San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

JAN 09 2014

Ben Curti
Curtimade Dairy Inc.
18337 Road 24
Tulare, CA 93274

Re: Notice of Preliminary Decision - Authority to Construct
Facility Number: S-4712
Project Number: S-1124291

Dear Mr. Curti:

Enclosed for your review and comment is the District's analysis of Curtimade Dairy Inc.'s application for an Authority to Construct for the expansion of an existing dairy operation from a maximum capacity of 3,300 milk cows, 300 dry cows, 2,710 support stock, and 1,500 calves to 5,378 milk cows, 1,000 dry cows, 4,500 support stock, and 2,100 calves, at 18337 Road 24 in Tulare.

The notice of preliminary decision for this project will be published approximately three days from the date of this letter. After addressing all comments made during the 30-day public notice period, the District intends to issue the Authority to Construct. Please submit your written comments on this project within the 30-day public comment period, as specified in the enclosed public notice.

Thank you for your cooperation in this matter. If you have any questions regarding this matter, please contact Mr. Jerry Sandhu of Permit Services at (559) 230-5928.

Sincerely,

David Warner
Director of Permit Services

DW:jss

Enclosures

cc: Mike Tollstrup, CARB (w/ enclosure) via email

San Joaquin Valley Air Pollution Control District
Authority to Construct Application Review
Dairy Expansion

Facility Name:	Curtimade Dairy Inc	Date:	November 8, 2013
Mailing Address:	18337 Road 24 Tulare, CA 93274	Engineer:	Jerry Sandhu
		Lead Engineer:	Sheraz Gill
Contact Person:	Ben Curti		
Telephone:	(559) 992-5866		
Application #s:	S-4712-1-3, -2-5, -3-5, -4-3, and -11-2		
Project #:	S-1124291		
Deemed Complete:	August 19, 2013		

I. PROPOSAL:

Curtimade Dairy Inc requests Authority to Construct (ATC) permits to modify its existing dairy. Multiple modifications are proposed, including expanding the dairy by increasing the herd sizes.

The dairy is currently permitted to house a maximum of 3,300 milk cows, 300 dry cows, 2,710 support stock (consisting of 1,110 large heifers, 800 medium heifers, and 800 small heifers), and 1,500 calves. The facility is proposing to expand to a maximum capacity of 5,378 milk cows, 1,000 dry cows, 4,500 support stock (consisting of 2,700 large heifers, 900 medium heifers, 900 small heifers), and 2,100 calves.

Additionally, the dairy operation is currently permitted to house and milk Holstein cows. Part of the proposed project is to convert the facility from a Holstein cow dairy to a Jersey cow dairy. Therefore, after the proposed modifications, the post-project capacity will consist entirely of Jersey cows.

To accommodate the increase in milk cows, the facility is proposing to expand its existing milking parlor and to build a new hospital milking parlor. The dairy is currently permitted for two double 22 herringbone (88 stalls) milking parlors, which is about half the size of what was originally approved under the dairy's Tulare County Special Use Permit. The facility intends to complete the build out of the second part of the existing milking parlor, as well as finally complete the build out of a hospital milking parlor, which was also approved under the Site Plan Review. After the proposed modification, the existing milking parlor will be expanded from 88 stalls to 184 stalls, and the new hospital milking parlor will consist of 10 stalls in a herringbone configuration.

The expansion to the existing herd sizes will also necessitate modifications to the current cow housing permit. The facility currently houses its milk cows in eight freestall barns[1]. As part of the proposed expansion, the capacities of the existing freestalls will be increased, and two new freestall barns will be constructed. The dry cows and heifers at the facility are currently housed in open corrals. Although the number of dry cows and heifers will be increasing, no modifications are proposed to add additional corrals. The additional heifers from the expansion will be housed in existing corrals or corrals that are currently unoccupied. The facility also proposes to construct a shade structure for any corral not currently equipped with such a structure. Finally, the facility is proposing to add aboveground calf hutches for 600 new calves. All manure from the cow housing will be served by a flush system.

Because of the expansion, there will be an increase in manure flushed to the lagoons. No new lagoons or storage ponds are proposed, nor will the surface area of any existing lagoons or storage ponds be modified. However, the liquid manure handling permit will be modified to account for the increase in emissions due to the additional manure flushed to the lagoons. Additionally, the facility proposes to add a mechanical separator for manure solids separation. The expansion will also result in an increase in solid manure at the dairy. Although the facility is not proposing any changes to the way it currently handles solid manure, the solid manure handling permit will be modified to account of the increase in manure and the resulting increase in emissions.

Finally, the facility is proposing to modify its feed storage and handling permit by constructing three new haybarns. Per District Policy, the construction of a haybarn is exempt from obtaining an ATC. However, the feed storage and handling permit will be modified to account for the increase in emissions from the total mixed ration (TMR).

The proposed modifications listed above will result in the District's best available control technology (BACT) requirements being triggered. The District's BACT requirements will be discussed in further detail in Section VIII under the discussion for District Rule 2201. The facility has provided a written statement proposing to implement all applicable BACT requirements.

The project also triggers the public notice requirements of District Rule 2201. Therefore, the preliminary decision for the project will be submitted to the California Air Resources Board (CARB), a public notice will be published in a local newspaper of general circulation in the county of the project, and a 30-day public comment period will be completed prior to issuance of the ATCs.

The proposed modifications for the facility and for each specific permit unit are summarized as follows:

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[1] The current cow housing PTO, S-4712-2-4, incorrectly states the facility has seven freestall barns. However, the facility was issued ATC S-4712-2-3 on March 30, 2010 to construct an additional freestall barn. ATC -2-3 was implemented on February 14, 2011.

Facility:

- Convert from a Holstein cow dairy to a Jersey Cow dairy

S-4712-1 (Milking Parlor):

- Expand from 3,300 milk cows to 5,378 milk cows
- Complete build out of existing milking parlor from 88 stalls to 184 stalls
- Construct 10 stall hospital milking parlor

S-4712-2 (Cow Housing):

- Expand from 3,300 milk cows, 300 dry cows, 1,110 large heifers, 800 medium heifers, 800 small heifers, and 1,500 calves to 5,378 milk cows, 1,000 dry cows, 2,700 large heifers, 900 medium heifers, 900 small heifers, and 2,100 calves
- Construct two new freestalls for milk cows
- Construct 600 individual calf hutches
- Construct shade structures over existing open corrals

S-4712-3 (Liquid Manure Handling):

- Allow for increase in flushed manure from the expansion to the herd sizes
- Install one new mechanical separator

S-4712-4 (Solid Manure Handling):

- Allow for increase in solid manure from the expansion to the herd sizes

S-4712-11 (Feed Storage and Handling):

- Construct three new haybarns
- Allow for increase in TMR from the expansion to the herd sizes

A copy of the current permits can be seen in Appendix A.

II. APPLICABLE RULES:

Rule 1070	Inspections (12/17/92)
Rule 2010	Permits Required (12/17/92)
Rule 2201	New and Modified Stationary Source Review Rule (4/21/11)
Rule 2520	Federally Mandated Operating Permits (6/21/01)
Rule 2550	Federally Mandated Preconstruction Review for Major Sources of Air Toxics (6/18/1998)
Rule 4101	Visible Emissions (2/17/05)
Rule 4102	Nuisance (12/17/92)

Rule 4550 Conservation Management Practices (8/19/04)
Rule 4570 Confined Animal Facilities (CAF) (10/21/10)
CH&SC 41700 Health Risk Assessment
CH&SC 42301.6 School Notice
Public Resources Code 21000-21177: California Environmental Quality Act (CEQA)
California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000-15387: CEQA Guidelines

III. PROJECT LOCATION:

The facility is located at 18337 Road 24 in Tulare, CA. The District has verified that the dairy is not located within 1,000 feet of the outer boundary of a K-12 school. Therefore, the public notification requirement of California Health and Safety Code 42301.6 is not applicable to this project.

IV. PROCESS DESCRIPTION:

The primary function of Curtimade Dairy Inc is the production of milk, which is used to make products for human consumption. Production of milk requires a herd of mature dairy cows that are lactating. In order to produce milk, the cows must be bred and give birth. The gestation period for a cow is 9 months, and dairy cows are bred again 4 months after calving. Thus, a mature dairy cow produces a calf every 12 to 14 months, which is why there are usually different ages and types of cows at the dairy, including lactating cows, dry cows, heifers, and calves.

The milk cows at a dairy usually generate anywhere from 130 to 150 pounds of manure per day. Manure accumulates in confinement areas such as barns, open corrals (dry lots), and the milking center. Manure is primarily deposited in areas where the herd is fed and given water. How the manure is collected, stored and treated depends directly on the manure management techniques used at a particular dairy.

Dairy manure is collected and managed as a liquid, a semi-solid or slurry, and a solid. Manure with a total solids or dry matter content of 20% or higher usually can be handled as a solid while manure with a total solids content of 10% or less can be handled as a liquid.

Milking Parlors

The milking parlor is a separate building, apart from the lactating cow confinement. The milking parlor is designed to facilitate changing the groups of cows milked and to allow workers access to the cows during milking. A holding area confines the cows that are ready for milking. The holding area is covered with open sides and is part of the milking parlor, which in turn, is located in the immediate vicinity of the cow housing. For the project, the dairy will expand its existing milking parlor from 88 stalls to 184 stalls, and construct one 10 stall herringbone hospital milking parlor. The lactating cows will be milked two times per day in the milking parlors. The milking parlors will have concrete floors sloped to a drain. Manure that is deposited in the milking parlors will be sprayed or flushed into the drain using fresh water after each milking. The effluent from the milking parlors will be carried through pipes to the lagoon system.

Cow Housing

The milk cows at this dairy will be housed in ten freestall barns with flushed lanes. In a freestall barn, the cows are grouped in large pens with free access to feed bunks, water, and stalls for resting. A standard freestall barn design has a feed alley in the center of the barn separating two feed bunks on each side. Of the ten freestalls at the facility, five will not have any exercise pens for the cows.

The dry cows and heifers at this dairy will be housed in open corrals with flushed lanes. An open corral is a large open area where cows are confined with unlimited access to feed and water. The open corrals will have structures that provide shade for the animals.

The applicant is proposing to flush the lanes and walkways in the corrals for the mature cows (lactating and dry cows) four times per day and to flush the lanes and walkways in the corrals for the heifers once per day. Baby calves (under 3 months) will be housed in individual calf hutches with a flush system.

Liquid Manure handling System

The liquid manure handling system at this dairy will consist of three settling basins, two processing pits, four mechanical separators, five storage ponds, and three anaerobic treatment lagoons.

Settling Basins

The liquid manure from the flushed lanes will flow to the settling basins for solids separation prior to entering the lagoon. Settling basins are structures designed to separate solids from liquid manure by sedimentation. The inflow of manure is restricted to allow some of the solids to settle out. A settling basin may achieve a solids removal rate of 40-70%. The liquids from the settling basins will gradually drain to the treatment lagoons. Solids remaining in settling basins are left to dry and then are removed. The separated solids will either be incorporated into cropland or stored for use as fertilizer.

Mechanical Separators

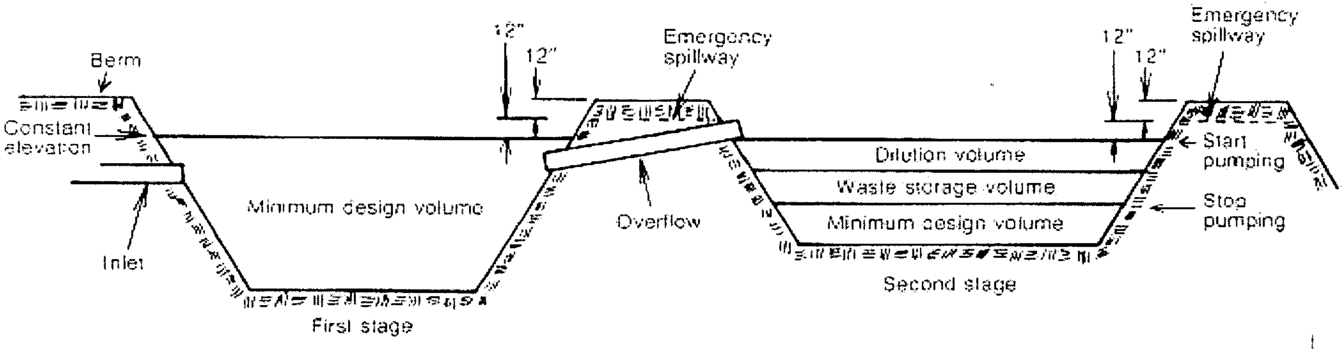
Mechanical separators separate solids out from the liquid/slurry stream. There are many different versions of separators on the market. The percentage of separation varies depending on screen size and type of separation system. However, a 50% solid removal efficiency is used as a general rule of thumb. Although the separation efficiency can be improved by better separation or addition of separators or screens, it does not necessarily result in an increase in VOC emission reduction. The type of solids removed are generally non-digestible (lignins, cellulose, etc.) materials that do not easily digest in the lagoons; the amount of volatiles solids that end up in the lagoon will most likely not change even though there is an increase in solid removal efficiency. In addition, there is no data that links higher removal efficiency with an increase in VOC emission reduction.

Anaerobic Treatment Lagoons

An anaerobic treatment lagoon is a waste treatment lagoon that is designed to facilitate the decomposition of manure by microbes in the absence of oxygen. This process of anaerobic decomposition results in the preferential conversion of organic compounds in the manure into methane, carbon dioxide, and water rather than intermediate metabolites (VOCs). The National Resource Conservation Service (NRCS) California Field Office Technical Guide Code 359 - Waste Treatment Lagoon specifies the following criteria for anaerobic treatment lagoons:

1) Minimum treatment volume - The minimum design volume must account for all potential sludge, treatment, precipitation, and runoff volumes;
2) Minimum hydraulic retention time – The retention time of the material in the lagoon must be adequate to provide environmentally safe utilization of waste;
3) Maximum Volatile Solids (VS) loading rate – The VS loading rate shall be based on maximum daily loading considering all waste sources that will be treated by the lagoon. The suggested loading rate for the San Joaquin Valley is 6.5-11 lb-VS/1000 ft^3/day depending on the type of system and solids separation; and
4) Minimum operating depth of at least 12 feet - Maximizing the depth of the lagoon has the following advantages: 1) The surface area in contact with the atmosphere is minimized, which will reduce volatilization of air pollutants; 2) The smaller surface area reduces the effects of the environment on the lagoon, which provides a more stable and favorable environment for anaerobic bacteria; 3) There is better mixing of lagoon due to rising gas bubbles; 4) and A deeper lagoon requires less land for the required treatment volume.

For the project, the applicant has proposed an anaerobic treatment lagoon system designed in accordance with the specifications set forth in NRCS practice standard 359. The anaerobic treatment lagoon system will consist of one 280 ft x 235 ft x 20 ft anaerobic treatment lagoon, one 280 ft x 225 ft x 20 ft anaerobic treatment lagoon, and one 280 ft x 215 ft x 20 ft anaerobic treatment lagoon, followed by five storage ponds. The three lagoons will be designed to maintain a constant liquid level to ensure a stable bacterial population, which will promote more efficient anaerobic digestion. The effluent from the lagoons will overflow into the storage ponds, which are designed for liquid storage. The liquid level of the storage ponds fluctuates and can be emptied when necessary. Effluent from the storage ponds is used for the irrigation of cropland. All the manure at the dairy will be pumped to the anaerobic treatment lagoons.



Anaerobic Lagoon Design Check

As shown in Appendix B, the volume of the three anaerobic treatment lagoons is as follows:

Total Lagoon Treatment Volume		
Lagoon 1 (280'x235'x20')	=	1,120,667 ft^3
Lagoon 2 (280'x225'x20')	=	1,068,667 ft^3
Lagoon 3 (280'x215'x20')	=	1,016,667 ft^3
Total Lagoon Volume	=	**3,206,001 ft^3**

And the minimum treatment volume is as follows:

Minimum Treatment Volume		
Minimum Treatment Volume	=	2,440,143 ft^3

Therefore, the three proposed anaerobic treatment lagoons will provide sufficient anaerobic treatment lagoon volume to handle the total post-project manure flushed to the lagoons.

Lagoon/Storage Ponds

The facility has five storage ponds. The storage ponds are designed to have sufficient volume to hold all of the following: all manure and wastewater accumulated at the dairy for a period of 120 days; normal precipitation and any drainage to the lagoon system minus evaporation from the surface of lagoons; and precipitation during a 25 year, 24 hour storm event. The liquid manure from the storage pond will be used to irrigate crops.

Manure Stock Piles (Storage)

The solid manure stockpiled at this dairy will include the separated solids from the mechanical separators. The separated solids will be immediately incorporated into cropland, be dried and used as fertilizer or as bedding in the freestalls, or hauled offsite. The applicant proposes to cover the dry separated solids piles and animal waste piles with weatherproof coverings from October through May, so that the solids will remain dry until they are ready to be used.

Feed Handling and Storage - Commodity Barns, Silage Piles, and Total Mixed Rations (TMR)

Dairy cattle feed consists primarily of silage, which is made from corn, wheat, alfalfa, or a variety of other feed crops. The silage is made by placing the harvested crops, chopped to desired pieces if necessary, into piles, which are then compacted with heavy equipment to remove air. The piles are then tightly covered to avoid reintroduction of air. This allows anaerobic microbes present in the crops to multiply, resulting in fermentation of the organic material in the feed. When the silage is ready, one end of the pile can be opened and the required amount of silage can be removed from that end on a daily basis.

In order to provide the right nutritional balance, silage is usually blended with other feed additives, such as oils, whey, seeds and grains, nut hulls, and various salts and minerals before it is fed to the cattle. These additives are usually stored in commodity barns to avoid exposure to weather.

