

Guidelines for Calculating Emissions from Dairy and Poultry Operations

December 2015

The dairy and poultry farms are required to report to the SCAQMD their emissions of Volatile Organic Compounds (VOC), Particulate Matter (PM) and Ammonia (NH₃) that result from the handling of livestock waste. For poultry operations, there are additional PM emissions from bird feed.

1. PROCEDURES

Facilities can estimate their VOC, PM, and NH₃ emissions using the equation:

$$E = Q * EF * (1 - CE)$$

Where,

E = VOC, PM or NH₃ emissions, expressed in pounds per year (lbs/yr)

Q = Throughput is the number of animals per reporting year by animal category. For poultry farms, the throughput is also expressed in tons of bird feed when estimating PM emissions from bird feed.

EF = Uncontrolled emission factors from Table 1 based on the animal categories and materials.

CE = Control effectiveness listed in Table 2 based on the types of manure disposal practices.

Table 1: Uncontrolled Emission Factors

Animals/Operations	VOC lbs/head	PM		NH ₃ lbs/head
		lbs/head	lbs/ton	
Dairy Farms:				
Milking Cows	12.8	3.56	---	51.0
Dry Cows	8.7	3.56	---	51.0
Heifers (4-24 months)	6.1	3.56	---	18.7
Heifers (4-24 months)*	4.4	3.56	---	18.7
Calf (under 3 months)	4.5	3.56	---	7.5
Mature Cows*	6.3	3.56	---	51.0
Poultry Farms:				
Manure	0.02565	0.0616	---	0.096
Feed	---	---	0.108	---

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

- *Milking cow is a cow raised to produce milk*
- *Dry cow is a cow of approximately 2 weeks from calving and in between lactation, hence, is not giving milk and is usually kept separately for different feeding*
- *Heifer is a young female calf under 3 years old and has not borne a calf*
- *Calf is a young cow or bull in its first year*
- *Mature cow is a cow that has had one or two calves and which may be more than 3 years old*

Table 2- Control Effectiveness

Type of Disposal	(VOC & NH₃) Control Effectiveness	(PM) Control Effectiveness
No Disposal	---	---
Best Management Practices	---	0.20
Manure Sent out of Basin	0.50	---
Composting (open window)	0.385	---
Composting (enclosed)	0.475	---
Digester (plug & complete mix)	1.0	---
Land Application	0.115	---

- *Best Management Practices are Class One Mitigation Measures defined in Rule 223, Appendix A, Table 1, subsections E & F, and Table 2, subsections C & D.*
- *Land Application is the use of methods such as tilling, injecting, or plowing that covers animal waste in accordance with NRCS Agricultural Waste Management Field Handbook Chapter 10, Section 651.1102.*

2. HOW TO REPORT

VOC, PM, NH₃ emissions must be reported separately for each animal category (i.e., milking cows, dry cows, heifers, birds, etc.). This can be done through the following steps:

1. Determine the annual average number of animals, (Throughput, Q):
 - For 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).

- For a poultry farm, take the annual average number of birds using your annual recordkeeping report. In addition, the total amount of bird feed used for the same time period is also needed.
2. Select proper emission factors listed in Table 1, (EF):
 - 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.
 - Note that the PM emission factors are different based on the source of emissions (bird’s manure or feed). There are no VOC or NH₃ emissions associated with bird feed.
 3. Select appropriate control effectiveness (CE) from Table 2 based on the type of emissions (i.e., VOC, PM, or NH₃) and manure handling method.
 4. Enter the information into the AER Reporting Tool.

EXAMPLE 1:

Last year, a dairy farm facility has reported to the Santa Ana Regional Water Quality Control Board 900 milking cows, 300 heifers (17-14 months) and no calves. The manure is sent out of the basin. This dairy does not have any lanes that are flushed with water to a pond.

STEPS TO REPORT THE EMISSIONS

Image 1: Click **Emission Sources (ES)**. The reporting tool displays existing permitted units (emission sources) as shown at bottom of the image below. If livestock waste handling is not listed, it must be added to the list by clicking [Add New Emission Source](#). In this example, this farm is operated with a permit. Click on the hyperlink [Open](#) for ES#1 which will take user to image 2 below.

Facility ID: 999115

- [Facility Information](#)
- [Build Reporting Structure](#)
- [Combustion Fuels](#)
- [Emission Sources \(ES\)](#)**
- [Report Process/Emissions](#)
- [Summaries](#)
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- [Report Submission](#)

Emission Sources (ES) Classification

This section contains facility permit profile. Please make sure that every device has a specified Emission Source (ES). New emission sources can also be added.

EPA TANKS Software DATA IMPORT - [Click here](#) for more instructions.

Displaying 5 emission sources.

