# SJVAPCD Best Available Control Technology (BACT) Guideline 5.7.2*

Last Update: June 10, 2026

## Poultry – Layer House

| Pollutant | Achieved in Practice or contained in SIP | Technologically Feasible | Alternate Basic Equipment |
|---|---|---|---|
| $PM_{10}$ | Use of the following practices:<br>a. Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors; AND<br>b. Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week; AND<br>c. Directing poultry house exhaust to a system that reduces $PM_{10}$ emissions by at least 40% (Manure drying tunnel(s), Dry filter(s) using centrifugal force, or equivalent) | 1. 85% Control (Capture and Electrostatic Precipitator)<br>2. 80% Control (Capture and Wet Scrubber)<br>3. 70% Control (Capture and High Efficiency Cyclones or Cyclonic De-Duster) | |
| VOC | Use of the following practices:<br>a. Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors; AND<br>b. Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week; AND<br>c. Applicable District Rule 4570 Feed and Housing Mitigation Measures; AND<br>d. All mortality removed from houses at least once per day | 1. 80% Control (Capture and Biofiltration)<br>2. 70% Control (Capture and Wet Scrubber) | |
| $NH_3$ | Use of the following practices:<br>a. Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors; AND<br>b. Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week; AND<br>c. Applicable District Rule 4570 Feed and Housing Mitigation Measures; AND<br>d. All mortality removed from houses at least once per day | 80% Control (Capture and Biofiltration or Wet Scrubber) | |

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in s a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

***This is a Summary Page for this Class of Source**

# Proactive Best Available Control Technology (BACT) Determination

## District BACT Guideline 5.7.2

Poultry Layer House

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## I. Introduction

The purpose of this project is to update previous District BACT Guideline 5.7.2, which applied to poultry layer houses. District BACT Guideline 5.7.2 was last updated on February 5, 2013 and was removed from the District BACT clearinghouse pending an update on August 16, 2023.

The current update will incorporate any applicable and more stringent emission control standards that have been achieved in practice or determined to be technologically feasible since the last update. Any corrections and/or changes needed to ensure consistency with the District's BACT policy and other District practices will also be made.

The discussions in this update will be limited to the following topics:

- Source of emissions
- Previous and Current BACT requirements
- Top-down BACT analysis for pollutants
- Recommendations

## II. Source of Emissions

The principal pollutants emitted from poultry houses are particulate matter (PM), Volatile Organic Compounds (VOC), and ammonia ($NH_3$). These pollutants are generally emitted through the ventilation system for the layer houses. Factors that affect emissions from layer houses include the moisture content of the manure, the pH, the ventilation rate, the temperature, and the amount of manure and length of the time the manure is present in the layer house.

Manure as excreted by the birds has a high water content, most of which evaporates, emitting ammonia as the manure dries out. Ideally, when litter is used in poultry houses, the litter should contain no more than 20-25% moisture.[1] High moisture content in the litter will lead to the development of anaerobic conditions and the production of hydrogen sulfide ($H_2S$) and other reduced sulfur compounds. High moisture content in the litter will also lead to greater production of VOCs and methane and will facilitate the further conversion of organic nitrogen to ammonia. Additionally, the greater the moisture content the more favorable the environment for microbes responsible for emissions of ammonia and VOC, which increases the likelihood that these compounds will be emitted. Moisture inside poultry houses is controlled by adequate ventilation and regular maintenance of waterers to minimize leaks.

[1] Patterson, P. H. (2001) Lesson 11: Using Dietary and Management Strategies to Reduce the Nutrient Excretion of Poultry. Lesson 11 in Livestock and Poultry Environmental Stewardship Curriculum. MidWest Plan Service. Iowa State University, Ames, IA. Accessed April 2026 at: https://lpelc.org/wp-content/uploads/2019/03/LES_11.pdf

In mechanically ventilated poultry houses, the ventilation rate affects the amount of particulate matter (PM), VOCs, and ammonia carried out of the houses. The continuous airflow removes ammonia and other gases and reduces the moisture content of freshly excreted manure.

Primary $PM_{10}$ emissions from poultry houses consist of dust and microscopic pieces of dander, skin, feathers and feed. These emissions pose a greater health risk to workers within the poultry facility than to people who are offsite. Various methods and management practices can be used to reduce $PM_{10}$ emissions. The first set of control methods include those that are aimed at preventing the generation of emissions; whereas the second set consists of those aimed at preventing emissions that have already been generated from escaping into the atmosphere. Control methods such as house design, hygiene, and feeding practices focus on preventing $PM_{10}$ generation. In an enclosed housing system, humidity and air flow can also be optimized at a level that results in the least amount of particulate matter being entrained in the air. In addition to air quality, other environmental concerns and animal welfare must also be considered when evaluating controls for confined animal facilities. For example, various studies have demonstrated for instance that cage-based layer housing systems generate less $PM_{10}$ than litter-based systems;[2] however, litter-based systems are often preferred or in some cases required because they provide birds with more space, allow them to engage in more natural behavior, and are therefore considered better for the welfare of birds than traditional cage-based systems, which are currently prohibited by California law.[3]

The potential for gaseous emissions, such as VOCs and ammonia, increases with greater manure storage time and greater manure accumulation in the houses.[2] The amount of manure and length of the time the manure is present in layer houses is determined by the frequency that manure is removed from the houses.

VOC emissions will vary with temperature because the rate of VOC formation, reduction to methane, and volatilization varies with temperature.[2]

Ammonia volatilization is the result of the microbial decomposition of nitrogenous compounds in poultry litter. The primary nitrogenous compound in poultry litter is uric acid, but nitrogenous compounds also occur in the form of undigested organic nitrogen in poultry feces. Whenever uric acid comes in contact with the enzyme urease, which is excreted in animal feces, the uric acid will hydrolyze rapidly to

[2] US EPA (August 15, 2001) Emissions from Animal Feeding Operations, Draft Report, Section 2.3 – Summary of Factors Affecting Emissions. EPA Contract No. 68–D6–0011. (Research Triangle Park, NC: US EPA, Office of Air Quality Planning and Standards, Emissions Standards Division). https://www.epa.gov/sites/default/files/2020-10/documents/draftanimalfeed.pdf

[3] California Department of Food and Agriculture (CDFA) Animal Care Program Guidance: Egg Producers. https://www.cdfa.ca.gov/AHFSS/AnimalCare/docs/Animal_Care_Producer_Eggs.pdf accessed June 8, 2026

form ammonia and this ammonia will be emitted soon after. The formation of ammonia will continue more slowly (over a period of months or years) with the microbial breakdown of organic nitrogen in the litter. The rate of ammonia volatilization is influenced by a number of factors including the concentrations of nitrogenous compounds in the litter, temperature, air velocity, surface area, and moisture.

## III. Previous BACT Requirements for Poultry Layer Houses

As stated above, the District BACT Clearinghouse does not currently include a valid BACT guideline that applies to poultry houses for laying hens. Previous District BACT Guideline 5.7.2 listed the following practices and technologies as potential BACT options to control emissions from layer houses.

| Pollutant | Achieved in Practice or contained in SIP | Technologically Feasible | Alternate Basic Equipment |
|---|---|---|---|
| VOC | 19% Control - Completely enclosed mechanically ventilated layer housing with evaporative cooling pads, mixing fans, and a computer control system; belt manure aeration/drying and removal system with manure removal at least twice per week; all birds fed in accordance with NRC or other District-approved guidelines; and all mortality removed from houses once per day. | 1. 98% control - Thermal Incineration<br>2. 95% control - Catalytic Incineration<br>3. 95% control - Carbon Adsorption<br>4. 80% control – Biofiltration | |
| $PM_{10}$ | 50% Control - Completely enclosed mechanically ventilated layer housing with evaporative cooling pads, mixing fans, and a computer control system; and belt manure aeration/drying and removal system with manure removal at least twice per week. | 1. 99% control - Electrostatic Precipitator<br>2. 99% control - Baghouse<br>3. 95% control - Wet Scrubber<br>4. 60% control - High Efficiency Cyclones | |
| $NH_3$ | 55% Control - Completely enclosed mechanically ventilated layer housing with evaporative cooling pads, mixing fans, and a computer control system; belt manure aeration/drying and removal system with manure removal at least twice per week; all birds fed in accordance with NRC or other District-approved guidelines; and all mortality removed from houses once per day. | 1. 99% control - Wet Scrubber<br>2. 80% control - Biofiltration | |

## IV. Top-Down BACT Analysis

As explained earlier, the principal pollutants emitted from poultry layer houses are particulate matter (PM), Volatile Organic Compounds (VOC), and ammonia ($NH_3$).

### A. BACT Analysis for $PM_{10}$ Emissions

**Step 1 - Identify All Possible Control Technologies**

Survey of BACT Guidelines:

The following BACT references were reviewed to identify potential control technologies for $PM_{10}$ emissions from poultry layer houses:

- EPA RACT/BACT/LAER clearinghouse
- California Air Resources Board (CARB) BACT clearinghouse/guideline list (https://ww2.arb.ca.gov/capp/cst/tch/bact-guidelines-tool)
- San Joaquin Valley APCD (SJVAPCD) BACT clearinghouse (https://ww2.valleyair.org/permitting/best-available-control-technology/district-bact-clearinghouse/)
- South Coast AQMD (SCAQMD) BACT guidelines (https://www.aqmd.gov/home/permits/bact/guidelines)
- Bay Area AQMD (BAAQMD) BACT/T-BACT workbook (https://www.baaqmd.gov/permits/permitting-manuals/bact-tbact-workbook)
- Sacramento Metropolitan AQMD (SMAQMD) BACT clearinghouse (https://www.airquality.org/businesses/permits-registration-programs/best-available-control-technology-(bact))
- Monterey Bay Air Resources District (MBARD) BACT Guidelines
- Santa Barbara County APCD (SBAPCD) BACT clearinghouse (https://www.ourair.org/bact/)
- San Diego County APCD (SDAPCD) BACT Guidance Document (https://www.sdapcd.org/content/dam/sdapcd/documents/permits/SDAPCD-BACT-Guidance.pdf)

The EPA RACT/BACT/LAER clearinghouse does not include general guidelines, only determinations made by individual agencies. The CARB BACT clearinghouse/guideline list includes BACT guidelines and determinations submitted by California air districts.

No BACT guidelines or determinations for poultry layer houses were found in the references given above, except previous District BACT guideline 5.7.2, which was presented above and included the BACT options for the control of $PM_{10}$ that are shown in the table below.

| Previous SJVAPCD BACT Guideline 5.7.2 – Poultry Layer House<br>BACT for $PM_{10}$ | | |
|---|---|---|
| Achieved in Practice | Technologically Feasible | Alternate Basic Equipment |
| 50% control - completely enclosed mechanically ventilated layer housing with evaporative cooling pads, mixing fans, and a computer control system; and belt manure aeration/drying and removal system with manure removal at least twice per week. | 1. 99% control - Electrostatic Precipitator<br>2. 99% control - Baghouse<br>3. 95% control - Wet Scrubber<br>4. 60% control - High Efficiency Cyclones | -- |

Survey of Applicable Rules and Regulations:

In addition, the following rules and regulations were reviewed to identify any emission limits or practices that could reduce $PM_{10}$ emissions from poultry layer houses:

- SCAQMD Rule 223 – Requirements for Confined Animal Facilities (amended 9/5/2025)
- SCAQMD Rule 403 – Fugitive Dust (last amended 6/3/2005)
- SCAQMD 1127 – Emission Reductions from Livestock Waste (adopted 8/6/2004)
- BAAQMD Regulation 2, Rule 10 – Large Confined Animal Facilities (adopted 7/19/2006)
- SMAQMD Rule 496 - Large Confined Animal Facilities (adopted 8/24/2006)
- SJVAPCD Rule 4550 - Conservation Management Practices (adopted 5/20/2004; re-adopted 8/19/2004)
- SJVAPCD Rule 4570 – Confined Animal Facilities (last amended 10/21/2010)
- Imperial County APCD (ICAPCD) Rule 217 - Large Confined Animal Facilities (LCAF) Permits Required (revised 2/9/2016)
- ICAPCD Rule 806 – Conservation Management Practices (revised 10/16/2012)
- Butte County AQMD (BCAQMD) Rule 450 - Large Confined Animal Facilities (adopted December 21, 2006)

No $PM_{10}$ emission limits for poultry houses or measures to control $PM_{10}$ emissions from poultry houses were found in SCAQMD Rules 223 and 1127; BAAQMD Regulation 2, Rule 10; SMAQMD Rule 496; District Rule 4570; ICAPCD Rule 217; ICAPCD Rule 806; or BCAQMD Rule 450. The requirements from SCAQMD Rule 403 and District Rule 4550 that potentially reduce $PM_{10}$ emissions from poultry operations are discussed below.

SCAQMD Rule 403

SCAQMD Rule 403 – Fugitive Dust states that the purpose of the rule is to reduce the amount of PM entrained in the ambient air as a result of anthropogenic (man-made) fugitive dust sources by requiring actions to prevent, reduce, or mitigate fugitive dust emissions. The provisions of this rule apply to activities and man-made conditions capable of generating fugitive dust. SCAQMD Rule 403 applies to confined animal facilities that raise 3,360 or more fowl or 50 or more animals and requires these operations to implement specified conservation management practices (CMPs) to reduce emissions of fugitive dust. SCAQMD Rule 403 does not apply to dairy farms or confined animal facilities that have a combined disturbed surface area within one continuous property line of one acre or less

SCAQMD Rule 403 requires any person who operates or authorizes the operation of a confined animal facility subject to the rule to implement the applicable conservation management practices in Table 4 of the rule. The SCAQMD Rule 403 requirements that potentially apply to poultry housing are shown in the table below.

| **SCAQMD Rule 403, Table 4 (Conservation Management Practices for Confined Animal Facilities)** | |
|---|---|
| **SOURCE CATEGORY** | **CONSERVATION MANAGEMENT PRACTICES** |
| Manure Handling<br><br>(Only applicable to Commercial Poultry Ranches) | (1a) Cover manure prior to removing material off-site; AND<br>(1b) Spread the manure before 11:00 AM and when wind conditions are less than 25 miles per hour; AND<br>(1c) Utilize coning and drying manure management by removing manure at laying hen houses at least twice per year and maintain a base of no less than 6 inches of dry manure after clean out; or in lieu of complying with conservation management practice (1c), comply with conservation management practice (1d).<br>(1d) Utilize frequent manure removal by removing the manure from laying hen houses at least every seven days and immediately thin bed dry the material. |
| Feedstock Handling | (2a) Utilize a sock or boot on the feed truck auger when filling feed storage bins. |

SCAQMD Rule 403, Table 4, CMP 1a, which requires covering of manure prior to it being removed onsite can reduce emissions from onsite storage of poultry manure. The only requirements included in SCAQMD Rule 403 that could potentially affect PM emissions directly from poultry houses are the manure handling CMPs included in Table 4, 1c and 1d that require owners and operators of laying hen houses to either 1) utilize coning and drying manure management by removing manure at laying hen houses at least twice per year and maintain a base of no less than 6 inches of dry manure after clean out, or

2) utilize frequent manure removal by removing the manure from laying hen houses at least every seven days and immediately thin bed dry the material. However, the SCAQMD Final Staff Report - Proposed Amendments to: Rule 403 – Fugitive Dust (June 2005)[4] states "*The coning and drying, and frequent manure removal CMPs (Rule 403, Table 4, 1c and 1d) were obtained from "The City of Yucaipa Guidelines to Manure Management Plans" that were developed in conjunction with Ordinance 216. While it is acknowledged that the manure handling coning and drying, and frequent manure removal CMPs were developed primarily to reduce vector problems (flies) and abate odor impacts, implementation of these practices is also expected to reduce ammonia and certain VOC emissions.*" The SCAQMD staff report does not indicate that these practices would reduce PM emissions or explain how these measures would reduce PM emissions and did not calculate any PM emission reductions for these measures. In addition, the CMPs included in SCAQMD Rule 403 for laying hen manure handling increase the frequency of manure removal from poultry houses, while the District Rule 4550 CMP for manure handling at poultry operations explains that reducing disturbance and handling of litter and manure will reduce PM emissions from poultry operations.[5] Therefore, it is not clear that increasing the frequency of manure removal from poultry houses reduces PM emissions. One possible way that more frequent removal of manure from layer houses may reduce PM emissions is by reducing the amount of manure particulate available that can be entrained by the ventilation system and emitted as PM.

