} * Wt_{lb\ C/lb\ Organic\ PM} \quad \text{(Eq. 63)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/hr)
$Em_{Organic\ PM\ Daily}$ = Maximum daily emissions of Organic Particulate Matter (lb Organic PM/day)
H_{Day} = Hours operated per day (hr/day)
$Wt_{lb\ C/lb\ Organic\ PM}$ = Weight fraction of pollutant C (lb C/lb Organic PM)

7.0 Gasoline Dispensing Facilities

Gasoline dispensing facilities, including standard commercial gas stations as well as fueling stations used exclusively for onsite vehicles within a stationary source, emit TACs. The toxic weight percentages within ROC for gasoline liquid and vapor were determined by the California Air Resources Board and California Air Pollution Control Officers Association in their *Gasoline Service Station Industrywide Risk Assessment Technical Guidance* document, noted in the References section of this document. The compiled values differ for the annual and maximum hourly emission calculations due to variations in winter and summer fuels, as well as the exclusion of pollutants with no acute RELs from the table for maximum hourly emission calculations. For that reason, the toxic weight percentages are listed in Tables 7.1 and 7.2 below rather than in the District's associated spreadsheet, *SBCAPCD-Approved TAC Emission Factors.xlsx*.

Table 7.1 – Toxic Weight Percentages in Gasoline for Annual Emission Calculations

Toxic Substance	Substance Weight Percentage in Liquid	Substance Weight Percentage in Vapor
Benzene	0.707	0.457
Ethyl Benzene	1.29	0.107
n-Hexane	1.86	1.82
Naphthalene	0.174	0.000445
Propylene	0.000122	0.003594
Toluene	5.63	1.11
Xylenes	6.59	0.409

Table 7.2 – Toxic Weight Percentages in Gasoline for Maximum Hourly Emission Calculations

Toxic Substance	Substance Weight Percentage in Liquid	Substance Weight Percentage in Vapor
Benzene	0.702	0.549
Toluene	5.80	1.35
Xylenes	6.91	0.509

ROC emissions from gasoline dispensing facilities are quantified for five different processes: loading, breathing, refueling, spillage and hose permeation. The ROC emission factors for each process vary depending on the type of enhanced vapor recovery (EVR) and fueling hose systems present at the facility. Use the methodology detailed in Attachment A of the District's *Gasoline Station Health Risk Assessment Application Form -25T*, noted in the References section of this document, to calculate ROC emissions from gasoline dispensing facilities.

Calculate the average annual and maximum hourly TAC emissions using the equations below.

Average Annual Emissions (from each process):

$$Em_{C\ Annual} = \frac{Em_{ROC\ Annual} * Wt_{lb\ C/lb\ ROC}}{100} \qquad \text{(Eq. 64)}$$

C = A specific pollutant
$Em_{C\ Annual}$ = Average annual emissions of pollutant C (lb C/yr)
$Em_{ROC\ Annual}$ = Annual emissions of Reactive Organic Compounds (lb ROC/yr)
$Wt_{lb\ C/lb\ ROC}$ = Weight percentage of pollutant C (lb C/100 lb ROC) from Table 7.1
100 = Conversion factor for weight percentage

Maximum Hourly Emissions (from each process):

$$Em_{C\ Hourly} = \frac{Em_{ROC\ Hourly} * Wt_{lb\ C/lb\ ROC}}{100} \qquad \text{(Eq. 65)}$$

C = A specific pollutant
$Em_{C\ Hourly}$ = Maximum hourly emissions of pollutant C (lb C/yr)
$Em_{ROC\ Hourly}$ = Hourly emissions of Reactive Organic Compounds (lb ROC/hr)
$Wt_{lb\ C/lb\ ROC}$ = Weight percentage of pollutant C (lb C/100 lb ROC) from Table 7.2
100 = Conversion factor for weight percentage

8.0 References

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