TMR refers to a blended mixture of silage and additives that is ready to be fed to the cattle. Most dairies prepare their TMRs in small batches using a feed wagon equipped with a mixer. The silage and additives are placed in the feed wagon in the proportions prescribed by the dietary requirements of the group of cows to be fed. These ingredients are then thoroughly mixed in the wagon and delivered to the feed bunks.

V. EQUIPMENT LISTING:

Pre-Project Equipment Description:

S-4712-1-2: 3,300 COW MILKING OPERATION WITH TWO DOUBLE 22 STALL HERRINGBONE (88 STALLS) MILK PARLOR

S-4712-2-3: COW HOUSING - 3,300 MILK COWS NOT TO EXCEED A COMBINED TOTAL OF 3,600 MATURE COWS (MILK AND DRY COWS); 4,210 TOTAL SUPPORT STOCK (HEIFERS, CALVES, AND BULLS); AND SEVEN FREESTALLS WITH FLUSH SYSTEM

S-4712-3-3: LIQUID MANURE HANDLING SYSTEM CONSISTING OF ONE SETTLING BASIN, TWO SEPARATION PITS, TWO CONCRETE SETTLING BASINS; THREE MECHANICAL SEPARATORS; FOUR NORTH STORAGE PONDS AND FOUR SOUTH STORAGE PONDS; MANURE LAND APPLIED THROUGH FLOOD AND FURROW IRRIGATION

S-4712-4-2: SOLID MANURE HANDLING CONSISTING OF MANURE STOCK PILES; SOLID MANURE APPLICATION TO LAND OR HAULED OFFSITE

S-4712-11-1: FEED STORAGE AND HANDLING CONSISTING OF COMMODITY BARNS AND SILAGE PILES

ATC Equipment Description:

S-4712-1-3: MODIFICATION OF 3,300 COW MILKING OPERATION WITH TWO DOUBLE 22 HERRINGBONE (88 STALLS) MILKING PARLOR: INCREASE MAXIMUM NUMBER OF MILK COWS FROM 3,300 TO 5,378 JERSEY COWS; COMPLETE BUILD-OUT OF EXISTING MILKING PARLOR TO 184 STALLS; CONSTRUCT ONE 10 STALL HERRINGBONE HOSPITAL MILKING PARLOR

S-4712-2-5[2]: MODIFICATION OF COW HOUSING - 3,300 MILK COWS NOT TO EXCEED A COMBINED TOTAL OF 3,600 MATURE COWS (MILK AND DRY COWS); 2,710 SUPPORT STOCK (HEIFERS AND BULLS); 1,500 CALVES (0-3 MONTHS) IN ABOVEGROUND HUTCHES; AND 8 FREESTALLS WITH FLUSH/SCRAPE SYSTEM: CONSTRUCT TWO NEW FREESTALLS WITH A FLUSH SYSTEM, ADD 600 ABOVEGROUND CALF HUTCHES, AND ESTABLISH WINDBREAKS AS PART OF AN EXPANSION THAT WILL INCREASE THE MAXIMUM HERD SIZE TO 5,378 JERSEY MILK COWS, 1,000 DRY COWS, 4,500 SUPPORT STOCK (HEIFERS AND BULLS), AND 2,100 CALVES

S-4712-3-5: MODIFICATION OF LIQUID MANURE HANDLING SYSTEM CONSISTING OF THREE SETTLING BASINS AND TWO SEPARATION PITS; MECHANICAL SEPARATOR(S); FOUR NORTH STORAGE PONDS AND FOUR SOUTH STORAGE PONDS; MANURE IS LAND APPLIED THROUGH FLOOD AND FURROW IRRIGATION: ALLOW FOR INCREASE IN LIQUID MANURE HANDLED DUE TO HERD SIZE EXPANSION; UTILIZE THREE EXISTING STORAGE PONDS AS THREE ANAEROBIC TREATMENT LAGOONS (280' X 235'

[2] As previously discussed, the current cow housing PTO incorrectly lists 7 freestalls. The ATC will have a corrected equipment description to indicate that there are 8 freestalls at the facility prior to the proposed modifications under this project.

X 20', 280' X 225' X 20', AND 280' X 215' X 20'); INSTALL ONE MECHANICAL SEPARATOR

S-4712-4-3: MODIFICATION OF SOLID MANURE HANDLING CONSISTING OF MANURE STOCK PILES; SOLID MANURE APPLICATION TO LAND AND/OR HAULED OFFSITE: ALLOW FOR INCREASE IN SOLID MANURE HANDLED DUE TO HERD SIZE EXPANSION

S-4712-11-2: MODIFICATION OF FEED STORAGE AND HANDLING CONSISTING OF COMMODITY BARNS AND SILAGE PILES: CONSTRUCT THREE NEW HAYBARNS AND ALLOW FOR INCREASE IN FEED THROUGHPUT DUE TO HERD SIZE EXPANSION

Post-Project Equipment Description:

S-4712-1-3: 5,378 JERSEY COW MILKING OPERATION WITH TWO DOUBLE 22 HERRINGBONE (88 STALLS) AND TWO DOUBLE 24 HERRINGBONE (96 STALLS) MILKING PARLOR AND ONE 10 STALL HOSPITAL MILKING PARLOR

S-4712-2-5: COW HOUSING – 5,378 JERSEY MILK COWS NOT TO EXCEED A COMBINED TOTAL OF 6,378 MATURE COWS (MILK AND DRY COWS); 4,500 SUPPORT STOCK (HEIFERS AND BULLS); 2,100 CALVES (0-3 MONTHS) IN ABOVEGROUND HUTCHES; AND 10 FREESTALLS WITH FLUSH/SCRAPE SYSTEM

S-4712-3-5: LIQUID MANURE HANDLING SYSTEM CONSISTING OF THREE SETTLING BASINS AND TWO SEPARATION PITS; MECHANICAL SEPARATOR(S); THREE ANAEROBIC TREATMENT LAGOONS (280' X 235' X 20', 280' X 225' X 20', AND 280' X 215' X 20') AND FIVE STORAGE PONDS; MANURE IS LAND APPLIED THROUGH FLOOD AND FURROW IRRIGATION

S-4712-4-3: SOLID MANURE HANDLING CONSISTING OF MANURE STOCK PILES; SOLID MANURE APPLICATION TO LAND AND/OR HAULED OFFSITE

S-4712-11-2: FEED STORAGE AND HANDLING CONSISTING OF COMMODITY BARNS AND SILAGE PILES

VI. EMISSION CONTROL TECHNOLOGY EVALUATION:

PM10, VOC, and NH_3 are the major pollutants of concern from dairy operations.

Gaseous pollutant emissions at a dairy result from the ruminant digestive processes (enteric emissions), from the decomposition and fermentation of feed, and also from decomposition of organic material in dairy manure. Volatile Organic Compounds (VOCs) are formed as intermediate metabolites when organic matter in manure degrades. Ammonia volatilization is the result of the microbial decomposition of nitrogenous compounds in manure. The quantity of enteric emissions depends directly on the number and types of cows. The quantity of emissions from manure decomposition depends on the amount of manure generated, which also depends on the number and types of cows. Therefore, the total herd size and composition is the critical factor in quantifying emissions from a dairy.

Various management practices are used to control emissions at this dairy. Examples of some of these practices are discussed below:

Milking Parlor (S-4712-1)

This dairy uses a flush/spray system to wash out the manure from the milking parlors after each group of cows is milked. Since the milking parlors are constantly flushed, there will be no particulate matter emissions from the milking parlors. Manure, which is a source of VOC emissions, is removed from the milking parlors many times a day by flushing after each milking. Because of ammonia's high affinity for and solubility in water, volatilization of ammonia from the milking parlors will also be reduced by flushing after each milking.

Cow Housing (S-4712-2)

The cows at the facility will be housed in a combination of freestall barns, open corrals, and calf hutches. Some of the practices that will be utilized to reduce emissions at the dairy are described below:

Freestall Barns (With and Without Exercise Pens):

Particulate matter emissions from freestall barns are greatly reduced because the cows will be on a paved surface rather than on dry dirt. Additionally, flushing of the freestall lanes creates a moist environment, which further decreases particulate matter emissions.

Several of the freestall barns will be constructed without exercise pens. Freestall housing with no exercise pens require cows to be housed entirely in the freestalls without any access to the open corrals. This eliminates the contact made with the dry manure from the corrals, which almost entirely reduces PM_{10} emissions from this portion of the dairy. The only time cows leave their freestall housing is to go to the milking parlor to get milked (twice a day or more depending on milking schedule). The distance from the freestalls to the milking parlor is insignificant and usually involves walking through a wet process (concrete flush lanes). The only source of PM_{10} emissions from this type of housing would be generated from the cow bedding.

Shade Structures and Scraping of Corrals/Pens

Some of the support stock will be housed in open corrals with concrete lanes and shade structures. Providing shade for the animals reduces movement and unnecessary activity during hot weather, which reduces PM_{10} emissions.

The surfaces of the freestall exercise pens and open corrals will be scraped in the morning hours on a biweekly basis, except during wet conditions. Frequent scraping of the freestall exercise pens and open corrals will reduce the amount of dry manure on the surfaces that may be pulverized by the cows' hooves and emitted as PM_{10}. This practice will also reduce the chance of anaerobic conditions developing in the manure pack of the freestall exercise pen and corral surface, potentially reducing VOC emissions.

Feeding Heifers at or Near Dusk

Young cattle naturally exhibit an increased level of play and activity in the evening hours, especially during hot and dry weather. This increased level of activity results in disturbance of loose dust and particulate matter, which is subsequently entrained into the atmosphere. However, if the young cattle are fed at dusk, unwanted activity and resultant emissions can be significantly reduced since feeding naturally takes priority over play.

Windbreaks

The facility has proposed to install downwind windbreaks along the south and southeast borders of the corral housing. The proposed windbreaks in relation to the corral housing area are shown in the following figure:

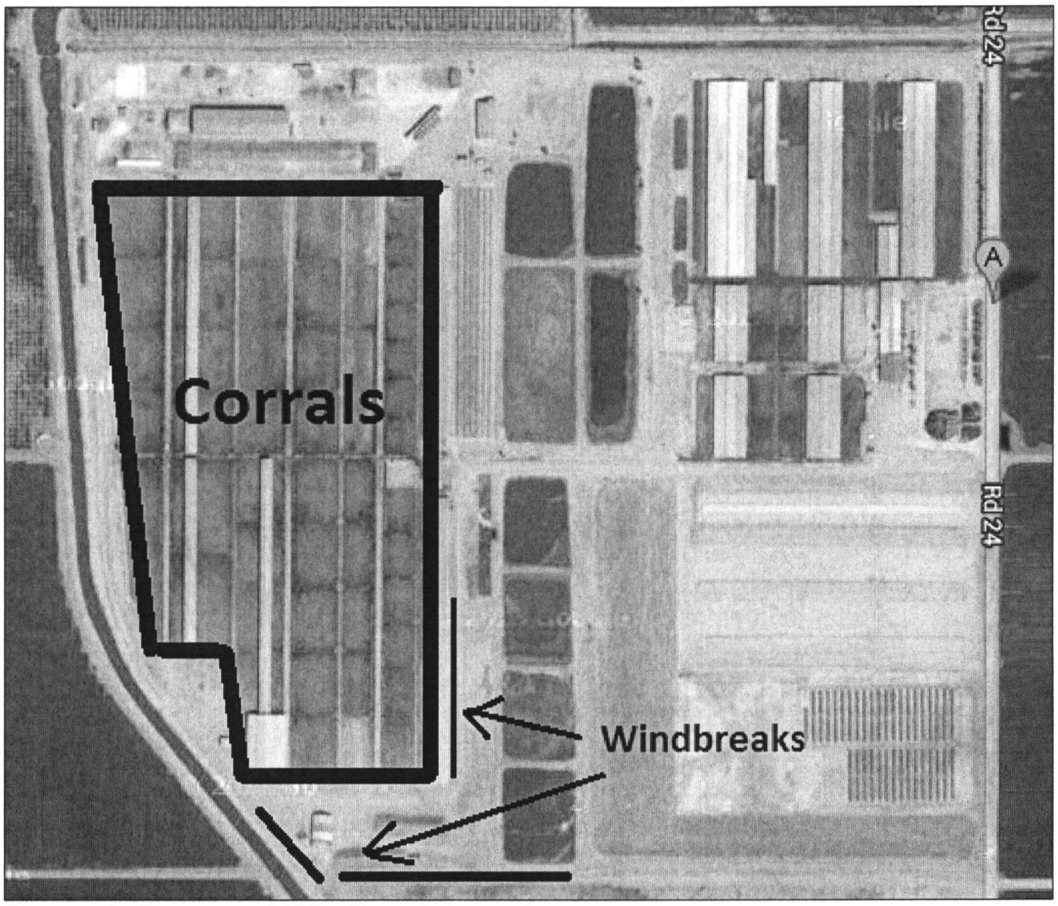


Figure 1: Proposed Windbreak Locations

Along the southern border of the corral housing area, there will be two rows of Italian Cypress trees. Trees will be spaced nine feet apart, and the rows will be separated by fifteen feet. Along the southeast side of the corrals, there will be two rows of Italian Cypress trees with each tree spaced five feet apart, with four feet between rows. A close up image of the windbreaks and an image showing the length of each row are shown below:

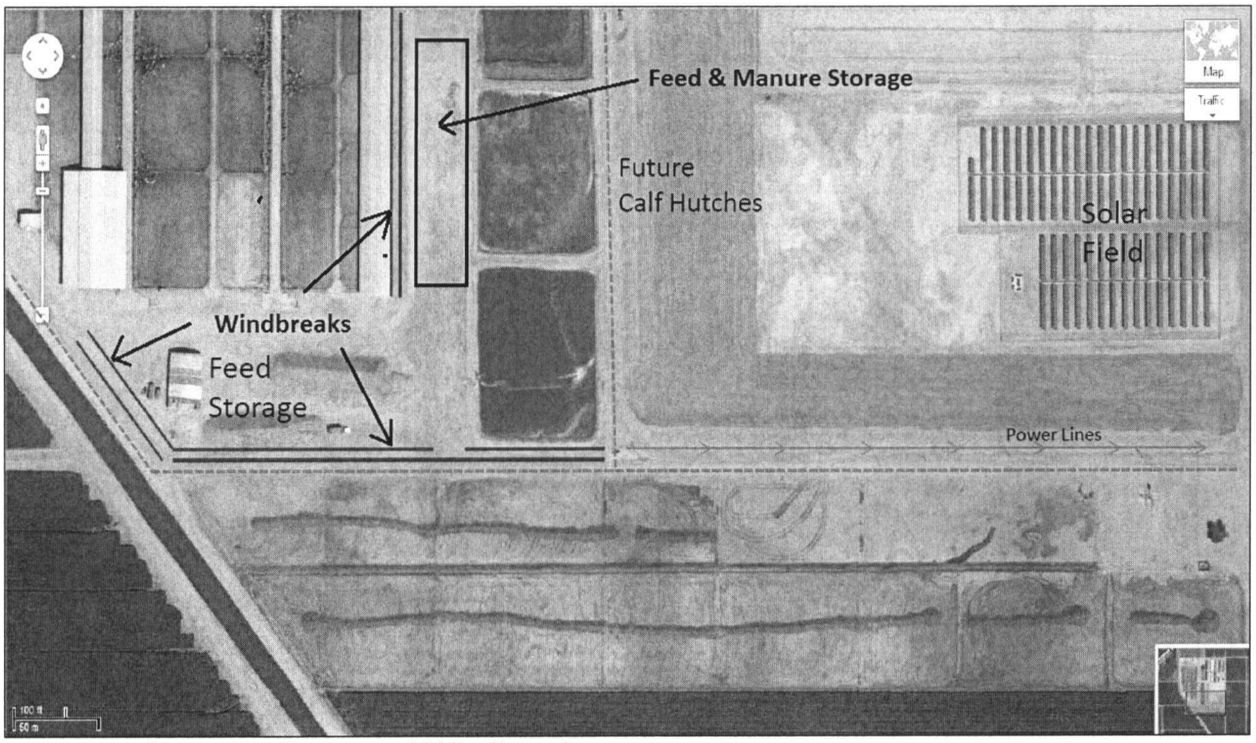


Figure 2: Close Up Proposed Windbreaks

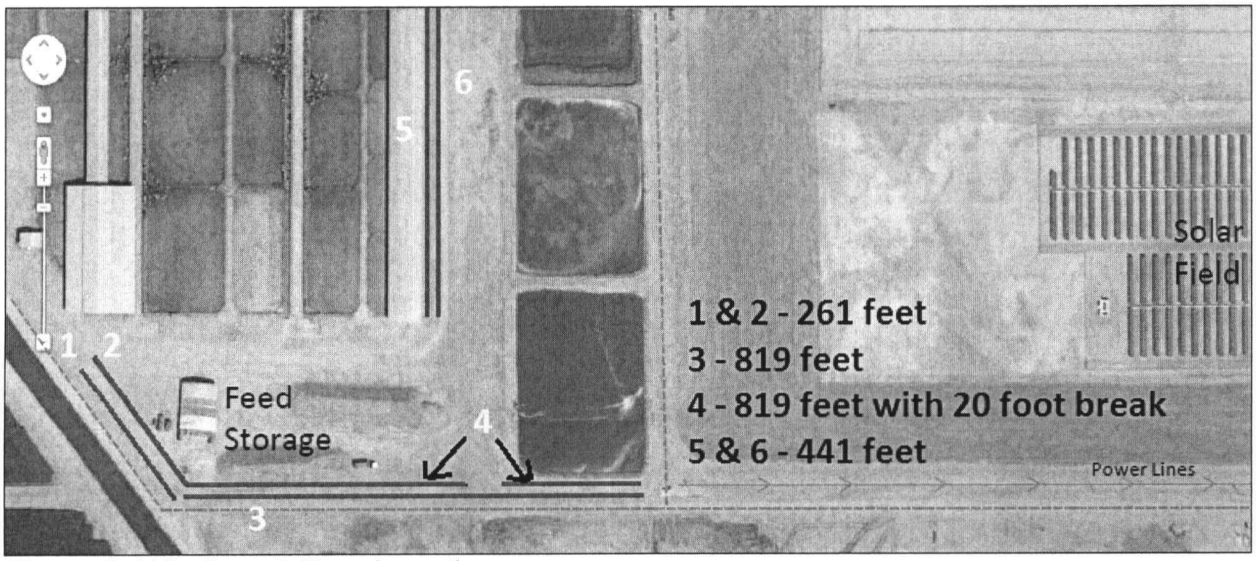


Figure 3: Windbreak Row Length

The applicant has indicated that extending the southern windbreaks further east is not feasible because of existing power lines and a solar panel field located on the east side of the facility. Establishing a windbreak with a height upwards of 35 feet will impact the efficiency of the existing solar panel field.

