air pollution control district
SANTA BARBARA COUNTY

# MEMORANDUM

TO: Michael F. Goldman
FROM: Robin Cobbs
SUBJECT: GDF Emission Factors for Phase I EVR and Phase II EVR
DATE: November 18, 2019
cc: Toxics Group

The District has updated our approved emission factors for gasoline dispensing facilities (GDF). In 2013, the California Air Resources Board (CARB) revised their recommended emission factors for GDFs and identified hose permeation as a new subcategory of emissions that must be quantified. In 2020, CARB will release screening tools to determine the risk from GDFs based on throughput and emission factors for each subcategory (loading, breathing, refueling, spillage, and hose permeation). To ensure that emissions are accurately quantified and those emissions are modeled in the most representative way possible, the District's approved emission factors were revised as follows: 1) Emission factors were added for hose permeation; and 2) the combined refueling and breathing emission factor was distributed for modeling purposes.

Table 1 contains the revised emission factors for GDFs with underground storage tanks and enhanced vapor recovery (EVR) for both Phase I and Phase II, while Table 2 shows the distribution of these factors for modeling purposes. The only change in Table 1 from the District's prior emission factors is the new hose permeation factors. In their December 23, 2013 *Revised Emission Factors for Gasoline Marketing Operations at California Gasoline Dispensing Facilities*, (CARB's 2013 GDF Emission Factors), CARB presented a hose permeation emission factor of 0.009 lb/1000 gallon for GDFs without controls, GDFs with vapor recovery (Pre-EVR) and GDFs with EVR. In lieu of using CARB's throughput-based hose permeation factor for all hose types, the District developed hose permeation emission factors based on the specific hose type and the number of hoses at a facility. The derivation of the District's hose permeation emission factors are documented in my November 18, 2019 memorandum to you regarding *Hose Permeation Emission Factors for Gasoline Dispensing Facilities*.

The loading, breathing, refueling and spillage emission factors for all other systems remain unchanged and are presented in Table 4 and Table 5 of this memo for completeness. In addition, the hose permeation factor from Table 3 must be included for those systems.

**Table 1. GDF ROC Emission Factors for Underground Tanks with Phase I EVR and Phase II EVR**

| Subcategory | ROC Emission Factor | Units | Reference |
|---|---|---|---|
| Loading | 0.150 | (lb/1000 gal) | Table 3-1 of CP-201 |
| Refueling with Breathing | 0.380 | (lb/1000 gal) | Table 4-1 of CP-201 |
| Spillage | 0.240 | (lb/1000 gal) | Table 4-1 of CP-201 |
| Hose Permeation – System Types: | | | SBCAPCD Internal Memo dated November 18, 2019 *Hose Permeation Emission Factors for Gasoline Dispensing Facilities* |
| Assist Controlled with EVR | 0.47<br>0.001 | (lb/year-per hose)<br>(lb/day-per hose) | |
| Balance | 3.74<br>0.010 | (lb/year-per hose)<br>(lb/day-per hose) | |

**REFUELING & BREATHING**

The District's prior EVR breathing emission factor was shown as zero because breathing emissions were included in the refueling emission factor. The District is retaining the combined refueling and breathing emission factor of 0.38 lb/1000 gal, as listed in Table 4-1 of CARB's CP-201 (April 23, 2015) which states that the "Phase II Emission Factor Includes: Refueling and Vent Emissions Pressure-Related Fugitives." However, for modeling purposes, the District distributed the emissions between breathing and refueling, as shown in Table 2. The District distributed 0.024 lb/1000 gal to the breathing process and the remaining 0.356 lb/1000 gal (i.e., 0.38 lb/1000 gal - 0.024 lb/1000 gal) to the refueling process. The District assigned 0.024 lb/1000 gal to the breathing process based on Table V-I, *Current and Revised TOG Pressure Driven Emission Factors for Gasoline Dispensing Facilities*, of CARB's 2013 GDF Emission Factors. CARB's 2013 GDF Emission Factors presents a lower combined value for breathing and refueling than the standards required by CP-201. However, the District is retaining the combined emission factor from CP-201 since the CP-201 emission standard was not reduced.