A/N

AER Device ID

Permit NO

Permit Device ID

[Search Emission Sources](#)

[Add New Emission Source](#)

Search: [Print Preview](#)

Action	A/N	Permit NO	Permit Device ID	Permit Equipment Description	AER Device ID	ES Name	ES Group Name	Source Category	Has Emissions	Equipment	ES Status	Process Reference
Open	445819	F86880		AGOPS DAIRY	ES1							
Open	499507	G3604		AGOPS EMERGENCY ICE (50,500 LBS)	ES5							

Image 2: Fill out relevant information to the Emission Source by identifying ES Name (example, Animal Waste Handling) and selecting the Operating ES Status (i.e., Normal Operation) from the drop-down menu. After selecting the appropriate Operating ES Status, the **Categorize Emission Source** button will appear. By clicking this button, the tool will take the user to the next screen (image 3 below) for categorizing this emission source.

Facility ID: 999115

Edit Emission Source

Providing correct information and proper selection categories would help to classify emission source.

Permitted	<input checked="" type="checkbox"/>
Uploaded	<input checked="" type="checkbox"/>
A/N	445819
Permit No	F86880
Permit Device ID	
Permit Equipment Description	AGOPS DAIRY
AER Device ID	ES1
ES Name	Animal waste handling
Operating ES Status	Normal Operation *
Comment	
Emission Source Category	Other Processes Categorize Emission Source *
Design Capacity	0

Save or Save and return to List of Emission Sources or Save and proceed to Process Reporting or Cancel
Optional: Save and Mark as Completed

Image 3: In this example, user selects No. 7 by clicking on any part of the selection. Click the box designated as “Other process equipment”, and click **Save** button.

Categorize Emission Source

Permitted	A/N	Permit No	Permit Device ID	Permit Equipment Description	AER Device ID	ES Name
Yes	445819	F86880		AGOPS DAIRY	ES1	Animal waste handling

- External Combustion Equipment (e.g., boiler, dryer, oven, furnace, heater, afterburner, flare, kiln or incinerator) [click here](#) to select one of the following Equipment:
- Internal Combustion Equipment (e.g., internal combustion engine (excluding vehicles), turbine or micro turbine) [click here](#) to select one of the following Equipment:
- Spray Coating/Spray Booth (e.g., coatings, solvents, adhesives, etc.) [click here](#) to select one of the following Equipment:
- Other Use of Organics (e.g., coatings, solvents, inks, adhesives, etc.) except in Spray Coating/Spray Booth, [click here](#) to select one of the following Equipment:
- Liquid Storage Tank (e.g. Underground, Aboveground, Small Tanks, Dispensing Systems) [click here](#) to select one of the following Equipment:
- Fugitive Components (Emission Leaks from Process Components per Rule 462, 1173 and 1176), [click here](#) to select all applicable Equipment:
- Other Processes (does not fit in any of the groups mentioned above), click [click here](#) to mark "Other Process Equipment":
 - Other process equipment

Save Cancel

After saving, the program return user to Image 2. Click **“Save and proceed to Process Reporting”** which will take the user to the screen shown in Image 4 for reporting emissions for this emission source.

Image 4: The reporting tool adds a new Process (P1). Click the hyperlink **“Open”** for entering process information such as throughputs, emissions, emission factors, and TACs as shown in Image 5.

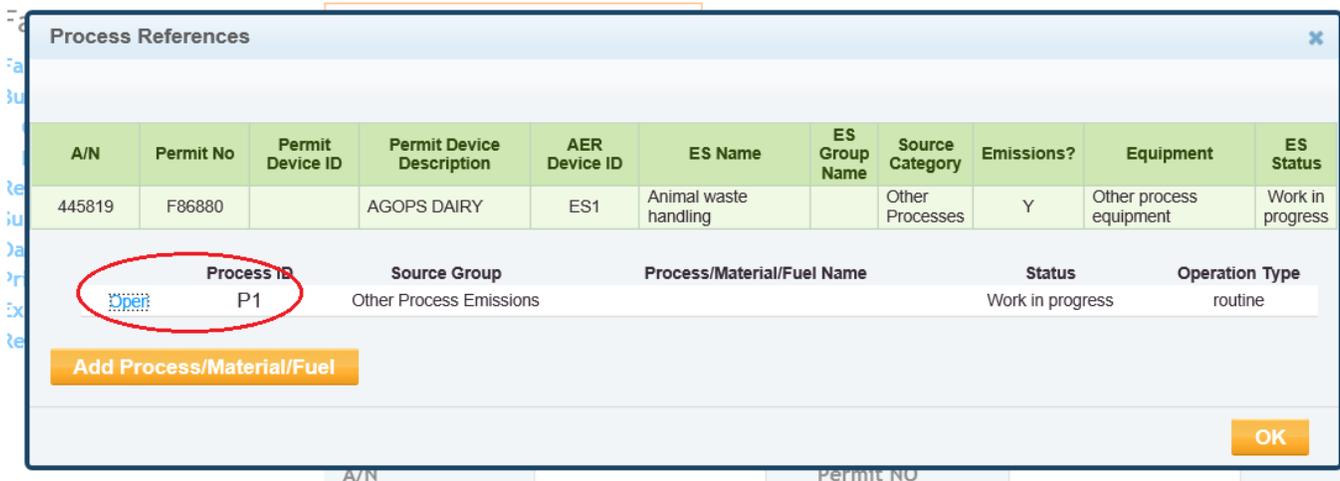


Image 5: The hyperlinks **“Open”** are designated for data entry to each section. The first one is for process information as shown in Image 6 below.