Based on the evaluation of the requirements SCAQMD Rule 403, the only measure that could potentially reduce $PM_{10}$ emissions from poultry layer houses is removing the manure from laying hen houses at least every seven days. However, previous District BACT Guideline 5.7.2 included removal of manure from poultry layer houses at least twice per week per week as an achieved in practice BACT requirement to reduce $PM_{10}$ emissions. Therefore, removal of manure from poultry layer houses at least twice per week rather than at least once per week will be considered for this proactive BACT analysis.

District Rule 4550

District Rule 4550 – Conservation Management Practices states that the purpose of the rule is to limit fugitive dust emissions from agricultural operation sites. District Rule 4550 applies to agricultural operation sites located within the San Joaquin Valley Air Basin. Except for recordkeeping, the requirements of District Rule 4550 do not apply to confined animal facilities for turkeys with less

[4] South Coast Air Quality Management District (SCAQMD). (June 2005). Final Staff Report - Proposed Amendments to: Rule 403 – Fugitive Dust. (Available under the June 3, 2005 SCAQMD Board Meeting, Agenda Item #40: http://www3.aqmd.gov/hb/2005/June/050640a.html

[5] San Joaquin Valley Air Pollution Control District (May 20, 2004). List of Conservation Management Practices, Poultry Operations – Manure Handling & Storage, Cleanout frequency. https://www.valleyair.org/rules/currntrules/r4550CMPList.pdf

than 55,000 turkeys; confined animal facilities for chickens, other than laying hens, with less than 125,000 chickens; confined animal facilities for laying hens with less than 82,000 laying hens, or confined animal facilities for animals that are not mature dairy cows, cattle, turkeys, chickens, or laying hens.

District Rule 4550 requires owners and operators agricultural operation sites subject to the rule to choose and implement the applicable conservation management practices (CMPs) specified in an approved CMP plan. The District Rule 4550 conservation management practices approved for poultry housing and manure handling operations are shown in the table below.

| SJVAPCD Approved Conservation Management Practices (CMPs) for Poultry Operations | | | |
|---|---|---|---|
| **PRELIMINARY CMPs** | **DESCRIPTION** | **BENEFITS** | **EXAMPLES** |
| **POULTRY OPERATIONS - MANURE HANDLING & STORAGE** | | | |
| **Time of manure spreading** | To spread the manure at a time that would help reduce the amount of $PM_{10}$ released in the air | Reduces the amount of fugitive dust released in the air | To spread manure during cooler times of day such as morning or evening and during times of low wind. |
| **Cleanout frequency** | To adjust the frequency of cleanouts from the houses | Reduces particulates released from poultry litter/manure accumulating or stored inside houses. The less disturbance and handling of the litter/manure, the less emissions. Any time poultry bedding material is moved, some of the bulk material may become airborne. The bedding may be used for several grow out cycles before it becomes so laden with waste that it is unsuitable for continued use. Optimizing the reuse of the bedding material can reduce the number of material transfers, thus the opportunity for some of the material to become airborne. Implementation of this CMP implies that the generation of dust will become a factor in the determination to perform a house clean-out, and more reuse of bedding is anticipated. | To allow bedding materials and manure to remain in the house for multiple flocks or grow out cycles, or to decrease the frequency of house cleanouts to minimize dust emissions. |

| SJVAPCD Approved Conservation Management Practices (CMPs) for Poultry Operations | | | |
|---|---|---|---|
| **PRELIMINARY CMPs** | **DESCRIPTION** | **BENEFITS** | **EXAMPLES** |
| **Outdoor Storage** | To use of a structure design to store the bulk materials (e.g.: used poultry litter/manure) or to securely cover the bulk materials if it must be stored outdoors not within any enclosure | Prevents contact with precipitation and prevents windblown dispersion. Poultry litter consists mainly of light organic materials such as rice hulls or wood shavings. During a poultry house cleanout the used litter is scrapped out of the house and left in piles outdoors. If left in these outdoor piles for extended periods, winds can cause material to become airborne. Any technique that will shield the litter from wind will prevent or reduce the amount of material becoming airborne. Securely tarping the piles will protect the used litter from precipitation and windblown dispersal until the liter can be removed from the ranch. A partially enclosed structure, with walls situated in the prevailing wind direction, may be used to protect used litter stored onsite from precipitation and windblown dispersal. | To employ a structure design to store used poultry litter (manure and bedding material) onsite or to cover the bulk materials with tarps, plastics or suitable materials. |
| **POULTRY OPERATIONS - FEEDING** | | | |
| **Boot or sock** | Feed is loaded into the feed storage bins by employing a sock or boot on the feed delivery truck auger | To reduce the release of particulates | Use of a sock or boot on the delivery truck auger |

As seen in the table above, the only practice included in the list of approved District CMPs that would reduce PM emissions directly from poultry houses is the cleanout frequency CMP, in which the frequency of disturbance and handling of the litter and manure is reduced by using bedding material for multiple flocks or grow-out cycles prior to removing the litter or manure from the poultry housing. Reducing disturbance and handling of the litter/manure reduces emissions of fugitive dust from these activities. However, using bedding material for multiple flocks or grow-out cycles prior to removing the litter or manure from the poultry housing is only applicable to birds that are raised for meat, such as broilers, which have a much shorter life-cycle than chickens that are used for the production of eggs. For example, the typical

grow-out cycle for commercial broilers is approximately seven weeks,[6, 7] while commercial laying hens that produce eggs are typically kept in layer houses for one or two years until egg production decreases below levels that are considered acceptable.[8] Thus, for broilers there may be six or seven grow-out cycles in one year, while for laying hens, one flock is typically kept for over one year. In addition, traditional laying hen houses in which birds are kept in cages generally do not use litter and in cage-free houses that do use litter, the total cleanout of the litter in the houses occurs less frequently than birds that are raised for meat because the majority of manure in laying hen houses is deposited and removed from the areas in which the birds roost (e.g. by belts or manually). Complete removal of all of the litter in poultry houses typically only occurs when there are no birds in the poultry houses, which for laying hen houses would typically be no more than once per year. Further reducing the cleanout frequency of litter in laying hen houses would generally not be feasible because of potential impacts to the health of the birds. Therefore, the cleanout frequency CMP is not applicable to laying hen houses and will not be considered for this proactive BACT update.

Additional Controls Identified:

Sending Layer House Exhaust Through Manure Drying Tunnels/Sheds

Many laying hen operations are now using manure drying tunnels that use the exhaust air from the poultry houses to dry manure to reduce the weight of the manure and facilitate handling. After the manure is removed from the layer house, it is distributed evenly on a multi-tiered conveyer system. The manure is then dried by either the exhaust fans of the layer house or by additional fans installed specifically for the drying tunnel.[9]

Some studies have shown that manure drying tunnels can filter PM from the exhaust of laying hen houses by removing PM in the exhaust by impaction and adherence to the moist, sticky manure in the drying tunnels; however, these studies have also shown that manure drying tunnels can increase emissions of

[6] Ohioline, Ohio State University Extension (2025) Fact Sheet ANR-0161 - Raising Meat Chickens. https://ohioline.osu.edu/factsheet/anr-0161, accessed June 5, 2026.

[7] US EPA (August 15, 2001) Emissions from Animal Feeding Operations, Draft Report, Section 6.0 – Poultry Feeding Operations. EPA Contract No. 68–D6–0011. (Research Triangle Park, NC: US EPA, Office of Air Quality Planning and Standards, Emissions Standards Division). https://www.epa.gov/sites/default/files/2020-10/documents/draftanimalfeed.pdf

[8] Stuttgen, S. (2020) Life Cycle of a Laying Hen. University of Wisconsin-Madison Livestock Division Extension. https://livestock.extension.wisc.edu/articles/life-cycle-of-a-laying-hen/, accessed June 5, 2026.

[9] Chai, L. (2025) Advanced Poultry Manure Drying Techniques. University of Georgia (UGA) Department of Poultry Science. December 4, 2025. https://site.caes.uga.edu/precisionpoultry/2025/12/advanced-poultry-manure-drying-techniques/

ammonia and odors.[10, 11] One study measured $PM_{10}$ emission reductions of 83% for a manure drying tunnel for an aviary laying hen house in which the thickness of the manure layers in the drying tunnel was 15-20 cm and measured $PM_{10}$ emission reductions of 33% for a manure drying tunnel for a laying hen house with conventional cages in which the thickness of the manure layers in the drying tunnel was 9 cm; however, concentrations of ammonia increased by a factor of 5.0 over the manure layers in the drying tunnel for the aviary laying hen house and 3.6 over the manure layers in the drying tunnel for the laying hen house with cages.[10] This study stated that reducing the time between deposition of fresh manure and transport to the drying system, followed by more rapid drying may reduce excess ammonia emissions. Another study that was set up as an emission survey at 16 laying hen farms with manure drying tunnels indicated that the $PM_{10}$ removal efficiency of manure drying tunnels increased linearly with manure layer thickness from about 35% at 4 cm to 84% at 17 cm, but that ammonia and odor concentrations in the drying air increased substantially upon passing the manure layers, from an average 5.5 to 13.9 ppmv ammonia and from 822 to 1178 European odor units (OU E) per cubic meter. This study also indicated that ammonia emissions decreased with increasing dry matter content of the manure; however, even at dry matter content levels above 50%, substantial ammonia emissions remained.[11] The study also found that shortening the manure accumulation time on the belts to 24 hours followed by rapid drying (beyond 55% dry matter within another 24 hours) inside the manure drying tunnel resulted in emission rates that were 44% lower for $PM_{10}$, 20% higher for ammonia, and 40% higher for odor than the theoretical situation of the houses without manure drying tunnels. The study indicated that further shortening manure accumulation time might be needed to reduce emissions from manure drying tunnels. To reduce ammonia emissions from manure drying tunnels, Dutch regulations for ammonia emissions from livestock houses, only allow manure drying tunnels for use in hen-rearing and hen-laying houses under the requirements that the manure must be pre-dried by manure belt aeration inside the poultry houses to a dry matter DM content of at least 45%, and that the manure inside the manure drying tunnel must reach a dry matter content of at least 80% within 72 hours.[11]

As mentioned above, many laying hen farms are currently using manure drying tunnels that use the exhaust air from the poultry houses to dry the manure from the birds. The District has also issued Authority to Construct (ATC) permits for laying hen houses with manure drying tunnels that are now operational. Examples include Central Valley Eggs, LLC (ATC S-8841-1-3), Barnhart Ranch (ATC N-

[10] Winkel, A.; Mosquera Losada, J.; Ellen, H.H.; Aarnink, A.J.A.; Ogink, N.W.M. (2012) Dust Filtering Properties and Ammonia Emission of On-farm Drying Systems for Poultry Manure. Proceedings of the International Symposium on Emissions of Gas and Dust from Livestock (EmiLi). p. 245 – 248. https://edepot.wur.nl/293453

[11] Winkel, A; Mosquera, J; Aarnink, AJA; Koerkamp, PWGG; Ogink, NWM. (2017) Evaluation of Manure Drying Tunnels to Serve as Dust Filters in the Exhaust of Laying Hen houses: Emissions of Particulate Matter, Ammonia, and Odour. Biosystems Engineering, Volume 162, 2017, Pages 81-98, ISSN 1537-5110. https://doi.org/10.1016/j.biosystemseng.2017.07.006

9091-1-1), and Pleasant Valley Farms (ATCs N-8185-1-0 and -1-1).[12] Because a large number of laying hen houses, including laying hen houses in the San Joaquin Valley, utilize manure drying tunnels that use the exhaust air from the poultry houses to dry the manure from the birds, this technology is considered to be achieved in practice. In addition, to reduce emissions of volatile compounds from the manure, ATCs S-8841-1-3 and N-8185-1-0 and -1-1 require that the belt for the belt manure removal system advance by a minimum of half the length of the belt every 24 hours and recently issued ATC S-8841-1-7 requires that the belt for the belt manure removal system advance by a by a minimum of a full belt length every 48 hours. Because reducing the time that manure accumulates on the belts prior to drying has been shown to reduce emissions of ammonia, odors, and potentially VOCs from manure drying tunnels, the requirement that the belts for the belt manure removal system advance by a minimum of the full length of the belts every 48 hours will also be considered part of the achieved in practice BACT requirements.