Furthermore, the applicant has indicated that along the eastern side of the corrals, there is only a six foot wide area in which to plant a windbreak. Beyond this area is a gravel road, which separates an area used for feed and manure storage. Therefore, the windbreaks cannot extend further east. Additionally, the eastern windbreaks cannot extend further north due to a mechanical separator.

Frequent Flushing

Manure, which is a source of emissions, will be removed from the freestall and corral lanes by flushing. Because of ammonia's high affinity for and solubility in water, flushing the lanes and walkways will also reduce volatilization of ammonia from the manure deposited in the corral lanes. The lanes and walkways in the new freestalls will be flushed four times per day and the lanes and walkways in the open corrals for dry cows and heifers and lanes in the calf hutches will be flushed once per day.

Liquid Manure Handling (S-4712-3)

Settling Basin Separation

The purpose of settling basin separation is to remove the fibrous materials prior to the liquid manure entering the lagoon. By removing the most fibrous material from the liquid stream prior to entering the pond, it is anticipated that the amount of intermediate metabolites released during digestion in the pond may be reduced. Removal of the fibrous material allows for more complete digestion in the pond and lower emissions.

Solids remaining in the settling basin are left to dry and then are removed. The separated solids can be immediately incorporated into cropland or spread in thin layers, harrowed, and dried.

Anaerobic Treatment Lagoons

As previously discussed, an anaerobic treatment lagoon is a waste treatment lagoon that is designed to facilitate the decomposition of manure by microbes in the absence of oxygen. This process of anaerobic decomposition results in the preferential conversion of organic compounds in the manure into methane, carbon dioxide, and water rather than intermediate metabolites (VOCs). An anaerobic treatment lagoon system is assumed to conservatively control VOC emissions by at least 40%.

Rule 4570 Mitigation Measures:

The facility currently complies with all applicable Phase II mitigation measure requirements of District Rule 4570, as previously processed under District project S-1111628. This project does not involve any change to the mitigation measures practiced at the facility.

All mitigation measures are expected to result in VOC emissions reductions; reductions in ammonia emissions are also expected. A complete list of the mitigation measures practiced at the facility, and the expected control efficiency for each, is included with the emissions calculations shown in Appendix C.

VII. GENERAL CALCULATIONS:

A. Assumptions:

- Potential to Emit for the dairy will be based on the maximum design capacity of the number and types of cows at the dairy.
- All PM_{10} emissions from the dairy will be allocated to the cow housing permit unit.
- Only emissions from the lagoon/storage ponds and the facility's internal combustion engine (S-4712-10-0) will be used in determining if this facility will be a major source since the lagoon/storage ponds and internal combustion engine are considered to be the only non-fugitive emissions at a dairy, as discussed in Section VII.C.5 below.
- The PM_{10} emission factors for the dairy animals are based on a District document titled "Dairy and Feedlot PM_{10} Emissions Factors," which compiled data from studies performed by Texas A&M ASAE and a USDA/UC Davis report quantifying dairy and feedlot emissions.
- Because of the moisture content of the separated solids, PM_{10} emissions from solid manure handling are considered negligible.
- The NH_3 emission factors for milk cows are based on an internal document entitled "*Breakdown of Dairy VOC Emission Factor into Permit Units*." The NH_3 emission factors for the other cows were developed by taking the ratio of manure generated by the different types of cows to the milk cow and multiplying it by the milk cow emission factor. Jersey cows will be assumed to generate 71% of the amount of NH_3 emissions as a Holstein cow, which is a direct relationship of manure generated.
- The VOC emission factors for the dairy animals are based on the District document entitled "Air Pollution Control Officer's Revision of the Dairy VOC Emissions Factor." Jersey cows will be assumed to generate 71% of the amount of VOC emissions as a Holstein cow, which is a direct relationship of manure generated.
- Pre-project it is assumed all cows are Holstein cows. Post-project it is assumed all cows are Jersey cows.
- The mitigation measures practiced at the dairy as well as the number, type, and size of silage piles are taken from the Rule 4570 Phase II application, processed under District project S-1111628.

- There will be no new lagoons/storage ponds or any change to the surface area of the existing lagoons/storage ponds
- An anaerobic treatment lagoon designed in accordance with the NRCS Guideline (359) has the potential of reducing significant amount of emissions, since the system is designed to promote the conversion of Volatile Solids (VS) into methane by methanogenic bacteria. Although VOC emission reductions are expected to be high, to be conservative, a control efficiency of 40% will be applied to this mitigation measure for both the lagoon(s) and land application until better data becomes available.
- All H_2S emissions from the dairy will be allocated to the lagoon/storage of the liquid manure handling permit unit, and will be assumed to be 10% of the post-project NH_3 emissions from the lagoon/storage ponds.
- Many of the mitigation measures required will also have a reduction in ammonia emissions, however, due to limited data, these reductions will not be quantified in this evaluation.

B. Emission Factors:

PM10, VOC, and NH_3, and H_2S

The emissions calculations shown in Appendix C include the PM10, VOC, NH3, and H_2S emission factors from the animals and silage at this dairy. These emission factors will be used to calculate the pre-project and post-project PM10, VOC, NH_3, and H_2S emissions from the dairy.

C. Calculations:

All emission calculations for this project are included in Appendix C.

1. Pre-Project Potential to Emit (PE1)

A summary of the pre-project emissions from the modified units are shown in the following table:

Pre-Project Potential to Emit (PE1)								
Permit Unit	PM_{10}		VOC		NH_3		H_2S	
	lbs/day	lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr
S-4712-1-2 (milking parlor)	0.0	0	3.6	1,320	1.7	627	0.0	0
S-4712-2-3 (cow housing)	91.5	33,389	119.9	43,743	594.9	217,140	0.0	0
S-4712-3-3 (liquid manure handling)	0.0	0	29.2	10,676	191.0	69,675	11.3	4,109
S-4712-4-2 (solid manure handling)	0.0	0	5.8	2,120	38.1	13,925	0.0	0
S-4712-11-1 (feed storage/handling)	0.0	0	156.7	57,186	0.0	0.0	0.0	0.0

2. Post-Project Potential to Emit (PE2)

A summary of the post-project emissions from the modified units are shown in the following table:

Post-Project Potential to Emit (PE2)								
Permit Unit	PM_{10}		VOC		NH_3		H_2S	
	lbs/day	lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr	lbs/day	lbs/yr
S-4712-1-3 (milking parlor)	0.0	0	4.1	1,506	1.9	699	0.0	0
S-4712-2-5 (cow housing)	100.0	36,504	148.8	54,313	727.8	265,651	0.0	0
S-4712-3-5 (liquid manure handling)	0.0	0	21.6	7,887	232.4	84,825	11.3	4,109
S-4712-4-3 (solid manure handling)	0.0	0	5.3	1,923	46.4	16,969	0.0	0
S-4712-11-2 (feed storage/handling)	0.0	0	257.4	93,941	0.0	0.0	0.0	0.0

3. Pre-Project Stationary Source Potential to Emit (SSPE1)

Pursuant to District Rule 2201, the Pre-Project Stationary Source Potential to Emit (SSPE1) is the Potential to Emit (PE) from all units with valid Authorities to Construct (ATC) or Permits to Operate (PTO) at the Stationary Source and the quantity of emission reduction credits (ERC) which have been banked since September 19, 1991 for Actual Emissions Reductions that have occurred at the source, and which have not been used on-site.

SSPE1 is summarized in the following table:

Pre-Project Stationary Source Potential to Emit [SSPE1] (lb/year)							
	NO_X	SO_X	PM_{10}	CO	VOC	NH_3	H2S
S-4712-1-2 (milking parlor)	0	0	0	0	1,320	627	0
S-4712-2-3 (cow housing)	0	0	33,389	0	43,743	217,140	0
S-4712-3-3 (liquid manure handling)	0	0	0	0	10,676	69,675	4,109
S-4712-4-2 (solid manure handling)	0	0	0	0	2,120	13,925	0
S-4712-10-0* (emergency IC engine)	664	0	19	81	10	0	0
S-4712-11-1 (feed storage/handling)	0	0	0	0	57,186	0	**0**
Pre-Project SSPE (SSPE1)	**664**	**0**	**33,408**	**81**	**115,055**	**301,367**	**4,109**

*Emissions calculations shown in Appendix D.

4. Post-Project Stationary Source Potential to Emit (SSPE2)

Pursuant to District Rule 2201, the Post-Project Stationary Source Potential to Emit (SSPE1) is the Potential to Emit (PE) from all units with valid Authorities to Construct (ATC) or Permits to Operate (PTO) at the Stationary Source and the quantity of emission reduction credits (ERC) which have been banked since September 19, 1991 for Actual Emissions Reductions that have occurred at the source, and which have not been used on-site.

SSPE2 is summarized in the following table:

Post-Project Stationary Source Potential to Emit [SSPE2] (lb/year)							
	NO_X	SO_X	PM_{10}	CO	VOC	NH_3	H2S
S-4712-1-3 (milking parlor)	0	0	0	0	1,506	699	0
S-4712-2-5 (cow housing)	0	0	36,504	0	54,313	265,651	0
S-4712-3-5 (liquid manure handling)	0	0	0	0	7,887	84,825	4,109
S-4712-4-3 (solid manure handling)	0	0	0	0	1,923	16,969	0
S-4712-10-0* (emergency IC engine)	664	0	19	81	10	0	0
S-4712-11-2 (feed storage/handling)	0	0	0	0	93,941	0	**0**
Post-Project SSPE (SSPE2)	**664**	**0**	**36,523**	**81**	**159,580**	**368,144**	**4,109**

5. Major Source Determination

<u>Rule 2201 Major Source Determination</u>:

Pursuant to District Rule 2201, a major source is a stationary source with post-project emissions or a Post-Project Stationary Source Potential to Emit (SSPE2) equal to or exceeding one or more of the major source threshold values.

In determining whether a facility is a major source, fugitive emissions are not counted unless the facility belongs to certain specified source categories. 40 CFR 71.2 (Definitions, Major Source (2)) states the following:

(2) A major stationary source of air pollutants or any group of stationary sources as defined in section 302 of the Act, that directly emits, or has the potential to emit, 100 tpy or more of any air pollutant (including any major source of fugitive emissions of any such pollutant, as determined by rule by the Administrator). <u>The fugitive emissions of a stationary source shall not be considered in determining whether it is a major stationary source</u> for the purposes of section 302(j) of the Act, unless the source belongs to one of the following categories of stationary source: (i) Coal cleaning plants (with thermal dryers); (ii) Kraft pulp mills; (iii) Portland cement plants; (iv) Primary zinc smelters; (v) Iron and steel mills; (vi) Primary aluminum ore reduction plants; (vii) Primary copper smelters; (viii) Municipal incinerators capable of charging more than 250 tons of refuse per day; (ix) Hydrofluoric, sulfuric, or nitric acid plants; (x) Petroleum refineries; (xi) Lime plants; (xii) Phosphate rock processing plants; (xiii) Coke oven batteries; (xiv) Sulfur recovery plants; (xv) Carbon black plants (furnace process); (xvi) Primary lead smelters; (xvii) Fuel conversion plants; (xviii) Sintering plants; (xix) Secondary metal production plants; (xx) Chemical process plants; (xxi) Fossil-fuel boilers (or combination thereof) totaling more than 250 million British thermal units per hour heat input; (xxii) Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels; (xxiii) Taconite ore processing plants; (xxiv) Glass fiber processing plants; (xxv) Charcoal production plants; (xxvi) Fossil-fuel-fired steam electric plants of more than 250 million British thermal units per hour heat input; or (xxvii) Any other stationary source category which, as of August 7, 1980, is being regulated under section 111 or 112 of the Act.

Because agricultural operations do not fall under any of the specific source categories listed above, fugitive emissions are not counted when determining if an agricultural operation is a major source. 40 CFR 71.2 defines fugitive emissions as "those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally-equivalent opening."

Since emissions at the dairy are not actually collected, a determination of whether emissions could be reasonably collected must be made by the permitting authority. The California Air Pollution Control Association (CAPCOA) prepared guidance in 2005 for estimating potential to emit of Volatile Organic Compounds from dairy farms. The guidance states that *"VOC emissions from the milking centers, cow housing areas, corrals, common manure storage areas, and land application of manure are not physically contained and could not reasonably pass through a stack, chimney, vent, or other functionally-equivalent opening. No collection technologies currently exist for VOC emissions from these emissions units. Therefore, the VOC emissions from these sources are considered fugitive."* The guidance also concludes that, because VOC collection technologies do exist for liquid waste systems at dairies, *"...the VOC emissions from waste lagoons and storage ponds are considered non-fugitive."* The District has researched this issue and concurs with the CAPCOA assessment, as discussed in more detail below.

Milking Center
The mechanical system for the milking parlors can be utilized to capture the gases emitted from the milking parlors, however in order to capture all of the gases, and to keep an appropriate negative pressure throughout the system, the holding area would also need to be entirely enclosed. No facility currently encloses the holding area since cows are continuously going in and out of the barn throughout the day. The capital required to enclose this large area would also be significant. Since the holding area is primarily kept open, the District cannot reasonably demonstrate that emissions can pass through a stack, chimney, vent, or other functionally equivalent opening.

Cow Housing
Although there are smaller dairy farms that have enclosed freestall barns, these barns are not fully enclosed and none of the barns have been found to vent the exhaust through a collection device. The airflow requirements through dairy barns are extremely high, primarily for herd health purposes. The airflow requirements will be even higher in the San Joaquin valley, where temperatures reach in excess of 110 degrees in the dry summer. Collection and control of the exhaust including the large amounts of airflow have not yet been achieved by any facility. Due to this difficultly, the District cannot reasonably demonstrate that emissions can pass through a stack, chimney, vent, or other functionally equivalent opening.

Manure storage Areas
Many dairies have been found to cover dry manure piles. Covering dry manure piles is also a mitigation measure included in District Rule 4570. However, the District was not able to find any facility, which currently captures the emissions from the storage or handling of manure piles. Although many of these piles are covered, the emissions cannot easily be captured. Therefore, the District cannot reasonably demonstrate that these emissions can pass through a stack, chimney, vent, or other functionally equivalent opening. In addition, emissions from manure piles have been shown to be insignificant from recent studies.

Land Application
Emissions generated from the application of manure on land cannot reasonably be captured due to the extremely large areas, in some cases thousands of acres, of

cropland at dairies. Therefore, the District cannot reasonably demonstrate that these emissions can pass through a stack, chimney, vent, or other functionally equivalent opening.

Feed Handling and Storage
The majority of dairies store the silage piles underneath a tarp or in an agbag. The entire pile is covered except for the face of the pile. The face of the pile is kept open due to the continual need to extract the silage for feed purposes. The silage pile is disturbed 2-3 times per day. Because of the ongoing disturbance to these piles, it makes it extremely difficult to design a system to capture the emissions from these piles. In fact, as far as the District is aware, no system has been designed to successfully extract the gases from the face of the pile to capture them, and, as important, no study has assessed the potential impacts on silage quality of a continuous air flow across the silage pile, as would be required by such a collection system. Therefore, the District cannot demonstrate that these emissions can be reasonably expected to pass through a stack, chimney, vent, or other functionally equivalent opening.

Therefore, the VOC emissions from these sources are considered fugitive. The District has determined that control technology to capture emissions from lagoons (biogas collection systems, for instance) is in use and these emissions can be reasonably collected and are not fugitive. Therefore, only emissions from the lagoons/storage ponds and IC engine will be used to determine if this facility is a major source.

Pre-Project Major Source Determination:

All housing at the dairy is served by a flush system. Therefore, it is assumed manure from all the animals is flushed to the lagoons.

Lagoon Emissions				
Daily Potential to Emit				
Type of Cow	**Number of Cows**		**lb-VOC/hd-yr**	**lbs-VOC/yr**
Milking Cows	3,300	x	1.17	3,861
Dry Cows	300	x	0.64	192
Large Heifers	1,110	x	0.49	544
Medium Heifers	800	x	0.33	264
Small Heifers	800	x	0.19	152
Calves	1,500	x	0.09	135
Total				**5,148**

Pre-Project Major Source Determination (lb/year)					
	NO_X	SO_X	PM_{10}	CO	VOC
S-4712-3-3 (Lagoon Emissions)	0	0	0	0	5,148
S-4712-10-0 (Diesel Emergency IC Engine)	664	0	19	81	10
Non-Fugitive SSPE2	664	0	19	81	5,158
Major Source Threshold	20,000	140,000	140,000	200,000	20,000

Post-Project Major Source Determination:

All housing at the dairy is served by a flush system. Therefore, it is assumed manure from all the animals will be flushed to the lagoons. The VOC emission factor for lagoons for each herd size is smaller post-project due to the facility converting from a Holstein cow dairy to a Jersey cow dairy, as well is the implementation of BACT requirements (as discussed in Section VIII under the District Rule 2201 discussion).

