Guidelines for Calculating Toxic Air Contaminants (TACs) Emissions

AB 2588 Air Toxics “Hot Spots” Program

August 2019

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1. Introduction

This document provides emission factors approved by the Monterey Bay Air Resources District (MBARD) for calculating emissions of toxic air contaminants (TACs) for health risk assessments (HRAs). Each equipment section of this document includes an equation to calculate annual, average annual, and maximum hourly emissions using the approved emission factors. For any method or emission factor not listed in this document, contact MBARD's Engineering Division for approval. When available, use site-specific emission factors from MBARD-approved source tests. All references in this document are numbered in parenthesis; links are available in the References section.

MBARD does not currently have an approved list of TAC emission factors for all source types. However, MBARD accepts the following approved TAC emission calculation methodologies and/or emission factors for other various source types:

- Site-specific emission factors from MBARD approved source tests;
- Continuous emissions monitoring systems;
- Manufacturer-guaranteed emission factors;
- Mass balance site-specific generated emission factors;
- San Joaquin Valley Air Pollution Control District AB 2588 "Hot Spots" Air Toxic Profiles (1);
- United States of Environmental Protection Agency AP-42: Compilation of Air Emission Factors (2); and
- Other representative emission factors and approved methods from such sources as CARB and other local air districts.

AB 2588 Air Toxics "Hot Spots" Program HRA

HRAs performed under AB 2588 are based on an inventory year. Thus, 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 AB 2588 "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." (3)

2. Unpermitted Sources

According to CARB's *AB 2588 "Hot Spots" Frequently Asked Question* (November 2006), "If the facility is subject to "Hot Spots", it does not matter if the equipment is permitted. All sources subject to the regulation must be included in the emission inventory." (4) Thus, if you have equipment/sources that are exempt from permit requirements under District Rule 201 *Sources Not Requiring Permits*, it will need to be reported for AB 2588 purposes. Typical sources that are unpermitted that need to be reported under AB 2588 are, but not limited to:

- Engines less than 50 horsepower;
- Boilers less than 2 Million British Thermal Units per hour (MMBTU/hr) when fired with natural gas or liquefied petroleum gas;
- Boilers less than 250,000 British Thermal Units per hour (BTU/hr) when fired on any other fuel that is not natural gas or liquefied petroleum gas; and,
- Diesel storage tanks;

If you are still unsure on what equipment/sources need to reported, please feel free to contact the District at 831-647-9411.

3. 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. If you do not have equipment-specific hourly operating records, please use the following default equation to calculate the maximum and average annual hourly emissions:

$$Average\ Annual\ Hourly\ Emissions\ \left(\frac{lb}{hr}\right) = \frac{Annual\ Emissions\ \left(\frac{lb}{yr}\right)}{8760\ hr/yr} \quad (1)$$

$$Max\ Hour\ Emissions\ \left(\frac{lb}{hr}\right) = Annual\ Emissions\ \left(\frac{lb}{yr}\right) \div 4\ \left(\frac{hr}{day}\right) \div 245\ \left(\frac{day}{yr}\right) \quad (2)$$

Natural Gas, and Digester Gas Fueled Internal Combustion Engines

The San Joaquin Valley Air Pollution Control District (SJVAPCD) AB 2588 "Hot Spots" Air Toxics Profiles #49, 130, 159 - 161, and 239 - 240 are the preferred toxic emission factors for natural gas and digester gas fired internal combustion engines (ICEs).

Calculate the annual emissions for each TAC using the equation below, and use equations 1 and 2 above to calculate the average and maximum hourly emissions for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = PR * EF_{LS} \quad (3)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual engine fuel usage (MMSCF/yr)
EF_{LS} = Emission factor for listed substance (lb/MMSCF)

Landfill Gas Fueled Internal Combustion Engines

The preferred toxic emission factors for landfill gas ICEs can be found from SJVAPCD approved toxic emission factor for *Landfill Gas-Fired Internal Combustion Engine*, which can be obtained from the following link - http://www.valleyair.org/busind/pto/emission_factors/Criteria/Toxics/Internal%20Combustion/LandfillGasICEngine.xls

Calculate the annual emissions for each TAC using the equation below, and use equations 1 and 2 above to calculate the average and maximum hourly emissions for each TAC. Due to variation of heat content in landfill

gas, no default values are available. For that reason, a site-specific higher heating value (HHV) value is required for landfill gas.