Dry Filters Using Centrifugal Force for PM Removal

Big Dutchman, a company based in Germany, has developed a dry filter system that uses centrifugal force to remove PM from the exhaust from poultry houses.[13] The company states that the filter has dust separation rates of 50% to 70%.[14] The company states that these systems have been installed in Europe in Asia. The exact number of these systems that have been installed at poultry operations is unknown. It is also unknown if any of these systems have been installed in the United States or if the system is currently available in the United States. No installations in California have been identified. Based on the available information, it appears that most of these systems would have been installed at poultry facilities in Germany. The climate in Germany is significantly different than the San Joaquin Valley. One of Big Dutchman's experts for exhaust air treatment stated that more than 50% of Germany's poultry stock live in the federal state of Lower Saxony.[14] The maximum average high temperature in Lower Saxony is approximately 75 °F in the summer.[15] While in the San Joaquin Valley the maximum average high

[12] Additional information on the Pleasant Valley Farms egg laying operation is available in the California Environmental Quality Act (CEQA) approval documents for the project, which specifically mention the addition of manure drying tunnels. See CEQA State Clearinghouse (SCH) # 2018072002, https://ceqanet.lci.ca.gov/2018072002 and San Joaquin County Community Development Department September 6, 2018 Planning Commission Minutes, Action Item 8 – Site Approval Application No. PA-1500200 of William Huang, https://www.sjgov.org/commdev/cgi-bin/cdyn.exe/file/Planning/PC/Past%20Meetings/Minutes/2018/2018-09-06.pdf

[13] Big Dutchman (2013) MagixX & StuffNix Exhaust air treatment systems for efficient reduction of emissions from poultry houses. https://cdn.bigdutchman.com/fileadmin/content/egg-poultry/products/en/egg-production-poultry-growing-exhaust-air-treatment-MagixX-StuffNix-Big-Dutchman-en.pdf Accessed June 9, 2026

[14] The Poultry Site (2019) Low Emissions in Pig and Poultry Production: How Exhaust Air Washers Decimate Ammonia, Odours and Dust. https://www.thepoultrysite.com/news/2019/10/low-emissions-in-pig-and-poultry-production-how-exhaust-air-washers-decimate-ammonia-odours-and-dust

[15] Weather Spark website: https://weatherspark.com/countries/DE/06 Accessed June 9, 2026

temperature in the summer is approximately 99 °F.[16] The high temperatures in the San Joaquin Valley require poultry houses to have higher ventilation rates to remove heat and cool the birds. Because of the significant difference in the climate where these systems have primarily been installed compared to the San Joaquin Valley and the potential the lack of information about the availability of the system in the United States, this system will be considered a technologically feasible control technology, rather than achieved in practice.

Controls Identified to Reduce for $PM_{10}$ emissions from Poultry Layer Houses

It should be noted that some poultry operations have started to raise "free-range" poultry to address concerns about animal welfare and consumer demand. Raising free-range poultry requires that the birds have an opportunity to roam outside for at least a part of the day. Providing the birds with the opportunity to roam outside necessitates that the poultry houses have openings to allow the birds to enter and exit; therefore, it may not be possible to completely enclose or seal free-range poultry houses to capture all of the emissions. Although capturing emissions from free-range poultry houses may require changing how the birds are raised, options that require the capture of emissions from the poultry houses will still be considered in this proactive BACT determination.

The following control technologies and practices were identified as potential options to control $PM_{10}$ emissions from poultry layer houses based on general applicability and transfer of controls and technology from similar operations:

1. Capture and Electrostatic Precipitator
2. Capture and Baghouse
3. Capture and Wet Scrubber
4. Capture and High Efficiency Cyclones
5. Layer House Exhausting through Manure Drying Tunnels
6. Dry Filters Using Centrifugal Force for PM Removal
7. Use of the following poultry house design and management practices:
   a. Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors, and
   b. Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week

**Step 2 - Eliminate Technologically Infeasible Options**

Option 1 listed above, the use of a baghouse, will be eliminated from consideration as a technologically feasible control option. Recent BACT analyses performed by the District for poultry facilities have concluded that this option is not a feasible

[16] Weather Spark website: https://weatherspark.com/compare/y/1482~1451/Comparison-of-the-Average-Weather-in-Fresno-and-Bakersfield Accessed June 9, 2026

option for poultry houses because feathers and large debris strongly adhere to the filter media and, unlike dust or other granular materials, cannot be dislodged using the available bag cleaning technologies, such as mechanical shaking and reverse pulse jets.

There are no other technologically infeasible options to be eliminated from Step 1.

**Step 3 - Rank Remaining Control Technologies by Control effectiveness**

The estimated $PM_{10}$ control efficiencies of the remaining control technologies identified are discussed below.

1. Capture and Electrostatic Precipitator (Technologically Feasible)

   Previous District BACT Guideline 5.7.2 included 99% control of $PM_{10}$ based on the use of an electrostatic precipitator (ESP) as a technologically feasible option for the control of $PM_{10}$ emissions from poultry layer houses. However, several studies and other documents list lower control efficiencies for electrostatic precipitators used to control $PM_{10}$ emissions from the housing for animals, such as poultry houses. The US EPA draft report, Emissions from Animal Feeding Operations states the following[17]:

   > *Although ionization (i.e., ESP's) have been demonstrated to achieve PM removal efficiencies of 99% or greater in other industries, ionization has been shown to reduce PM emissions by only 40 to 60% in agricultural applications, based on the results of three separate studies (Bundy, 1984; Bundy, 1991; and Moller). No explanation for the lower PM removal efficiencies of ionization used for agricultural applications was found in the studies. However, high moisture content of the air stream may have been a factor.*

   The measured and estimated $PM_{10}$ control efficiencies for electrostatic precipitators controlling emissions from poultry operations listed in studies and documents located are discussed below.

   The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) and EPA Agricultural Air Quality Conservation Measures Reference Guide for Poultry and Livestock Production Systems (2017),[18] Appendix A.1: Table of Mitigation Effectiveness for Selected

[17] US EPA (August 15, 2001) Emissions from Animal Feeding Operations, Draft Report, Section 9.1.5 – Ionization. EPA Contract No. 68–D6–0011. (Research Triangle Park, NC: US EPA, Office of Air Quality Planning and Standards, Emissions Standards Division). https://www.epa.gov/sites/default/files/2020-10/documents/draftanimalfeed.pdf

[18] United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) and EPA (September 2017) Agricultural Air Quality Conservation Measures Reference Guide for Poultry and

Measures lists a PM control efficiency of 30-80% for electrostatic precipitators controlling emissions from animal confinement.

The Agrivita Canada Canadian AgriSafety Program study "Development and Assessment of Emerging Green Technologies to Reduce Aerosol Risks and Hazards in Livestock Production"[19] measured average $PM_{10}$ and $PM_{2.5}$ reductions of 49% and 50%, respectively, when a commercially-available electrostatic precipitator system was evaluated for the reduction of PM, bacteria, and gases in experimental broiler rooms in Saskatchewan, Canada from 16 February to 22 March 2021.[20]

The results of the project Electrostatic Precipitation Air Cleaning of Particulate Matter (PM) Emissions at Animal Production Facilities conducted by Ohio State University and funded by the USDA National Institute of Food and Agriculture (NIFA)[21] indicates that the electrostatic precipitators tested at a commercial poultry egg production facility in September to November 2019, September to November 2020, and throughout February 2021 had mean $PM_{2.5}$, $PM_{10}$, and TSP removal efficiencies of 79.6%, 92.7%, and 94.6%, respectively, for the smaller indoor electrostatic precipitator and 93.6%, 94.0%, and 94.7%, respectively, for the larger exhaust electrostatic precipitator.[22]

The study "An Optimized Electrostatic Precipitator for Air Cleaning of Particulate Emissions from Poultry Facilities"[23] indicates that an electrostatic precipitator used to control particulate matter from a poultry house had average $PM_{10}$ and $PM_{2.5}$ control efficiencies in the field of 84% and 86%, respectively.

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Livestock Production Systems. https://www.nrcs.usda.gov/sites/default/files/2022-06/Ag_AQ_Conservation_Measures_Poultry_and_Livestock_September_2017.pdf

[19] Agrivita Canada. 2019-2024 Canadian AgriSafety Program. Activity 2: Development and Assessment of Emerging Green Technologies to Reduce Aerosol Risks and Hazards in Livestock Production. https://www.agrivita.ca/2019-2024-canadian-agrisafety-program/activity-2.php#ProjectOverview Accessed April 22, 2026.

[20] Martel, M.C., Kirychuk, S., Predicala, B.Z., Bolo, R., Yang, Y., Thompson, B., Guo, H., & Zhang, L. (2023). Improving Air Quality in Broiler Rooms Using an Electrostatic Particle Ionization System. Journal of the ASABE, 66(4): pg. 887-896, 2023. https://elibrary.asabe.org/abstract.asp?aid=54297. https://agrivita.ca/documents/publications/act-2-martel-et-al-20231.pdf

[21] Ohio State University project: Electrostatic Precipitation Air Cleaning of Particulate Matter (PM) Emissions at Animal Production Facilities. Funded by United States Department of Agriculture (USDA) National Institute of Food and Agriculture (NIFA), Project OHO01125-CG, Grant No. 2016-67021-24434. https://www.nal.usda.gov/research-tools/food-safety-research-projects/electrostatic-precipitation-air-cleaning-particulate; https://portal.nifa.usda.gov/enterprise-search/projects/1007612

[22] Knight, Reyna M., Herkins, Matthew J., Hocter, Jeb S., Milliken, Shannon R., Zhao, Lingying, and Zhu, Heping. (2023) Field Evaluation of Electrostatic Precipitators for Particulate Matter Mitigation in a Manure-belt Layer Facility. Biosystems Engineering, Volume 230, 2023, Pages 131-144, ISSN 1537-5110. https://doi.org/10.1016/j.biosystemseng.2023.04.005

[23] Manuzon, R., Zhao, L., & Gecik, C. (2014) An Optimized Electrostatic Precipitator for Air Cleaning of Particulate Emissions from Poultry Facilities. ASHRAE Transactions. 120. 490-503. See: https://www.researchgate.net/publication/287888719_An_optimized_electrostatic_precipitator_for_air_cleaning_of_particulate_emissions_from_poultry_facilities

The Iowa State University Extension and Outreach Air Management Practices Assessment Tool lists $PM_{10}$ control efficiencies ranging from 49% to 57% and $PM_{2.5}$ control efficiencies ranging from 45% to 65% for electrostatic precipitators controlling emissions from animal housing.[24]

The study "Using an improved electrostatic precipitator for poultry dust removal"[25] indicates that the overall dust removal efficiency for an electrostatic precipitator used to control particulate matter from a poultry house ranged from 37% to 79% with the maximum removal efficiency occurring at -30 kV.

The research project report prepared for EPA "Final: Report: The Development and Evaluation of an Enhanced Electrostatic Precipitator for Poultry Dust Removal"[26] indicates that an electrostatic precipitator used to control particulate matter from a poultry house achieved up to 86% particulate matter removal.

Based on the available research that was located, it will be assumed that electrostatic precipitators used to control $PM_{10}$ emissions from poultry houses can be optimized to achieve an estimated conservative $PM_{10}$ control efficiency of 85%, which is on the higher end of the $PM_{10}$ control efficiencies that have been measured.

2. Capture and Wet Scrubber (Technologically Feasible)

Previous District BACT Guideline 5.7.2 included 95% control of $PM_{10}$ based on capture and the use of a wet scrubber as a technologically feasible option for the control of $PM_{10}$ emissions from poultry layer houses. However, the information that is currently available indicates that wet scrubbers installed to control emissions from animal housing at confined animal facilities generally have a lower control efficiency for $PM_{10}$. The US EPA draft report, Emissions from Animal Feeding Operations states, "*The evaluation of wet scrubbers in the AFO industry has been limited. One study (Pearson, 1989) showed a PM reduction of up to 90% using wet scrubbing.*"[27] The USDA NRCS and EPA document Agricultural Air Quality Conservation Measures Reference Guide for

[24] Iowa State University Extension and Outreach Air Management Practices Assessment Tool https://www.extension.iastate.edu/ampat/electrostatic-precipitation. Accessed June 9, 2026

[25] Chai, M., Lu, M., Keener, T., Khang, S., Chaiwatpongsakorn, C., & Tisch, J. (2009) Using an Improved Electrostatic Precipitator for Poultry Dust Removal. Journal of Electrostatics, 67**,** pg. 870-875. https://doi.org/10.1016/j.elstat.2009.07.006

[26] Tisch, W.J. (2006) Final Report: The Development and Evaluation of an Enhanced Electrostatic Precipitator for Poultry Dust Removal. Final Report to US EPA Small Business Innovation Research (SBIR) Program. EPA Contract Number: EPD06026. Available at: https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract_id/7951/report/0

[27] US EPA (August 15, 2001) Emissions from Animal Feeding Operations, Draft Report, Section 9.1.6 – Wet Scrubbing. EPA Contract No. 68–D6–0011. (Research Triangle Park, NC: US EPA, Office of Air Quality Planning and Standards, Emissions Standards Division). https://www.epa.gov/sites/default/files/2020-10/documents/draftanimalfeed.pdf

Poultry and Livestock Production Systems,[18] Appendix A.1 and the Iowa State University Extension and Outreach Air Management Practices Assessment Tool[24] list control efficiencies for wet scrubbers ranging from 60% to 90% for PM. For purposes of this proactive BACT determination, it will be assumed that the $PM_{10}$ control efficiency of a wet scrubber used to control emissions from poultry housing is 80%.

3. Capture and Capture and High Efficiency Cyclones (Technologically Feasible)

   Previous District BACT Guideline 5.7.2 included 60% control of $PM_{10}$ based on the use of high efficiency cyclones as a technologically feasible option for the control of $PM_{10}$ emissions from poultry layer houses. However, there is very limited information on the control efficiency of cyclones used to control PM emissions from poultry facilities.

   The EPA Air Pollution Control Technology Fact Sheet: Cyclones[28] states that the $PM_{10}$ control efficiency of high efficiency cyclones ranges from 60% to 95%. One cyclone-like de-duster that was developed and evaluated to control emissions from confined animal facilities had PM separation efficiencies that were measured to be 50%, 77%, and 90% for particles with diameters of about 4 µm, larger than 7 µm, and larger than 10 µm, respectively, and 85% separation efficiency in terms of mass concentration measured using mass samplers.[29, 30] Because of the lack of available information about the performance of cyclonic separators to control emissions from confirmed animal facilities, for purposes of this BACT determination, a conservative $PM_{10}$ control efficiency of 70% will be assumed for high efficiency cyclones and cyclonic de-dusters controlling emissions from poultry houses.

