

MEMORANDUM

TO: Michael F. Goldman
FROM: Robin Cobbs
SUBJECT: GDF Emission Factors for Phase I EVR and Phase II EVR
DATE: November 22, 2006 (Corrected ¹ April 3, 2007)
cc: Peter Cantle, Paula Iorio

Table 1 below contains the revised emission factors for Gasoline Dispensing Facilities (GDF) with Phase I EVR and Phase II. Table 1 also contains emission factors for GDFs with Phase I EVR and Phase II EVR. The emission factors were updated because systems for Phase II EVR were approved by the ARB and are now available for installation. During the process of researching emission factors for Phase II EVR, additional information was found regarding Phase I EVR emission factors. The revisions to the emission factors are based on the Air Resources Board's CP-201, *Certification Procedure for Vapor Recovery Systems at Dispensing Facilities*, amended February 9, 2005 (http://www.arb.ca.gov/testmeth/vol2/cp201_feb2005.pdf).

The emission factors for all other systems/scenarios remain unchanged and are presented in Table 2 and Table 3 for completeness. The derivation of these factors is presented in the May 20, 2003 memorandum, *New GDF Emission Factors*. The unchanged emission factors are based on CAPCOA's December 1997 *Gasoline Service Station Industrywide Risk Assessment Guidelines* and Section 5.2 of USEPA's AP-42 (1/95).

**Table 1 – GDF ROC Emission Factors for Underground Tanks
w/ Phase I EVR and Phase II (Non-EVR and EVR) and Vent Valves**

	SBCAPCD Approved	
	<i>Phase I EVR and Phase II Non-EVR</i>	<i>Phase I EVR and Phase II EVR</i>
	lb/1000 gal	lb/1000 gal
Loading	0.15	0.15
Breathing	0.25	0.00 ²
Refueling	0.42	0.38
Spillage	0.42	0.24
Total	1.24	0.77

LOADING & BREATHING

The APCD's revised emission factor for loading is from Table 3-1 of ARB's CP-201 (February 9, 2005). Table 3-1 lists the Phase I EVR emission standard of 0.15 lb/1000 gallon. A system will be tested using ARB's TP-201.1A *Emission Factor For Phase I Systems at Dispensing Facilities* to determine that it meets that standard. The test procedure in TP-201.1A (http://www.arb.ca.gov/testmeth/vol2/tp201_1a.pdf) evaluates emissions only during loading. Page one of TP-201.1A addresses the purpose of the test procedure:

¹ Scenario 6C in Table 3 was corrected to match the values in Table 1. No other changes were made.

² Emissions from breathing are included in the refueling emission factor per Table 4-1 of ARB's CP-201 (February 9, 2005)

“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).”

Based on the text above, it was concluded that the emission standard or factor of 0.15 lb/1000 gallons is for loading only.

The Phase II EVR breathing emission factor is shown as zero in Table 1 above. This is not because there are no emissions from the vent valve. Rather, these emissions are included in the refueling emission factor. Table 4-1 of ARB’s CP-201 (February 9, 2005) gives a Phase II EVR emission factor of 0.38 lb/1000 gal. The table notes that *“Phase II Emission Factor Includes: Refueling and Vent Emissions Pressure-Related Fugitives.”* For that reason, the breathing emission factor was set to zero.

The Phase II Non-EVR emission factor for breathing remains unchanged from the original memo (May 20, 2003). A discussion from the original memo is included below.

“CAPCOA’s emission factor for breathing losses was based on a historical emission factor and the Aeorenvironment Study³. The study showed that the effectiveness of vent valves reduces emissions by 75 percent. CAPCOA’s historical emission factor was not used as it had no documentation as to its basis.

The EPA did not show the derivation of the breathing emission factor so it was not clear if it was for vent valves or without. Based on the fact the EPA’s emission factor was derived from the 1970’s, it assumed that this emission factor was for facilities not having vent valves.

The APCD used EPA’s emission factor as the uncontrolled breathing factor. It was adjusted it by the results of Aeorenvironment Study, 75 percent mass emission reduction, to account for the use of vent valves.”

REFUELING

The APCD’s revised emission factor for loading is based on Table 4-1 of ARB’s CP-201 (February 9, 2005). Table 4-1 lists the Phase II EVR emission standard of 0.38 lb/1000 gallon. As mentioned above in the Loading & Breathing section, this emission factor includes the breathing emissions for a Phase II EVR system.