Lagoon Emissions				
Daily Potential to Emit				
Type of Cow	Number of Cows		lb-VOC/hd-yr	lbs-VOC/yr
Milking Cows	5,378	x	0.50	2,689
Dry Cows	1,000	x	0.27	270
Large Heifers	2,700	x	0.21	567
Medium Heifers	900	x	0.14	126
Small Heifers	900	x	0.08	72
Calves	2,100	x	0.04	84
Total				**3,808**

Major Source Determination (lb/year)					
	NO_X	SO_X	PM_{10}	CO	VOC
S-4712-3-5 (Lagoon Emissions)	0	0	0	0	3,808
S-4712-10-0 (Diesel Emergency IC Engine)	664	0	19	81	10
Non-Fugitive SSPE2	664	0	19	81	3,818
Major Source Threshold	20,000	140,000	140,000	200,000	20,000
Major Source?	No	No	No	No	No

As seen in the table above, the facility is not a Major Source.

Rule 2410 Major Source Determination:

The facility or the equipment evaluated under this project is not listed as one of the categories specified in 40 CFR 52.21 (b)(1)(i). Therefore the following PSD Major Source thresholds are applicable.

Fugitive emissions at dairies are excluded in determining if a source is a major source for PSD. Except for PM10 emissions from the IC engine located at the facility, all other PM10 emissions at the facility are fugitive, and are therefore excluded. Further, all VOC emissions except for non-fugitive VOC emissions from the lagoon and IC engine are also excluded from PSD calculations.

PSD Major Source Determination (tons/year)							
	NO2	VOC	SO2	CO	PM	PM10	CO2e*
Estimated Facility PE before Project Increase	0.3	2.6	0.0	0.0	0.0	0.0	14,801
PSD Major Source Thresholds	250	250	250	250	250	250	100,000
PSD Major Source ? (Y/N)	N	N	N	N	N	N	N

* Pre-project CO2e calculations are shown in Appendix E.

As shown above, the facility is not an existing major source for PSD for at least one pollutant. Therefore the facility is not an existing major source for PSD.

6. Baseline Emissions (BE)

BE = Pre-project Potential to Emit for:

- Any unit located at a non-Major Source,
- Any Highly-Utilized Emissions Unit, located at a Major Source,
- Any Fully-Offset Emissions Unit, located at a Major Source, or
- Any Clean Emissions Unit, located at a Major Source.

otherwise,

BE = Historic Actual Emissions (HAE), calculated pursuant to Section 3.23

As shown in Section VII.C.5 above, the facility is not a major source for any of the pollutants involved in this project, hence BE = PE1 for these pollutants.

7. SB 288 Major Modification

SB 288 Major Modification is defined in 40 CFR Part 51.165 as "*any physical change in or change in the method of operation of a major stationary source that would result in a significant net emissions increase of any pollutant subject to regulation under the Act.*"

Since this facility is not a major source for any of the pollutants addressed in this project, this project does not constitute an SB 288 major modification.

8. Federal Major Modification

District Rule 2201 states that a Federal Major Modification is the same as a "Major Modification" as defined in 40 CFR 51.165 and part D of Title I of the CAA.

Since this facility is not a Major Source for any pollutants, this project does not constitute a Federal Major Modification. Additionally, since the facility is not a major source for PM_{10} (140,000 lb/year), it is not a major source for PM2.5 (200,000 lb/year).

9. Rule 2410 – Prevention of Significant Deterioration (PSD) Applicability Determination

Rule 2410 applies to pollutants for which the District is in attainment or for unclasssified, pollutants. The pollutants addressed in the PSD applicability determination are listed as follows:

- NO2 (as a primary pollutant)
- SO2 (as a primary pollutant)
- CO
- PM
- PM10
- Greenhouse gases (GHG): CO2, N2O, CH4, HFCs, PFCs, and SF6

The first step of this PSD evaluation consists of determining whether the facility is an existing PSD Major Source or not (See Section VII.C.5 of this document).

In the case the facility is an existing PSD Major Source, the second step of the PSD evaluation is to determine if the project results in a PSD significant increase.

In the case the facility is NOT an existing PSD Major Source but is an existing source, the second step of the PSD evaluation is to determine if the project, by itself, would be a PSD major source.

In the case the facility is new source, the second step of the PSD evaluation is to determine if this new facility will become a new PSD major Source as a result of the project and if so, to determine which pollutant will result in a PSD significant increase.

I. Potential to Emit for New or Modified Emission Units vs PSD Major Source Thresholds

As a screening tool, the project potential to emit from all new and modified units is compared to the PSD major source threshold, and if total project potential to emit from all new and modified units is below this threshold, no futher analysis will be needed.

The facility or the equipment evaluated under this project is not listed as one of the categories specified in 40 CFR 52.21 (b)(1)(i). Therefore the following PSD Major Source thresholds are applicable.

CO2e calculations for the modified unit are shown in Appendix E.

For VOC emissions, only non-fugitive VOC emissions from the liquid manure handling permit are included in the determination below.

PSD Major Source Determination: Potential to Emit (tons/year)							
	NO2	VOC	SO2	CO	PM	PM10	CO2e
Total PE from New and Modified Units	0.0	1.9	0.0	0.0	0.0	0.0	42,031
PSD Major Source threshold	250	250	250	250	250	250	100,000
New PSD Major Source?	N	N	N	N	N	N	N

As shown in the table above, the project potential to emit, by itself, does not exceed any of the PSD major source thresholds. Therefore Rule 2410 is not applicable and no further discussion is required.

10. Quarterly Net Emissions Change (QNEC)

The QNEC is calculated solely to establish emissions that are used to complete the District's PAS emissions profile screen. Detailed QNEC calculations are included in Appendix F.

VIII. COMPLIANCE:

Rule 1070 Inspections

This rule allows the District to perform inspections for the purpose of obtaining information necessary to determine whether air pollution sources are in compliance with applicable rules and regulations. The rule also allows the District to require record keeping, to make inspections and to conduct tests of air pollution sources. The following conditions will be listed on the permit to ensure compliance:

- {3215} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]

- {3216} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]

Rule 2010 Permits Required

The provisions of this rule apply to any person who plans to or does operate, construct, alter, or replace any source operation, which may emit air contaminants or may reduce the emission of air contaminants.

Pursuant to section 4.0, a written permit shall be obtained from the APCO. No Permit to Operate shall be granted either by the APCO or the Hearing Board for any source operation described in section 3.0 constructed or installed without authorization as required by section 3.0 until the information required is presented to the APCO and such source operation is altered, if necessary, and made to conform to the standards set forth in Rule 2070 (Standards for Granting Applications) and elsewhere in these rules and regulations.

The facility has obtained all required Air District permits and is in compliance with the requirements of this rule.

Rule 2201 New and Modified Stationary Source Review Rule

A. BACT

1. BACT Applicability:

BACT requirements are triggered on a pollutant-by-pollutant basis and on an emissions unit-by-emissions unit basis. Unless specifically exempted by Rule 2201, BACT shall be required for the following actions*:

a. Any new emissions unit with a potential to emit exceeding two pounds per day,
b. The relocation from one Stationary Source to another of an existing emissions unit with a potential to emit exceeding two pounds per day,

c. Modifications to an existing emissions unit with a valid Permit to Operate resulting in an AIPE exceeding two pounds per day, and/or
d. Any new or modified emissions unit, in a stationary source project, which results in an SB 288 Major Modification or a Federal Major Modification, as defined by the rule.

*Except for CO emissions from a new or modified emissions unit at a Stationary Source with an SSPE2 of less than 200,000 pounds per year of CO.

a. New emissions units – PE > 2 lb/day

There are two new freestalls and a new calf hutch area proposed for this project.

Based on the BACT Applicability values in Appendix G, BACT is triggered for the following new emission units:

- New freestalls: VOC and NH_3
- New calf hutch area: NH_3

b. Relocation of emissions units – PE > 2 lb/day

There are no emissions units being relocated from one stationary source to another; therefore BACT is not triggered.

c. Modification of emissions units – AIPE > 2 lb/day

Adjusted Increase in Permitted Emissions (AIPE)

AIPE = PE2 – HAPE,

Where,
AIPE = Adjusted Increase in Permitted Emissions, (lb/day)
PE2 = Post-Project Potential to Emit, (lb/day)
HAPE = Historically Adjusted Potential to Emit, (lb/day)

HAPE = PE1 x (EF2/EF1)

Where,
PE1 = The emissions unit's Potential to Emit prior to modification or relocation, (lb/day)
EF2 = The emissions unit's permitted emission factor for the pollutant after modification or relocation. If EF2 is greater than EF1 then EF2/EF1 shall be set to 1.
EF1 = The emissions unit's permitted emission factor for the pollutant before the modification or relocation

AIPE = PE2 – (PE1 x (EF2/EF1))

Based on the AIPE values in Appendix G, BACT is triggered for the following modified emission units:

- Cow housing – freestalls: VOC, NH3, PM10
- Cow housing – corrals: VOC, NH3, PM10
- Cow housing – calf hutches: VOC, NH3, PM10
- Liquid Manure Handling – lagoons/storage ponds: VOC and NH3
- Liquid Manure Handling – land application: VOC and NH3
- Solid Manure Handling – Storage piles: NH3
- Solid Manure Handling – Land application: VOC and NH3
- Feed – TMR: VOC

It should be noted that for the cow housing, the AIPE values indicate that BACT might not triggered for each pollutant for *each* individual freestall, corral, or calf hutch area. However, in order for the project to pass the Ambient Air Quality Analysis (see Section F, below, of the Rule 2201 discussion) and to satisfy the requirements of the Risk Management Review (see Rule 4102 discussion below), BACT requirements will be implemented for each freestall, corral, and calf hutch area. Additionally, BACT may also not be triggered because the facility's proposal of mitigation measures that may be determined to be BACT may have dropped the AIPE for a particular freestall or corral below 2.0 lb/day

d. SB 288/Federal Major Modification

As discussed in Section VII.C.7 above, this project does not constitute a SB 288 and/or Federal Major Modification for NO_X emissions; therefore BACT is not triggered for any pollutant.

2. Top-Down BACT Analysis

Per Permit Services Policies and Procedures for BACT, a Top-Down BACT analysis shall be performed as a part of the application review for each application subject to the BACT requirements pursuant to the District's NSR Rule.

Pursuant to the attached Top-Down BACT Analysis (see Appendix G), BACT has been satisfied with the following:

Cow Housing and TMR:

VOC: 1) Concrete feed lanes and walkways;
2) Flushing the feed lanes and walkways for the milk and dry cows four times per day and flushing feed lanes and walkways for the remaining animals once per day;
3) Feeding all animals in accordance with National Research Council (NRC) or other District-approved guidelines;
4) Properly sloping corrals (minimum of 3% slope where the available space for each animal is 400 square feet or less and minimum of 1.5% where the available space for each animal is more than 400 square feet per animal) or managing corrals to maintain a dry surface; and
5) Scraping corrals and exercise pens every two weeks
6) VOC mitigation measures required by District Rule 4570

NH_3: 1) Concrete feed lanes and walkways;
2) Flushing the feed lanes and walkways for the milk and dry cows four times per day and flushing feed lanes and walkways for the remaining animals once per day;
3) Feeding all animals in accordance with National Research Council (NRC) or other District-approved guidelines;
4) Properly sloping corrals (minimum of 3% slope where the available space for each animal is 400 square feet or less and minimum of 1.5% where the available space for each animal is more than 400 square feet per animal) or managing corrals to maintain a dry surface; and
5) Scraping corrals and exercise pens every two weeks

PM_{10}: 1) Scraping of exercise pens and open corrals every two weeks using pull-type scraper in the morning hours except when prevented by wet conditions.
2) Concrete feed lanes and walkways for all cows
3) Shade structures in open corrals
4) Feeding heifers near (within 1 hour of) dusk
5) Windbreaks/Shelterbelts
6) Above-ground calf hutches for baby calves under three months

Liquid Manure Handling System:

Lagoon/Storage Pond:

VOC: 1) Anaerobic treatment lagoon designed according to NRCS guidelines; solids separation using mechanical separator

NH_3: 1) All animals fed in accordance with National Research Council (NRC) or other District-approved guidelines utilizing routine nutritional analysis for rations

Land Application:

VOC: 1) Irrigation of crops using liquid and slurry manure from a holding/storage pond after an Anaerobic Treatment Lagoon

NH_3: 1) All animals fed in accordance with National Research Council (NRC) or other District-approved guidelines utilizing routine nutritional analysis for rations

Solid Manure:

VOC: 1) Rapid incorporation of solid manure into the soil after land application

NH3: 1) All animals fed in accordance with National Research Council (NRC) or other District-approved guidelines utilizing routine nutritional analysis for rations
2) Rapid incorporation of solid manure into the soil after land application

B. Offsets:

Per Section 4.6.9, offsets are not required for agricultural sources unless they are a major source. Since this facility is not a major source for any pollutant, offsets are not required.

C. Public Notification:

1. Applicability

Public noticing is required for:

a. New Major Sources, Federal Major Modifications, and SB288 Major Modifications,
b. Any new emissions unit with a Potential to Emit greater than 100 pounds during any one day for any one pollutant,
c. Any project which results in the offset thresholds being surpassed, and/or
d. Any project with an SSIPE of greater than 20,000 lb/year for any pollutant.

a. New Major Sources, Federal Major Modifications, and SB288 Major Modifications

New Major Sources are new facilities, which are also Major Sources. Since this is not a new facility, public noticing is not required for this project for New Major Source purposes.

As demonstrated in Sections VII.C.7 and VII.C.8, this project does not constitute an SB 288 or Federal Major Modification; therefore, public noticing for SB 288 or Federal Major Modification purposes is not required.

b. PE > 100 lb/day

Applications which include a new emissions unit with a Potential to Emit greater than 100 pounds during any one day for any pollutant will trigger public noticing requirements.

The facility is proposing to construct two new freestalls and one new calf hutch area. As shown in the cow housing calculations in Appendix C, each of these new emissions units does not have a Potential to Emit greater than 100 lb/day for any pollutant; therefore, public noticing is not required for daily Potential to Emit purposes.

c. Offset Threshold

The following table compares the SSPE1 with the SSPE2 in order to determine if any offset thresholds have been surpassed with this project.

Offset Threshold				
Pollutant	SSPE1 (lb/year)	SSPE2 (lb/year)	Offset Threshold	Public Notice Required?
NO_X	664	664	20,000 lb/year	No
SO_X	0	0	54,750 lb/year	No
PM_{10}	33,408	36,523	29,200 lb/year	No
CO	81	81	200,000 lb/year	No
VOC	115,055	159,580	20,000 lb/year	No

As detailed above, there were no thresholds surpassed with this project; therefore public noticing is not required for offset purposes.

d. SSIPE > 20,000 lb/year

Public notification is required for any permitting action that results in a Stationary Source Increase in Permitted Emissions (SSIPE) of more than 20,000 lb/year of any affected pollutant. According to District policy, the SSIPE is calculated as the

Post Project Stationary Source Potential to Emit (SSPE2) minus the Pre-Project Stationary Source Potential to Emit (SSPE1), i.e. SSIPE = SSPE2 – SSPE1. The values for SSPE1 and SSPE2 are calculated according to Rule 2201, Sections 4.9 and 4.10, respectively. The SSIPE is compared to the SSIPE Public Notice thresholds in the following table:

Stationary Source Increase in Permitted Emissions [SSIPE] – Public Notice					
Pollutant	SSPE2 (lb/year)	SSPE1 (lb/year)	SSIPE (lb/year)	SSIPE Public Notice Threshold	Public Notice Required?
NO_x	664	664	0	20,000 lb/year	No
SO_x	0	0	0	20,000 lb/year	No
PM_{10}	36,523	33,408	3,115	20,000 lb/year	No
CO	81	81	0	20,000 lb/year	No
VOC	159,580	115,055	44,525	20,000 lb/year	Yes
NH_3	368,144	301,367	66,777	20,000 lb/year	Yes

As demonstrated above, the SSIPEs for VOC and NH_3 are greater than 20,000 lb/year; therefore public noticing for SSIPE purposes is required.

2. Public Notice Action

As discussed above, public noticing is required for this project because the SSIPEs for VOC and NH3 are greater than 20,000 lb/yr. Therefore, public notice documents will be submitted to the California Air Resources Board (CARB) and a public notice will be published in a local newspaper of general circulation prior to the issuance of the ATCs for the proposed modifications.

D. Daily Emission Limits

DELs and other enforceable conditions are required by Rule 2201 to restrict a unit's maximum daily emissions, to a level at or below the emissions associated with the maximum design capacity. The DEL must be contained in the latest ATC and contained in or enforced by the latest PTO and enforceable, in a practicable manner, on a daily basis. DELs are also required to enforce the applicability of BACT.