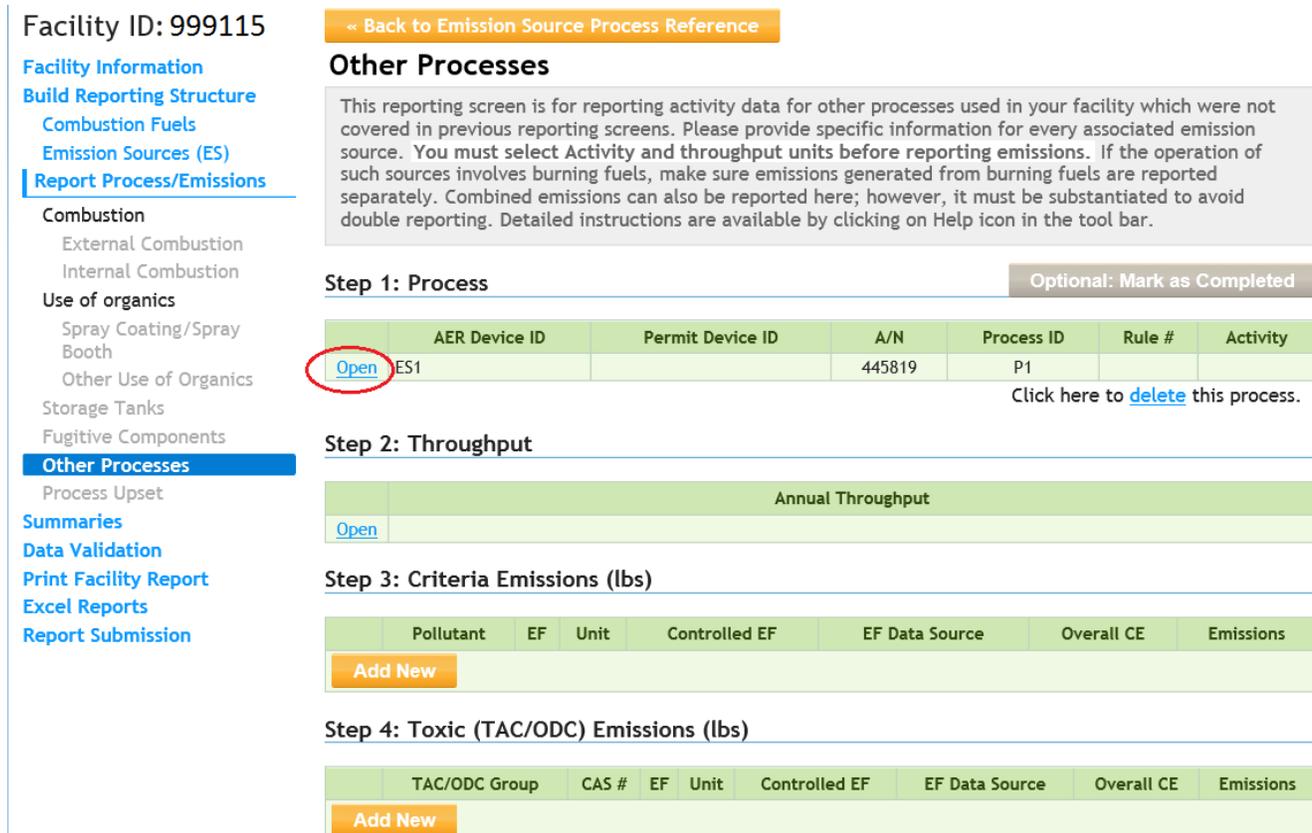


Image 6: After clicking Open, this image will pop-out. Identify the Process Name for the first process P1 and fill out the Activity Code by selecting the appropriate information from the drop-down menu from each box. Example shows correct sector, industry, operation, process, and rule for the milking cows. Click **Save** button.

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
ES1		445819	P1		

AER Device ID: ES1
 PERMITTED
 AN: 445819
 AER Device Name: Animal waste handling
 Permit Device ID: AN: 445819
 Process ID: P1
 Process Name: Milking cows
 Process Comment:
 Activity Code *
 Sector: Manufacturing
 Industry: Food and Agricultural
 Operation: Dairy
 Process: Milking Cows
 Rule #: 1127 * [Add Rule](#)
 Save Cancel

Image 7: After saving, the program returns to Image 5. This time, open the **Throughput** section (see Image 5) to enter the Annual Throughput, Type and Comment for the Process, as shown below. Click the **Save** button.