4. Layer House Air Exhausting Through Manure Tunnel Dryer (Achieved in Practice)

   As mentioned above, some studies have shown that manure drying tunnels can filter PM from the exhaust of laying hen houses, but may also increase emissions of ammonia and odors. As discussed above, one study measured $PM_{10}$ emission reductions of 83% for a manure drying tunnel for an aviary laying hen house in which the thickness of the manure layers in the drying tunnel was 15-20 cm and measured $PM_{10}$ emission reductions of 33% for a manure drying tunnel for a laying hen house with conventional cages in which the thickness of

[28] US EPA. Air Pollution Control Technology Fact Sheet: Cyclones. EPA 452/F-03-025. Available at: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100C75Q.PDF
[29] Zhang, Y., Wang, X., Riskowski, G. L., Christianson, L. L., and Ford, S. E. (2001) Particle Separation Efficiency of a Uniflow Deduster with Different Types of Dusts. Transactions of Amer. Soc. Heat. Refrig. Air Cond. Engr. (ASHRAE) 107(2): 93-98.
[30] Mostafa, E (2012) Air-Polluted with Particulate Matters from Livestock Buildings. In Air Quality - New Perspective. InTech. https://doi.org/10.5772/45766; https://cdn.intechopen.com/pdfs/37974/InTech-Air_polluted_with_particulate_matters_from_livestock_buildings.pdf

the manure layers in the drying tunnel was 9 cm, but concentrations of ammonia increased by a factor of 5.0 and 3.6, respectively, over the manure layers in the drying tunnels.[10] Another study that surveyed emissions from manure drying tunnels at 16 laying hen farms indicated that the $PM_{10}$ removal efficiency of manure drying tunnels increased linearly with manure layer thickness from about 35% at 4 cm to 84% at 17 cm, but that ammonia and odor concentrations in the drying air increased upon passing the manure layers. This study also indicated that ammonia emissions decreased with increasing dry matter content of the manure and also found that shortening the manure accumulation time on the belts to 24 hours followed by rapid drying (over 55% dry matter within another 24 hours) inside the manure drying tunnel resulted in emission rates that were 44% lower for $PM_{10}$, 20% higher for ammonia, and 40% higher for odor than the theoretical situation of the houses without manure drying tunnels.[11] Some suppliers of manure drying tunnels also state that their manure tunnel dryers reduce dust or PM. For example, VDL Agrotech states on their website that their PoulDry manure drying tunnel reduces fine dust emissions by 55%,[31] VDL Jansen states on their website that, depending on several factors, their BeltDry drying tunnel is able to reduce fine dust by 30-60%,[32] and Hellman Poultry Equipment states in a brochure that their PRO HenDry Plate drying tunnel is able to reduce ammonia and PM by up to 55%.[33] However, there is not sufficient information available to evaluate the claimed fine dust or PM reductions, the exact size fraction of PM that some the manure drying tunnel suppliers refer to as “fine dust” is not clear, and other manure drying tunnel suppliers only claim reductions of total PM rather than $PM_{10}$. In addition, although the two studies cited above measured $PM_{10}$ reductions as high as 80% for manure drying tunnels using the exhaust from laying hen houses, the higher $PM_{10}$ reductions were associated with greater manure accumulation in the manure drying tunnels and higher emissions of ammonia, which is a precursor for $PM_{2.5}$, and odors, which may indicate increased VOC emissions. When practices were implemented to reduce the amount of manure in the manure drying tunnels and the associated excess emissions of ammonia and odor emissions, the $PM_{10}$ emission reductions measured were approximately 44%. Therefore, based on the limited information available, for purposes of this proactive BACT update, it will be assumed that manure drying tunnels reduce $PM_{10}$ emissions by 40% when practices are utilized to reduce excess emissions of other pollutants from the manure drying tunnels.

[31] VDL Agrotech. Manure Drying web page. https://www.vdlagrotech.com/en/products/dryingtechnology/manure-drying, accessed June 8, 2026
[32] VDL Jansen. BeltDry webpage. https://www.vdljansen.com/en/products/manurehandling/manure-drying/beltdry, accessed June 8, 2026
[33] Hellman Poultry Equipment (2024) PRO HenDry Plate brochure. https://hellmannpoultry.com/wp-content/uploads/2024/12/Climate_PRO-HenDry-Plate_202411_ENG.pdf, accessed June 8, 2026

5. Dry Filters Using Centrifugal Force for PM Removal

Various studies have measured the PM control efficiency of a commercially-available dry filter system using centrifugal force to remove PM at poultry operations. One study of the dry filter system at a commercial poultry farm measured a 72% reduction of the dust emission rate, but does not give a specific control efficiency for $PM_{10}$.[34] A study conducted in the United Kingdom on the dry filter system measured 67% reduction in $PM_{10}$ from poultry houses.[35] Measurements from another study to evaluate PM mitigation options for the poultry industry in the Netherlands indicated that the dry filter system effectively reduced concentrations of $PM_{10}$ in the exhaust air from a layer house by an average of 40.1%.[36] A study to evaluate the dry filter for removal of dust that was conducted at an aviary laying hen barn in North Rhine-Westphalia, Germany measured $PM_{10}$ reductions of 24% in the summer and 63% in the winter.[37]

Based on the information from the studies that have been performed to measure the control efficiency of dry filter systems using centrifugal force to remove PM at poultry operations, the $PM_{10}$ control efficiency of this technology will be estimated to be 40% when used on poultry farms.

Although it was determined above that this specific option has not been demonstrated to be achieved in practice in the San Joaquin Valley, because it is estimated to have an equivalent $PM_{10}$ control efficiency as a practice that is achieved in practice, manure tunnel dryers, it will be considered an alternative achieved in practice option for purposes of this proactive BACT update.

[34] Mostafa, E, and Buescher, W (2011) Indoor Air Quality Improvement from Particle Matters for Laying Hen Poultry Houses. Biosystems Eng 109:22–36. https://doi.org/10.1016/j.biosystemseng.2011.01.011
[35] Demmers, T., Saponja, A., Thomas, R., Phillips, G., McDonald, A., Stagg, S., Bowry, A., Nemitz, E., (2010) Dust and ammonia emissions from UK poultry houses, XVII-th World Congress of the International Commission of Agricultural and Biosystems Engineering (CIGR), Québec City, QC, Canada, 13–17 June 2010. https://library.csbe-scgab.ca/docs/meetings/2010/CSBE100942.pdf
[36] Winkel, A.; Mosquera, J.; Aarnink, A.J.A.; Groot Koerkamp, P.W.G.; Ogink, N.W.M. (2015) Evaluation of a Dry Filter and an Electrostatic Precipitator for Exhaust Air Cleaning at Commercial Non-Cage Laying Hen Houses. Biosystems. Eng. 2015, 129, 212–225. https://doi.org/10.1016/j.biosystemseng.2014.10.006
[37] Strohmaier, C., Schmithausen, A. J., Krommweh, M. S., Diekmann, B., Büscher, W. (2018). Evaluation of a dry filter for dust removal under laboratory conditions in comparison to practical use at a laying hen barn. Environmental Science and Pollution Research, 25(29), 29511–29517. https://doi.org/10.1007/S11356-018-2981-3

6. Use of the following poultry house design and management practices: a) Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors, and b) Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week (Achieved in Practice)

   The $PM_{10}$ control efficiency for this achieved in practice BACT requirement is not currently known; however, the previous District BACT guideline for poultry layer houses estimated up to 50% $PM_{10}$ control for this option.

The control options being considered are ranked as follows based on their $PM_{10}$ control efficiencies:

1. 85% Control (Capture and Electrostatic Precipitator) (Technologically Feasible)
2. 80% Control (Capture and Wet Scrubber) (Technologically Feasible)
3. 70% Control (Capture and High Efficiency Cyclones/Cyclonic De-Duster) (Technologically Feasible)
4. Use of the following practices (Achieved in Practice):
   a. Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors, AND
   b. Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week; AND
   c. Directing poultry house exhaust to a system that reduces $PM_{10}$ emissions by at least 40% (Manure drying tunnel(s), Dry filter(s) using centrifugal force, or equivalent)

## Step 4 - Cost Effectiveness Analysis

Since this is a proactive BACT determination that is not part of a specific permitting action, a cost effectiveness analysis is not required.

## Step 5 - Select BACT

Since this is a proactive BACT determination that is not part of a specific permitting action, selecting BACT is not applicable. Recommendations for updates and corrections/changes to the current BACT requirements are discussed in the following section and summarized in the draft updated BACT guideline attached in Appendix A.

## B. BACT Analysis for VOC Emissions

### Step 1 - Identify All Possible Control Technologies

Survey of BACT Guidelines:

The following BACT references were reviewed to identify potential control technologies for VOC emissions from poultry layer houses:

- EPA RACT/BACT/LAER clearinghouse
- California Air Resources Board (CARB) BACT clearinghouse/guideline list (https://ww2.arb.ca.gov/capp/cst/tch/bact-guidelines-tool)
- San Joaquin Valley APCD (SJVAPCD) BACT clearinghouse (https://ww2.valleyair.org/permitting/best-available-control-technology/district-bact-clearinghouse/)
- South Coast AQMD (SCAQMD) BACT guidelines (https://www.aqmd.gov/home/permits/bact/guidelines)
- Bay Area AQMD (BAAQMD) BACT/T-BACT workbook (https://www.baaqmd.gov/permits/permitting-manuals/bact-tbact-workbook)
- Sacramento Metropolitan AQMD (SMAQMD) BACT clearinghouse (https://www.airquality.org/businesses/permits-registration-programs/best-available-control-technology-(bact))
- Monterey Bay Air Resources District (MBARD) BACT Guidelines
- Santa Barbara County APCD (SBAPCD) BACT clearinghouse (https://www.ourair.org/bact/)
- San Diego County APCD (SDAPCD) BACT Guidance Document (https://www.sdapcd.org/content/dam/sdapcd/documents/permits/SDAPCD-BACT-Guidance.pdf)

The EPA RACT/BACT/LAER clearinghouse does not include general guidelines, only determinations made by individual agencies. The CARB BACT clearinghouse/guideline list includes BACT guidelines and determinations submitted by California air districts.

No BACT guidelines or determinations for poultry layer houses were found in the references given above, except previous District BACT guideline 5.7.2, which was presented above and included the BACT options for the control of VOC that are shown in the table below.

| Previous SJVAPCD BACT Guideline 5.7.2 – Poultry Layer House<br>BACT for VOC | | |
|---|---|---|
| Achieved in Practice | Technologically Feasible | Alternate Basic Equipment |
| 19% Control - Completely enclosed mechanically ventilated layer housing with evaporative cooling pads, mixing fans, and a computer control system; belt manure aeration/drying and removal system with manure removal at least twice per week; all birds fed in accordance with NRC or other District-approved guidelines; and all mortality removed from houses once per day. | 1. 98% control - Thermal Incineration<br>2. 95% control - Catalytic Incineration<br>3. 95% control - Carbon Adsorption<br>4. 80% control - Biofiltration | -- |

Survey of Applicable Rules and Regulations:

In addition, the following rules and regulations were reviewed to identify any emission limits or practices that could reduce VOC emissions from poultry layer houses:

- SCAQMD Rule 223 – Requirements for Confined Animal Facilities (amended 9/5/2025)
- SCAQMD 1127 – Emission Reductions from Livestock Waste (adopted 8/6/2004)
- BAAQMD Regulation 2, Rule 10 – Large Confined Animal Facilities (adopted 7/19/2006)
- SMAQMD Rule 496 - Large Confined Animal Facilities (adopted 8/24/2006)
- SJVAPCD Rule 4550 - Conservation Management Practices (adopted 5/20/2004; re-adopted 8/19/2004)
- SJVAPCD Rule 4570 – Confined Animal Facilities (last amended 10/21/2010)
- Imperial County APCD (ICAPCD) Rule 217 - Large Confined Animal Facilities (LCAF) Permits Required (revised 2/9/2016)
- ICAPCD Rule 806 – Conservation Management Practices (revised 10/16/2012)
- Butte County AQMD (BCAQMD) Rule 450 - Large Confined Animal Facilities (adopted December 21, 2006)

The following air district rules were identified that include measures for which the stated purpose is to reduce VOC emissions from poultry facilities: SCAQMD Rule 223, SMAQMD Rule 496, District Rule 4570, and ICAPCD Rule 217. Other air district rules did not include specific measures to reduce VOC emissions from

poultry facilities. For example, SCAQMD Rule 1127 states that the purpose of the rule is to reduce $NH_3$, VOC, and $PM_{10}$ emissions from livestock waste, but only applies to dairies and related cattle operations and the manure from these operations, not poultry operations. BAAQMD Regulation 2, Rule 10 states that the purpose of the rule is to reduce emissions of air contaminants from large confined animal facilities through control measures established during permit review; however, the rule does not contain any specific measures that reduce emissions; instead it contains the general requirement that any permit issued for a large confined animal facility must include permit conditions to implement control measures that represent reasonably available control technology (RACT) to reduce emissions. Similarly, Butte County AQMD Rule 450 does not contain any specific measures that reduce emissions from confined animal facilities, but requires operators of large confined animal facilities to implement control measures to reduce emissions that are identified in an application submitted by the operator.

SCAQMD Rule 223, SMAQMD Rule 496, District Rule 4570, and ICAPCD Rule 217 were adopted to comply with California Health & Safety Code, Section 40724.6, which required each California air district that was designated as a federal nonattainment area for ozone as of January 1, 2004 to adopt and implement a rule or regulation that required Large Confined Animal Facilities, as defined by the California Air Resources Board (CARB), to obtain a permit from the district to reduce, to the extent feasible, emissions of air contaminants from the facility.

It should be noted that the District, as the air district that has jurisdiction over the largest agriculture area in California, took the lead in developing the initial mitigation measures for confined animal facilities. Other California air districts that were required to adopt rules with specific requirements for confined animal facilities generally adopted rules with identical or nearly identical mitigation measures as contained in the original version of District Rule 4570. The requirements of these rules that are expected to reduce VOC emissions from layer houses are discussed below.

SCAQMD Rule 223

SCAQMD Rule 223 – Emission Reduction Permits for Large Confined Animal Facilities establishes the requirements for agricultural sources in the SCAQMD subject to permit as a result of California Health & Safety Code Section 40724.6 as effective January 1, 2004 and federal and state Clean Air Act requirements.