For dairies, the DEL is satisfied based on the number and types of cows at the dairy. The number and types of cows are listed in the permit equipment description for the milking parlor and cow housing permits. Additionally, the following District Rule 2201 conditions will also be added:

S-4712-2-5 (Cow Housing):

- The total number of cattle housed at this dairy at any one time shall not exceed any of the following: 5,378 Jersey milk cows; 1,000 dry cows; 2,700 large heifers (15-24 months); 900 medium heifers (7-14 months); 900 small heifers (3-6 months); and 2,100 calves (0-3 months). [District Rule 2201]

- Open corrals and exercise pens shall be scraped at least once every other week using a pull-type scraper in the morning hours, except when this is prevented by wet conditions. [District Rules 2201 and 4570]

- Calves shall be housed in individual calf hutches. [District Rule 2201]

- All open corrals shall be equipped with at least one shade structure. [District Rule 2201]

- At least one of the feedings of the heifers at this dairy shall be near (within one hour of) dusk. [District Rule 2201]

- The feed lanes and walkways at this dairy shall be constructed of concrete. [District Rule 2201]

- Freestalls 1, 5, 8, 9, and 10 shall not have exercise pens. [District Rule 2201]

Refer to Figure 3 on page 14 of this application review for the row lengths in the following windbreak condition:

- Permittee shall establish windbreaks along the south and southeast corner of the open corral housing area. Windbreaks shall consist of Italian Cypress trees and be located in the following areas: Area 1) Rows 1 and 2 – Both rows starting from the most southwest corral and going southeast (parallel to the adjacent canal) for at least 261 feet. Trees shall be spaced 9 feet apart. Each row should be offset from the adjacent row. Spacing between rows shall be sufficient to accommodate cultivation equipment, but shall not exceed 20 feet; Area 2) Rows 1 and 2 – Both starting from the end of Area 1 and going east. Row 1 shall extend east toward the southernmost lagoon for at least 819 feet. Row 2 shall run parallel to Row 1, with a break of no more than 20 feet allowed in Row 2 for equipment travel. Trees shall be spaced 9 feet apart. Each row should be offset from the adjacent row. Spacing between rows shall be sufficient to accommodate cultivation equipment, but shall not exceed 20 feet; Area 3) Rows 1 and 2 – Starting from the southeast corner of the corral housing area and going north for at least 441 feet. Trees shall be spaced 5 feet apart. Each row should be offset from the adjacent row. Spacing between rows shall be sufficient to accommodate cultivation equipment, but shall not exceed 10 feet. An alternative windbreak proposal must be approved by the District. [District Rule 2201]

- Windbreaks shall be irrigated and maintained for survivability and rapid growth. Dead trees shall be replaced as necessary to maintain a windbreak density of 65%. [District Rule 2201]

- Density is the percentage of the background view that is obscured or hidden when viewing through the windbreak from 60 ft to 100 ft upwind of the rows. [District Rule 2201]

- The feed lanes and walkways for mature cows at this dairy shall be flushed at least four times per day. The feed lanes and walkways for support stock at this dairy shall be flushed at least once per day. [District Rules 2201 and 4570]

- All animals at this dairy shall be fed in accordance with the National Research Council (NRC) guidelines utilizing routine dairy nutritionist analyses of rations. [District Rule 2201]

- Permittee shall implement at least one of the following corral mitigation measures: 1) slope the surface of the corrals at least 3% where the available space for each animal is 400 square feet or less and shall slope the surface of the corrals at least 1.5% where the available space for each animal is more than 400 square feet per animal; 2) maintain corrals to ensure proper drainage preventing water from standing more than forty-eight hours; or 3) harrow, rake, or scrape corrals sufficiently to maintain a dry surface except during periods of rainy weather. [District Rules 2201 and 4570]

- Permittee shall pave feedlanes, where present, for a width of at least 8 feet along the corral side of the feedlane fence for milk and dry cows and at least 6 feet along the corral side of the feedlane for heifers. [District Rules 2201 and 4570]

- Permittee shall remove manure that is not dry from individual cow freestall beds or shall rake, harrow, scrape, or grade freestall bedding at least once every seven (7) days. [District Rules 2201 and 4570]

- Permittee shall inspect water pipes and troughs and repair leaks at least once every seven (7) days. [District Rules 2201 and 4570]

- Shade structures shall be installed in any of the following ways: 1) constructed with a light permeable roofing material; 2) uphill of any slope in the corral; 3) installed so that the structure has a North/South orientation. OR Permittee shall clean manure from under corral shades at least once every fourteen (14) days, when weather permits access into the corral. [District Rules 2201 and 4570]

- Permittee shall manage corrals such that the manure depth in the corral does not exceed twelve (12) inches at any time or point, except for in-corral mounding. Manure depth may exceed 12 inches when corrals become inaccessible due to rain events. However, permittee must resume management of the manure depth of 12 inches or lower immediately upon the corral becoming accessible. [District Rules 2201 and 4570]

<u>S-4712-3-5 (Liquid Manure Handling)</u>:

- The liquid manure handling system shall handle flush manure from no more than 5,378 Jersey milk cows; 1,000 dry cows; 2,700 large heifers (15-24 months); 900 medium heifers (7-14 months); 900 small heifers (3-6 months); and 2,100 calves (0-3 months). [District Rule 2201]

- Permittee shall use an anaerobic treatment lagoon designed according to NRCS Guideline No. 359. [District Rule 2201]

- Permittee shall remove solids with a solid separator system prior to the manure entering the lagoons. [District Rules 2201 and 4570]

- Permittee shall only land apply liquid manure that has been treated with an anaerobic treatment lagoon. [District Rules 2201 and 4570]

- Permittee shall not allow liquid manure to stand in the fields for more than twenty-four (24) hours after irrigation. [District Rule 2201 and 4570]

- All animals at this dairy shall be fed in accordance with the National Research Council (NRC) guidelines utilizing routine dairy nutritionist analyses of rations. [District Rule 2201]

<u>S-4712-4-3 (Solid Manure Handling)</u>:

- Solid manure applied to fields shall be incorporated into the soil immediately (within two hours) after application. [District Rules 2201 and 4570]

- All animals at this dairy shall be fed in accordance with the National Research Council (NRC) guidelines utilizing routine dairy nutritionist analyses of rations. [District Rule 2201]

- Within seventy two (72) hours of removal of separated solids from the drying process, permittee shall either 1) remove separated solids from the facility, or 2) cover separated solids 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. [District Rules 2201 and 4570]

S-4712-11-2 (Feed Storage and Handling):

- Permittee shall feed all animals according to National Research Council (NRC) guidelines. [District Rules 2201 and 4570]
- Permittee shall push feed so that it is within three feet of feedlane fence within two hours of putting out the feed or use a feed trough or other feeding structure designed to maintain feed within reach of the animals. [District Rules 2201 and 4570]
- Permittee shall begin feeding total mixed rations within two hours of grinding and mixing rations. [District Rules 2201 and 4570]
- Permittee shall store grain in a weatherproof storage structure or under a weatherproof covering from October through May. [District Rules 2201 and 4570]
- Permittee shall remove uneaten wet feed from feed bunks within twenty-four (24) hours after the end of a rain event. [District Rules 2201 and 4570]

E. Compliance Assurance

The following measures shall be taken to ensure continued compliance with District Rules:

1. Source Testing

No source testing is currently required for dairy operations.

2. Monitoring

No monitoring is required for this project.

3. Record Keeping

S-4712-2-5 (Cow Housing):

- Permittee shall maintain a record of the number of animals of each production group at the facility and shall maintain quarterly records of any changes to this information. [District Rules 2201 and 4570]
- Permittee shall keep records or maintain an operating plan that requires the feed lanes and walkways for mature cows to be flushed at least four times per day and the feed lanes and walkways for support stock to be flushed at least once per day. [District Rules 2201 and 4570]

- Permittee shall maintain records of feed content, formulation, and quantity of feed additive utilized, to demonstrate compliance with National Research Council (NRC) guidelines. Records such as feed company guaranteed analyses (feed tags), ration sheets, or feed purchase records may be used to meet this requirement. [District Rule 2201]

- Permittee shall maintain records of dates open corrals and exercise pens are scraped. [District Rule 2201]

- Permittee shall either 1) maintain sufficient records to demonstrate that corrals are maintained to ensure proper drainage preventing water from standing for more than forty-eight hours or 2) maintain records of dates corrals are groomed (i.e., harrowed, raked, or scraped, etc.). [District Rules 2201 and 4570]

- Permittee shall record either of the following: 1) the dates when manure that is not dry is removed from individual cow freestall beds or 2) the dates when freestall bedding is raked, harrowed, scraped, or graded. [District Rules 2201 and 4570]

- Permittee shall maintain records demonstrating that water pipes and troughs are inspected and leaks are repaired at least once every seven (7) days. [District Rules 2201 and 4570]

- Permittee shall measure and document the depth of manure in the corrals at least once every ninety (90) days. [District Rules 2201 and 4570]

- If permittee has selected to comply using shades constructed with a light permeable roofing material, then permittee shall maintain records, such as design specifications, demonstrating that the shade structures are equipped with such roofing material or if Permittee has selected to comply by cleaning the manure from under the corral shades, then Permittee shall maintain records demonstrating that manure is cleaned from under the shades at least once every fourteen (14) days, as long as weather permits access to corrals. [District Rules 2201 and 4570]

- Permittee shall keep and maintain all records for a minimum of five (5) years and shall make records available to the APCO and EPA upon request. [District Rules 1070 and 4570]

S-4712-3-5 (Liquid Manure Handling):

- Permittee shall maintain records, such as design specifications, calculations, including Minimum Treatment Volume (MTV), Hydraulic Retention Time (HRT) demonstrating that the anaerobic treatment lagoon meets the requirements listed in the NRCS Field Office Technical Guide Code 359. [District Rule 2201]

- Permittee shall maintain records that only liquid manure treated with an anaerobic treatment lagoon is applied to fields. [District Rule 2201]

- Permittee shall maintain records to demonstrate liquid manure did not stand in the fields for more than twenty-four (24) hours after irrigation. [District Rules 2201 and 4570]

- Permittee shall maintain records to demonstrate liquid/slurry manure is applied via injection with drag hose or similar apparatus. [District Rules 2201 and 4570]

- Permittee shall maintain records of feed content, formulation, and quantity of feed additive utilized, to demonstrate compliance with National Research Council (NRC) guidelines. Records such as feed company guaranteed analyses (feed tags), ration sheets, or feed purchase records may be used to meet this requirement. [District Rule 2201]

S-4712-4-3 (Solid Manure Handling):

- Permittee shall maintain records to demonstrate that all solid manure has been incorporated within two hours of land application. [District Rules 2201 and 4570]

- Permittee shall maintain records of feed content, formulation, and quantity of feed additive utilized, to demonstrate compliance with National Research Council (NRC) guidelines. Records such as feed company guaranteed analyses (feed tags), ration sheets, or feed purchase records may be used to meet this requirement. [District Rule 2201]

- Permittee shall keep records of dates when separated solids are removed from the facility or permittee shall maintain records to demonstrate that separated solids piles outside the pens are covered with a weatherproof covering from October through May. [District Rules 2201 and 4570]

- Permittee shall maintain records, such as manufacturer warranties or other documentation, demonstrating that the weatherproof covering over separated solids are installed, used, and maintained in accordance with manufacturer recommendations and applicable standards listed in NRCS Field Office Technical Guide Code 313 or 367, or any other applicable standard approved by the APCO, ARB, and EPA. [District Rules 2201 and 4570]

S-4712-11-2 (Feed Storage and Handling):

- Permittee shall maintain records of feed content, formulation, and quantity of feed additive utilized, to demonstrate compliance with National Research Council (NRC) guidelines. Records such as feed company guaranteed analyses (feed tags), ration sheets, or feed purchase records may be used to meet this requirement. [District Rules 2201 and 4570]

- Permittee shall maintain an operating plan/record that requires feed to be pushed within three feet of feedlane fence within two hours of putting out the feed, or use of a feed trough or other structure designed to maintain feed within reach of the animals. [District Rules 2201 and 4570]

- Permittee shall maintain an operating plan/record of when feeding of total mixed rations began within two hours of grinding and mixing rations. [District Rules 2201 and 4570]

- Permittee shall maintain records demonstrating grain is/was stored in a weatherproof storage structure or under a weatherproof covering from October through May. [District Rules 2201 and 4570]

- Permittee shall maintain records demonstrating that uneaten wet feed was removed from feed bunks within twenty-four (24) hours after the end of a rain event. [District Rules 2201 and 4570]

4. Reporting

No reporting is required to demonstrate compliance with Rule 2201.

F. Ambient Air Quality Analysis (AAQA)

An AAQA shall be conducted for the purpose of determining whether a new or modified Stationary Source will cause or make worse a violation of an air quality standard. The District's Technical Services Division conducted the required analysis. Refer to Appendix H of this document for the AAQA summary sheet.

The proposed location is in an attainment area for NO_X, CO, and SO_X. As shown by the AAQA summary sheet the proposed equipment will not cause a violation of an air quality standard for NO_X, CO, or SO_X.

The proposed location is in a non-attainment area for the state's PM_{10} as well as federal and state $PM_{2.5}$ thresholds. As shown by the AAQA summary sheet the proposed equipment will not cause a violation of an air quality standard for PM_{10} and $PM_{2.5}$.

Rule 2520 Federally Mandated Operating Permits

Since this facility's potential emissions do not exceed any major source thresholds of Rule 2201, this facility is not a major source, and Rule 2520 does not apply.

Rule 2550 Federally Mandated Preconstruction Review for Major Sources of Air Toxics

The provisions of this rule only apply to applications to construct or reconstruct a major air toxics source with Authority to Construct issued on or after June 28, 1998.

Under Rule 2550, newly constructed facilities or reconstructed units or sources[3] at existing facilities would be subject to preconstruction review requirements if they have the potential to emit hazardous air pollutants (air toxics) in "major" amounts (10 tons or more of an individual pollutant or 25 tons or more of a combination of pollutants) and the new units are not already subject to a standard promulgated under Section 112(d), 112(j), or 112(h) of the Clean Air Act." Facilities or sources subject to Rule 2550 would be subject to stringent air pollution control requirements, referred to Maximum Achievable Control Technology.

The federal Clean Air Act lists 189 substances as potential HAPs (Clean Air Act Section 112(b)(1)). Based on the current emission factor for dairies, the following table outlines the HAPs expected to be emitted at dairies. Since this dairy is complying with Best Available Control Technology (BACT) emissions control requirements, many of the pollutants listed below are expected to be reduced significantly; however, no control is being applied in the emissions estimates in order to calculate worst-case emissions. Please note that a conclusion that MACT requirements are triggered would necessarily involve consideration of controlled emissions levels. The following is a list of HAPs generated at dairies including the associated emission factor. The emission factors are based on Holstein cows, and will therefore be conservative for the proposed Jersey cow dairy.

[3] Reconstruction" is defined as a change that costs 50 percent of the cost of constructing a new unit or source like the one being rebuilt.

Hazardous Air Pollutant Emissions		
HAP	lbs-milk cow-yr	Source
Methanol	1.35	UC Davis - *VOC Emission from Dairy Cows and their Excreta*, 2005
Carbon disulfide	0.027	Dr. Schmidt - *Dairy Emissions using Flux Chambers (Phase I & II)*, 2005
Eythylbenzene	0.003	
o-Xylene	0.005	
1,2-Dibromo-3chloropropane	0.011	
1,2,4-Trichlorobenzene	0.025	
Napthalene	0.012	
Hexachlorobutadiene	0.012	
Formaldehyde	0.005	
Acetaldehyde	0.029	
Chloroform	0.017	California State University Fresno (CSUF) - *Monitoring and Modeling of ROG at California Dairies*, 2005
Styrene	0.01	
Vinyl acetate[4]	0.08	Dr. Schmidt - *Dairy Emissions using Flux Chambers (Phase I & II)* & California State University Fresno (CSUF) - *Monitoring and Modeling of ROG at California Dairies*, 2005
Toluene[5]	0.162	
Cadmium	0.009	Air Resources Board's Profile No. 423, Livestock Operations Dust
Hexavalent Chromium	0.004	
Nickel	0.026	
Arsenic	0.005	
Cobalt	0.003	
Lead	0.033	
Total	**1.828**	

Although some of the pollutants listed above may have been misidentified as HAPs due to similarities of many compounds consisting of very similar spikes (as measured through the gas Chromatograph Mass Spectroscopy–GCMS), all of these pollutants will be used in calculating the worst-case HAP emissions. Since this dairy is complying with all of the Best Available Control Technology (BACT) requirements and Rule 4570 mitigation measures, many of the pollutants listed above are expected to be mitigated, however, no control is being applied to these factors at this time in order to calculate the worst-case emissions. The emission calculations are shown below:

[4] 0.01 + 0.07 = 0.08 lbs/hd-yr
[5] 0.012 + 0.15 = 0.162 lbs/hd-yr

HAP Emissions						
Type of Cow	**Number of cows**		**Emission Factor lbs/hd-yr**[6]		**lbs/yr**	**tons/yr**
Milking Cow	5,378	x	1.828	=	9,831	4.9
Dry Cow	1,000	x	1.123	=	1,123	0.6
Large Heifers	2,700	x	0.786	=	2,122	1.1
Medium Heifers	900	x	0.686	=	617	0.3
Small Heifers	900	x	0.621	=	559	0.3
Calves	2,100	x	0.584	=	1,226	0.6
Total				=	**15,478**	**7.8**

As shown above, each individual HAP is expected to be below 10 tons per year and total HAP emissions are expected to be below 25 tons per year. The largest individual HAP would be methanol, at 5.8 tons per year (7.8 tons/yr x (1.35 lbs-methanol/1.828 lbs-HAPs)). Therefore, this facility will not be a major air toxics source and the provisions of Rule 2550 do not apply.

There are several recently completed and ongoing research studies that that will be considered in future revisions of the current emission factors for dairies, including the recent study conducted by Dr. Mitloehner in a study entitled "*Dairy Cow Measurements of Volatile Fatty Acids, Amine, Phenol, and Alcohol Emissions Using an Environmental Chamber*" completed in 2006. These studies have not been fully vetted or reviewed in the context of establishing standardized emission factors. For instance, although Dr. Mitloehner indicates a high methanol emissions rate from fresh manure in the cited study, in the same report he also indicates that the flushing of manure may significantly reduce alcohol emissions, including methanol.

Future review of these studies may indeed result in a change in the current emission factors and/or control efficiencies for various practices and controls, but until that scientific review process is complete and the District has had opportunity to consider public comment on any proposed changes, the premature, and therefore potentially flawed, use of such emissions data would be inconsistent with good governance and good science.