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
ES1		445819	P1	1127	Manufacturing : Food and Agricultural : Dairy : Milking Cows

Annual Throughput: 900.000000 * head *
 Throughput Type: Existing *
 Throughput Comment: As reported to SARWQC Board
 Save Cancel

Image 8: After saving, the program returns to Image 5. Add the Criteria Emissions generated by the Process by clicking “Add New” (yellow button)” under **Criteria Emissions** section.

- External Combustion
- Internal Combustion
- Use of organics
 - Spray Coating/Spray Booth
 - Other Use of Organics
- Storage Tanks
- Fugitive Components
- Other Processes**
 - Process Upset
- Summaries
- Data Validation
- Print Facility Report
- Excel Reports
- Report Submission

Step 1: Process
Optional: Mark as Completed

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity	
Open	ES1		445819	P1	1127	Manufacturing : Food and Agricultural : Dairy : Milking Cows

Click here to [delete](#) this process.

Step 2: Throughput

Annual Throughput	
Open	900.000000 head

Step 3: Criteria Emissions (lbs)

Pollutant	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
Add New						

Step 4: Toxic (TAC/ODC) Emissions (lbs)

TAC/ODC Group	CAS #	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
Add New							

[« Back to Emission Source Process Reference](#)

Image 9: Select the type of pollutant, (i.e., VOC, etc.) from drop-down menu, enter the applicable emission factor (from Table 1), control efficiency (from Table 2), emission factor comment and the emission factor data source for the Process. Click **Save** button.

Open Criteria Emission Information - Other Processes
✕

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity	SCC
ES1		445819	P1	1127	Manufacturing : Food and Agricultural : Dairy : Milking Cows	

Annual Throughput

900.000000 head

Pollutant

Emission Factor (EF)

Controlled EF value
(mark checkbox if EF listed represents EF determined after control)

Overall Control Efficiency

Emission Factor Comment

Emission Factor Data Source

Emissions

VOC - Volatile Organic Compounds

* lbs/head

Controlled EF value
(mark checkbox if EF listed represents EF determined after control)

5.76000e+3 lbs

Click here to [delete](#) this Emission.

[Save](#)

[Cancel](#)

Image 10: After saving, the program returns to Image 5. To add the next pollutant type (PM) for the same Process P1, click the **Add New** button under **Criteria Emissions** section, Select PM from the drop-down menu, enter the applicable emission factor (from Table 1), control efficiency (from Table 2), emission factor comment and emission factor data source and enter them in the appropriate boxes. Click the **Save** button.

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
ES1		445819	P1	1127	Manufacturing : Food and Agricultural : Dairy : Milking Cows

Annual Throughput
900.000000 head

Pollutant: PM

Emission Factor (EF): 3.56000e+0 lbs/head

Controlled EF value
(mark checkbox if EF listed represents EF determined after control)

Overall Control Efficiency: []

Emission Factor Comment: []

Emission Factor Data Source: AQMD default

Emissions: 3.20400e+3 lbs

Save Cancel

STEPS TO REPORT NH₃ (TAC/ODC)

Image 11: After saving, the program returns to Image 5. To add TAC/ODC emissions from the same Process P1, click the **Add Toxic (TAC/ODC) Emissions** under **Toxic Emissions** section (NH₃ emissions in this example). Select NH₃ (Ammonia) from the drop-down menu and select the applicable Emission Factor (from Table 1) and Control Efficiency (from Table 2) and enter them in the appropriate boxes. Click **Save** button.

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity	SCC
ES1		445819	P1	1127	Manufacturing : Food and Agricultural : Dairy : Milking Cows	

Annual Throughput
900.000000 head

TAC/ODC Toxic Pollutants / Ozone Depleting Compounds

TAC Group: 32 - Ammonia

CAS # (Pollutant): 7664417 - Ammonia

Emission Factor (EF): 5.10000e+1 lbs/head

Controlled EF value
(mark checkbox if EF listed represents EF determined after control)

Overall Control Efficiency: 0.50000

Emission Factor Comment: Manure sent out of basin

Emission Factor Data Source: AQMD default

Emissions: 2.29500e+4 lbs

Click here to [delete](#) this Emission.

Save Cancel

After saving, the program returns to Image 5. The emissions from the 900 Milking Cows have been reported as shown below.

- Build Reporting Structure
 - Combustion Fuels
 - Emission Sources (ES)
 - Report Process/Emissions
- Combustion
 - External Combustion
 - Internal Combustion
- Use of organics
 - Spray Coating/Spray Booth
 - Other Use of Organics
- Storage Tanks
- Fugitive Components
- Other Processes
 - Process Upset
- Summaries
- Data Validation
- Print Facility Report
- Excel Reports
- Report Submission

such sources involves burning fuels, make sure emissions generated from burning fuels are reported separately. Combined emissions can also be reported here; however, it must be substantiated to avoid double reporting. Detailed instructions are available by clicking on Help icon in the tool bar.