The Phase II Non-EVR emission factor for refueling remains unchanged from the original memo (May 20, 2003). A discussion from the original memo is included below.

“The notes on page A-5 of CAPCOA’s guidelines state that a 95 percent capture efficiency was assumed for the use of Phase II vapor control during the refueling of vehicles. However, the equation used to calculate refueling emissions⁴ used 90 percent as the capture efficiency. Furthermore, the same emission factor is used for Scenario 6A (Phase I and Phase II, without vent valves) and 6B. The equation used to determine the refueling emission factor is inter-dependent on breathing emissions, which is different for Scenario 6A and 6B. Therefore, the refueling emission factor should not be the same for these scenarios.

The EPA used an equation⁵ that is dependent on the Reid vapor pressure, temperature of dispensed fuel, and temperature of fuel in the vehicle’s tank. When using values from the CAPCOA guidelines for the

³ Aerovironment, Inc., Prepared for WSPA, “Underground Storage Tank Vent Line Emissions from Retail Gasoline Outlets”, Report # AV-FR-92-01-204R2, p. 3-23, May 1994.

⁴ Refueling = Uncontrolled x [100-90%] – Breathing, Scenario 6A, page A-4 of CAPCOA guidelines

⁵ AP-42, Equation 6, Chapter 5, Section 2, page 15, dated 1/95.

parameters in the equation, the results were erratic. However, the EPA's default value, 11.0 lb/1000 gal, for uncontrolled displacement losses due to refueling was in the same range as the emission factor from BAAQMD data.

The APCD chose to use BAAQMD data (8.4 lb/1000 gal) with an assumed capture efficiency of 95 percent, and control efficiency of 100 percent. The 100 percent control efficiency was used since the breathing losses account for any emissions captured and then released by the vent valve."

SPILLAGE

The APCD's Phase II EVR emission factor for spillage is based on ARB's performance standard for Phase II EVR systems in CP-201 (February 9, 2005). Table 4-1 lists the performance standard for spillage as 0.24 lb/1000 gal. It is worthwhile to note that ARB proposed reducing the performance standard for spillage to 0.15 lb/1000 gal in the proposed amendments to CP-201 (http://www.arb.ca.gov/vapor/cp201_100305.pdf). This memorandum will be updated with any revisions to emission factor related performance standards if ARB's Board approves the amendments.

The APCD's Phase II non-EVR emission factor for spillage is based on ARB's CP-201 (April 28, 2000) (http://www.arb.ca.gov/testmeth/vol2/cp201_072800.pdf). Section 4.1.4.1 of that document discusses the performance standard for spillage:

"Vapor recovery systems at dispensing facilities shall control spillage of liquid so that no more than 0.42 pounds are spilled per 1000 gallons of liquid dispensed."

SBCAPCD APPROVED GDF EMISSION FACTORS FOR ALL SCENARIOS

The emission factors for aboveground tanks and other scenarios for underground tanks (e.g., no control) not addressed in this revised memo remain unchanged.

Table 2 – SBCAPCD ROC GDF Emission Factors for Aboveground Tanks in lb/1000 gal

Aboveground Tanks	Scenario	Loading	Breathing	Refueling	Spillage	Total
No Control	1	8.400	2.100	8.400	0.610	19.510
Phase I only	2	0.420	2.100	8.400	0.610	11.530
Phase I and II w/o Vent Valve	3A	0.420	2.100	0.420	0.420	3.360
Phase I and II w/Vent Valve	3B	0.420	0.525	0.420	0.420	1.785

Table 3 – SBCAPCD ROC GDF Emission Factors for Underground Tanks in lb/1000 gal

Underground Tanks	Scenario	Loading	Breathing	Refueling	Spillage	Total
No Control	4	8.40	1.00	8.40	0.61	18.41
Phase I only	5A	0.42	1.00	8.40	0.61	10.43
Phase I with Vent Valve	5B	0.42	0.25	8.40	0.61	9.68
Phase I and II w/o Vent Valve	6A	0.42	1.00	0.42	0.42	2.26
Phase I and II w/Vent Valve	6B	0.42	0.25	0.42	0.42	1.51
Phase I EVR and II w/Vent Valve	6C	0.15	0.25	0.42	0.42	1.24
Phase I EVR and II EVR w/Vent Valve	7	0.15	0.00	0.38	0.24	0.77