Rule 4101 Visible Emissions

Rule 4101 states that no air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity.

Pursuant to section 4.12, emissions subject to or specifically exempt from Regulation VIII (Fugitive PM10 Prohibitions) are exempt from Rule 4101.

[6] The emission factor has been adjusted for each type of cow based on the ratio of amount of manure generated for each cow.

Pursuant to District Rule 8011, section 4.12, on-field agricultural sources are exempt from the requirements of Regulation VIII.

On-field agricultural sources are defined in Rule 8011, section 3.35 as the following:

- Activities conducted solely for the purpose of preparing land for the growing of crops or ***the raising of fowl or animals***, such as brush or timber clearing, grubbing, scraping, ground excavation, land leveling, grading, turning under stalks, disking, or tilling;

Therefore, activities conducted solely for the purpose of raising fowl or animals are exempt from the requirements of Regulation VIII and Rule 4101.

Rule 4102 Nuisance

Rule 4102 states that no air contaminant shall be released into the atmosphere which causes a public nuisance.

This project is proposing BACT and has proposed all mitigation measures required by District Rule 4570. Therefore, compliance with this rule is expected.

California Health & Safety Code Section 41700 (Health Risk Assessment)

District Policy APR 1905 – Risk Management Policy for Permitting New and Modified Sources specifies that for an increase in emissions associated with a proposed new source or modification, the District perform an analysis to determine the possible impact to the nearest resident or worksite.

An HRA is not required for a project with a total facility prioritization score of less than one. According to the Technical Services Memo for this project (Appendix H), the total facility prioritization score including this project was greater than one. Therefore, an HRA was required to determine the short-term acute and long-term chronic exposure from this project.

The cancer risk for this project is shown below:

RMR Summary					
Categories	**Dairy Milking Parlor (Unit 1-3)**	**Dairy Cow Housing (Unit 2-5)**	**Dairy Lagoons & Liquid Manure Land Application (Unit 3-5)**	**Dairy Solid Manure Storage & Land Application (Unit 4-3)**	**Facility Totals**
Prioritization Score	**0.57[1]**	28.8	27.9	2.18	>1.0
Acute Hazard Index	N/A	0.50	0.03	0.01	0.53
Chronic Hazard Index	N/A	0.19	0.02	0.00	0.21
Maximum Individual Cancer Risk	N/A	**4.80E-06**	**3.95E-06**	**N/A[2]**	8.75E-06
T-BACT Required?	**No**	**Yes (for VOC)**	**Yes (for VOC)**	**No**	
Special Permit Conditions?	**No**	**Yes**	**Yes**	**No**	

[1]The unit passed on prioritization with a score of less than 1, therefore, no further analysis was required.
[2]The Maximum Individual Cancer Risk was not calculated since there are no risk factors associated with any of the Hazardous Air Pollutants (HAPs) under analysis.

Discussion of T-BACT

BACT for toxic emission control (T-BACT) is required if the cancer risk exceeds one in one million. As demonstrated above, T-BACT is required for this project because the HRA indicates that the risk is above the District's thresholds for triggering T-BACT requirements.

For this project, T-BACT is triggered for VOC emissions from the cow housing and liquid manure handling permits. T-BACT is satisfied with the District's BACT for source categories. A Top Down BACT analysis was performed (see Appendix G), and the facility has proposed BACT for these source categories. Therefore, compliance with the District's Risk Management Policy is expected. See the BACT discussion under the previous District Rule 2201 discussion of this application review for a complete list of conditions to satisfy BACT/T-BACT requirements.

District policy APR 1905 also specifies that the increase in emissions associated with a proposed new source or modification not have acute or chronic indices, or a cancer risk greater than the District's significance levels (i.e. acute and/or chronic indices greater than 1 and a cancer risk greater than 10 in a million). As outlined by the HRA Summary in Appendix H of this report, the emissions increases for this project was determined to be less than significant.

Special Permit Conditions

To ensure that human health risks will not exceed District allowable levels, the following special permit conditions will be added to the permits in accordance with the how the RMR was modeled.

- The maximum number of cows housed in Freestalls 1, 2, and 3 shall not exceed 620 cows per each freestall. [District Rule 4102]

- The maximum number of cows housed in Freestalls 4, 5, 6, and 7 shall not exceed 250 cows per each freestall. [District Rule 4102]
- The maximum number of cows housed in Freestalls 8, 9, and 10 shall not exceed 820 cows per each freestall. [District Rule 4102]
- The total number of cows housed in the western corrals directly adjacent to Freestall 1 shall not exceed 400 cows. [District Rule 4102]
- The total number of cows housed in the eastern corrals directly adjacent to Freestall 1 shall not exceed 400 cows. [District Rule 4102]
- The total number of calves in the north calf hutch area shall not exceed 1,500 calves. [District Rule 4102]
- The total number of calves in the south calf hutch area shall not exceed 600 calves. [District Rule 4102]
- The total number of cows housed in the open corrals located west of the lagoons/storage ponds shall not exceed 4,758 cows. [District Rule 4102]

Additionally, as previously discussed, BACT requirements will be added to permits -2-5 and -3-5 to ensure compliance with T-BACT.

Rule 4550 Conservation Management Practices

This rule applies to agricultural operation sites located within the San Joaquin Valley Air Basin. The purpose of this rule is to limit fugitive dust emissions from agricultural operation sites.

Pursuant to Section 5.1, effective on and after July 1, 2004, an owner/operator shall implement the applicable CMPs selected pursuant to Section 6.2 for each agricultural operation site.

Pursuant to Section 5.2, an owner/operator shall prepare and submit a CMP application for each agricultural operation site to the APCO for approval.

The facility received District approval for its CMP plan on May 18, 2005. Continued compliance with the requirements of District Rule 4550 is expected.

Rule 4570 Confined Animal Facilities (CAF)

This rule applies to Confined Animal Facilities (CAF) located within the San Joaquin Valley Air Basin. The purpose of this rule is to limit emissions of Volatile Organic Compounds (VOC) from Confined Animal Facilities (CAF).

PTOs incorporating Phase II mitigation measures of District Rule 4570, as evaluated under District project S-1111628, have already been issued to this facility. All District Rule 4570 conditions on the current milking parlor, cow housing, liquid manure handling, solid manure handling, and feed storage and handling PTOs will be carried over to the proposed ATCs.

California Health & Safety Code Section 42301.6 (School Notice)

California Health & Safety Code Section 42301.6 requires that the District prepare a school notice prior to approving an application for a permit to construct or modify a source that emits toxic air emissions which is located within 1,000 feet from the outer boundary of a K-12 school site. This facility is not located within 1,000 feet of any K-12 school and therefore a school notice is not required.

California Environmental Quality Act (CEQA)

The California Environmental Quality Act (CEQA) requires each public agency to adopt objectives, criteria, and specific procedures consistent with CEQA Statutes and the CEQA Guidelines for administering its responsibilities under CEQA, including the orderly evaluation of projects and preparation of environmental documents. The San Joaquin Valley Unified Air Pollution Control District (District) adopted its *Environmental Review Guidelines* (ERG) in 2001. The basic purposes of CEQA are to:

- Inform governmental decision-makers and the public about the potential, significant environmental effects of proposed activities.
- Identify the ways that environmental damage can be avoided or significantly reduced.
- Prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible.
- Disclose to the public the reasons why a governmental agency approved the project in the manner the agency chose if significant environmental effects are involved.

Tulare County (County) is the Agency which has principal responsibility for approving this dairy project. The County determined that the Project would have a significant adverse environmental impact and prepared an Environmental Impact Report (EIR) for the Project. In certifying the Final EIR, the County determined that after implementing all feasible mitigation measures certain impacts on air quality would be significant and unavoidable. The County approved the Project and adopted a Statement of Overriding

Considerations (SOC), in accordance with CEQA Guidelines §15093(a), stating that economic, legal, social, technological, and other benefits resulting from the project will outweigh the unavoidable adverse environmental effects.

The District is a Responsible Agency for the project because of its discretionary approval power over the project via its Permits Rule (Rule 2010) and New Source Review Rule (Rule 2201), (CEQA Guidelines §15381) Rule 2010 requires operators of emission sources to obtain an Authority to Construct (ATC) and Permit to Operate (PTO) from the District. Rule 2201 requires that new and modified stationary sources of emissions mitigate their emissions using best available control technology (BACT) and for non-agricultural sources offsetting emissions when above certain thresholds (SB 700). As a responsible agency the District complies with CEQA by considering the EIR prepared by the Lead Agency, and by reaching its own conclusion on whether and how to approve the project involved (CEQA Guidelines §15096).

The District has prepared an Authority to Construct Application Review, this document, and has determined that compliance with District rules and required mitigation measures will reduce project specific stationary source emissions to the extent feasible. Before reaching a final decision to approve the project and issue ATCs the District will prepare findings and file a Notice of Determination consistent with CEQA Guidelines §15096 requirements.

IX. Recommendation

Pending the public notice period, issue Authority to Construct permits S-4712-1-3, -2-5, -3-5, -4-3, and -11-2 subject to conditions listed on the attached drafts.

X. Billing Information

Permit Number	Fee Schedule	Fee Description
S-4712-1-3	3020-06	Milking Parlor
S-4712-2-5	3020-06	Cow Housing
S-4712-3-5	3020-06	Liquid Manure Handling
S-4712-4-3	3020-06	Solid Manure Handling
S-4712-11-2	3020-06	Feed Storage and Handling

XI. Appendices

A: Current Permits to Operate
B: Anaerobic Treatment Lagoon Design Check
C: Dairy Emissions Calculations
D: Emissions Calculations for Unit S-4712-10-0
E: CO2e Calculations
F: QNEC

G: BACT Analysis
H: RMR/AAQA Summary
I: Draft ATCs

Appendix A

Current Permits to Operate

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: S-4712-1-2 **EXPIRATION DATE:** 12/31/2014

EQUIPMENT DESCRIPTION:

3,300 COW MILKING OPERATION WITH TWO DOUBLE 22 STALL HERRINGBONE (88 STALLS) MILK PARLOR

PERMIT UNIT REQUIREMENTS

1. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
2. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]
3. Permittee shall implement and maintain all the Mitigation Measures contained in this permit no later than 12-20-12. [District Rule 4570]
4. Mitigation measures that are currently being implemented as required by Phase I of Rule 4570 should continue to be implemented until the mitigation measures required under this permit are implemented. [District Rule 4570]
5. If a licensed veterinarian or a certified nutritionist determines that any VOC mitigation measure will be required to be suspended as a detriment to animal health or necessary for the animal to molt, the owners/operators must notify the District in writing within forty-eight (48) hours of the determination including the duration and the specific health condition requiring the mitigation measure to be suspended. If the situation is expected to exist longer than a thirty-day (30) period, the owner/operator shall submit a new emission mitigation plan designating a mitigation measure to be implemented in lieu of the suspended mitigation measure. [District Rule 4570]
6. Permittee shall flush or hose milk parlor immediately prior to, immediately after, or during each milking. [District Rule 4570]
7. Permittee shall provide verification that milk parlors are flushed or hosed prior to, immediately after, or during each milking. [District Rule 4570]
8. Permittee shall keep and maintain all records for a minimum of five (5) years and shall make records available to the APCO and EPA upon request. [District Rule 4570]
9. This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: S-4712-2-3 **EXPIRATION DATE:** 12/31/2014

EQUIPMENT DESCRIPTION:
COW HOUSING - 3,300 MILK COWS NOT TO EXCEED A COMBINED TOTAL OF 3,600 MATURE COWS (MILK AND DRY COWS); 4,210 TOTAL SUPPORT STOCK (HEIFERS, CALVES, AND BULLS); AND SEVEN FREESTALLS WITH FLUSH SYSTEM

PERMIT UNIT REQUIREMENTS

1. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
2. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]
3. Permittee shall implement and maintain all the Mitigation Measures contained in this permit no later than 12-20-12. [District Rule 4570]
4. Mitigation measures that are currently being implemented as required by Phase I of Rule 4570 should continue to be implemented until the mitigation measures required under this permit are implemented. [District Rule 4570]
5. If a licensed veterinarian or a certified nutritionist determines that any VOC mitigation measure will be required to be suspended as a detriment to animal health or necessary for the animal to molt, the owners/operators must notify the District in writing within forty-eight (48) hours of the determination including the duration and the specific health condition requiring the mitigation measure to be suspended. If the situation is expected to exist longer than a thirty-day (30) period, the owner/operator shall submit a new emission mitigation plan designating a mitigation measure to be implemented in lieu of the suspended mitigation measure. [District Rule 4570]
6. Permittee shall pave feedlanes, where present, for a width of at least 8 feet along the corral side of the feedlane fence for milk and dry cows and at least 6 feet along the corral side of the feedlane for heifers. [District Rule 4570]
7. Permittee shall flush, scrape or vacuum freestall lanes immediately prior to, immediately after or during each milking. [District Rule 4570]
8. Permittee shall maintain records sufficient to demonstrate that freestall lanes are flushed, scraped or vacuumed immediately prior to, immediately after or during each milking. [District Rule 4570]
9. Permittee shall remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every seven (7) days. [District Rule 4570]
10. Permittee shall record the date that manure that is not dry is removed from individual cow freestall beds or raked, harrowed, scraped, or freestall bedding is graded at least once every seven (7) days. [District Rule 4570]
11. Permittee shall inspect water pipes and troughs and repair leaks at least once every seven (7) days. [District Rule 4570]
12. Permittee shall maintain records demonstrating that water pipes and troughs are inspected and leaks are repaired at least once every seven (7) days. [District Rule 4570]

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

13. Permittee shall clean manure from corrals at least four (4) times per year with at least sixty (60) days between each cleaning, or permittee shall clean corrals at least once between April and July and at least once between September and December. [District Rule 4570]

14. Permittee shall demonstrate that manure from corrals are cleaned at least four (4) times per year with at least sixty (60) days between each cleaning or demonstrate that corrals are cleaned at least once between April and July and at least once between September and December. [District Rule 4570]

15. Permittee shall implement at least one of the following corral mitigation measures: 1) slope the surface of the corrals at least 3% where the available space for each animal is 400 square feet or less and shall slope the surface of the corrals at least 1.5% where the available space for each animal is more than 400 square feet per animal; 2) maintain corrals to ensure proper drainage preventing water from standing more than forty-eight hours; or 3) harrow, rake, or scrape pens sufficiently to maintain a dry surface except during periods of rainy weather. [District Rule 4570]

16. Permittee shall either 1) maintain sufficient records to demonstrate that corrals are maintained to ensure proper drainage preventing water from standing for more than forty-eight hours or 2) maintain records of dates pens are groomed (i.e., harrowed, raked, or scraped, etc.). [District Rule 4570]

17. Permittee shall scrape, vacuum or flush concrete lanes in corrals at least once every day for mature cows and every seven (7) days for support stock. [District Rule 4570]

18. Permittee shall maintain records demonstrating that concrete lanes in corrals are scraped, vacuumed, or flushed at least once every day for mature cows and at least once every seven (7) days for support stock. [District Rule 4570]

19. Shade structures shall be installed in any of the following ways: 1) constructed with a light permeable roofing material; 2) uphill of any slope in the corral; 3) installed so that the structure has a North/South orientation. OR Permittee shall clean manure from under corral shades at least once every fourteen (14) days, when weather permits access into the corral. [District Rule 4570]

20. Permittee shall manage corrals such that the manure depth in the corral does not exceed twelve (12) inches at any time or point, except for in-corral mounding. Manure depth may exceed 12 inches when corrals become inaccessible due to rain events. However, permittee must resume management of the manure depth of 12 inches or lower immediately upon the corral becoming accessible. [District Rule 4570]

21. Permittee shall measure and document the depth of manure in the corrals at least once every ninety (90) days. [District Rule 4570]

22. Permittee shall maintain a record of the number of animals of each species and production group at the facility and shall maintain quarterly records of any changes to this information. [District Rule 4570]

23. Permittee shall keep and maintain all records for a minimum of five (5) years and shall make records available to the APCO and EPA upon request. [District Rule 4570]

24. This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: S-4712-3-3 **EXPIRATION DATE:** 12/31/2014

EQUIPMENT DESCRIPTION:
LIQUID MANURE HANDLING SYSTEM CONSISTING OF ONE SETTLING BASIN, TWO SEPARATION PITS, TWO CONCRETE SETTLING BASINS; THREE MECHANICAL SEPARATORS; FOUR NORTH STORAGE PONDS AND FOUR SOUTH STORAGE PONDS; MANURE LAND APPLIED THROUGH FLOOD AND FURROW IRRIGATION

PERMIT UNIT REQUIREMENTS

1. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
2. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]
3. Permittee shall implement and maintain all the Mitigation Measures contained in this permit no later than 12-20-12. [District Rule 4570]
4. Mitigation measures that are currently being implemented as required by Phase I of Rule 4570 should continue to be implemented until the mitigation measures required under this permit are implemented. [District Rule 4570]
5. If a licensed veterinarian or a certified nutritionist determines that any VOC mitigation measure will be required to be suspended as a detriment to animal health or necessary for the animal to molt, the owners/operators must notify the District in writing within forty-eight (48) hours of the determination including the duration and the specific health condition requiring the mitigation measure to be suspended. If the situation is expected to exist longer than a thirty-day (30) period, the owner/operator shall submit a new emission mitigation plan designating a mitigation measure to be implemented in lieu of the suspended mitigation measure. [District Rule 4570]
6. Permittee shall remove solids with a solid separator system, prior to the manure entering the lagoon. [District Rule 4570]
7. Permittee shall not allow liquid manure to stand in the fields for more than twenty-four (24) hours after irrigation. [District Rule 4570]
8. Permittee shall maintain records to demonstrate liquid manure did not stand in the fields for more than twenty-four (24) hours after irrigation. [District Rule 4570]
9. Permittee shall maintain records to demonstrate liquid/slurry manure is applied via injection with drag hose or similar apparatus. [District Rule 4570]
10. This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: S-4712-4-2 **EXPIRATION DATE:** 12/31/2014