SCAQMD Rule 223 requires different types of Large Confined Animal Facilities to select from menus of options to reduce emissions from different areas and processes at the facility (e.g., feed, housing, solid manure, liquid manure, etc.). The SCAQMD Rule 223 measures for poultry operations are shown in the tables below.

| SCAQMD Rule 223 - Poultry Operation LCAF Mitigation Measures<br>**(A) Poultry House**<br>Each poultry house shall incorporate at least four (4) of the following mitigation measures: | |
|---|---|
| *Class One Mitigation Measures* | |
| 1. | a. Remove cake manure daily in accordance with the recommendation of Natural Resource Conservation Services (NRCS) Agricultural Waste Management Field Handbook Chapter 10 Section 651.1002, or more recent NRCS guidance, or<br>b. Clean under poultry cages daily in accordance with the recommendation of NRCS Agricultural Waste Management Field Handbook Chapter 10 Section 651.1002, or more recent NRCS guidance. |
| 2. | Use poultry litter additives designed to reduce air emissions or moisture content in litter, such as aluminum sulfate or sodium bisulfate, according to manufacturer recommendations. |
| 3. | Use a dry housing cleaning method at all times, except when a wet cleaning method is required for animal health or biosecurity issues. |
| 4. | Use drinkers that do not drip. |
| 5. | Adjust the height, volume, and location of drinkers daily. |
| 6. | Use evaporative cooling pad or tunnel ventilation with no foggers in houses. |
| 7. | Slope the ground of the houses or pens a minimum of 3%. |
| 8. | Install mounds or berms up gradient to prevent the runoff of stormwater into pens (only an option for animals allowed to freely move between indoor housing structures and outdoor pens) |
| 9. | Inspect water pipes and drinkers and repair leaks at least once a day. |
| 10. | Maintain the roof structure and manage roof runoff in accordance with the recommendations of NRCS Practice Standard 561 – Heavy Use Area Protection, or more recent NRCS standards. |
| 11. | Only use fogger systems designed, operated and maintained according to manufacturer recommendations that provide water droplets with an average size of 50 microns or less. |
| 12. | Implement Alternative Mitigation Measure(s), not listed above, subject to approval of the Executive Officer. |
| *Class Two Mitigation Measures* | |
| 13. | Vent housing to a VOC control device with an overall VOC capture and control efficiency of at least 80%. |
| 14. | a. Use a belt litter removal system that dries the litter, or<br>b. House animals in a tunnel ventilated houses with mechanical ventilation, or<br>c. Use a litter drying system, such as a flat bed drying system. |

| SCAQMD Rule 223 - Poultry Operation LCAF Mitigation Measures<br>**(B) Feed Operations**<br>Owners/operators shall incorporate at least five (5) of the following feed mitigation measures: | |
|---|---|
| *Class One Mitigation Measures* | |
| 1. | a. Feed according to National Research Council (NRC) guidelines, or<br>b. Feed animals probiotics designed to improve digestion according to manufacturer recommendations, or<br>c. Feed animals an amino acid supplemented diet to meet their nutrient requirements, or<br>d. Feed animals feed additives such as amylase, xylanase, and protease, designed to maximize digestive efficiency according to manufacturer recommendations. |
| 2. | Remove spilled feed from housing at least once every seven (7) days. |
| 3. | Enclose grain in a weatherproof storage structure from October through May. |
| 4. | Feed or dispose of feed within forty-eight (48) hour of grinding and mixing feed. |
| 5. | Remove wet feed from animal housing within twenty-four (24) hours of a rain event. |
| 6. | Remove spilled feed from facility at least once every seven (7) days. |
| 7. | Implement Alternative Mitigation Measure(s), not listed above, subject to approval of the Executive Officer. |

| SCAQMD Rule 223 - Poultry Operation LCAF Mitigation Measures<br>**(C) Handling of Solid Manure or Separated Solids**<br>Owners/operators that handle or store solid manure or separated solids outside the animal housing shall incorporate at least one (1) of the following mitigation measures: | |
|---|---|
| *Class One Mitigation Measures* | |
| 1. | a. Remove all Animal Waste from site within seventy-two (72) hours of removal from housing, or<br>b. Send all animal waste to a storage facility designed, constructed, maintained, and operated to the recommendations in NRCS Practice Standard 313 (Waste Storage Facility) or more recent NRCS standard. |
| 2. | Cover Animal Waste outside the housing with a waterproof covering from October through May, except for times, not to exceed twenty-four (24) hours per calendar year, when wind events remove the covering, the covering shall be in accordance with applicable recommendations in NRCS Agricultural Waste Management Field Handbook Chapter 10 Section 651.1003, or more recent NRCS guidance. |
| 3. | Use a Dry Manure handling system in housing, such as stockpiles, solid land application, or a thin bed manure drying system, instead of a wet system such as flushing, manure Storage Ponds, or manure treatment Lagoons. |
| 4. | Implement Alternative Mitigation measure(s), not listed above, subject to approval of the Executive Officer. |
| *Class Two Mitigation Measures* | |
| 5. | Store all removed Animal Waste in an enclosure vented to a control device with an overall control efficiency of at least 80%. |
| 6. | Send at least 51% of the Animal Waste removed from site to a digester, with an overall control efficiency of at least 80%, within seventy two (72) hours of removal from housing. The digester shall be designed, constructed, maintained, and operated in accordance with NRCS Agricultural Waste Management Field Handbook Chapter 10 Section 651.1006, or more recent NRCS guidance. |

| SCAQMD Rule 223 - Poultry Operation LCAF Mitigation Measures<br>**(C) Handling of Solid Manure or Separated Solids**<br>Owners/operators that handle or store solid manure or separated solids outside the animal housing shall incorporate at least one (1) of the following mitigation measures: | |
|---|---|
| 7. | Compost Animal Waste removed from the housing with an Aerated Static Pile vented to a control device with an overall control efficiency of at least 80% designed, constructed, operated, and maintained in accordance with NRCS Agricultural Waste Management Field Handbook Chapter 10 Section 651.1004, or more recent NRCS guidance. |

| SCAQMD Rule 223 - Poultry Operation LCAF Mitigation Measures<br>**(D) Handling of Manure in Liquid Form**<br>Owners/operators that handle manure in a liquid form shall incorporate at least one (1) of the following mitigation measures: | |
|---|---|
| *Class One Mitigation Measures* | |
| 1. | Manage the facility such that only storm water and water used to wash eggs enters the Lagoon. |
| 2. | a. Use Phototrophic Lagoons, or<br>b. Use an Anaerobic Treatment Lagoon designed, constructed, maintained, and operated in accordance with NRCS Agricultural Waste Management Field Handbook Chapter 10 Section 651.1004, or more recent NRCS guidance. |
| 3. | Remove solids from the waste system with a Solid Separator System, prior to the waste entering the Lagoon that is designed, constructed, operated, and maintained in accordance with NRCS Practice Standard 629 (Waste Treatment), or more recent NRCS standard. |
| 4. | Maintain Lagoon at a pH between 6.5 and 7.5. |
| 5. | Implement Alternative Mitigation Measure(s), not listed above, subject to approval of the Executive Officer. |
| *Class Two Mitigation Measures* | |
| 6. | a. Use Aerobic Lagoons designed, constructed, maintained, and operated to the recommendations in NRCS Agricultural Waste Management Field Handbook Chapter 10 Section 651.1004 or more recent NRCS guidance, or<br>b. Use a mechanically aerated Lagoon designed, constructed, maintained, and operated according to the recommendations in NRCS Agricultural Waste Management Field Handbook Chapter 10 Section 651.1004 or more recent NRCS guidance, or<br>c. Maintain organic loading in the Lagoon that is less than 3.5 mg (dry weight)/mL, or total volatile solids is less than 3.5 mg/mL. |
| 7. | Use additional non-standard equipment or chemicals on the solid separator system, such as roller or screw presses or chemical coagulants and flocculants that increase the percent of solid separation achieved by the separator and is approved by the Executive Officer. |
| 8. | Cover the lagoon or storage pond and vent to a biofilter or a control device with an overall control efficiency of at least 80%. |

District BACT Guideline 5.7.2 only applies to pollutants that are emitted directly from layer houses; therefore, for purposes of updating District BACT Guideline 5.7.2, the SCAQMD Rule 223 requirements shown above for solid manure and liquid manure outside of the houses are not applicable. The remaining

requirements of SCAQMD Rule 223 are mostly identical to the requirements in the original version of District Rule 4570, with the exception that SCAQMD Rule 223 requires increased frequency for some measures (e.g. removal of cake manure and manure under cages daily rather than every 14 days and adjusting drinkers daily rather than every 14 days). As discussed below, the District determined that frequent removal of cake manure was infeasible. The current Phase II requirements of District Rule 4570 also increased the required frequency for adjusting drinkers and inspection and repair of water pipes and drinkers to levels that were determined to be practical for these measures. Also, because California law currently prohibits the confinement of laying hens in traditional cages,[38] the measure to clean under poultry cages is no longer applicable.

Furthermore, when District Rule 4570 was last amended in 2010, many of the Class Two mitigation measures were removed from the current Phase II requirements of the rule because they were theoretical measures that were infeasible or impractical and/or had not been demonstrated at confined animal facilities. However, previous District BACT guideline 5.7.2 for poultry layer houses did require the use of a belt manure removal and system that dries the manure and mechanical ventilation, which are listed as Class Two mitigation measures in SCAQMD Rule 223. The remaining requirements of SCAQMD Rule 223 that are applicable to poultry layer operations are similar to the current requirements of District Rule 4570.

SMAQMD Rule 496

The purpose of SMAQMD Rule 496 - Large Confined Animal Facilities is to limit VOC emissions from large confined animal facilities. SMAQMD Rule 496 requires dairies and poultry ranches that are Large Confined Animal Facilities to select from menus of options to reduce emissions from different areas and processes at the facility (e.g., feed, housing, solid manure, liquid manure, etc.) and requires other Large Confined Animal Facilities to submit an emission mitigation plan demonstrating Best Available Retrofit Control Technology (BARCT). SMAQMD Rule 496 contains basically identical mitigation measures for poultry operations as the previous District Rule 4570, Phase I mitigation measures. The SMAQMD Rule 496 mitigation measures for poultry operations are also similar to measures in SCAQMD Rule 223. The SMAQMD Rule 496 measures for poultry operations are shown in the tables below.

[38] California Department of Food and Agriculture (CDFA) Animal Care Program Guidance: Egg Producers. https://www.cdfa.ca.gov/AHFSS/AnimalCare/docs/Animal_Care_Producer_Eggs.pdf accessed June 8, 2026

| SMAQMD Rule 496 - Poultry Ranch LCAF Mitigation Measures | |
|---|---|
| **Feed Mitigation Measures**<br>a. The owner/operator shall incorporate at least five of the following feed mitigation measures. Measures 1 through 9 are classified as class one mitigation measures. If any of measures 1 through 5 are being utilized in the emission mitigation plan and the owner/operator is contractually obligated to use proprietary feed, the supplier of that feed must provide a quarterly certification to the owner/operator that the provided feed meets the mitigation measure(s). Additionally, the supplier must provide notice to the owner/operator 90 days before the provided feed ceases to meet the requirements of the mitigation measure. If the supplier fails to notify the owner/operator of such change the supplier will be responsible for any resulting violations. | |
| *Class One Mitigation Measures* | |
| 1. | Feed according to National Research Council guidelines specified in “Nutrient Requirements of Poultry: Ninth Revised Edition, 1994,”or a more recent edition. |
| 2. | Feed animals probiotics designed to improve digestion according to manufacturer recommendations. |
| 3. | Feed animals an amino acid supplement diet to meet their nutrient requirements. |
| 4. | Feed animals feed additives such as amylase, xylanase, and protease, designed to maximize digestive efficiency according to manufacturer recommendations. |
| 5. | Use feed additives designed to reduce feed decomposition or oxidation. |
| 6. | Remove spilled feed from animal housing at least once every seven days. |
| 7. | Enclose grain in a weatherproof storage structure from October through May. |
| 8. | Feed or dispose of feed within 48 hours of grinding and mixing feed. |
| 9. | Remove uneaten wet feed from the animal housing within 24 hours of feed becoming wet due to rain. |

| SMAQMD Rule 496 - Poultry Ranch LCAF Mitigation Measures | |
|---|---|
| **b. Housing Mitigation Measures**<br>The owner/operator shall incorporate four of the following mitigation measures in all animal housing. Measures 1 through 12 are classified as class one mitigation measures and measures 13 through 16 are classified as class two mitigation measures. | |
| *Class One Mitigation Measures* | |
| 1. | Remove caked animal waste at least once every 14 days. |
| 2. | Clean under poultry cages at least once every 14 days. |
| 3. | Use poultry litter additives designed to reduce air emissions or moisture content in litter, such as aluminum sulfate or sodium bisulfate, according to manufacturer recommendations. |
| 4. | Use a dry housing cleaning method at all times, except when a wet cleaning method is required for animal health or biosecurity issues. |
| 5. | Use drinkers that do not have a drip system. |
| 6. | Adjust the height, volume, and location of drinkers at least once every 14 days. |
| 7. | Use no foggers in the house. |
| 8. | Only use fogger systems designed, operated and maintained according to manufacturer recommendations that provide water droplets with an average size of 50 microns or less. |
| 9. | Slope the floor of the house 3%. |

| SMAQMD Rule 496 - Poultry Ranch LCAF Mitigation Measures<br>**b. Housing Mitigation Measures**<br>The owner/operator shall incorporate four of the following mitigation measures in all animal housing. Measures 1 through 12 are classified as class one mitigation measures and measures 13 through 16 are classified as class two mitigation measures. | |
|---|---|
| 10. | Install mounds or berms up gradient to prevent the runoff of storm water into pens (only an option for animals allowed to freely move between indoor housing structures and outdoor pens). |
| 11. | Inspect water pipes and drinkers and repair leaks at least once every day. |
| 12. | Maintain the roof structure and manage roof runoff in accordance with the applicable standards in the NRCS Field Office Technical Guide Code 558 or other applicable standards approved by the Air Pollution Control Officer, California Air Resources Board, and U.S. Environmental Protection Agency. |
| *Class Two Mitigation Measures* | |
| 13. | Vent animal housing to a VOC control device with an overall VOC capture and VOC control efficiency of at least 80%. |
| 14. | Use a belt litter removal system that dries the litter. |
| 15. | House animals in a tunnel ventilated house with mechanical ventilation. |
| 16. | Use a litter drying system, such as a flat bed drying system. |

| SMAQMD Rule 496 - Poultry Ranch LCAF Mitigation Measures<br>**c. Solid Waste/Separated Solids Mitigation Measures:**<br>The owner/operator of a poultry ranch that handles or stores solid animal waste or separated solids outside the animal housing shall incorporate at least one of the following mitigation measures. Measures 1 through 3 are classified as class one mitigation measures and measures 4 and 5 are classified as class two mitigation measures. | |
|---|---|
| *Class One Mitigation Measures* | |
| 1. | Choose one of the following measures<br>a. Remove all animal waste from facility within 72 hours of removal from animal housing, or<br>b. Send all animal waste to a lagoon within 72 hours of removal from animal housing. |
| 2. | Cover animal waste outside the animal housing with a waterproof covering from October through May, except for times, not to exceed 24 hours, when wind removes the covering. |
| 3. | Use a solid animal waste handling system in housing, such as stockpiles, solid land application, or a thin bed animal waste drying system, instead of a liquid system such as flushing, animal waste storage ponds, or animal waste treatment lagoons. |
| *Class Two Mitigation Measures* | |
| 4. | Send at least 51% of the animal waste removed from site to an anaerobic digester, with a VOC control device with an overall VOC capture and VOC control efficiency of at least 80%. |
| 5. | Compost animal waste removed from the animal housing with an aerated static pile vented to a VOC control device with an overall VOC capture and VOC control efficiency of at least 80%. |

| SMAQMD Rule 496 - Poultry Ranch LCAF Mitigation Measures<br>**d. Liquid Waste Mitigation Measures:**<br>The owner/operator of a poultry ranch that handles or stores solid animal waste or separated solids outside the animal housing shall incorporate at least one of the following mitigation measures. Measures 1 through 3 are classified as class one mitigation measures and measures 4 and 5 are classified as class two mitigation measures. | |
|---|---|
| *Class One Mitigation Measures* | |
| 1. | Manage the facility such that there are no lagoons at the facility. |
| 2. | Choose one of the following measures:<br>a. Use phototropic lagoons, or<br>b. Use an anaerobic lagoon |
| 3. | Remove solids from the waste system with a solid separator system, prior to waste entering the lagoon |
| 4. | Maintain lagoon at a pH between 6.5 and 7.5 |
| *Class Two Mitigation Measures* | |
| 5. | Choose one of the following measures:<br>a. Use an aerobic lagoon, or<br>b. Use a mechanically aerated lagoon. |
| 6. | Maintain organic loading in the lagoon that is less than 3.5 mg (dry weight)/mL |
| 7. | Use additional non-standard equipment or chemicals on the solid separator system, such as roller or screw presses or chemical coagulants and flocculants, that increase the percent of solid separation achieved by the separator and is approved by the Air Pollution Control Officer, California Air Resources Board, and U.S. Environmental Protection Agency. |
| 8. | Cover the lagoon or storage pond and vent to a VOC control device with an overall VOC capture and VOC control efficiency of at least 80%. |

As discussed above, because District BACT Guideline 5.7.2 applies to pollutants that are emitted directly from layer houses, for purposes of updating District BACT Guideline 5.7.2, the requirements shown above for solid manure and liquid manure outside of the houses are not applicable.