Step 1: Process Optional: Mark as Completed

	AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
Open	ES1		445819	P1	1127	Manufacturing : Food and Agricultural : Dairy : Milking Cows

Click here to [delete](#) this process.

Step 2: Throughput

	Annual Throughput
Open	900.000000 head

Step 3: Criteria Emissions (lbs)

	Pollutant	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
Open	VOC	1.28000e+1	lbs / head	No	AQMD default	0.50000	5.76000e+3
Open	PM	3.56000e+0	lbs / head	No	AQMD default		3.20400e+3

[Add New](#)

Step 4: Toxic (TAC/ODC) Emissions (lbs)

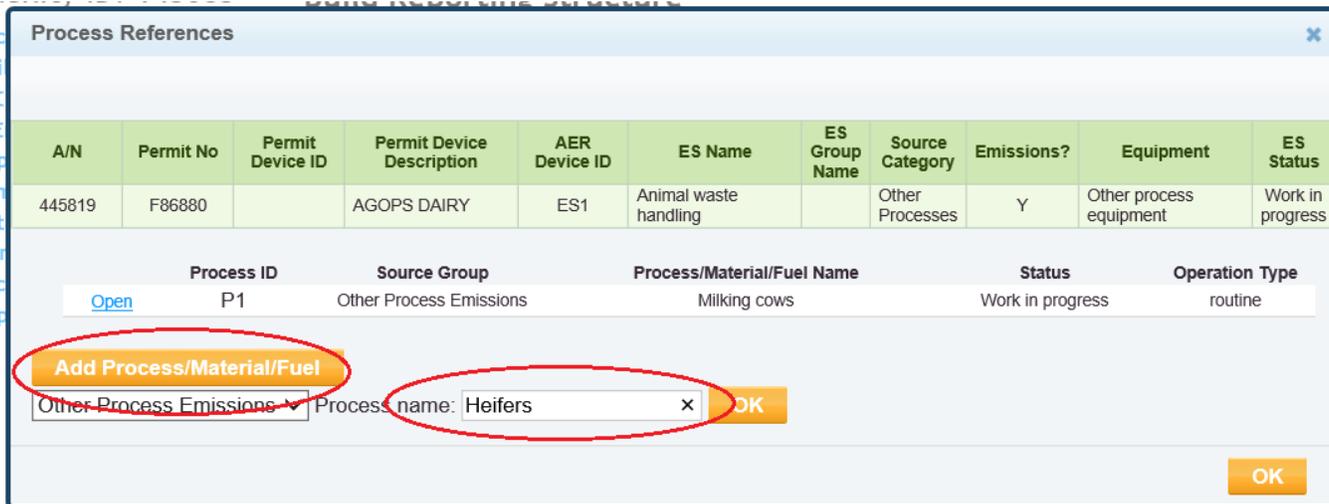
	TAC/ODC Group	CAS #	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
Open	Ammonia	7664417	5.10000e+1	lbs / head	No		0.11500	4.06215e+4

[Add New](#)

STEPS TO REPORT THE NEXT PROCESS

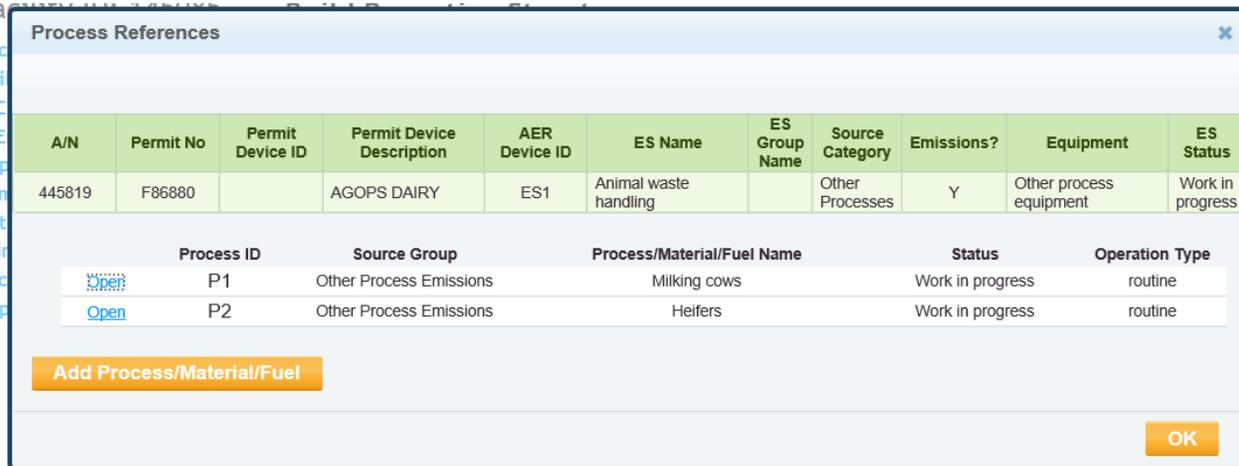
Image 12:

- To add the next Process (Heifers), click “**Add Process/Material/Fuel**” button as shown below.
- Name the Process (i.e. Heifers) in the box and click the OK button next to it.