EQUIPMENT DESCRIPTION:
SOLID MANURE HANDLING CONSISTING OF MANURE STOCK PILES; SOLID MANURE APPLICATION TO LAND OR HAULED OFFSITE

PERMIT UNIT REQUIREMENTS

1. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
2. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]
3. Permittee shall implement and maintain all the Mitigation Measures contained in this permit no later than 12-20-12. [District Rule 4570]
4. Mitigation measures that are currently being implemented as required by Phase I of Rule 4570 should continue to be implemented until the mitigation measures required under this permit are implemented. [District Rule 4570]
5. If a licensed veterinarian or a certified nutritionist determines that any VOC mitigation measure will be required to be suspended as a detriment to animal health or necessary for the animal to molt, the owners/operators must notify the District in writing within forty-eight (48) hours of the determination including the duration and the specific health condition requiring the mitigation measure to be suspended. If the situation is expected to exist longer than a thirty-day (30) period, the owner/operator shall submit a new emission mitigation plan designating a mitigation measure to be implemented in lieu of the suspended mitigation measure. [District Rule 4570]
6. Within seventy two (72) hours of removal of separated solids from the drying process, permittee shall either 1) remove separated solids from the facility, or 2) cover separated solids 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. [District Rule 4570]
7. Permittee shall keep records of dates when separated solids are removed from the facility or permittee shall maintain records to demonstrate that separated solids piles outside the pens are covered with a weatherproof covering from October through May. [District Rule 4570]
8. Permittee shall maintain records, such as manufacturer warranties or other documentation, demonstrating that the weatherproof covering over separated solids are installed, used, and maintained in accordance with manufacturer recommendations and applicable standards listed in NRCS Field Office Technical Guide Code 313 or 367, or any other applicable standard approved by the APCO, ARB, and EPA. [District Rule 4570]
9. Permittee shall incorporate all solid manure within seventy-two (72) hours of land application. [District Rule 4570]
10. Permittee shall maintain records to demonstrate that all solid manure has been incorporated within seventy-two (72) hours of land application. [District Rule 4570]
11. Permittee shall keep and maintain all records for a minimum of five (5) years and shall make records available to the APCO and EPA upon request. [District Rule 4570]

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

12. This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: S-4712-11-1 **EXPIRATION DATE:** 12/31/2014

EQUIPMENT DESCRIPTION:
FEED STORAGE AND HANDLING CONSISTING OF COMMODITY BARNS AND SILAGE PILES

PERMIT UNIT REQUIREMENTS

1. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
2. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]
3. Permittee shall implement and maintain all the Mitigation Measures contained in this permit no later than 12-20-12. [District Rule 4570]
4. Mitigation measures that are currently being implemented as required by Phase I of Rule 4570 should continue to be implemented until the mitigation measures required under this permit are implemented. [District Rule 4570]
5. If a licensed veterinarian or a certified nutritionist determines that any VOC mitigation measure will be required to be suspended as a detriment to animal health or necessary for the animal to molt, the owners/operators must notify the District in writing within forty-eight (48) hours of the determination including the duration and the specific health condition requiring the mitigation measure to be suspended. If the situation is expected to exist longer than a thirty-day (30) period, the owner/operator shall submit a new emission mitigation plan designating a mitigation measure to be implemented in lieu of the suspended mitigation measure. [District Rule 4570]
6. Permittee shall feed all animals according to National Research Council (NRC) guidelines. [District Rule 4570]
7. Permittee shall maintain records of feed content, formulation, and quantity of feed additive utilized, to demonstrate compliance with National Research Council (NRC) guidelines. Records such as feed company guaranteed analyses (feed tags), ration sheets, or feed purchase records may be used to meet this requirement. [District Rule 4570]
8. Permittee shall push feed so that it is within three feet of feedlane fence within two hours of putting out the feed or use a feed trough or other feeding structure designed to maintain feed within reach of the animals. [District Rule 4570]
9. Permittee shall maintain an operating plan/record that requires feed to be pushed within three feet of feedlane fence within two hours of putting out the feed, or use of a feed trough or other structure designed to maintain feed within reach of the animals. [District Rule 4570]
10. Permittee shall begin feeding total mixed rations within two hours of grinding and mixing rations. [District Rule 4570]
11. Permittee shall maintain an operating plan/record of when feeding of total mixed rations began within two hours of grinding and mixing rations. [District Rule 4570]
12. Permittee shall store grain in a weatherproof storage structure or under a weatherproof covering from October through May. [District Rule 4570]
13. Permittee shall maintain records demonstrating grain is/was stored in a weatherproof storage structure or under a weatherproof covering from October through May. [District Rule 4570]

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

These terms and conditions are part of the Facility-wide Permit to Operate.

14. Permittee shall remove uneaten wet feed from feed bunks within twenty-four (24) hours after the end of a rain event. [District Rule 4570]
15. Permittee shall maintain records demonstrating that uneaten wet feed was removed from feed bunks within twenty-four (24) hours after the end of a rain event. [District Rule 4570]
16. For bagged silage/feedstuff, permittee shall utilize a sealed feed storage system (e.g., ag bag). [District Rule 4570]
17. Permittee shall cover all silage piles, except for the area where feed is being removed from the pile, with a plastic tarp that is at least five (5) mils (0.005 inches) thick, multiple plastic tarps with a cumulative thickness of at least 5 mils (0.005 inches), or an oxygen barrier film covered with a UV resistant material. Silage piles shall be covered within seventy-two (72) hours of last delivery of material to the pile. Sheets of material used to cover silage shall overlap so that silage is not exposed where the sheets meet. [District Rule 4570]
18. Permittee shall maintain records of the thickness and type of cover used to cover each silage pile. Permittee shall also maintain records of the date of the last delivery of material to each silage pile and the date each pile is covered. [District Rule 4570]
19. Permittee shall select and implement one of the following mitigation measures for building each silage pile at the facility: Option 1) build the silage pile such that the average bulk density is at least 44 lb/cu ft for corn silage and 40 lb/cu ft for other silage types, as measured in accordance with Section 7.11 of District Rule 4570; Option 2) Adjust filling parameters when creating the silage pile to achieve an average bulk density of at least 44 lb/cu ft for corn silage and at least 40 lb/cu ft for other silage types as determined using a District-approved spreadsheet; or Option 3) build silage piles using crops harvested with the applicable minimum moisture content, maximum Theoretical Length of Chop (TLC), and roller opening identified in District Rule 4570, Table 4.1, 1.d and manage silage material delivery such that the thickness of the layer of un-compacted material delivered on top of the pile is no more than six (6) inches. Records of the option chosen as a mitigation measure for building each silage pile shall be maintained. [District Rule 4570]
20. For each silage pile that Option 1 (Measured Bulk Density) is chosen as a mitigation measure for building the pile, records of the measured bulk density shall be maintained. [District Rule 4570]
21. For each silage pile that Option 2 (Bulk Density Determined by Spreadsheet) is chosen as a mitigation measure for building the pile, records of the filling parameters entered into the District-approved spreadsheet to determine the bulk density shall be maintained. [District Rule 4570]
22. For each silage pile that Option 3 (Moisture, TLC, Roller Opening, & Material Delivery) is chosen as a mitigation measure for building the pile, the permittee shall harvest corn used for the pile at an average moisture content of at least 65% and harvest other silage crops for the pile at an average moisture content of at least 60%. [District Rule 4570]
23. For each silage pile that Option 3 (Moisture, TLC, Roller Opening, & Material Delivery) is chosen as a mitigation measure for building the pile, records of the average percent moisture of crops harvested for silage shall be maintained. [District Rule 4570]
24. For each silage pile that Option 3 (Moisture, TLC, Roller Opening, & Material Delivery) is chosen as a mitigation measure for building the pile, the permittee shall adjust setting of equipment used to harvest crops for the pile to incorporate the following parameters for Theoretical Length of Chop (TLC) and roller opening, as applicable: 1) Corn with no processing: TLC not exceeding 1/2 inch, 2) Processed Corn: TLC not exceeding 3/4 inch and roller opening of 1-4 mm, 3) Alfalfa/Grass: TLC not exceeding 1.0 inch, 4) Other silage crops: TLC not exceeding 1/2 inch. [District Rule 4570]
25. For each silage pile that Option 3 (Moisture, TLC, Roller Opening, & Material Delivery) is chosen as a mitigation measure for building the pile, records that equipment used to harvest crops for the pile was set to the required TLC and roller opening for the type of crop harvested shall be maintained. [District Rule 4570]
26. For each silage pile that Option 3 (Moisture, TLC, Roller Opening, & Material Delivery) is chosen as a mitigation measure for building the pile, the permittee shall manage silage material delivery such that the thickness of the layer of un-compacted material delivered on top of the pile is no more than six (6) inches. [District Rule 4570]

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

27. For each silage pile that Option 3 (Moisture, TLC, Roller Opening, & Material Delivery) is chosen as a mitigation measure for building the pile, the permittee shall maintain a plan that requires that the thickness of the layer of un-compacted material delivered on top of the pile is no more than six (6) inches. [District Rule 4570]

28. Permittee shall select and implement at least two of the following mitigation measures for management of silage piles at the facility: Option 1) manage silage piles such that only one silage pile has an uncovered face and the total exposed surface area is less than 2,150 square feet, or manage multiple uncovered silage piles such that the total exposed surface area of all uncovered silage piles is less than 4,300 square feet; Option 2) use a shaver/facer to remove silage from the silage pile, or shall use another method to maintain a smooth vertical surface on the working face of the silage pile; or Option 3) inoculate silage with homolactic lactic acid bacteria in accordance with manufacturer recommendations to achieve a concentration of at least 100,000 colony forming units per gram of wet forage, apply propionic acid, benzoic acid, sorbic acid, sodium benzoate, or potassium sorbate at the rate specified by the manufacturer to reduce yeast counts when forming silage piles, or apply other additives at rates that have been demonstrated to reduce alcohol concentrations in silage and/or VOC emissions from silage and have been approved by the District and EPA. Records of the options chosen for managing each silage pile shall be maintained. [District Rule 4570]

29. If Option 1 (Limiting Exposed Area of Silage) is chosen as a mitigation measure for managing silage piles, the permittee shall calculate and record the maximum (largest part of pile) total exposed area of each silage pile. Records of the maximum calculated area shall be maintained. [District Rule 4570]

30. For each silage pile that Option 2 (Shaver/Facer or Smooth Face) is chosen as a mitigation measure for building the pile, the permittee shall maintain records that a shaver/facer was used to remove silage from the pile or shall visually inspect the pile at least daily to verify that the working face was smooth and maintain records of the visual inspections. [District Rule 4570]

31. For each silage pile that Option 3 (Silage Additives) is chosen as a mitigation measure for building the pile, records shall be maintained of the type additive (e.g. inoculants, preservative, other District & EPA-approved additive), the quantity of the additive applied to the pile, and a copy of the manufacturers instructions for application of the additive. [District Rule 4570]

32. Permittee shall keep and maintain all records for a minimum of five (5) years and shall make records available to the APCO and EPA upon request. [District Rule 4570]

33. This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]

Appendix B

Anaerobic Treatment Lagoon Design Check

Lagoon Design Check in Accordance with NRCS Guideline #359

Proposed Lagoon Volume

Volume of treatment lagoon = $(L \times W \times D) - (S \times D^2) \times (W + L) + (4 \times S^2 \times D^3 \div 3)$

Primary Treatment Lagoon Dimensions

Length	235	ft
Width	280	ft
Depth	20	ft
Slope	1	ft

Primary Lagoon Volume	**1,120,667 ft3**

Primary Treatment Lagoon Dimensions

Length	225	ft
Width	280	ft
Depth	20	ft
Slope	1	ft

Primary Lagoon Volume	**1,068,667 ft3**

Primary Treatment Lagoon Dimensions

Length	215	ft
Width	280	ft
Depth	20	ft
Slope	1	ft

Primary Lagoon Volume	**1,016,667 ft3**

INSTRUCTIONS

* only input yellow fields

Step 1 Enter primary lagoon dimensions on this sheet

Step 2 Go to "Net Volatile Solids Loading" sheet and enter number of animals flushing manure to lagoon
Step 3 Adjust % in flush and separation as necessary (see notes on sheet)
Step 4 Go to "Minimum Treatment Volume"
Step 5 Minimum treatment volume should be less than lagoon volume to be considered anaerobic treatment lagoon
Step 6 Go to "Hydraulic Retention Time"
Step 7 Adjust fresh water as applicable
Step 8 Hydraulic retention time should be greater than 34 days to be considered anaerobic treatment lagoon.

Lagoon Design Check in Accordance with NRCS Guideline #359

Net Volatile Solids loading Calculation

Net Volatile Solids (VS) Loading of Treatment Lagoons									
Breed: Jersey **Type of Cow**	**Number of Animals**	**x**	VS Excreted[1] (lb/day)	**x**	% Manure in Flush[2]	**x**	(1 - % VS Removed in Separation[3])	**=**	**Net VS Loading (lb/day)**
Milk Cows	3,330	x	12.07	x	100%	x	50%	=	**20,097**
Milk Cows	1,990	x	12.07	x	71%	x	50%	=	**8,527**
Milk Cows	58	x	12.07	x	48%	x	50%	=	**168**
Dry Cow	1,000	x	6.53	x	48%	x	50%	=	**1,567**
Heifer (15 to 24 months)	2,700	x	5.04	x	48%	x	50%	=	**3,266**
Heifer (7 to 14 months)	900	x	3.48	x	48%	x	50%	=	**752**
Heifer (3 to 6 months)	900	x	1.92	x	48%	x	50%	=	**415**
Calf (under 3 months)	2,100	x	0.7	x	100%	x	50%	=	**746**
Bulls	0	x	6.53	x	48%	x	50%	=	**0**
Total for Dairy									**35,536**

[1]The Volatile Solids (VS) excretion rates for Holstein cattle are based on Table 1.b – Section 3 of ASAE D384.2 (March 2005). VS excretion rates for milk cows, dry cows, & heifers 15-24 months were taken from directly from the table. The VS excretion rate for heifers 3-6 months was estimated based on total solids excretion. The VS excretion rate for heifers 7-14 months was estimated as the average of heifers 15-24 months and heifers 3-6 months. The table did not give values for total solids or volatile solids excreted by baby calves. The VS excretion rate for baby calves was estimated based on an estimated dry matter intake (DMI) of 1.7% of body weight and the ratio of DMI to VS excretion for 150 kg calves. The VS excretion rate for mature bulls was assumed to be similar to dry cows.

[2] The % manure was taken from Table 3-1 of the California Regional Water Quality Control Board Document "Managing Dairy Manure in the Central Valley of California", UC Davis, June 2005. This document estimated that 21-48% of the manure in open corral dairies is handled as a liquid. Therefore, as a worst case assumption, 48% will be used for all cows housed in open corrals with flush lanes. The document also estimates a range of 42-100% manure handled as a liquid in the freestalls. For freestalls without exercise pens, 100% of manure as a liquid in the flush will be used; for freestalls with exercise pens, the average of the range ((100+42)/2 = 71%) will be used. (http://groundwater.ucdavis.edu/Publications/uc-committee-of-experts-final-report%202006.pdf) Saudi style/loafing barns are hybrids between freestalls and open corrals, the percentage of manure collected on the concrete feed lanes will be averaged between the values from the cows housed in freestall barns and open corrals. Therefore the % of manure deposited on the concrete lanes is equal to 60% [(71+48)/2].

[3] Chastain, J.P., Vanotti, M. B., and Wingfield, M. M., Effectiveness of Liquid-Solid Separation For Treatment of Flushed Dairy Manure: A Case Study, Applied Engineering in Agriculture, Vol 17(3): 343-354 - This document outlines a VS removal rate of 50.1% to 70% depending on the type of separation system used, however to be conservative, a 50% VS removal will be used for all systems.

Lagoon Design Check in Accordance with NRCS Guideline #359

Minimum Treatment Volume Calculation

MTV = TVS/VSLR

Where:

MTV = Minimum Treatment Volume (ft^3)

TVS = daily Total Volatile solids Loading (lb/day) = 0.011 lb/ft3-day

VSLR = Volatile Solids Loading Rate (lb/1000 ft3-day)

Minimum Treatment Volume in Primary Lagoon					
Breed: Holstein **Type of Cow**	**Net VS Loading (lb/day)**		**VSLR** (lb/ft3-day)[1]		**MTV (ft^3)**
Milk Cows	20,097	÷	0.011	=	**1,826,959**
Dry Cow	1,567	÷	0.011	=	**142,473**
Heifer (15 to 24 months)	3,266	÷	0.011	=	**296,902**
Heifer (7 to 14 months)	752	÷	0.011	=	**68,335**
Heifer (3 to 6 months)	415	÷	0.011	=	**37,702**
Calf (under 3 months)	746	÷	0.011	=	**67,773**
Bulls	0	÷	0.011	=	**0**
Total for Dairy					**2,440,143**

[1] VSLR for an anaerobic treatment lagoon in San Joaquin Valley would be 6.5 lb VS/1000 ft3-day to 11 lb VS/1000 ft3-day according to the NRCS and USDA AWTFH. Based on phone conversation with Matt Summers (USDA) on July 14, 2006, he suggested that the 11 lb VS VS/1000 ft3-day

Lagoon Design Check in Accordance with NRCS Guideline #359

Sludge Accumulation Volume

The sludge accumulation volume accounts for the solids contained in the manure that cannot be fully digested by bacteria and that gradually settle to the bottom of the lagoon as sludge. The sludge accumulation volume for lagoon systems without solids separation can be calculated from the USDA Field Handbook. However, there are no accepted guidelines for calculating the sludge accumulation volume for lagoon systems with solids separation, but many designers of digester expect it to be minimal.