Annual Emissions:

$$E_{Annual\ LS} = PR * EF_{LS}*\text{HHV} \quad (4)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual engine fuel usage (MMSCF/yr)
EF_{LS} = Emission factor for listed substance (lb/MMBTU)
HHV = Fuel higher heating value (Btu/scf); obtained from the most recent source test data

Natural Gas, Propane, and Digester Gas Fueled Turbines

SJVAPCD toxic profiles #130, 162, and 163 are the preferred toxic emissions factors for natural gas and digester gas turbines.

Calculate the annual and maximum hourly emissions for each TAC using the equations below and use equation 1 above to calculate the average hourly emissions for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = PR * EF_{LS} \quad (5)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual engine fuel usage (MMSCF/yr)
EF_{LS} = Emission factor for listed substance (lb/MMSCF)

Maximum Hourly Emissions:

$$E_{Hourly\ LS} = \frac{Max_{capacity} * EF_{LS}}{HHV} \quad (6)$$

$E_{Hourly\ LS}$ = Hourly emissions of listed substance (lb/hr)
$Max_{capacity}$ = Maximum capacity of the unit (MMBtu/hr)
EF_{LS} = Emission factor for listed substance (lb/MMSCF)
HHV = Fuel higher heating value (Btu/scf); Natural gas default is 1020 Btu/scf; Digester gas default is 600 Btu/scf

Propane Fueled Turbines and Propane and Gasoline Fueled IC Engines.

SJVAPCD toxic profiles #108, 137, 154, 156, 158, 175, 176, and 177 are the preferred toxic emission factors for propane fueled turbines, and propane and gasoline fueled IC engines.

Calculate the annual and maximum hourly emissions for each TAC using the equation below, and use equations 1 and 2 above to calculate the average and maximum hourly emissions for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = \frac{PR * EF_{LS}}{1000} \quad (7)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual engine fuel usage (gal/yr)
EF_{LS} = Emission factor for listed substance (lb/kgal)
1000 = Conversion factor (1000 gal = kgal)

Diesel Internal Combustion Engines

In August 1998, CARB identified diesel particulate matter (PM) as a TAC, therefore the SJVAPCD toxic profile #136 is the preferred emission factor to calculate toxic emissions from diesel PM. In addition, the preferred emission factor to calculate the speciated organic compounds from diesel engines can be found in AP-42 Section 3.3 *Gasoline and Diesel Industrial Engines, Table 3.3.2* (5)

The equation for calculating the annual emissions for Diesel PM and speciated organic compounds from diesel engines is shown below. Use equations 1 and 2 to calculate the annual average and maximum hourly emissions for each TAC.

Annual Diesel PM Emissions:

$$E_{LS} = \frac{EF_{PM} * HP * PR * EF_{LS}}{454} \quad (8)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
EF_{PM} = PM Emission factor (g/bhp-hr); if unknown, please use the default emission factor listed in Table 1. If the engine was manufactured in or after 1996, it is highly recommended to use the EPA engine family name to determine the certified PM emission factor, if applicable.[1]
HP = Engine horsepower (HP)
PR = Annual engine operating hours (hr/yr)
EF_{LS} = Emission factor for listed substance (lb/lb-PM)
454 = Conversion factor (454 g = lb)

Table 1. Default PM Emission Factors (g/hp-hr)		
Horsepower	Model Year	PM
120 or less	all years	0.84
121 – 250	pre-1970	0.77
	1970 and newer	0.66
251 +	pre-1970	0.74
	1970 and newer	0.63

[1] Off-Road Compression-Ignition (Diesel) Engine Certification Database -https://ww3.arb.ca.gov/msprog/offroad/cert/cert.php

Annual Speciated Organic Compounds Emissions:

$$E_{LS} = \frac{PR * EF_{LS} * ESFC * HHV}{10^6} \quad (9)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual engine operating hours (hr/yr)
EF_{LS} = Emission factor of listed substance (lb/MMBtu)
ESFC = Engine specific fuel consumption (lb/hr)
HHV = Fuel higher heating value (Btu/lb); Diesel default is 19,300 Btu/lb
10^6 = Conversion factor (10^6 Btu = MMBtu)

4. External Combustion

The following section addresses TAC emission calculations for external combustion equipment, including boilers, flares, ovens, dyers, furnaces, heaters, and crematories.