As mentioned above, when District Rule 4570 was last amended in 2010, many of the Class Two mitigation measures were removed from the current Phase II requirements of the rule because they were theoretical measures that were infeasible or impractical and/or had not been demonstrated at confined animal facilities or are not applicable to poultry layer houses. The remaining requirements of SMAQMD Rule 496 for poultry layer operations are similar to the requirements of District Rule 4570.

District Rule 4570

The purpose of District Rule 4570 - Confined Animal Facilities is to limit emissions of VOC from Confined Animal Facilities. District Rule 4570 requires the different types of Large Confined Animal Facilities to implement mitigation measures and select from limited options to reduce emissions from different

areas and processes at the facility. As stated above, the mitigation measures included in the original version (Phase I) of District Rule 4570 served as model that other California air districts used to develop rules for Large Confined Animal Facilities.

District Rule 4570 was last amended on October 21, 2010. The amendments were to incorporate the results of more recent scientific studies, strengthen requirements, decrease redundancy and ambiguity, and remove measures that were not applicable or had not been shown to reduce emissions. Examples of mitigation measures that were removed for poultry operations include removal of cake manure/litter at least once every 14 days and feeding or disposing of feed within 48 hours of grinding and mixing feed. It was determined that removal of caked manure/litter at least once every 14 days was not practical. Special machines are used to remove caked manure/litter from poultry operations; however, these machines cannot be used while birds are in the houses, so removal of caked manure is typically only performed between flocks. This typically occurs in poultry facilities that raise broilers or turkeys for meat. In layer houses, the majority of manure is removed from under the areas where the birds roost and conditions are managed to minimize production of cake manure. It was determined that feeding or disposing of rations within 48 hours of grinding and mixing feed was not applicable to poultry operations and would not reduce emissions. Poultry feed primarily consists of dry grain that has been ground and mixed offsite and shipped to the poultry operation. Because of the low moisture content of poultry feed it remains stable for fairly long periods of time and is not expected to contribute significantly to gaseous emissions while being fed to the birds.

The current District Rule 4570 measures for layer operations are shown in the tables below.

| **District Rule 4570, Phase II – Layer Mitigation Measures**<br>**A. Feed Mitigation Measures**<br>Owners/operators of a layer CAF shall implement at least one (1) of the following feed mitigation measures: | |
|---|---|
| 1. | Choose one of the following:<br>a. Feed according to NRC guidelines; or<br>b. Feed animals probiotics designed to improve digestion according to manufacturer recommendations; or<br>c. Feed animals an amino acid supplemented diet to meet their nutrient requirements; or<br>d. Feed animals feed additives such as amylase, xylanase, and protease, designed to maximize digestive efficiency according to manufacturer recommendations. |
| 2. | Implement an alternative mitigation measure(s), not listed above. |

| District Rule 4570, Phase II – Layer Mitigation Measures<br>**B. Housing Mitigation Measures**<br>Owners/operators of a layer CAF shall implement at least two (2) of the following housing mitigation measures: | |
|---|---|
| 1. | Use drinkers that do not drip continuously. |
| 2. | Inspect water pipes and drinkers and repair leaks daily. |
| 3. | Implement an alternative mitigation measure(s), not listed above. |

| District Rule 4570, Phase II – Layer Mitigation Measures<br>**C. Solid Manure/Separated Solids Mitigation Measures:**<br>Owners/operators of a layer CAF that handle or store solid litter/manure or separated solids outside the animal housing shall implement at least one (1) of the following mitigation measures: | |
|---|---|
| 1. | Within seventy-two (72) hours of removal from housing, either:<br>a. Remove all litter/manure from the facility; or<br>b. Cover litter/manure outside the housing with a weatherproof covering from October through May, except for times when wind events remove the covering, not to exceed twenty-four (24) hours per event. |
| 2. | Implement an alternative mitigation measure(s), not listed above. |

| District Rule 4570, Phase II – Layer Mitigation Measures<br>**D. Liquid Manure Mitigation Measures:**<br>Owners/operators of a layer CAF that handle manure in a liquid form shall implement at least one (1) of the following mitigation measures: | |
|---|---|
| 1. | Use a phototropic lagoon. |
| 2. | Use an anaerobic treatment lagoon designed in accordance with NRCS Guideline No. 359. |
| 3. | Maintain lagoon pH between 6.5 and 7.5. |
| 4. | Implement an alternative mitigation measure(s), not listed above. |

As previously mentioned, the mitigation measures for solid manure and liquid manure outside of the houses will not be considered for this proactive BACT determination for poultry layer houses. However, the feed and housing mitigation measures for laying hens will be considered for purposes of this proactive BACT determination.

ICAPCD - Rule 217

Imperial County APCD Rule 217 - Large Confined Animal Facilities (LCAF) Permits Required states that the purpose of the rule is to limit emissions of Volatile Organic Compounds (VOC) and Ammonia from Large Confined Animal Facilities (LCAFs). The rule requires Large Confined Animal Facilities to obtain an air permit and requires the different types of Large Confined Animal Facilities to select from menus of options to reduce emissions from different areas and processes at the facility. ICAPCD Rule 217 was last revised February 9, 2016. The revisions incorporated requirements for poultry operations that were identical to the District Rule 4570, Phase II requirements

shown above. The ICAPCD Rule 217 measures for layer operations are shown in the tables below.

| ICAPCD Rule 217 – Layer Mitigation Measures<br>**A. Feed Mitigation Measures**<br>Owners/operators of a layer CAF shall implement at least one (1) of the following feed mitigation measures: | |
|---|---|
| 1. | a. Feed according to NRC guidelines; or<br>b. Feed animals probiotics designed to improve digestion according to manufacturer recommendations; or<br>c. Feed animals an amino acid supplemented diet to meet their nutrient requirements; or<br>d. Feed animals feed additives such as amylase, xylanase, and protease, designed to maximize digestive efficiency according to manufacturer recommendations. |
| 2. | Implement an alternative mitigation measure(s), not listed above. |

| ICAPCD Rule 217 – Layer Mitigation Measures<br>**B. Housing Mitigation Measures**<br>Owners/operators of a layer CAF shall implement at least two (2) of the following housing mitigation measures: | |
|---|---|
| 1. | Use drinkers that do not drip continuously. |
| 2. | Inspect water pipes and drinkers and repair leaks daily |
| 3. | Implement an alternative mitigation measure(s), not listed above. |

| ICAPCD Rule 217 – Layer Mitigation Measures<br>**C. Solid Manure/Separated Solids Mitigation Measures:**<br>Owners/operators of a layer CAF that handle or store solid litter/manure or separated solids outside the animal housing shall implement at least one (1) of the following mitigation measures: | |
|---|---|
| 1. | Within seventy-two (72) hours of removal from housing, either:<br>a. Remove all litter/manure from the facility; or<br>b. Cover litter/manure outside the housing with a weatherproof covering from October through May, except for times when wind events remove the covering, not to exceed twenty-four (24) hours per event. |
| 2. | Implement an alternative mitigation measure(s), not listed above. |

| ICAPCD Rule 217 – Layer Mitigation Measures<br>**D. Liquid Manure Mitigation Measures:**<br>Owners/operators of a layer CAF that handle manure in a liquid form shall implement at least one (1) of the following mitigation measures: | |
|---|---|
| 1. | Use a phototropic lagoon. |
| 2. | Use an anaerobic treatment lagoon designed in accordance with NRCS Guideline No. 359. |
| 3. | Maintain lagoon pH between 6.5 and 7.5. |
| 4. | Implement an alternative mitigation measure(s), not listed above. |

Discussion of Rules for Layer Houses:

The requirements of District Rule 4570, Phase I were used as model for other California air districts to develop their rules for Large Confined Animal Facilities. The District Rule 4570, Phase II requirements incorporated the results of more recent scientific studies, strengthened these requirements, and removed measures that were not applicable or had not been shown to reduce emissions. Therefore, the requirements of District Rule 4570, Phase II will primarily be considered for purpose of updating District BACT Guideline 5.7.2.

Controls Identified to Reduce for VOC emissions from Layer Houses

As mentioned above, some poultry operations have started to raise “free-range” poultry to address concerns about animal welfare and consumer demand and this requires that the poultry houses have openings to allow the birds to enter and exit to roam outside for at least part of the day. Although completely sealing free-range poultry houses to capture all of the emissions may require changing how the birds are raised, options that require the capture of emissions from poultry houses will still be considered for in this proactive BACT determination.

In addition to the controls listed above, current District BACT guidelines 5.7.1 – Poultry Broiler House and 5.7.3 – Turkey House identify a wet scrubber as a technologically feasible control that can achieve 70% control of VOC from these operations. Because wet scrubbers have been determined to be technologically feasible for other types of poultry houses, they will also be considered technologically feasible for layer houses in this proactive BACT determination. As discussed above, because District permits for at least two laying operations require that the belts for the belt manure removal system advance by a minimum of their full length every 48 hours to reduce emissions, this requirement will be considered part of the achieved in practice BACT requirements for poultry layer houses.

The following control technologies and practices were identified as potential options to control VOC emissions from poultry housing for layers based on general applicability and transfer of controls and technology from similar operations:

1. 98% Control - Thermal Incineration
2. 95% Control - Catalytic Incineration
3. 95% Control - Carbon Adsorption
4. 80% Control - Biofiltration
5. 70% Control - Wet Scrubber
6. Use of the following poultry house design and management practices:
    a. Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors; AND
    b. Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week; AND

c. Compliance with applicable District Rule 4570 Feed and Housing Mitigation Measures; AND
d. All mortality removed from houses at least once per day

**Step 2 - Eliminate Technologically Infeasible Options**

Option 1, 98% Control - Thermal Incineration, and Option 2, 95% Control - Catalytic Incineration, will be removed from further consideration. Although previous District BACT Guideline 5.7.2 listed thermal and catalytic incineration as technologically feasible options to control VOC emissions from layer houses and these options are included in current District BACT Guideline 5.7.1 for poultry broiler houses, these options are generally not practical options for confined animal facilities because of the very large air flowrates that must be controlled and the resulting requirement for large amounts of auxiliary fuel to combust the very small concentrations of VOCs in the exhaust air from the buildings housing animals. In addition to generally being impractical for controlling emissions from confined animal facilities, thermal and catalytic incineration also generate combustion pollutants that negatively impact air quality, including NOx, which is a precursor to tropospheric ozone and $PM_{2.5}$, and direct emissions of $PM_{10}$ and $PM_{2.5}$.

Option 3, Carbon Adsorption (95% Control), will also be removed from further consideration. The EPA Air Pollution Control Cost Manual, Section 3.1 – VOC Recapture Controls, Chapter 1 – Carbon Adsorbers[39] indicates that the use of carbon adsorption to control VOC has certain limitations. The EPA Air Pollution Control Cost Manual states the following concerning some of these limitations:

> "*activated carbon is less effective for compounds that are highly polar, volatile or have small diameters*",
>
> "*activated carbon is less effective in situations where the waste gas has high relative humidity as the water molecules readily adsorb to the activated carbon reducing the number of available absorption sites*" and "*Moisture in the bed can also promote biological growth on the carbon surface*"; and
>
> "*Wastes with oxygen bearing compounds, such as peroxides, ketones, organic acids, aldehydes and organic sulfur compounds should be avoided as activated carbon can cause exothermic reactions with these compounds. The heat from exothermic reactions can ignite any flammable compounds present in the waste stream.*"

The EPA Air Pollution Control Cost Manual, Section 3.1 – VOC Recapture Controls, Chapter 1 – Carbon Adsorbers, Table 1.1: Comparison of Activated

[39] EPA (2018) EPA Air Pollution Control Cost Manual, 7th Edition, Section 3 – VOC Controls; Section 3.1 – VOC Recapture Controls, Chapter 1 – Carbon Adsorbers. https://www.epa.gov/sites/default/files/2018-10/documents/final_carbonadsorberschapter_7thedition.pdf

Carbon, Zeolite and Polymer Adsorbents lists the following disadvantages of activated carbon adsorbents:

- Not effective for VOCs with high polarity (e.g., alcohols, organic acids).
- Not effective for highly volatile compounds (e.g., vinyl chloride, MTBE)
- Reduced capacity in high moisture applications.
- High annual costs for carbon replacement/regeneration when used for concentrated waste streams.
- Fire hazard if used with oxygen bearing compounds or VOCs having high heat of adsorption.
- Degrades during desorption cycles.

The majority of VOC emissions measured from confined animal facilities consist of polar and oxygen-bearing compounds, such as alcohols, organic acids, and aldehydes, which as mentioned above, are not effectively controlled by activated carbon adsorbents. These compounds also can cause exothermic reactions with activated carbon that can cause fires in the activated carbon vessels. Furthermore, the exhaust from houses for animals on confined animal facilities can have high relative humidity. Many publications recommend that the relative humidity in poultry houses be maintained between 50% and 70%.[40, 41] However, the EPA Air Pollution Control Cost Manual states that "*the adsorption capacity of activated carbon is significantly impacted at levels below 50%*" relative humidity. Thus, the moisture in the exhaust from buildings housing animals can significantly lower the control efficiency of carbon adsorption. In addition, the moisture and contaminants in the exhaust from buildings housing animals can promote biological growth in the activated carbon, which can clog the pores and channels required for adsorption. Therefore, the use of carbon adsorption to control emissions from buildings housing animals on confined animal facilities is not practical and will not be considered further.

