

### 3.4 PETROLEUM REFINERY FUGITIVE EMISSIONS

by M.K. Carol Lee  
February 15, 2007

#### Process Description

[EPA's Chapter 5.1 \(Petroleum Refining\)](#) of [AP-42](#) provides information regarding the petroleum refining industry.

Fugitive emissions from leaking process equipment and control systems include pumps, valves, compressors, and flanges. The emissions from these components should be identified and accounted for in the application for the proposed change or addition of new process equipment at the petroleum refinery.

Modifications, replacement, or addition of fugitive components (e.g., valves, flanges, pumps, compressors, relief valves, process drains) at existing permitted process units at petroleum refineries, chemical plants, bulk terminals or bulk plants are exempt from permitting requirements per [Regulation 2-1-128.21](#), provided that the cumulative emissions from all additional components installed a given process unit during any consecutive twelve month period do not exceed 10 pounds per day, and that the components meet applicable requirements in Regulation 8-18. However, even if the proposed change in fugitive components is exempt per [Regulation 2-1-128.21](#), an application for an "alteration" of the process unit is required, per Regulation [2-1-233](#) and [3-304](#).

Storage vessels, which contain hydrocarbon condensate, require a permit if the vessel is greater than 260 gallons in capacity, per [Regulation 2-1-123.1](#) and contain an organic layer which is greater than 1 weight percent VOC per [Regulation 2-1-123.6](#). The permitting of these storage tanks is covered in the permit handbook for [Organic Liquid Storage Tanks](#). However, the fugitive components that are added to route product from the refinery to and from the tank should be accounted for as described in the Emission Calculations section of this permit handbook.

#### Completeness Determination

The following District forms should be completed and fees provided for the petroleum refinery fugitive components. Use the [Completeness Determination Checklist](#) to verify completeness. Use the [Data Form Guidance](#) to ensure that the forms are completed correctly. Use the [Fee Calculation Guidance](#) to ensure that the fees are calculated accurately.

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. <a href="#">Form 101-B</a> (one for facility).</li> <li>2. <a href="#">Form G</a> (one per process vessel)</li> <li>3. Identification of the total number of components (pumps, valves, compressors, and flanges added to petroleum refinery).</li> <li>4. If process vessel or fugitive components are abated, <a href="#">Form A</a> (one per device).</li> <li>5. If Health Risk Screening is triggered, <a href="#">Form HRSA</a> (one per source).</li> <li>6. Fees, calculated per <a href="#">Regulation 3</a> Schedule G1 for alkylation units, asphalt oxidizers, benzene saturation, catalytic reforming,</li> </ol> | <p>chemical treating units, converting units, distillation units (1000 barrels/hour or less), hydrogen manufacturing, hydrotreating or hydrofining, isomerization, MTBE process units, sludge converters, solvent extraction, sour water stripping, and miscellaneous process units; Schedule G2 for stockpiles and wastewater treatment at petroleum refineries; and Schedule G3 for waste gas flares, cracking units, and distillation units greater than 1000 barrel/hour</p> |
|--|--|

#### Emission Calculations

##### FUGITIVE EMISSIONS

Sources of emissions are from the fugitive emissions from fugitive components, such as valves, flanges, connectors, flanges, and pumps. The emission factors proposed for this installation are the "uncontrolled" emission factors from the "[California Implementation Guidelines for Estimating Mass Emissions of Fugitive Hydrocarbon Leaks at Petroleum Facilities](#)" prepared by the California Air Pollution Control Officers Association Engineering Managers Committee (CAPCOA) and the California Air Resources Board (ARB). The Average Emission Factor Method (Method 1) of the [Guidelines](#) may be used as the emission factors for the fugitive components (see Table IV-1b).

TABLE IV-1b: 1995 EPA PROTOCOL MARKETING TERMINAL  
AVERAGE EMISSION FACTORS<sup>a</sup>

Component Type	Service Type	THC Emission Factor (kg/hr/source) <sup>b</sup>
Valves	Gas	1.3E-05
	Light liquid	4.3E-05
Pump seals	Gas	6.5E-05
	Light liquid	5.4E-04
Others (compressors and others) <sup>c</sup>	Gas	1.2E-04
	Light liquid	1.3E-04
Fittings (connectors and flanges) <sup>d</sup>	Gas	4.2E-05
	Light liquid	8.0E-06

Each of the five major refineries (Chevron, ConocoPhillips, Shell, Tesero, and Valero) in the Bay Area already have District-approved fugitive emission factors derived from the Correlation Equation Method (Method 3) of the [Guidelines](#), based on a comprehensive inspection program of the fugitive components at each of the refineries. When reviewing permits for these five refineries, the permit engineer should use the refinery’s District-approved refinery-specific fugitive emission factors.