Natural Gas, Digester Gas, & Landfill Gas Fueled External Combustion

The calculations used to determine the 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 emissions factors are discussed below in Sections "Boilers and Heaters" and "Flares." Emissions must be calculated based on the HHV of the fuel. For natural gas, use the default value of 1020 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, unless the District has approved a different value for use or site-specific value is available. Due to the variation of heat content in landfill gas, no default values are available. For that reason, a site-specific HHV is required for landfill gas.

Annual Emissions:

$$E_{Annual\ LS} = PR * EF_{LS} \quad (10)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual fuel usage (MMSCF/yr)
EF_{LS} = Emission factor for listed substance (lb/MMSCF)

Maximum Hourly Emissions:

$$E_{Hourly\ LS} = \frac{Max_{capacity} * EF_{LS}}{HHV} \quad (11)$$

$E_{Hourly\ LS}$ = Hourly emissions of listed substance (lb/hr)
$Max_{capacity}$ = Maximum capacity of the unit (MMBTU/hr)
EF_{LS} = Emission factor of listed substance (lb/MMSCF)
HHV = Fuel higher heating value (Btu/scf); Natural gas default is 1020 Btu/scf; Digester gas default is 600 Btu/scf

Boilers and Heaters

SJVAPCD Toxic Profiles #3, 6, 8, 134, 230, 234, 235, and 236 are the preferred toxic emission factors for natural gas, digester gas, and landfill gas boilers and heaters.

Use equations 10 and 11 to calculate the annual and maximum hourly TAC emissions, and equation 1 above to calculate the average annual hourly TAC emission for each TAC.

Flares

SJVAPCD Toxic Profiles #9 and 131 are the preferred toxic emission factors for natural gas and landfill gas flares.

Use equations 10 and 11 to calculate the annual and maximum hourly TAC emissions, and equation 1 above to calculate the average annual hourly TAC emission for each TAC.

Propane Fueled External Combustion

SJVAPCD Toxic Profiles #102 to 105 are the preferred toxic emission factors for propane fueled external combustions (e.g. boilers, heaters, and flares).

Calculate the annual and average annual and maximum hourly emissions for each TAC using the equations below. Use equation 1 above to calculate the annual average hourly TAC emissions for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = \frac{PR * EF_{LS}}{1000} \quad (12)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual engine fuel usage (gal/yr)
EF_{LS} = Emission factor for listed substance (lb/kgal)
1000 = Conversion factor (1000 gal = kgal)

Maximum Hourly Emissions:

$$E_{Hourly\ LS} = \frac{Max_{capacity} * EF_{LS} * 10^6}{1000 * HHV} \quad (13)$$

$E_{Hourly\ LS}$ = Hourly emissions of listed substance (lb/hr)
$Max_{capacity}$ = Maximum capacity of the unit (MMBTU/hr)
EF_{LS} = Emission factor of listed substance (lb/kgal)
10^6 = Conversion factor (BTU/MMBTU)
1000 = Conversion factor (1000 gal = kgal)
HHV = Fuel higher heating value (Btu/gal); Propane gas default is 91,500 Btu/gal

Diesel External Combustion

SJVAPCD Toxic Profile #2 is the preferred toxic emission factors for external combustion of diesel fuel.

Calculate the annual and maximum hourly emissions for each TAC using the equations below, and use equation 1 above to calculate the average annual hourly emission for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = \frac{PR * EF_{LS}}{1000} \quad (14)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual engine fuel usage (gal/yr)
EF_{LS} = Emission factor for listed substance (lb/kgal)
1000 = Conversion factor (1000 gal = kgal)

Maximum Hourly Emissions:

$$E_{Hourly\ LS} = \frac{FC * EF_{LS}}{1000} \quad (15)$$

$E_{Hourly\ LS}$ = Hourly emissions of listed substance (lb/hr)
FC = Equipment's fuel consumption at 100% load from manufacturer's specifications (gal/hr)
EF_{LS} = Emission factor of listed substance (lb/kgal)
1000 = Conversion factor (1000 gal = kgal)

Crematories

SJVAPCD Toxic Profiles #22 and 109 are the preferred toxic emission factors for crematories that combust human or animal remains.