As an additional note, although zeolites are an alternative adsorbent material that can handle exhausts with high relative humidity and can be selected to remove specific polar compounds from air streams, the zeolites chosen must be selected to target specific compounds and as stated in the EPA Air Pollution Control Cost Manual, Section 3.1 – VOC Recapture Controls, Chapter 1 – Carbon Adsorbers, are generally "*not suitable for waste streams containing wide ranges of VOC*," such as in the exhaust from buildings housing animals on confined animal facilities. Furthermore, additional research is currently needed to determine if polymer adsorbents would be suitable for controlling emissions from poultry houses.

[40] Czarick, M. and Fairchild, B. (2012) Poultry Housing Tips Relative Humidity...The Best Measure of Overall Poultry House Air Quality. The University of Georgia College of Agricultural and Environmental Sciences Cooperative Extension. Poultry Housing Tips, Volume 24, Number 2, February 2012. https://www.poultryventilation.com/resources/relative-humidity-the-best-measure-of-overall-poultry-house-air-quality/

[41] Poul Tech Poultry Farm Solutions (2025) Factors Affecting Egg Production in Laying Hens – Management Factors. https://www.poultech.com/factors-affecting-egg-production-in-laying-hens-management-factors/, accessed June 9, 2026

There are no other technologically infeasible options to be eliminated from Step 1.

**Step 3 - Rank Remaining Control Technologies by Control effectiveness**

The control options being considered are ranked as follows based on their VOC control efficiencies:

1. 80% Control (Capture and Biofiltration) (Technologically feasible)
2. 70% Control (Capture and Wet Scrubber) (Technologically feasible)
3. Use of the following design and management practices (Achieved in Practice):
   a. Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors; AND
   b. Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week; AND
   c. Compliance with applicable District Rule 4570 Feed and Housing Mitigation Measures; AND
   d. All mortality removed from houses at least once per day

**Step 4 - Cost Effectiveness Analysis**

Since this is a proactive BACT determination that is not part of a specific permitting action, a cost effectiveness analysis is not required.

**Step 5 - Select BACT**

Since this is a proactive BACT determination that is not part of a specific permitting action, selecting BACT is not applicable. Recommendations for updates and corrections/changes to the previous BACT requirements are summarized in the following section and summarized in the draft updated BACT guideline attached in Appendix A.

**C. BACT Analysis for $NH_3$ Emissions**

**Step 1 - Identify All Possible Control Technologies**

Survey of BACT Guidelines:

The following BACT references were reviewed to identify potential control technologies for $NH_3$ emissions from poultry layer houses:

- EPA RACT/BACT/LAER clearinghouse
- California Air Resources Board (CARB) BACT clearinghouse/guideline list (https://ww2.arb.ca.gov/capp/cst/tch/bact-guidelines-tool)

- San Joaquin Valley APCD (SJVAPCD) BACT clearinghouse (https://ww2.valleyair.org/permitting/best-available-control-technology/district-bact-clearinghouse/)
- South Coast AQMD (SCAQMD) BACT guidelines (https://www.aqmd.gov/home/permits/bact/guidelines)
- Bay Area AQMD (BAAQMD) BACT/T-BACT workbook (https://www.baaqmd.gov/permits/permitting-manuals/bact-tbact-workbook)
- Sacramento Metropolitan AQMD (SMAQMD) BACT clearinghouse (https://www.airquality.org/businesses/permits-registration-programs/best-available-control-technology-(bact))
- Monterey Bay Air Resources District (MBARD) BACT Guidelines
- Santa Barbara County APCD (SBAPCD) BACT clearinghouse (https://www.ourair.org/bact/)
- San Diego County APCD (SDAPCD) BACT Guidance Document (https://www.sdapcd.org/content/dam/sdapcd/documents/permits/SDAPCD-BACT-Guidance.pdf)

The EPA RACT/BACT/LAER clearinghouse does not include general guidelines, only determinations made by individual agencies. The CARB BACT clearinghouse/guideline list includes BACT guidelines and determinations submitted by California air districts.

No BACT guidelines or determinations for poultry layer houses were found in the references given above, except previous District BACT guideline 5.7.2, which was presented above and included the BACT options for the control of $NH_3$ that are shown in the table below.

| **Previous SJVAPCD BACT Guideline 5.7.2 – Poultry Layer House BACT for $NH_3$** | | |
|---|---|---|
| Achieved in Practice | Technologically Feasible | Alternate Basic Equipment |
| 55% control - completely enclosed mechanically ventilated layer housing with evaporative cooling pads, mixing fans, and a computer control system; belt manure aeration/drying and removal system with manure removal at least twice per week; all birds fed in accordance with NRC or other District-approved guidelines; and all mortality removed from houses once per day. | 1. 99% control - Wet Scrubber<br>2. 80% control - Biofiltration | -- |

Survey of Applicable Rules and Regulations:

In addition, the following rules and regulations were reviewed to identify any emission limits or practices that could reduce $NH_3$ emissions from poultry houses for layers:

- SCAQMD Rule 223 – Requirements for Confined Animal Facilities (amended 9/5/2025)
- SCAQMD 1127 – Emission Reductions from Livestock Waste (adopted 8/6/2004)
- BAAQMD Regulation 2, Rule 10 – Large Confined Animal Facilities (adopted 7/19/2006)
- SMAQMD Rule 496 - Large Confined Animal Facilities (adopted 8/24/2006)
- SJVAPCD Rule 4550 - Conservation Management Practices (adopted 5/20/2004; re-adopted 8/19/2004)
- SJVAPCD Rule 4570 – Confined Animal Facilities (last amended 10/21/2010)
- Imperial County APCD (ICAPCD) Rule 217 - Large Confined Animal Facilities (LCAF) Permits Required (revised 2/9/2016)
- ICAPCD Rule 806 – Conservation Management Practices (revised 10/16/2012)
- Butte County AQMD (BCAQMD) Rule 450 - Large Confined Animal Facilities (adopted December 21, 2006)

Only one air district rule was located that applied to poultry houses and specifically stated that a purpose of the rule was to reduce or control $NH_3$ emissions, ICAPCD Rule 217. Other air district rules did not apply to poultry operations or did not include reduction of $NH_3$ as a specific purpose of the rule. For example, SCAQMD Rule 1127 states that the purpose of the rule is to reduce $NH_3$, VOC, and $PM_{10}$ emissions from livestock waste, but only applies to dairies and related cattle operations and the manure from these operations, not poultry operations. BAAQMD Regulation 2, Rule 10 states that the purpose of the rule is to reduce emissions of air contaminants from large confined animal facilities through control measures established during permit review; however, the rule does not contain any specific measures that reduce emissions; instead it contains the general requirement that any permit issued for a large confined animal facility must include permit conditions to implement control measures that represent reasonably available control technology (RACT) to reduce emissions. Similarly, Butte County AQMD Rule 450 does not contain any specific measures that reduce emissions from confined animal facilities, but requires operators of large confined animal facilities to implement control measures to reduce emissions that are identified in an application submitted by the operator.

Although the primary purpose of SCAQMD Rule 223, SMAQMD Rule 496, and District Rule 4570 is to control VOC emissions from confined animal facilities,

these rules will also be considered for potential measures that could control $NH_3$ emissions since many of the measures in these rules that control VOC emissions may also control $NH_3$ from these operations.

As mentioned above, California air districts that were required to adopt rules with specific requirements for confined animal facilities generally adopted rules with identical or nearly identical mitigation measures as contained in the original version of District Rule 4570. The requirements of these rules that are expected to reduce $NH_3$ emissions from layer houses are discussed below.

SCAQMD Rule 223

SCAQMD Rule 223 – Emission Reduction Permits for Large Confined Animal Facilities establishes the requirements for agricultural sources in the SCAQMD subject to permit as a result of California Health & Safety Code Section 40724.6 as effective January 1, 2004 and federal and state Clean Air Act requirements.

SCAQMD Rule 223 requires different types of Large Confined Animal Facilities to select from menus of options to reduce emissions from different areas and processes at the facility (e.g., feed, housing, solid manure, liquid manure, etc.). The SCAQMD Rule 223 measures for poultry operations were shown in the tables above in the section for the BACT analyses for VOC emissions from layer houses.

As mentioned above, the requirements of SCAQMD Rule 223 are mostly identical to the requirements in the original version of District Rule 4570, with the exception that SCAQMD Rule 223 requires increased frequency for some measures (i.e. removal of cake manure and manure under cages daily rather than every 14 days, adjusting drinkers daily rather than every 14 days, and inspection and repair of water pipes and drinkers at least once a day rather than every 14 days). As previously discussed, the District determined that frequent removal of cake manure was infeasible. The current Phase II requirements of District Rule 4570 also increased the required frequency for adjusting drinkers and inspection and repair of water pipes and drinkers to levels that were determined to be practical for these measures.

As explained above, when District Rule 4570 was last amended in 2010, many of the Class Two mitigation measures were removed from the current Phase II requirements of the rule because they were theoretical measures that were infeasible or impractical and/or had not been demonstrated at confined animal facilities. However, previous District BACT guideline 5.7.2 for poultry layer houses did require the use of a belt manure removal and system that dries the manure and mechanical ventilation, which are listed as Class Two mitigation measures in SCAQMD Rule 223. As also discussed above, because District BACT Guideline 5.7.2 applies to pollutants that are emitted directly from layer houses, for purposes of updating District BACT Guideline 5.7.2, the

requirements shown above for solid manure and liquid manure outside of the houses are not applicable. The remaining requirements of SCAQMD Rule 223 that are applicable to poultry layer operations are similar to the current requirements of District Rule 4570

SMAQMD Rule 496

The purpose of SMAQMD Rule 496 - Large Confined Animal Facilities is to limit VOC emissions from large confined animal facilities. SMAQMD Rule 496 requires dairies and poultry ranches that are Large Confined Animal Facilities to select from menus of options to reduce emissions from different areas and processes at the facility (e.g., feed, housing, solid manure, liquid manure, etc.) and requires other Large Confined Animal Facilities to submit an emission mitigation plan demonstrating Best Available Retrofit Control Technology (BARCT). SMAQMD Rule 496 contains basically identical mitigation measures for poultry operations as the previous District Rule 4570, Phase I mitigation measures. The SMAQMD Rule 496 mitigation measures for poultry operations are also similar to measures in SCAQMD Rule 223. The SMAQMD Rule 496 measures for poultry operations were shown in the tables above in the section for the BACT analyses for VOC emissions from layer houses.

As mentioned above, when District Rule 4570 was last amended in 2010, many of the Class Two mitigation measures were removed from the current Phase II requirements of the rule because they were theoretical measures that were infeasible or impractical and/or had not been demonstrated at confined animal facilities and the mitigation measures for solid and liquid manure outside of poultry houses are not applicable to this proactive BACT determination, which only applies to emissions from the layer houses. The remaining requirements of SMAQMD Rule 496 for poultry layer operations are similar to the requirements of District Rule 4570.

District Rule 4570

The purpose of District Rule 4570 - Confined Animal Facilities is to limit emissions of VOC from Confined Animal Facilities. In addition to limiting VOC emissions, District Rule 4570 also includes measures that control ammonia ($NH_3$) emissions. District Rule 4570 requires the different types of Large Confined Animal Facilities to implement mitigation measures and select from limited options to reduce emissions from different areas and processes at the facility. As stated above, the mitigation measures included in the original version (Phase I) of District Rule 4570 served as model that other California air districts used to develop rules for Large Confined Animal Facilities.

District Rule 4570 was last amended on October 21, 2010. The amendments were to incorporate the results of more recent scientific studies, strengthen requirements, decrease redundancy and ambiguity, and remove measures that

were not applicable or had not been shown to reduce emissions. Examples of mitigation measures that were removed for poultry operations include removal of cake manure/litter at least once every 14 days and feeding or disposing of feed within 48 hours of grinding and mixing feed. It was determined that removal of caked manure/litter at least once every 14 days was not practical. Special machines are used to remove caked manure/litter from poultry operations; however, these machines cannot be used while birds are in the houses, so removal of caked manure is typically only performed between flocks. This typically occurs in poultry facilities that raise broilers or turkeys for meat. In layer houses, the majority of manure is removed from under the areas where the birds roost and conditions are managed to minimize production of cake manure. It was determined that feeding or disposing of rations within 48 hours of grinding and mixing feed was not applicable to poultry operations and would not reduce emissions. Poultry feed primarily consists of dry grain that has been ground and mixed offsite and shipped to the poultry operation. Because of the low moisture content of poultry feed it remains stable for fairly long periods of time and is not expected to contribute significantly to gaseous emissions while being fed to the birds.

The current District Rule 4570 measures for layer operations were shown in the tables above in the section for the BACT analyses for VOC emissions from layer houses.

As previously mentioned, the mitigation measures for solid manure and liquid manure outside of the houses will not be considered for this proactive BACT determination for poultry layer houses. However, the feed and housing mitigation measures for laying hens will be considered for purposes of this proactive BACT determination.

ICAPCD - Rule 217

Imperial County APCD Rule 217 - Large Confined Animal Facilities (LCAF) Permits Required states that the purpose of the rule is to limit emissions of Volatile Organic Compounds (VOC) and Ammonia from Large Confined Animal Facilities (LCAFs). The rule requires Large Confined Animal Facilities to obtain an air permit and requires the different types of Large Confined Animal Facilities to select from menus of options to reduce emissions from different areas and processes at the facility. ICAPCD Rule 217 was last revised February 9, 2016. The revisions incorporated requirements for poultry operations that were identical to the District Rule 4570, Phase II requirements shown above. The ICAPCD Rule 217 measures for layer operations were shown in the tables above in the section for the BACT analyses for VOC emissions from layer houses.

Discussion of Rules for Poultry Layer Houses

As discussed above, the requirements of District Rule 4570, Phase I were used as model for other California air districts to develop their rules for Large Confined Animal Facilities. The District Rule 4570, Phase II requirements incorporated the results of more recent scientific studies, strengthened these requirements, and removed measures that were not applicable or had not been shown to reduce emissions. Therefore, the requirements of District Rule 4570, Phase II will primarily be considered for purpose of updating District BACT Guideline 5.7.2.

Controls Identified to Reduce for $NH_3$ emissions from Poultry Layer Houses

As mentioned above, some poultry operations have started to raise "free-range" poultry to address concerns about animal welfare and consumer demand and this requires that the poultry houses have openings to allow the birds to enter and exit to roam outside for at least part of the day. Although completely sealing free-range poultry houses to capture all of the emissions may require changing how the birds are raised, options that require the capture of emissions from poultry houses will still be considered for in this proactive BACT determination.