The permit engineer should ensure that the permit application includes all new or changing fugitive components counts so that they can estimate emissions of the proposed change or new installation.

$$\begin{aligned} \text{Emissions (lb/hr)} &= \# \text{ of Components} \times \text{Emission Factor (kg/hr/source)} \times 2.2 \text{ lb/kg} \\ \text{Emissions (lb/day)} &= \text{Emissions lb/hr} \times 24 \text{ hr/day} \\ \text{Emissions (lb/yr)} &= \text{Emissions lb/day} \times 365 \text{ day/yr} \\ \text{Emissions (TPY)} &= \text{Emissions lb/yr} / 2000 \text{ lb/ton} \end{aligned}$$

The permit conditions will reiterate the number of fugitive components and require that upon startup a final count of the fugitive components be provided to the District. If there is an increase in the total fugitive component emissions, the plant’s cumulative emissions for the project shall be adjusted to reflect the difference between emissions based on predicted versus actual component counts (and additional offsets provided, if necessarily).

**Toxic Risk Screening:**

The permit engineer should request that the applicant provide a detailed breakdown of the components, which make up the gasoline. Generally, gasoline consists of the following compounds:

Toxic Pollutant	% by volume in gasoline	Risk Screening (lb/yr)
Benzene	up to 5%	6.7
Toluene	up to 35%	39000
Xylenes	up to 25%	58000
n-Hexane	up to 8%	83000
Naphthalene	up to 1.1%	270
Styrene	up to 4%	140000

Then, based on the total organic emissions estimated and the toxics components breakdown, the permit engineer should ensure that the emission calculations include the hourly and annual emission estimates for these TACs to determine whether an acute or chronic risk screening trigger level listed in [Table 2-5-1 of Regulation 2-5](#) is exceeded.

## **Applicable Requirements**

### District Rules and Regulations

Fugitive components at petroleum refineries are subject to [Regulation 8-18 \(Equipment Leaks\)](#). The permit engineer should review the application and ensure that the applicant has or will demonstrate compliance with the applicable emission standards and operating requirements.

### Best Available Control Technology (BACT)

The following are applicable BACT requirements for:

#### *Petroleum Refinery Fugitive Emissions*

- [Flare - Refinery](#)
- [Flanges](#)
- [Pressure Relief Valves, Emergency - Process Units](#)
- [Process Valves](#)
- [Pumps](#)
- [Compressors](#)

#### *Sulfur Recovery Plant*

- [Sulfur Recovery Plant](#)

Inform the [BACT Coordinator](#) of updates to the BACT/TBACT Workbook.

### NSPS

Fugitive components at petroleum refineries are subject to [NSPS Subpart GGG - Standards of Performance for Equipment Leaks of VOC in Petroleum Refineries](#), which requires compliance with the equipment leak standards of [NSPS Subpart VV - Standards of Performance for Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry](#). In general, District [Regulation 8-18](#) is more stringent than Subpart VV and GGG, and so compliance with [Regulation 8-18](#) is also compliance with Subparts [VV](#) and [GGG](#).

### California Environmental Quality Act (CEQA)

Permit applications which are reviewed following the specific procedures, fixed standards and objective measurements set forth in this chapter (3.4) are classified as ministerial and will accordingly be exempt from CEQA review per [Regulation 2-1-311](#).

In addition to the above-mentioned source-specific applicable requirements, other requirements may also be applicable depending on the facility, its application emissions, and its source location:

- |  |  |
|--|--|
| <input type="checkbox"/> Offsets                                 | <input type="checkbox"/> School Notification     |
| <input type="checkbox"/> Prevention of Significant Deterioration | <input type="checkbox"/> Risk Screening Analysis |

### **Permit Conditions**

Standardized conditions for petroleum refinery fugitive components are available from the [Permit Condition Guidance](#). Refer to the [Evaluation Report Template Guidance](#) to obtain the Microsoft Word formatted permit conditions for this source category.