REMINDER:

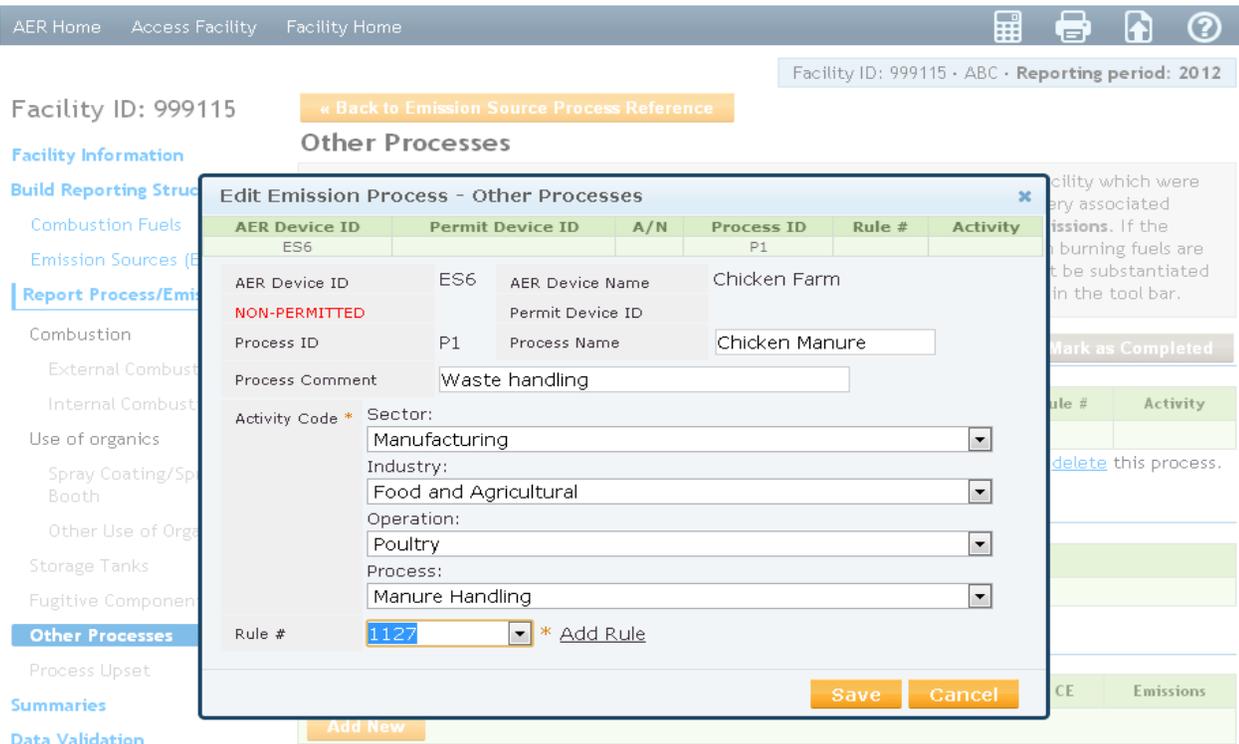
To report the VOC, PM, and NH₃ emissions from the 300 Heifers, repeat the procedures as illustrated in Image 5 and follow the steps leading to Image 11.



EXAMPLE 2:

Last year, a poultry farm facility raised 5,000 chicken on 100 tons of feed. The manure is sent out of the basin. This poultry does not have any lanes that are flushed with water to a pond.

Since this poultry farm does not possess an operating permit, the user must add this emission source by clicking on the hyperlink “[Add New Emission Source](#)”. Follow the procedure illustrated in Images 1-5 of Example 1 and fill in the information for Chicken Farm as shown in the following image. Click the **Save** button.



After saving, the program returns to Image 5. Open the **Throughput** section to enter the amount, as shown below. Click **Save** button.

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
ES6			P1	1127	Manufacturing : Food and Agricultural : Poultry : Manure Handling
Annual Throughput					
5,000.000000 head					

Annual Throughput: 5,000.000000 * head

Throughput Type: Existing *

Throughput Comment: From annual recordkeeping report

Buttons: Save, Cancel

After saving, the program returns to Image 5. Open the **Criteria Emissions** section (by clicking **Add New**) to enter the criteria pollutant (i.e., VOC) and its emission factor information, as shown below. Click **Save** button.