The following control technologies and practices were identified as potential options to control $NH_3$ emissions from poultry housing for layers based on general applicability and transfer of controls and technology from similar operations:

1. Capture and Wet Scrubber
2. Capture and Biofiltration
3. Use of the following design and management practices (Achieved in Practice):
   a. Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors; AND
   b. Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week; AND
   c. Compliance with applicable District Rule 4570 Feed and Housing Mitigation Measures; AND
   d. All mortality removed from houses at least once per day

**Step 2 - Eliminate Technologically Infeasible Options**

There are no technologically infeasible options to be eliminated from Step 1.

**Step 3 - Rank Remaining Control Technologies by Control effectiveness**

Previous District BACT guideline 5.7.2 indicated that wet scrubbers used to control emissions from layer houses have a 99% control efficiency for $NH_3$ emissions and

that biofilters used to control emissions from layer houses have 80% control efficiency for $NH_3$ emissions.

The 80% $NH_3$ control efficiency for biofilters used to control emissions from poultry layer houses is similar to the $NH_3$ control efficiency achieved by biofilters that control emissions from composting operations. However, the 99% $NH_3$ control efficiency for wet scrubbers appears to be much higher than the $NH_3$ control efficiencies typically given for wet scrubbers used to control emissions from animal housing at confined animal facilities. The US EPA draft report, Emissions from Animal Feeding Operations states the following:[42]

> *Although no performance data was located during the literature review for absorbers applied to gaseous emissions from animal housing, one study (University of Minnesota, 1999) reported the ammonia removal achieved by a washing wall at a swine facility. A washing wall is a water curtain intended to remove PM as the building air passes through it, using the same removal mechanism (i.e., impaction) as a wet scrubber. Because of ammonia's solubility in water, the washing wall was shown to reduce ammonia emissions up to 53%.*

The USDA NRCS and EPA Agricultural Air Quality Conservation Measures Reference Guide for Poultry and Livestock Production Systems,[18] Appendix A.1 and the Iowa State University Extension and Outreach Air Management Practices Assessment Tool[43] list $NH_3$ control efficiencies for wet scrubbers ranging from 70% to 90%. For purposes of this proactive BACT determination, it will be assumed that the $NH_3$ control efficiency of a wet scrubber used to control emissions from poultry housing is 80%, which is in the middle of the $NH_3$ control efficiency range for wet scrubbers in these documents.

The control options being considered are ranked as follows based on their $NH_3$ control efficiencies:

1. 80% Control (Capture and Biofiltration or Wet Scrubber) (Technologically Feasible)
2. Use of the following design and management practices (Achieved in Practice):
   a. Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors; AND
   b. Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week; AND

[42] US EPA (August 15, 2001) Emissions from Animal Feeding Operations, Draft Report, Section 9.2.4 – Gas Absorption in Confinement Housing Exhaust. EPA Contract No. 68–D6–0011. (Research Triangle Park, NC: US EPA, Office of Air Quality Planning and Standards, Emissions Standards Division). https://www.epa.gov/sites/default/files/2020-10/documents/draftanimalfeed.pdf

[43] Iowa State University Extension and Outreach Air Management Practices Assessment Tool https://www.extension.iastate.edu/ampat/scrubber. Accessed June 9, 2026

c. Compliance with applicable District Rule 4570 Feed and Housing Mitigation Measures; AND
d. All mortality removed from houses at least once per day

**Step 4 - Cost Effectiveness Analysis**

Since this is a proactive BACT determination that is not part of a specific permitting action, a cost effectiveness analysis is not required.

**Step 5 - Select BACT**

Since this is a proactive BACT determination that is not part of a specific permitting action, selecting BACT is not applicable. Recommendations for updates and corrections/changes to the previous BACT requirements are summarized in the following section and summarized in the draft updated BACT guideline attached in Appendix A.

## V. Recommendations

Based on the preceding analyses, the following updates are recommended for previous District BACT Guideline 5.7.2:

Update Achieved in Practice BACT to Require Enclosed Housing with Mechanical Ventilation Rather than Completely Enclosed Housing

Previous District BACT Clearinghouse Guideline 5.7.2 requires completely enclosed mechanically ventilated layer housing as achieved in practice BACT for $PM_{10}$, VOC, and $NH_3$ emissions from poultry layer houses. Previously, completely enclosed housing with laying hens kept in individual cages was the standard for new poultry layer houses. However, current regulations require produces to provide poultry more space to express natural behaviors because this is considered more humane. Although, it is more common for broilers and turkeys, in some cases other types of poultry may also be given occasional access to areas outside of the poultry houses. Therefore, as part of the update to District BACT Clearinghouse Guideline 5.7.2, it is proposed that the BACT requirements for poultry layer houses by updated from “completely enclosed mechanically ventilated layer housing with evaporative cooling pads, mixing fans, and a computer control system” to enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors.

Update Achieved in Practice BACT to Require that Belts for Belt Manure Removal System Advance at Least the Full Length of the Belt Every 48 Hours

As discussed above, at least two poultry layer facilities that are operating have permit requirements that require that the belts for the belt manure removal system for the poultry houses advance at least their full length every 48 hours to reduce

emissions; therefore, this requirement will be part of the achieved in practice BACT requirements for poultry layer houses.

Add Compliance with District Rule 4570 Feed and Housing Mitigation Measures as Achieved in Practice BACT Requirements for both VOC and $NH_3$

Layer operations that are subject to District permitting requirements are also generally subject to the requirements of District Rule 4570 and must implement mitigation measures from District Rule 4570 to reduce emissions. Because all layer operations subject to District permitting requirements are expected to be required to implement applicable District Rule 4570 feed and housing mitigation measures, these measures are achieved in practice. Therefore, it is recommended that the District Rule 4570 feed and housing mitigation measures be listed as achieved in practice BACT requirements for VOC and $NH_3$ under this update to BACT Guideline 5.7.2.

Add Manure Drying Tunnels, Dry Filters Using Centrifugal Force, or Equivalent Technology with a $PM_{10}$ Control Efficiency of 40% as part of an Achieved in Practice BACT for $PM_{10}$

As discussed above, some poultry facilities, including facilities in the San Joaquin Valley have been using the air from laying hen houses to dry manure in manure drying tunnels or sheds. Studies have shown that the manure drying tunnels can reduce $PM_{10}$ emissions from the poultry houses. It is estimated that manure drying tunnels can reduce $PM_{10}$ emissions by at least 40%. Therefore, manure drying tunnels, or an equivalent control that reduces PM10 emissions from poultry houses by 40% is considered achieved in practice.

Update Electrostatic Precipitator $PM_{10}$ Control Efficiency for Poultry Houses to 85%

Previous District BACT Guideline 5.7.2 included electrostatic precipitators as a technologically feasible option for the control of $PM_{10}$ from layer houses and gave 99% $PM_{10}$ control efficiency for this option. As discussed in this proactive BACT analysis, based on a review of the available studies and reports about electrostatic precipitators controlling emissions from poultry facilities that were located, it will be assumed that electrostatic precipitators used to control $PM_{10}$ emissions from poultry facilities can be optimized to achieve a conservative $PM_{10}$ control efficiency of 85%.

Remove Baghouses as a Technologically Feasible Option to Control $PM_{10}$ Emissions

As discussed above, although previous District BACT Guideline 5.7.2 listed a baghouse dust collector as a technologically feasible option to control $PM_{10}$ emissions from layer houses, in recent BACT analyses for projects for poultry facilities, the District determined that this is not a feasible option to control

emissions from poultry houses because feathers and large debris strongly adhere to the filter media and cannot be dislodged using the available bag cleaning technologies, such as mechanical shaking and reverse pulse jets.

Update the $PM_{10}$ Control Efficiency for High Efficiency Cyclones for Poultry Houses to 70% and add Cyclonic De-Duster

Previous District BACT Guideline 5.7.2 included high efficiency cyclones as a technologically feasible option for the control of $PM_{10}$ from layer houses and listed a $PM_{10}$ control efficiency of 60% for this option. As discussed previously in this proactive BACT analysis, based on the information from available reports and research, it will be assumed that high efficiency cyclones and cyclonic de-dusters controlling emissions from poultry houses will have a typical $PM_{10}$ control efficiency of 70%.

Remove Thermal and Catalytic Incineration as Technologically Feasible Options for Control of VOC

Previous District BACT Guideline 5.7.2 listed thermal and catalytic incineration as technologically feasible options to control VOC emissions from layer houses. However, as discussed above thermal and catalytic incineration are generally not practical options for confined animal facilities because of the high air flowrates and small concentrations of VOCs that requires large quantities of supplemental fuel. In addition, these options generate combustion pollutants that negatively impact air quality, such as NOx, $PM_{10}$, and $PM_{2.5}$.

Remove Carbon Adsorption as Technologically Feasible Option for Control of VOC

As discussed above, carbon adsorption is generally not a feasible option to control emissions from building housing animals at confined animal facilities because of the types of compounds emitted from confined animal facilities are not easily adsorbed and are a fire hazard because of the potential to cause exothermic reactions in the vessels, and because high relative humidity in the exhaust from animal housing can significantly reduce the effectiveness of carbon adsorption.

Update $PM_{10}$ and $NH_3$ Control Efficiency of Wet Scrubbers and Add Wet Scrubbers as a Technologically Feasible Option for Control of VOC

Previous District BACT Guideline 5.7.2 – Poultry Layer House included wet scrubbers as a technologically feasible option for the control of $PM_{10}$ and $NH_3$ from layer houses and listed a $PM_{10}$ control efficiency of 95% and a $NH_3$ control efficiency of 99% for this option. As discussed above in this document, the information that is currently available indicates that wet scrubbers installed to control emissions from animal housing at confined animal facilities would generally have lower control efficiencies for $PM_{10}$ and $NH_3$.

The USDA NRCS and EPA Agricultural Air Quality Conservation Measures Reference Guide for Poultry and Livestock Production Systems,[18] Appendix A.1 and the Iowa State University Extension and Outreach Air Management Practices Assessment Tool[44] also include wet scrubbers as a potential option to control $NH_3$, PM, and VOCs from animal housing. These documents list the following PM, VOC, and $NH_3$ control efficiency ranges for wet scrubbers controlling emissions from animal housing: 60% to 90% for PM, 50% to 90% for VOC, and 70% to 90% for $NH_3$. The use of acidic solutions is required for wet scrubbers to achieve higher control efficiencies for $NH_3$. As discussed above in this document, it will be assumed that a wet scrubber used at a poultry facility will have an 80% control efficiency for $PM_{10}$ and will have VOC and NH3 control efficiencies that are in the middle of the ranges given in the EPA Agricultural Air Quality Conservation Measures Reference Guide for Poultry and Livestock Production Systems and Iowa State University Extension and Outreach, Air Management Practices Assessment Tool.

Wet Scrubber Control Efficiencies: 80% for $PM_{10}$; 70% for VOC Control Efficiency; and 80% for $NH_3$

Appendices

A: Draft Updated BACT Guideline 5.7.2

B: Previous BACT Guideline 5.7.2

[44] Iowa State University Extension and Outreach Air Management Practices Assessment Tool https://www.extension.iastate.edu/ampat/scrubber. Accessed June 9, 2026

# Appendix A
# Draft Updated BACT Guideline 5.7.2

# SJVAPCD Best Available Control Technology (BACT) Guideline 5.7.2*

Last Update: June 10, 2026

## Poultry – Layer House

| Pollutant | Achieved in Practice or contained in SIP | Technologically Feasible | Alternate Basic Equipment |
|---|---|---|---|
| $PM_{10}$ | Use of the following practices:<br>a. Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors; AND<br>b. Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week; AND<br>c. Directing poultry house exhaust to a system that reduces $PM_{10}$ emissions by at least 40% (Manure drying tunnel(s), Dry filter(s) using centrifugal force, or equivalent) | 1. 85% Control (Capture and Electrostatic Precipitator)<br>2. 80% Control (Capture and Wet Scrubber)<br>3. 70% Control (Capture and High Efficiency Cyclones or Cyclonic De-Duster) | |
| VOC | Use of the following practices:<br>a. Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors; AND<br>b. Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week; AND<br>c. Applicable District Rule 4570 Feed and Housing Mitigation Measures; AND<br>d. All mortality removed from houses at least once per day | 1. 80% Control (Capture and Biofiltration)<br>2. 70% Control (Capture and Wet Scrubber) | |
| $NH_3$ | Use of the following practices:<br>a. Enclosed housing with mechanical ventilation and computerized control of environmental conditions using sensors; AND<br>b. Belt manure removal and aeration/drying system with belts that advance at least a full length every 48 hours and manure removal at least twice per week; AND<br>c. Applicable District Rule 4570 Feed and Housing Mitigation Measures; AND<br>d. All mortality removed from houses at least once per day | 80% Control (Capture and Biofiltration or Wet Scrubber) | |

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in s a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

***This is a Summary Page for this Class of Source**

# Appendix B
# Previous BACT Guideline 5.7.2

# SJVAPCD Best Available Control Technology (BACT) Guideline 5.7.2*

Last Update: 2/05/2013; Rescinded: August 16, 2023

## Poultry Layer House

| Pollutant | Achieved in Practice or contained in SIP | Technologically Feasible | Alternate Basic Equipment |
|---|---|---|---|
| VOC | 19% control - completely enclosed mechanically ventilated layer housing with evaporative cooling pads, mixing fans, and a computer control system; belt manure aeration/drying and removal system with manure removal at least twice per week; all birds fed in accordance with NRC or other District-approved guidelines; and all mortality removed from houses once per day. | 1. 98% control - Thermal Incineration<br>2. 95% control - Catalytic Incineration<br>3. 95% control - Carbon Adsorption<br>4. 80% control – Biofiltration | |
| $PM_{10}$ | 50% control - completely enclosed mechanically ventilated layer housing with evaporative cooling pads, mixing fans, and a computer control system; and belt manure aeration/drying and removal system with manure removal at least twice per week. | 1. 99% control - Electrostatic Precipitator<br>2. 99% control - Baghouse<br>3. 95% control - Wet Scrubber<br>4. 60% control - High Efficiency Cyclones | |
| $NH_3$ | 55% control - completely enclosed mechanically ventilated layer housing with evaporative cooling pads, mixing fans, and a computer control system; belt manure aeration/drying and removal system with manure removal at least twice per week; all birds fed in accordance with NRC or other District-approved guidelines; and all mortality removed from houses once per day. | 1. 99% Control - Wet Scrubber<br>2. 80% Control - Biofiltration | |

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in s a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

***This is a Summary Page for this Class of Source**