**Table 2. Distribution for HRA Modeling – GDF ROC Emission Factors for Underground Tanks with Phase I EVR and Phase II EVR**

| Subcategory | ROC Emission Factor | Units |
|---|---|---|
| Loading | 0.150 | (lb/1000 gal) |
| Breathing | 0.024 | (lb/1000 gal) |
| Refueling | 0.356 | (lb/1000 gal) |
| Spillage | 0.240 | (lb/1000 gal) |
| Hose Permeation – System Types: | | |
| Assist Controlled with EVR | 0.47<br>0.001 | (lb/year-per hose)<br>(lb/day-per hose) |
| Balance | 3.74<br>0.010 | (lb/year-per hose)<br>(lb/day-per hose) |

**HOSE PERMEATION**

The District's hose permeation emission factors are shown in Tables 1-3 and documented in my November 18, 2019 memorandum to you, *Hose Permeation Emission Factors for Gasoline Dispensing Facilities*.

**Table 3. Hose Permeation Emission Factors**

| System Type | ROC Emission Factor (lb/day-per hose) | ROC Emission Factor (lb/year-per hose) |
|---|---|---|
| Conventional, Assist Uncontrolled (Pre-EVR) | 0.030 | 10.98 |
| Assist Controlled (EVR for both Phase I and II) | 0.001 | 0.47 |
| Balance (All Balance System Types) | 0.010 | 3.74 |

Since the District's approved emission factors for hose permeation are based on the number of hoses instead of throughput, the user cannot directly enter the District's hose permeation emission factor into CARB's GDF screening tools. In order to use CARB's GDF screening tools, the user must calculate the annual emissions based on the number of hoses, and then divide by the permitted annual throughput. For example, to use CARB's screening tools, the throughput-based hose permeation factor for a balance station with 8 hoses and a requested throughput of 3 million gallons per year would be calculated as shown below:

<u>HRA Screening Example – Facility with 8 Balance Hoses and a Permitted Throughput of 3,000,000 gal/yr</u>

Annual ROC Hose Permeation Emissions = (3.74 lb/yr per balance hose) * 8 balance hoses
= 29.9 lb ROC/yr

Throughput-Based Hose Permeation Factor (Specific to Example) for CARB's GDF Screening Tool
= (Annual ROC Emissions from Hose Permeation) / (Annual Permitted Throughput)
= (29.9 lb/yr) / (3,000,000 gal/yr) = 0.00997 lb/1000 gal

Note that the throughput-based hose permeation factor will overestimate the hourly emission rate for hose permeation in CARB's screening tools. CARB's screening tools will calculate emissions from hose permeation based on the hourly dispensing throughput and the throughput-based hose permeation factor. However, as hose permeation contributes only one percent of the acute risk[1], the overestimation will have minimal impacts.

**If a site-specific refined health risk assessment is performed, calculating the throughput-based hose permeation factor is not necessary.** For a refined HRA, the annual emissions from hose permeation should be calculated directly from the factors in Table 3. For a refined HRA, hourly emissions for hose permeation should be calculated based on the daily emission rate from Table 3 divided by 24 hours. For example, the annual and hourly hose permeation emission calculations for a facility with 8 balance hoses are shown below:

Site-Specific Refined HRA Example – Facility with 8 Balance Hoses

Annual ROC Hose Permeation Emissions = (3.74 lb/yr per balance hose) * 8 balance hoses
= 29.9 lb ROC/yr

Hourly ROC Hose Permeation Emissions = (0.010 lb/day-per balance hose * 8 balance hoses) / 24 hours
= 0.003 lb ROC/hr

### SPILLAGE

The District's approved Phase II EVR emission factor for spillage is based on CARB's performance standard for Phase II EVR systems in CP-201 (April 23, 2015). Table 4-1 of CP-201 lists the performance standard for spillage as 0.24 lb/1000 gal.