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
ES6			P1	1127	Manufacturing : Food and Agricultural : Poultry : Manure Handling
Annual Throughput					
5,000.0 head					

Pollutant: VOC *

Emission Factor (EF): 0.0257 * lbs/head

Controlled EF value
(mark checkbox if EF listed represents EF determined after control)

Overall Control Efficiency: 0.50000

Emission Factor Comment: from Tables 1 and 2 of Guidelines for Dairy and Poultry Operations

Emission Factor Data Source: AQMD default *

Emissions: 64.25 lbs

Buttons: Save, Cancel

After saving, the program returns to Image 5. Open the **Criteria Emissions** section again by clicking **Add New** to enter the next criteria pollutant (PM) and its emission factor information, as shown below. Click the **Save** button.

Open Criteria Emission Information - Other Processes

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
ES6			P1	1127	Manufacturing : Food and Agricultural : Poultry : Manure Handling
Annual Throughput					
5,000.0 head					

Pollutant: PM *

Emission Factor (EF): 0.0616 * lbs/head

Controlled EF value
(mark checkbox if EF listed represents EF determined after control)

Overall Control Efficiency: []

Emission Factor Comment: from Table 1 of the Guidelines for Dairy & Poultry Operations

Emission Factor Data Source: AQMD default *

Emissions: 308.00 lbs

Buttons: Save, Cancel

After saving, the program returns to Image 5. Open the **Toxic Emissions** section by clicking **Add New** to enter the TAC/ODC (i.e. NH₃) and its emission factor information, as shown below. Click **Save** button.

Open Toxic (TAC/ODC) Emission Information - Other Processes

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
ES6			P1	1127	Manufacturing : Food and Agricultural : Poultry : Manure Handling
Annual Throughput					
5,000.0 head					

TAC/ODC Toxic Pollutants / Ozone Depleting Compounds

Pollutant: 32 - Ammonia *

TAC Group: 32 - Ammonia

CAS # (Pollutant): 7664417 - Ammonia

Emission Factor (EF): 9.60000e-2 * lbs/head

Controlled EF value
(mark checkbox if EF listed represents EF determined after control)

Overall Control Efficiency: 0.50000

Emission Factor Comment: from Tables 1 & 2 of Guidelines for Dairy & Poultry Operations

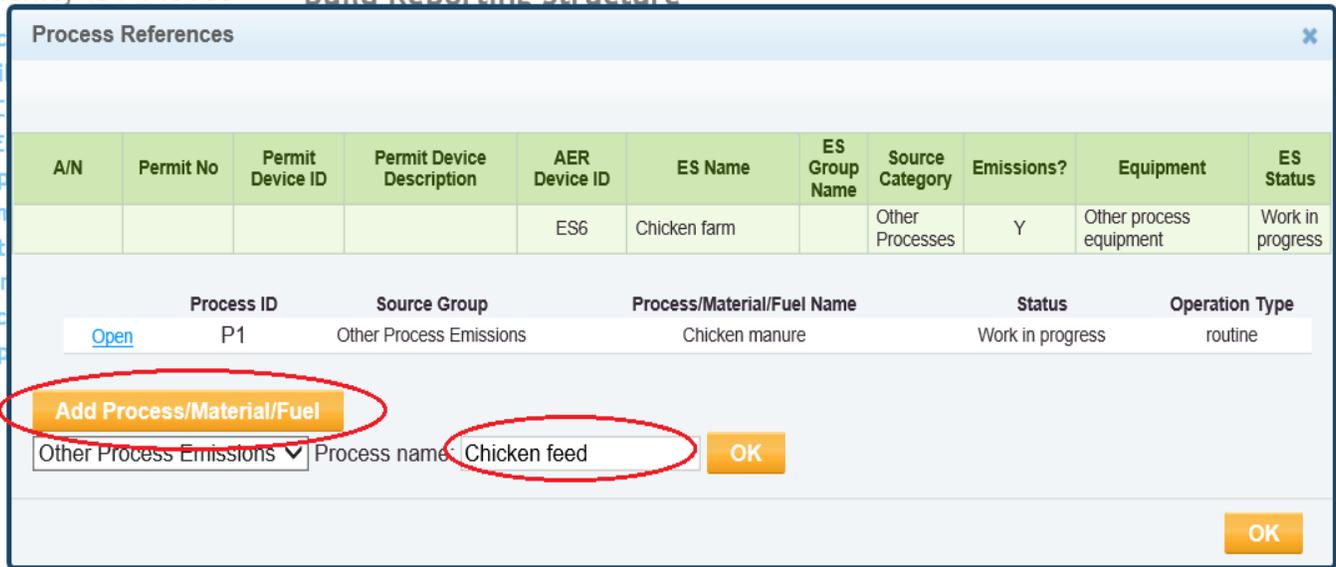
Emission Factor Data Source: AQMD default *

