



**South Coast
Air Quality Management District**

21865 Copley Drive, Diamond Bar, CA 91765-4182
(909) 396-2000 • www.aqmd.gov

Guidelines for Calculating Emissions from Dairy and Poultry Operations JANUARY 2009

Descriptions:

Starting with FY 05-06, dairy and poultry farms are required to report their Particulate Matter (PM), volatile organic compounds (VOCs), and ammonia (NH3) emissions to the District. VOC, PM and NH3 emissions are a result from the livestock waste. For poultry operations, there are also PM emissions from the bird feed.

1. EMISSION CALCULATION PROCEDURES

- a) Facilities can estimate their VOC, PM, and NH3 emissions using equation (1). Facilities may also calculate the emission factors using equation (2).

$$\text{EMISSION} = \text{THROUGHPUT} \times \text{EMISSION FACTOR} \quad (1)$$

$$\text{EMISSION FACTOR} = \text{UNCONTROLLED EMISSION FACTOR} \times \left(1 - \frac{\text{CONTROL EFFECTIVENESS}}{100}\right) \quad (2)$$

Where,

Emissions: VOC, PM or NH3 emissions expressed in pounds per year (lb/yr)

Throughput: Is number of animals per reporting period for each animal category such as birds, milking cows, dry cows, heifers, and/or calves (head). For poultry farms, the throughput is also expressed in tons of bird feed used during the reporting period when estimating the PM emissions from the bird feed.

Emission factors: Are values calculated using equation (2).

Uncontrolled Emission Factors: Are values listed in Table 1 (for dairy farm) and Table 2 (for poultry farm) based on the types of animals and expressed in pounds per animal per year (lbs/head). Except for poultry farms, for which the uncontrolled PM emission factor from bird feed is expressed in pounds per tons of bird feed (lbs/ton of bird feed).

Control Effectiveness: Are the values listed in Table 3 based on the types of manure disposal practices (land application or composting) or type of emissions (VOC, NH3, or PM).

b) Emission Factors for Dairy and Poultry Operations:

The uncontrolled emission factors are provided in Table 1 for dairy farms and in Table 2 for poultry farms.

Table 1: Dairy Farms - Uncontrolled Emission Factors

Animals/Operations	VOC Emission Factor (lbs/head)	PM Emission Factor (lbs/head)	NH3 Emission Factor (lbs/head)
Milking Cows	12.8	3.56	51
Dry Cows	8.7	3.56	51
Heifers (4-24 months)	6.1	3.56	18.7
Calves (under 3 months)	4.5	3.56	7.5
Mature Cows*	6.3	3.56	51
Heifers (4-24 months)*	4.4	3.56	18.7

*Emission factors for dairy operation with flush lanes that are flushed with water to a holding pond.

Table 2: Poultry Farms - Uncontrolled Emission Factors

Animals/Operations	VOC Emission Factor	PM Emission Factor		NH3 Emission Factor
	(lbs/head)	(lbs/head)	(lbs/ton of bird feed)	(lbs/head)
Birds (Chicken, ducks, etc)-manure	0.02565	0.0616	0.0	0.096
Birds-Feed	0.0	0.0	0.108	0.0

Table 3: Control Effectiveness for Different Types of Manure Disposal

Type of Disposal	(VOC & NH3) Control Effectiveness	(PM) Control Effectiveness
Land Application	11.5%	0%
Composting (open windrow)	38.5%	0%
Composting (enclosed)	47.5%	0%
Digester (plug & complete mix)	100%	0%
Manure Sent out of Basin	50%	0%
Best Management Practices	0%	20%
No Disposal	0%	0%

c) VOC, PM, and NH3 Emissions Calculations

To estimate the total VOC, PM, NH3 emissions, the facility needs to calculate the emissions for each animal category (i.e., birds, milking cows, dry cows, heifers, etc) and then sum them up. This can be done through the following steps:

1. Take the annual average number of animals:
 - o If you are a dairy farm, take the annual average number of animals for each annual category from the annual report submitted to the Santa Ana Regional Water Quality Control Board (SARWQCB) then report that amount as “Throughput”. The January dairy report submitted to the SARWQCB for the previous calendar year would be used to estimate emissions for this emissions report.
 - o If you are a poultry farm, take the annual average number of birds using your annual recordkeeping report then report that amount as “Throughput”. (e.g. use the annual average number of birds in previous year for this emissions report). You also need to have the total amount of bird feed used for the same time period (January 1st – December 31st).
2. Take the uncontrolled emission factors listed in Table 1 or Table 2:
 - o If you are a dairy farm, take the uncontrolled emission factors listed in Table 1 which are developed based on the type of animal. Please note that the VOC emission factors are different based on the animal category (e.g., milking cows versus dry cows) and whether the dairy farm has lanes that are flushed with water to a holding pond.
 - o If you are a poultry farm, take the uncontrolled emission factors listed in Table 2. Please note that the PM emission factors are different based on source of emissions (bird’s manure or feed) and there are no VOC or NH3 emissions associated with the bird feed.
3. Take the control effectiveness from Table 3 based on the type of emissions (i.e., VOC, NH3 or PM) and manure disposal (i.e., land application or composting).
4. Calculate the emission factors using equation (2).
5. Enter the values obtained in steps 1 and 4 in equation (1) to estimate the VOC, PM, and NH3 emissions for each animal category. For cases where the facility is not using any of the disposal methods listed in Table 3, enter zero for control effectiveness in equation (2).
6. Add up all the VOC, PM, and NH3 emissions calculated in step 5 for each animal category to estimate the total VOC, PM, and NH3 emissions from the dairy or poultry operation.

Note: The above procedures are based on the assumption that the farm would use only one type of manure disposal. However, a split calculation can be performed based on the percentage of manure disposed.

2. APPLICABLE AER FORMS AND PROCEDURES TO FILL OUT THE FORMS

Facilities are required to report their VOC, PM, and NH₃ emissions to District using the applicable AER forms. VOC and PM Emissions must be reported on Form B4 and NH₃ must be reported on TAC form. In addition, there are other AER forms that are automatically filled out, such as Forms C and/or CU, TACS, and S. The procedures to fill out forms B4 and TAC are demonstrated through the example problem listed below. If a dairy/poultry farm is using any type of internal combustion engines (pumps, compressors, etc.) or external combustion engines (boilers, heaters, etc.), other forms such as Forms B1, B1U, B2, and/or B2U need to be filled out, as well. To find out about the procedures to fill out these forms, you may also refer to HELP & SUPPORT Section of the Web Application under Examples. The summary of descriptions of these forms is also listed on-line under HELP & SUPPORT Section.

EXAMPLE PROBLEM: For this reporting period an ABC dairy farm facility has reported to the Santa Ana Regional Water Quality Control Board 900 milking cows, 200 dry cows, 400 heifers (15-24 months), 300 heifers (17-14 months), 300 heifers (4-6 months), and no calves in previous year. The manures are disposed via land application. This dairy does not have any lanes that are flushed with water to a pond and they are not using any types of Best Management Practices (BMPs) to reduce their PM emissions.

Facility needs to report its VOC and PM emissions on Form B4 and NH₃ emissions must be reported on TAC.

STEPS TO FOLLOW TO FILL OUT FORM B4: The following parameters are needed to fill out Form B4:

Process Description: Specify the information about the process/device (e.g., Dairy Operation)

Activity Code: The following seven activity codes describe the animal reporting categories for dairy and poultry facilities (from Form B4 Activity Codes, Under Reference Tables of Help & Support Section of the Web Application). Choose an appropriate activity code from the dropdown list. In this example, the appropriate activity codes are 58a for milking cows, 58b for dry cows, and 58c for heifers as shown on the attached Form B4.

- 58a: Dairy Farms - Milking Cows
- 58b: Dairy Farms - Dry Cows
- 58c: Dairy Farms - Heifers (for farms that do not flush the lanes with water)
- 58d: Dairy Farms - Calves
- 58e: Dairy Farms - Mature Cows
- 58f: Dairy Farms - Heifers (farms with lanes that are flushed with water to a holding pond)
- 59a: Poultry farms - Birds (Chicken, ducks, etc.) - Manure
- 59b: Poultry farms - Birds (Chicken, ducks, etc.) – Bird Feed

Throughputs: enter the annual average number of animals as described in Section (1)(c)(1) of this document.