Calculate the annual emissions for each TAC using the equation below, and use equations 1 and 2 above to calculate the annual average and maximum hourly TAC emissions for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = PR * EF_{LS} \quad (16)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual tons of material cremated (ton material/yr)
EF_{LS} = Emission factor for listed substance (lb/ton material)

5. 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 such as Material Safety Data Sheets (MSDS) must be provided to the District. If the MSDS shows a range for the TAC weight fractions, 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 annual and maximum hourly emissions for each TAC using the equations below, and use equation 1 above to calculate the average annual hourly TAC emissions for each TAC.

Uncontrolled Annual Emissions:

$$E_{Annual\ LS} = PR * \rho_{solv} * Wt_{solv} \quad (17)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual solvent usage (gal/yr)
ρ_{solv} = Density of solvent (lb/gal)
Wt_{solv} = Percent weight fraction of listed substance (% of solvent)

Controlled Annual Emissions

$$E_{Annual\ LS} = PR * \rho_{solv} * Wt_{solv} * (1\text{-CE}) \quad (18)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual solvent usage (gal/yr)
ρ_{solv} = Density of solvent (lb/gal)
Wt_{solv} = Percent weight fraction of listed substance (% of solvent)
CE = VOC control system efficiency (%);

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 both Scenario 1 and 2, it is assumed that the maximum hourly emissions are equal to daily emissions (i.e., daily solvent usage occurs in one hour).

Maximum Hourly Emissions for Scenario 1- If monthly records are kept:

$$E_{Hourly\ LS} = E_{Daily\ LS} = \frac{Solv_{Monthly} * \rho_{solv} * Wt_{solv}}{21.7} \quad (19)$$

$E_{Hourly\ LS}$ = Maximum hourly emissions of listed substance (lb/hr)
$E_{Daily\ LS}$ = Maximum daily emissions of listed substance (lb/day)
$Solv_{Monthly}$ = Maximum monthly solvent usage (gal/month)
ρ_{solv} = Density of solvent (lb/gal)
Wt_{solv} = Percent weight fraction of listed substance (% of solvent)
21.7 = Default operating days per month (day/month)

Maximum Hourly Emissions for Scenario 2- If daily records are kept:

$$E_{Hourly\ LS} = E_{Daily\ LS} = Solv_{Max\ Daily} * \rho_{solv} * Wt_{solv} \quad (20)$$

$E_{Hourly\ LS}$ = Maximum hourly emissions of listed substance (lb/hr)
$E_{Daily\ LS}$ = Maximum daily emissions of listed substance (lb/day)
$Solv_{Monthly}$ = Maximum daily solvent usage (gal/day)
ρ_{solv} = Density of solvent (lb/gal)
Wt_{solv} = Percent weight fraction of listed substance (% of solvent)

6. Oilfield Equipment

The following section addresses TAC emission calculation for sources most commonly found in oilfields such as oil heater treaters, steam generators, oilfield fugitive components, and oilfield tanks. For natural gas, use the default value of 1020 Btu/scf, 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, no default values are available. For that reason, use site-specific data for the process gas.

Heater Treaters

SJVAPCD Toxic Profile #238 is the preferred toxic emission factors for heater treaters that combust using natural gas fuel.

Calculate the annual and maximum hourly TAC emissions for each TAC using the equations below, and use equation 1 above to calculate the average annual hourly TAC emissions for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = PR * EF_{LS} \quad (21)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual fuel usage (MMSCF/yr)
EF_{LS} = Emission factor for listed substance (lb/MMSCF)

Maximum Hourly Emissions:

$$E_{Hourly\ LS} = \frac{Max_{capacity} * EF_{LS}}{HHV} \quad (22)$$

$E_{Hourly\ LS}$ = Hourly emissions of listed substance (lb/hr)
$Max_{capacity}$ = Maximum capacity of the unit (MMBTU/hr)
EF_{LS} = Emission factor of listed substance (lb/MMSCF)
HHV = Fuel higher heating value (Btu/scf); Natural gas default is 1020 Btu/scf