### LOADING

The District's approved EVR emission factor for loading is 0.15 lb/1000 gallon, from Table 3-1 of CARB's *CP-201 Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities* (April 23, 2015). Table 3-1 of CP-201 lists the Phase I EVR emission standard of 0.15 lb/1000 gallon, with the test procedure used to verify the emission factor as CARB's *Vapor Recovery Test Procedure TP-201.1A Emission Factor For Phase I Systems at Dispensing Facilities* (February 1, 2001). TP-201.1A evaluates emissions only during loading, as described on Page 1 of the test procedure:

> "*The purpose of this test procedure, TP-201.1A, is to determine the emission factor (in units of pounds of hydrocarbon emitted per 1000 gallons of gasoline transferred from cargo tank to storage tank, lb/kgal) for installations of Phase I vapor recovery systems (VRS) at gasoline dispensing facilities (GDFs).*"

### DISTRICT-APPROVED GDF EMISSION FACTORS FOR NO CONTROL AND PRE-EVR

The loading, breathing, refueling and spillage emission factors for aboveground storage tanks and other systems for underground storage tanks (e.g., no control and Pre-EVR) remain unchanged and are presented in Table 4 and Table 5 below. Emissions from hose permeation must be added according to Table 3. The derivation of the loading, breathing, refueling and spillage factors is presented in my May 20, 2003 memorandum to you, *New GDF*

[1] CARB and CAPCOA's draft 2019 *Gasoline Service Station Industrywide Risk Assessment Guidance.*

*Emission Factors*. These unchanged emission factors are based on CAPCOA's December 1997 *Gasoline Service Station Industrywide Risk Assessment Guidelines* and Section 5.2 of EPA's AP-42 (January 1995).

**Table 4. ROC GDF Emission Factors for Aboveground Storage Tanks**

| Aboveground Tanks | Loading (lb/1000 gal) | Breathing (lb/1000 gal) | Refueling (lb/1000 gal) | Spillage (lb/1000 gal) | Hose Permeation |
|---|---|---|---|---|---|
| No Control | 8.400 | 2.100 | 8.400 | 0.610 | By No. of Hoses & Hose Type – **See Table 3** |
| Phase I only | 0.420 | 2.100 | 8.400 | 0.610 | |
| Phase I and II w/o Vent Valve | 0.420 | 2.100 | 0.420 | 0.420 | |
| Phase I and II w/Vent Valve | 0.420 | 0.525 | 0.420 | 0.420 | |

**Table 5. ROC GDF Emission Factors for Underground Storage Tanks – No Controls and Pre-EVR**

| Underground Tanks | Loading (lb/1000 gal) | Breathing (lb/1000 gal) | Refueling (lb/1000 gal) | Spillage (lb/1000 gal) | Hose Permeation |
|---|---|---|---|---|---|
| No Control | 8.40 | 1.00 | 8.40 | 0.61 | By No. of Hoses & Hose Type – **See Table 3** |
| Phase I only | 0.42 | 1.00 | 8.40 | 0.61 | |
| Phase I with Vent Valve | 0.42 | 0.25 | 8.40 | 0.61 | |
| Phase I and II w/o Vent Valve | 0.42 | 1.00 | 0.42 | 0.42 | |
| Phase I and II w/Vent Valve | 0.42 | 0.25 | 0.42 | 0.42 | |
| Phase I EVR and II w/Vent Valve | 0.15 | 0.25 | 0.42 | 0.42 | |

## REFERENCES


- California Air Pollution Control Officers Association. December 1997. *Gasoline Service Station Industrywide Risk Assessment Guidelines.* https://ww3.arb.ca.gov/ab2588/rrap-iwra/gasiwra.pdf
- California Air Resources Board and California Air Pollution Control Officers Association. September 2019. Draft *Gasoline Service Station Industrywide Risk Assessment Guidance.*
- California Air Resources Board. December 23, 2013. *Revised Emission Factors for Gasoline Marketing Operations at California Gasoline Dispensing Facilities*. https://ww3.arb.ca.gov/vapor/gdf-emisfactor/gdfumbrella.pdf
- California Air Resources Board. April 23, 2015. *CP-201 Certification Procedure for Vapor Recovery Systems at Dispensing Facilities*. https://ww3.arb.ca.gov/testmeth/vol2/cp201_april2016.pdf
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- U.S. Environmental Protection Agency. January 1995. Section 5.2, *Transportation and Marketing of Petroleum Liquids*. https://www3.epa.gov/ttn/chief/ap42/oldeditions/5th_edition/ap42_5thed_orig.pdf