Based on the SARWQCB dairy report for previous year, the total number of animals in each category is specified as follows:

- Total annual number of milking cows = 900,
- Total number of dry cows = 200
- Total annual number of heifers = 400 + 300 + 300 = 1000
- Total number of calves = 0

Unit Code: Select unit code 22. This unit code 22 is assigned to represent the number of animal per year (head).

Rule Number: Enter 1127 since the dairy farms are required to comply with Rule 1127.

TAC/ODC (Y/N): Check mark the box to indicate the activity reported on each row emits toxic air contaminants (NH₃).

Application Number: Enter the application number or permit number associated with the process/device description

Emission Factors: In this example the manures are disposed by land application. Therefore, below are the calculated emission factors using equation (2), listed above. For cases that the manures are not disposed of by any of the methods listed in Table 3, you should enter the appropriate uncontrolled emission factors from Table 1. Enter the calculated emission factors for VOC and PM, as listed below, and zero for other pollutants (SPOG, NO_x, SO_x, and CO) in the appropriate box. For PM, the control effectiveness is zero unless the facility uses the Best Management

Practices (BMP) as specified in AQMD Rule 1127. For this example for PM, the control effectiveness is zero since the facility does not use BMP.

Milking cows:

VOC emission factor = 12.8 lbs/head x (1 - 11.5/100) = 11.33 lbs/head

PM emission factor = 3.56 lbs/head x (1 - 0.0) = 3.56 lbs/head

Dry Cows:

VOC emission factor = 8.7 lbs/head x (1 - 11.5/100) = 7.7 lbs/head

PM emission factor = 3.56 lbs/head x (1 - 0.0) = 3.56 lbs/head

Heifers:

VOC emission factor = 6.1 lbs/head x (1 - 11.5/100) = 5.4 lbs/head

PM emission factor = 3.56 lbs/head x (1 - 0.0) = 3.56 lbs/head

Please note that the PM emission factor is independent of the animal's type (milking cows or heifers) and farm's type (farms with or without flushed lanes).

Emissions: the emissions for each animal category are automatically calculated using equation (1). The results are as follows:

Milking cows:

VOC emissions = 900 cows x 11.33 lbs/head = 10,197 lbs/yr

PM emissions = 900 cows x 3.56 lbs/head = 3,204 lbs/yr

Dry cows:

VOC emissions = 200 dry cows x 7.7 = 1,540 lbs/yr

PM emissions = 200 dry cows x 3.56 lbs/head = 712 lbs/yr

Heifers:

VOC emissions = 1000 heifers x 5.4 lbs/head = 5,400 lbs/yr

PM emissions = 1000 heifers x 3.56 lbs/head = 3,560 lbs/yr

Total VOC Emissions = 10,197 + 1,540 + 5,400 = 17,137 lbs/yr

Total PM Emissions = 3,204 + 712 + 3,560 = 7,476 lbs/yr

Total VOC Emissions = 17,137 lbs/yr / 2000 = 8.57 tons/yr

Total PM Emissions = 7,476 lbs/yr / 2000 = 3.74 tons/yr

Save Data: Click ADD RECORD button to save the data.

STEPS TO FOLLOW TO FILL OUT FORM TAC: This form is used to report NH3 emissions. The following parameters are needed to fill out form TAC:

TAC ROW: Use the dropdown list to select the B4 and the row number associated with each animal category that you already listed on Form B4 as shown in the attached Form TAC.

TAC Code: Select TAC code 32 from dropdown list since the TAC code for NH3 is 32.

CAS #: Will be automatically populated. The CAS # for NH3 is 7664417.

Usage: Will be populated with value on Form B4 for each animal category.

Unit Code: Select unit code 22 from the dropdown list.