Steam Generators

The preferred toxic emission factors for steam generators can be found from SJVAPCD approved toxic emission factor for *Petroleum Steam Generators fueled by Natural Gas, Natural Gas and Casing Vapor Recovery Gas,*

Refinery Gas, or Oil, which can be obtained from the following link - http://www.valleyair.org/busind/pto/emission_factors/Criteria/Toxics/Oilfield/PetroleumSteamGenerators.xls

Calculate the annual and maximum hourly TAC emissions for each TAC using the equations below, and use equation 1 above to calculate the average annual hourly TAC emissions for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = PR * EF_{LS} \quad (23)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual fuel usage (MMSCF/yr)
EF_{LS} = Emission factor for listed substance (lb/MMSCF)

Maximum Hourly Emissions:

$$E_{Hourly\ LS} = \frac{Max_{capacity} * EF_{LS}}{HHV} \quad (24)$$

$E_{Hourly\ LS}$ = Hourly emissions of listed substance (lb/hr)
$Max_{capacity}$ = Maximum capacity of the unit (MMBTU/hr)
EF_{LS} = Emission factor of listed substance (lb/MMSCF)
HHV = Fuel higher heating value (Btu/scf); Natural gas default is 1020 Btu/scf; Use site-specific data for process gas

Fugitive Components

To calculate the ROC/VOC emissions from fugitive components, please use Santa Barbara County Air Pollution Control District's (SBCAPCD) spreadsheet for the component leak path method. The spreadsheet is available on the District's website under the *Fugitive Hydrocarbon Component Leakpath Method* bullet for *SBCAPCD Emission Calculation Spreadsheets* at: https://www.ourair.org/eng/tech/. Additional direction on using the component leak path method is provided in the SBCAPCD Policy and 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.

The TAC listed substances from oilfield fugitive components are based upon the SJVAPCD Toxic Profile #204.

Calculate the annual TAC emissions for each TAC using the equation below, and use equations 1 and 2 above to calculate the average annual and maximum hourly TAC emissions for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = ROC/VOC_{Annual} * EF_{LS} \quad (25)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)

ROC/VOC_{Annual} = Annual ROC/VOC emissions from fugitive components (lb VOC/yr)
EF_{LS} = Emission factor for listed substance (lb/lb VOC)

Oilfield Tank

The District calculates the VOC emissions from tanks in accordance with AP-42 Chapter 7.1, *Organic Liquid Storage Tanks* (5). The District uses the spreadsheet developed by SBAPCD to calculate the VOC emissions from fixed roof tanks. The spreadsheet is available on SBCAPCD's website under the *Fixed Roof Tanks* bullet for *SBAPCD Emission Calculation Spreadsheets* at: https://www.ourair.org/eng/tech/.

The TAC listed substances are based upon SJVAPCD Toxic Profile #259.

Calculate the annual TAC emissions for each TAC using the equation below, and use equations 1 and 2 above to calculate the average annual and maximum hourly TAC emissions for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = ROC/VOC_{Annual} * EF_{LS} \quad (26)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
ROC/VOC_{Annual} = Annual ROC/VOC emissions from fugitive components (lb VOC/yr)
EF_{LS} = Emission factor for listed substance (lb/lb VOC)

7. Mineral Industry Emissions

Aggregate Materials

Particulate matter (PM) is emitted from activities such as, crushing, screening, transfer points, and stockpiles. The District calculates PM emissions from aggregate plant operations in accordance with AP-42 Chapter 11.19.1, *Sand & Gravel Processing* (7), and 11.19.2, *Crushed Stone Processing and Pulverized Material Processing* (8). The District calculates PM emissions for stockpile drop points in accordance with equation 1 of AP-42 Chapter 13.2.4, *Aggregate Handling and Storage Piles* (9).

The TAC listed substances for crushing, screening, and transfer points are based upon SJVAPCD Toxic Profile #39, and the TAC listed substances for stockpile drop points are based upon SJVAPCD Toxic Profile #207.