Emissions: 2.400e+2 lbs

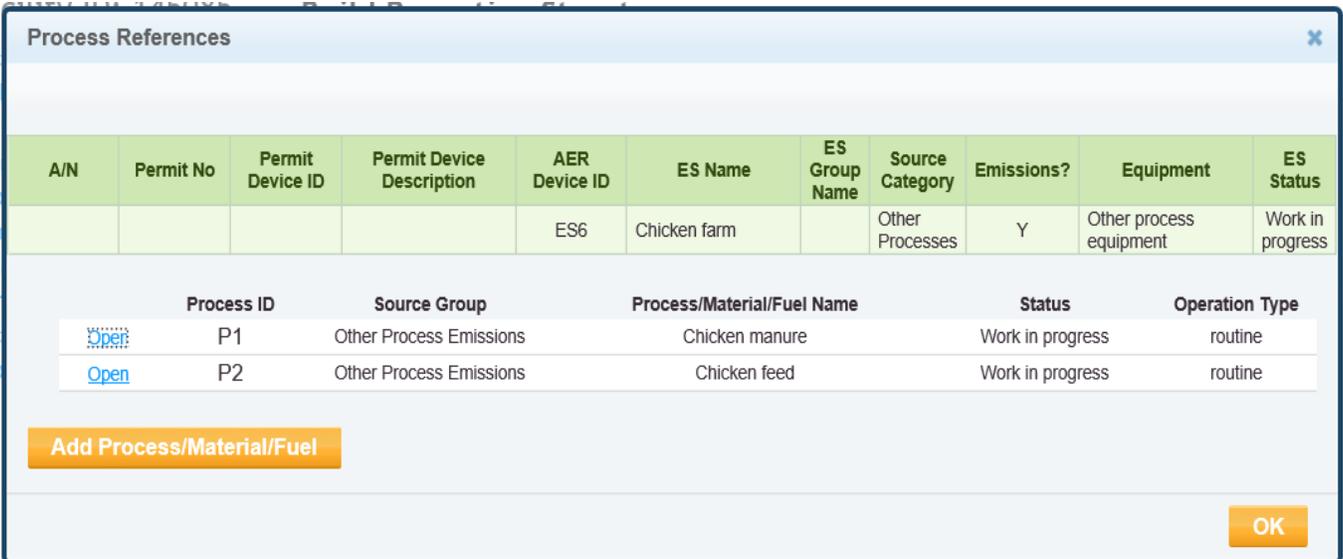
Buttons: Save, Cancel

STEPS TO REPORT THE NEXT PROCESS FOR PM EMISSIONS FROM FEEDS.

The following images will illustrate how to report emissions from handling of chicken feed. After saving, the program returns to Image 8. By clicking the **“Back to Emission Source Process Reference”** button at the bottom, the tool will pop up a screen (shown below) for user to add another process. Click **“Add Process/Material/Fuel”** button, name the process (i.e. Chicken Feed), and click OK button next to it.



After clicking OK, process P2 is added for chicken feed operation as shown below. Click on **“Open”** for P2 and start entering the information for that process.



After clicking P2, the tool will present to user a process data entry screen similar to Image 5 where user can enter information for the steps as shown in the following screens. Use the drop-down arrow at the right of each box to report information for this process as shown below. Click the **Save** button.

Facility ID: 999115 · ABC · Reporting period: 2012

Edit Emission Process - Other Processes

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
ES6			P2		

AER Device ID: ES6 AER Device Name: Chicken Farm
 NON-PERMITTED Permit Device ID:
 Process ID: P2 Process Name: Chicken Feed
 Process Comment: Consumed Feed

Activity Code *
 Sector: Manufacturing
 Industry: Food and Agricultural
 Operation: Poultry
 Process: Feed Operation

Rule #: 1127 * Add Rule

Save Cancel

After saving, the program returns to Image 5. Open the **Throughput** section to enter the amount, as shown below. Click **Save** button.

Edit Throughput Information - Other Processes

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
ES6			P2	1127	Manufacturing : Food and Agricultural : Poultry : Feed Operation

Annual Throughput
 100.000000 tons

Annual Throughput: 100.000000 * tons
 Throughput Type: Input *
 Throughput Comment: based on usage records x

Save Cancel

After saving, the program returns to Image 5. **Open** the **Criteria Emissions** section (by clicking **Add New**) to enter the criteria pollutant (i.e., PM) and its emission factor information, as shown below. Click the **Save** button.

Reported separately, combined emissions can also be reported using inventory to make up substances to avoid double reporting. Detailed instructions are available by clicking on Help icon in the tool bar.

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
ES6			P2	1127	Manufacturing : Food and Agricultural : Poultry : Feed Operation

Annual Throughput
100.0 tons

Pollutant: PM *

Emission Factor (EF): 0.1080 * lbs/tons

Controlled EF value
(mark checkbox if EF listed represents EF determined after control)

Overall Control Efficiency: []

Emission Factor Comment: from Table 1 of Guidelines for Dairy & Poultry Operations

Emission Factor Data Source: AQMD default *

Emissions: 10.80 lbs

Save Cancel

After saving, the program returns to Image 5. Emissions from process P2 are reported. Complete the report by validating the entries.