Emission factors: enter 51 for milking cows and dry cows and 18.7 for heifers. The uncontrolled emission factor for NH3 is 51 lb/head for milking cows and dry cows, and 18.7 lb/head for heifers as listed in Table 1.

Overall Control Efficiency: Enter 0.115. The control effectiveness for land application is 11.5% (0.115) as listed in Table 3. For cases that the manures are not being disposed by any of the methods listed in Table 3, enter zero.

Gross Emissions: The emissions are calculated automatically using equation 2. The results are as follows:

Milking cows:

$$(900) \times (51) \times (1 - 0.115) = 40,621.5 \text{ lbs/yr}$$

Dry cows:

$$(200) \times (51) \times (1 - 0.115) = 9,027 \text{ lbs/yr}$$

Heifers:

$$(1000) \times (18.7) \times (1 - 0.115) = 16,549.5 \text{ lbs/yr}$$

Waste Credit (Y/N): do not check mark the waste credit box for (No).

Save Data: Click the ADD RECORD button to save the data.

COMPLETED FORMS SAMPLE:

Form B4:

The screenshot shows the 'B4 - Permitted Annual Equipment Emissions from Miscellaneous Sources' form. The form includes the following fields and sections:

- Form Header:** South Coast Air Quality Management District, crosas@aqmd.gov, CESAR I ROSAS
- Navigation:** Form Data Entry, Form Selection, Submission Review, Forms & Reports, Manage Users, Help & Support, Home
- Facility:** 346 Year 2008 +
- Form Fields:**
 - Process Description:
 - Activity Code:
 - Annual Throughput:
 - Unit Code:
 - Rule Number:
 - TAC/ODC:
 - Permit Device IDs:
- Emission Factors Table:**

Emission Factor	Emissions
Organic Gases	<input type="text"/>
Specific Organics	<input type="text"/>
Nitrogen Oxides	<input type="text"/>
Sulfur Oxides	<input type="text"/>
Carbon Monoxide	<input type="text"/>
Particulate Matter	<input type="text"/>
- Summary Table:**

Process Description	Annual Usage	Organic Gases	Specific Organics	Nitrogen Oxides	Sulfur Oxides	Carbon Monoxide	Partic. Matter
<input type="checkbox"/> 1. Dairy Operation	900.00	10,197.00	0.00	0.00	0.00	0.00	3,204.00
<input type="checkbox"/> 2. Dairy Operation	200.00	1,540.00	0.00	0.00	0.00	0.00	712.00
<input type="checkbox"/> 3. Dairy Operation	1,000.00	5,400.00	0.00	0.00	0.00	0.00	3,560.00
Total Emissions in Pounds:		17,137.00	0.00	0.00	0.00	0.00	7,476.00
Total Emissions in Tons:		0.57	0	0	0	0	3.74
- Buttons:** ADD RECORDS, CANCEL
- Footer:** Page 1 of 1 (3 records), Export To Excel

Form TAC:

TAC - Toxic Air Contaminants & Ozone Depleters by Reference Numbers

TAC Row: *

Device Description: *

TAC Code: *

CAS #: *

Annual Usage: *

Units: *

Permit Device IDs:

Emission Factor:

Overall Control Efficiency:

Annual Gross Emissions:

Waste Credit (Yes/No)

Use Default Emission Factor

* Required Fields

ADD RECORDS **CANCEL**

Form ID	Device Description	TAC Code	CAS#	Annual Usage	Emission Factor	Annual Gross Emission
<input type="checkbox"/> B4-1	1. Dairy Operation	32	7664417	900.00	51	40,621.500000
<input type="checkbox"/> B4-2	2. Dairy Operation	32	7664417	200.00	51	9,027.000000
<input type="checkbox"/> B4-3	3. Dairy Operation	32	7664417	1,000.00	18.7	16,549.500000

First Prev Page 1 of 1 (3 records) Next Last Page 1 of 1 Export To Excel

Form TACS:

TACS - Toxic Air Contaminants and Ozone Depleters Emissions / Fee Summary

TAC Code	Toxic Air Contaminants / Ozone Depleters	Reference	Annual Gross Emissions (lbs)	Recycling Credit (lbs)	Annual Net Emissions (lbs)	Fee Rate (\$/lb)	Fee Due (\$)
01	Asbestos					\$5.42	
02	Benzene					\$1.81	
03	Beryllium					\$5.42	
04	1,3-Butadiene					\$5.42	
05	Cadmium					\$5.42	
06	Carbon Tetrachloride					\$1.81	
07	Chlorinated Dioxins & Dibenzofurans					\$9.01	
08	1,4-Dioxane					\$0.39	
09	Ethylene Dibromide					\$1.81	
10	Ethylene Dichloride					\$1.81	
11	Ethylene Oxide					\$1.81	
12	Formaldehyde					\$0.39	
13	Hexavalent Chromium					\$7.21	
14	Inorganic Arsenic					\$5.42	
15	Lead					\$1.81	
16	Methylene Chloride					\$0.08	
17	Nickel					\$3.58	
18	Perchloroethylene					\$0.39	
19	Polynuclear Aromatic Hydrocarbons (PAHs)					\$5.42	
20	Trichloroethylene					\$0.16	
21	Vinyl Chloride					\$1.81	
22	Chlorofluorocarbons (CFCs/Freons)					\$0.33	
23	1,1,1-Trichloroethane (Methyl chloroform)					\$0.05	
32	Ammonia	details	66,198.00		66,198.00	\$0.03	\$1,985.94
Total Fees Due: \$1,985.94							

First Prev Page 1 of 1 (32 records) Next Last Page 1 of 1 Export To Excel

Form C:

South Coast Air Quality Management District

Form Data Entry | Form Selection | Submission Review | Forms & Reports | Manage Users | Help & Support | Home

FACILITY : 346 Year 2008 +

C - Annual Emissions Summary - Permitted

Form ID	Organic Gases	Specific Organics	Nitrogen Oxides	Sulfur Oxides	Carbon Monoxide	Particulate Matter
Form B1, DCB, AB	0		0	0	0	0
Form B2	0		0	0	0	0
Form B3	0	0				
Form B4	8.57	0	0	0	0	3.74
Form E1	0		0	0	0	0
Form R1	0		0	0	0	0
Total Permitted Emissions (tons)	8.57	0	0	0	0	3.74

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Form S:

South Coast Air Quality Management District

Form Data Entry | Form Selection | Submission Review | Forms & Reports | Manage Users | Help & Support | Home

FACILITY : 346 Year 2008 +

S - Fees Due Summary

Submittal Date no later than March 31 st 2009	Total Permitted Emissions from Form C, Line 7 (tons)	Total Non-Permitted Emissions from Form CU, Line 7 (tons)	Total Emissions from Form CR (tons)	Total Emissions	Emissions Fee Due
Organic Gases	8.57	0.00		9	\$3,102.48
Specific Organics	0.00	0.00		0	\$0.00
Nitrogen Oxides	0.00	0.00	0.00	0	\$0.00
Sulfur Oxides	0.00	0.00	0.00	0	\$0.00
Carbon Monoxide	0.00	0.00		0	\$0.00
Particulate Matter	3.74	0.00		0	\$0.00
1. TOTAL EMISSION FEES FOR ALL CRITERIA POLLUTANTS					\$3,102.48
2. TOXIC AIR CONTAMINANTS/OZONE DEPLETER FEES (Enter the total amount from Form TACS or DIC)					\$1,985.94
3. TOTAL FEES DUE (Add Line 1 and Line 2)					\$5,088.42
4. INSTALLMENTS PAID FOR 2008 (If any) -- All criteria pollutants					\$0.00
5. INSTALLMENTS PAID FOR 2008 (If any) -- Toxic Air Contaminants/Ozone Depleters					\$0.00
6. BALANCE DUE (Line 3 - Line 4 - Line 5)					\$5,088.42
7. LATE PAYMENT SURCHARGE (if any)					\$0.00
8. AMOUNT DUE					\$5,088.42
9. AMOUNT ENCLOSED (Please write Facility ID#(s) and 2008 AER on the check.)					N/A

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