Calculate the annual TAC emissions for each TAC using the equation below, and use equations 1 and 2 above to calculate the average annual and maximum hourly TAC emissions for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = PM_{Annual} * EF_{LS} \quad (27)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PM_{Annual} = Annual PM emissions (lb PM/yr)
EF_{LS} = Emission factor for listed substance (lb/lb PM)

Concrete Batch Plants

Particulate matter is emitted from storage piles, conveyors, loading operations, weight batchers, silos, and storage hoppers and bins. The District calculates particulate matter emissions for concrete batch plants (CBPs) in accordance with AP-42 Chapter 11.12, *Concrete Batching, June 2006* (10).

The TAC listed substances for CBPs operations from SJVAPCD approved toxic emission factor for *Concrete Batch Plant Operations, Cement Silos or Fly Ash Silos PM10 Emissions* can be obtained from the following link - http://www.valleyair.org/busind/pto/emission_factors/Criteria/Toxics/Asphalt%20Concrete%20Cement%20Fly%20Ash%20Minerals/Concrete%20Batch%20Plant.xls

Calculate the annual TAC emissions for each TAC using the equation below, and use equation 1 and 2 to calculate the average annual and maximum hourly TAC emissions for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = PM_{Annual} * EF_{LS} \quad (28)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PM_{Annual} = Annual CBPs PM emissions (lb PM/yr)
EF_{LS} = Emission factor for listed substance (lb/lb PM)

Hot Mix Asphalt Plants

The sections below describe how the emissions are calculated for dyers at batch mix and drum mix plants, load-out, yard, silo filling and asphalt storage tanks. In addition, the emission factors for aggregate screening and transfer at hot mix asphalts plants are the same as the aggregate material emission factors as discussed in Section *Aggregate Materials*.

Dryers at Batch Mix and Drum Mix Plants

The toxic emission factors for dryers at batch mix plants are from SJVAPCD Toxic Profile #167 *Asphalt Batch Plant Batch Mix HM NG or #2 Fuel Oil*. The toxic emission factors for dryers at drum mix plants fired using natural gas are from SJVAPCD Toxic Profile #169. The toxic emission factors for dryers at drum mix plants fired using hot mix fuel oil are from SJVAPCD Toxic Profile #170. The toxic emission factors for dryers at drum mix plants fired using waste oil are from SJVAPCD Toxic Profile #171.

Calculate the annual TAC emissions for each TAC using the equation below, and use equations 1 and 2 above to calculate the average annual and maximum hourly TAC emissions for each TAC.

Annual Emissions:

$$E_{Annual\ LS} = PR * EF_{LS} \quad (29)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
PR = Annual asphalt production (tons of asphalt produced/yr)
EF_{LS} = Emission factor for listed substance (lb/ton of asphalt produced)

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* (11) and Table 11.1-16. *Speciation Profiles for Load-Out, Silo Filling, and Asphalt Storage Emissions – Organic Volatile-Based Compounds* (11). These emission factors are in units of lb/lb-Total Organic Compound (TOC), except for 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* (11).

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* (11). 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 PAHs) in the yard emissions (12).

For that reason, AP-42 Table 11.1-15 should not be used to calculate PAHs from yard emissions. Calculate TOC emissions from asphalt storage tanks in accordance with AP-42 Chapter 7.1, *Organic Liquid Storage Tanks* (6), as described in AP-42 Chapter 11.1.2.5, *Fugitive Emissions from Production Operations* (11), of AP-42 Chapter 11.1, *Hot Mix Asphalt Plants* (11). Do not use Table 11.1-15 to calculate 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 annual TAC emissions for pollutants that are not PAHs using the equation below.

Annual Emissions:

$$E_{Annual\ LS} = TOC_{Annual} * Wt_{LS} \quad (30)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)
TOC_{annual} = Annual Total Organic Compounds emissions (lb TOC/yr)
Wt_{LS} = weight fraction of pollutant (lb/lb TOC)

Calculate the annual TAC emissions for speciated PAHs using the equation below.

Annual Emissions:

$$E_{Annual\ LS} = Organic\ PM_{Annual} * Wt_{LS} \quad (31)$$

$E_{Annual\ LS}$ = Annual emissions of listed substance (lb/yr)

Organic PM_{annual} = Annual Organic Particulate Matter emissions (lb Organic PM/yr)
Wt_{LS} = weight fraction of pollutant (lb/lb PM)

Lastly calculate the annual average and maximum hourly TAC emissions for each TAC using equations 1 and 2.

8. References

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