This facility has an efficient solids separation system consisting prior to the anaerobic treatment lagoon system. The separation system will remove a large portion of the fibers, lignin, cellulose, and other fibrous materials from the manure. These are the materials that would otherwise cause sludge accumulation from the lack of digestion in a lagoon or digester. Because fibrous materials and other solids will not enter the lagoon system, the sludge accumulation volume required will be minimized and can be considered negligible.

Nevertheless, the primary lagoon will have sufficient space remaining for sludge accumulation, as shown by the following calculation:

SAV = VPL - MTV

Where:

SAV = Sludge Accumulation Volume (ft^3)
VPL = total Volume of Primary Lagoon (ft^3)
MTV = Minimum Treatment Volume (ft^3)

SAV =	**VPL**	**-**	**MTV**	
SAV =	**3,206,000**		**2,440,143 =**	**765,857 (ft3)**

Lagoon Design Check in Accordance with NRCS Guideline #359

Hydraulic Retention Time (HRT) Calculation

The anaerobic treatment lagoon and covered lagoon anaerobic digester must be designed to provide sufficient Hydraulic Retention Time (HRT) to adequately treat the waste entering the lagoon and to allow environmentally safe utilization of this waste. The NRCS Technical Guide Code 365 – Anaerobic Digester – Ambient Temperature specifies a minimum HRT 38 days in the San Joaquin Valley.

The Hydraulic Retention Time (HRT) is calculated as follows:

HRT = MTV/HFR

where:

HFR = Hydraulic flow rate (1000ft^3/day)

HRT = Hydraulic Retention Time (day)

The Hydraulic Flow Rate is Calculated below

Type	# of cows		Amount of Manure*			HFR	
Milk Cows	3,330	x	2.40	ft^3	=	7,992	ft^3/day
Dry Cows	1,000	x	1.30	ft^3	=	1,300	ft^3/day
Heifers (15-24 mo)	2,700	x	0.78	ft^3	=	2,106	ft^3/day
Heifers (7-14 mo)	900	x	0.78	ft^3	=	702	ft^3/day
Heifers (3-6 mo)	900	x	0.30	ft^3	=	270	ft^3/day
Calves	2,100	x	0.15	ft^3	=	315	ft^3/day
Bulls	0	x	1.30	ft^3	=	-	ft^3/day
Total	10,930					**12,685**	**ft^3/day**
Fresh water per milk cow used in flush at milk parlor			**50**	gal/day			

*Table 1.b - Section 3 of ASAE D384.2 (March 2005). The calf manure was estimated to be 1/2 of the calf number found in the table, since the average weight of these calves is approx. 1/2 of the calves identified in the table.

Lagoon Design Check in Accordance with NRCS Guideline #359 Cont.

Formula:

$$\frac{\text{Gallon}}{\text{Milk Cow*Day}} \quad \frac{\#}{\text{Milk Cows}} \times \frac{\text{ft3}}{\text{gallon}} + \frac{\text{ft3}}{\text{day}}$$

Total HFR:

$$\frac{50\ \cancel{\text{gal}}}{\cancel{\text{milk cow *}}\ \text{day}} \quad 3330\ \cancel{\text{milk cows}} \times \frac{\text{ft3}}{7.48\ \cancel{\text{gal}}} + \frac{12{,}685\ \text{ft3}}{\text{day}} = \mathbf{34{,}944.4}\ \mathbf{ft3/day}$$

Formula:

$$\text{MTV (ft3)} \ / \ \frac{\text{(day)}}{\text{HFR}\ (\cancel{\text{ft3}})} =$$

HRT:

$$2{,}440{,}143\ \cancel{\text{ft3}} \quad \frac{\text{day}}{34{,}944.4\ \cancel{\text{ft3}}} = \mathbf{69.8293758}\ \mathbf{days}$$

Appendix C

Dairy Emissions Calculations

1. Is this an existing facility that already has permits for the dairy operations? yes
Complete BOTH the Pre-Project and Post-Project Dairy Information sections below.

Pre-Project Dairy Information

1. Does this dairy house Holstein or Jersey cows? Holstein
Most dairies house Holstein cows unless explicitly stated on the PTO or application.

2. Does the facility have an <u>anaerobic</u> treatment lagoon? no

3. Does the facility land apply liquid manure? yes
Answering "yes" assumes worst case.

4. Does the facility land apply solid manure? yes
Answering "yes" assumes worst case.

5. Is <u>any</u> scraped manure sent to a lagoon? facility does not scrape manure
Answering "yes" assumes worst case.

All heifers and bulls should be entered together as Support Stock. However, if doing so will result in NSR/AAQA/RMR implications, it may be appropriate to enter each herd size individually and to add a permit condition specifying the maximum herd sizes.

For existing dairies, if the current PTO includes calves with the support stock, contact the facility to determine the maximum number of calves. **Calves should be entered separately from support stock.**

If unsure whether herd is housed in freestalls or open corrals, assume open corrals to be conservative.

If unsure whether manure is flushed or scraped, assume flushed to be conservative.

Pre-Project Herd Size

Herd	Flushed Freestalls	Scraped Freestalls	Flushed Corrals	Scraped Corrals	Total # of Animals
Milk Cows	3,300				3,300
Dry Cows			300		300
Support Stock (Heifers and Bulls)					0
Large Heifers			1,110		1,110
Medium Heifers			800		800
Small Heifers			8DD		800
Bulls					0

	Calf Hutches				Calf Corrals		
	Aboveground Flushed	Aboveground Scraped	On-Ground Flushed	On-Ground Scraped	Flushed	Scraped	Total # of Calves
Calves	1,500						1,5DD

Total Herd Summary	
Total Milk Cows	3,300
Total Mature Cows	3,600
Support Stock (Heifers and Bulls)	2,710
Total Calves	1,500
Total Dairy Head	7,810

Silage info may be found in the Rule 4570 Phase II application or, for existing dairies, in the Rule 4570 compliance engineering evaluation.

Pre-Project Silage Information

Feed Type	Max # <u>Open</u> Piles	Max Height (ft)	Max Width (ft)
Corn	1	25	60
Alfalfa			
Wheat	1	25	60

Post-Project Dairy Information

1. Does this dairy house Holstein or Jersey cows? Jersey
Most dairies house Holstein cows unless explicitly stated on the PTO or application.

2. Does the facility have an <u>anaerobic</u> treatment lagoon? yes

3. Does the facility land apply liquid manure? yes
Answering "yes" assumes worst case.

4. Does the facility land apply solid manure? yes
Answering "yes" assumes worst case.

5. Is <u>any</u> scraped manure sent to a lagoon? facility does not scrape manure
Answering "yes" assumes worst case.

6. Does this project result in any new lagoon/storage pond(s) or an <u>increase</u> in surface area for any existing lagoon/storage pond(s)? no

All heifers and bulls should be entered together as Support Stock. However, if doing so will result in NSR implications, it may be appropriate to enter each herd size individually and to add a permit condition specifying the maximum herd sizes.

Calves should be entered separately from support stock.

If unsure whether herd is housed in freestalls or open corrals, assume open corrals to be conservative.

If unsure whether manure is flushed or scraped, assume flushed to be conservative.

Post-Project Herd Size

Herd	Flushed Freestalls	Scraped Freestalls	Flushed Corrals	Scraped Corrals	Total # of Animals
Milk Cows	5,32D		58		5,378
Dry Cows			1,0DD		1,000
Support Stock (Heifers and Bulls)					0
Large Heifers			2,700		2,700
Medium Heifers			900		900
Small Heifers			900		900
Bulls					0

	Calf Hutches				Calf Corrals		
	Aboveground Flushed	Aboveground Scraped	On-Ground Flushed	On-Ground Scraped	Flushed	Scraped	Total # of Calves
Calves	2,100						2,100

Total Herd Summary	
Total Milk Cows	5,378
Total Mature Cows	6,378
Support Stock (Heifers and Bulls)	4,500
Total Calves	2,100
Total Dairy Head	12,978

Silage info may be found in the Rule 4570 Phase II application or, for existing dairies, in the Rule 4570 compliance engineering evaluation.

Post-Project Silage Information

Feed Type	Max # <u>Open</u> Piles	Max Height (ft)	Max Width (ft)
Corn	1	25	60
Alfalfa			
Wheat	1	25	60

Milking Parlor				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	VOC Control Efficiency	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Enteric Emissions Mitigations		
☑ TRUE	☑ TRUE	Feed according to NRC guidelines	10%	10%
		Total Control Efficiency	10%	10%
		Milking Parlor Floor Mitigations		
☑ TRUE	☑ TRUE	Feed according to NRC guidelines	10%	10%
☑ TRUE	☑ TRUE	Flush or hose milk parlor immediately prior to, immediately after, or during each milking. Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF.	0%	0%
		Total Control Efficiency	10%	10%

Cow Housing				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	VOC Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Enteric Emissions Mitigations		
☑ TRUE	☑ TRUE	Feed according to NRC guidelines	10%	10%
		Total Control Efficiency	10%	10%
		Corrals/Pens Mitigations		
☑ TRUE	☑ TRUE	Feed according to NRC guidelines	10%	10%
☑ TRUE	☑ TRUE	Inspect water pipes and troughs and repair leaks at least once every seven days. Note: If selected for dairies > 999 milk cows, CE is already included in EF.	0%	0%
☑ TRUE	☑ TRUE	Clean manure from corrals at least four times per year with at least 60 days between cleaning, or clean corrals at least once between April and July and at least once between September and December. Note: If selected for dairies > 999 milk cows, CE is already included in EF. Note: No additional control given for increased cleaning frequency (e.g. BACT requirement).	0%	0%
☑ TRUE	☑ TRUE	Scrape, vacuum, or flush concrete lanes in corrals at least once every day for mature cows and every seven days for support stock, or clean concrete lanes such that the depth of manure does not exceed 12 inches at any point or time. Note: No additional control given for increased cleaning frequency (e.g. BACT requirement).	10%	10%
☑ TRUE	☑ TRUE	Implement one of the following: 1) slope the surface of the corrals at least 3% where the available space for each animal is 400 sq ft or less and slope the surface of the corrals at least 1.5% where the available space for each animal is more than 400 sq ft; 2) maintain corrals to ensure proper drainage preventing water from standing more than 48 hrs; 3) harrow, rake, or scrape pens sufficiently to maintain a dry surface. Note: If selected for dairies > 999 milk cows, CE already included in EF.	0%	0%
☐	☐	Install shade structures such that they are constructed with a light permeable roofing material. Note: If selected for dairies > 999 milk cows, the control efficiency will be 5% since the EF used includes a partial control for this measure.	5%	5%
☑ TRUE	☑ TRUE	Install all shade structures uphill of any slope in the corral. Note: If selected for dairies > 999 milk cows, the control efficiency will be 5% since the EF used includes a partial control for this measure.		
☐	☐	Clean manure from under corral shades at least once every 14 days, when weather permits access into corral. Note: If selected for dairies > 999 milk cows, the control efficiency will be 5% since the EF used includes a partial control for this measure.		
☑ TRUE	☑ TRUE	Install shade structure so that the structure has a North/South orientation. Note: If selected for dairies > 999 milk cows, the control efficiency will be 5% since the EF used includes a partial control for this measure.		

☑ TRUE	☑ TRUE	Manage corrals such that the manure depth in the corral does not exceed 12 inches at any time or point, except for in-corral mounding. Manure depth may exceed 12 inches when corrals become inaccessible due to rain events. The manure facility must resume management of the manure depth of 12 inches or lower immediately upon the corral becoming accessible. Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF.	0%	0%
☐	☐	Knockdown fence line manure build-up prior to it exceeding a height of 12 inches at any time or point. Manure depth may exceed 12 inches when corrals become inaccessible due to rain events. The facility must resume management of the manure depth of 12 inches or lower immediately upon the corral becoming accessible.	0%	0%
☐	☐	Use lime or a similar absorbent material in the corral according to the manufacturer's recommendation to minimize moisture in the corrals.	0%	0%
☐	☐	Apply thymol to the corral soil in accordance with the manufacturer's recommendation.	0%	0%
		Total Control Efficiency	23.05%	23.05%
		Bedding Mitigations		
☑ TRUE	☑ TRUE	Feed according to NRC guidelines	10%	10%
☐	☐	Use non-manure-based bedding and non-separated solids based bedding for at least 90% of the bedding material, by weight, for freestalls (e.g. rubber mats, almond shells, sand, or waterbeds).	0%	0%
☑ TRUE	☑ TRUE	For a large dairy only (1,000 milk cows or larger) - Remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every 7 days.	10%	10%
☐	☐	For a medium dairy only (500 to 999 milk cows) - Remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every 14 days.	0%	0%
		Total Control Efficiency	19.00%	19.00%
		Lanes Mitigations		
☑ TRUE	☑ TRUE	Feed according to NRC guidelines	10%	10%
☑ TRUE	☑ TRUE	Pave feedlanes, where present, for a width of at least 8 feet along the corral side of the feedlane fence for milk and dry cows and at least 6 feet along the corral side of the feedlane for heifers. Note: No control efficiency at this time.	0%	0%
☑ TRUE	☑ TRUE	Flush, scrape, or vacuum freestall flush lanes immediately prior to or after, or during each milking; or flush or scrape freestall flush lanes at least 3 times per day.	10%	10%
☐	☐	Have no animals in exercise pens or corrals at any time.	0%	0%
		Total Control Efficiency	19.00%	19.00%

Liquid Manure Handling				
Measure Proposed?		**Mitigation Measure(s) per Emissions Point**	**VOC Control Efficiency (%)**	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Lagoons/Storage Ponds Mitigations		
☑ TRUE	☑ TRUE	Feed according to NRC guidelines	10%	10%
☐	☐	Use phototropic lagoon	0%	0%
☐	☑ TRUE	Use an anaerobic treatment lagoon designed according to NRCS Guideline No. 359	0%	40%
☑ TRUE	☑ TRUE	Remove solids from the waste system with a solid separator system, prior to the waste entering the lagoon. Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF.	0%	0%
☐	☐	Maintain lagoon pH between 6.5 and 7.5	0%	0%
		Total Control Efficiency	10.00%	46.00%
		Liquid Manure Land Application Mitigations		
☑ TRUE	☑ TRUE	Feed according to NRC guidelines	10%	10%
☐	☑ TRUE	Only apply liquid manure that has been treated with an anaerobic or aerobic treatment lagoon, aerobic lagoon, or digester system	0%	40%

☑ TRUE	☑ TRUE	Allow liquid manure to stand in the fields for no more than 24 hours after irrigation. Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF.	0%	0%
☐	☐	Apply liquid/slurry manure via injection with drag hose or similar apparatus	0%	0%
		Total Control Efficiency	10.00%	46.00%

Solid Manure Handling				
Measure Proposed?		**Mitigation Measure(s) per Emissions Point**	**VOC Control Efficiency (%)**	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Solid Manure Storage Mitigations		
☑ TRUE	☑ TRUE	Feed according to NRC guidelines	10%	10%
☐	☐	Within 72 hours of removal from housing, either a) remove dry manure from the facility, or b) cover dry manure outside the housing with a weatherproof covering from October through May, except for times when wind events remove the covering, not to exceed 24 hours per event.	0%	0%
		Total Control Efficiency	10.00%	10.00%
		Separated Solids Piles Mitigations		
☑ TRUE	☑ TRUE	Feed according to NRC guidelines	10%	10%
☑ TRUE	☑ TRUE	Within 72 hours of removal from the drying process, either a) remove separated solids from the facility, or b) cover separated solids outside the housing with a weatherproof covering from October through May, except for times when wind events remove the covering, not to exceed 24 hours per event.	10%	10%
		Total Control Efficiency	19.00%	19.00%
		Solid Manure Land Application Mitigations		
☑ TRUE	☑ TRUE	Feed according to NRC guidelines	10%	10%
☑ TRUE	☑ TRUE	Incorporate all solid manure within 72 hours of land application. Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF. Note: No additional control given for rapid manure incorporation (e.g. BACT requirement).	0%	0%
☐	☑ TRUE	Only apply solid manure that has been treated with an anaerobic treatment lagoon, aerobic lagoon or digester system.	0%	40%
☐	☐	Apply no solid manure with a moisture content of more than 50%	0%	0%
		Total Control Efficiency	10.00%	46.00%

Silage and TMR				
Measure Proposed?		**Mitigation Measure(s) per Emissions Point**	**VOC Control Efficiency (%)**	
Pre-Project	Post-Project		Pre-Project	Post-Project
		Corn/Alfalfa/Wheat Silage Mitigations		
☑ TRUE	☑ TRUE	1. Utilize a sealed feed storage system (e.g. Ag-Bag) for bagged silage, or 2. Cover the surface of silage piles, except for the area where feed is being removed from the pile, with a plastic tarp that is at least 5 mils thick (0.005 inches), multiple plastic tarps with a cumulative thickness of at least 5 mils (0.005 inches), or an oxygen barrier film covered with a UV resistant material within 72 hours of last delivery of material to the pile, and implement one of the following: a) build silage piles such that the average bulk density is at least 44 lb/cu-ft for corn silage and 40 lb/cu-ft for other silage types, as measured in accordance with Section 7.10 of Rule 4570, b) when creating a silage pile, adjust filling parameters to assure a calculated average bulk density of at least 44 lb/cu-ft for corn silage and at least 40 lb/cu-ft for other silage types, using a spreadsheet approved by the District, c) harvest silage crop at > or = 65% moisture for corn; and >= 60% moisture for alfalfa/grass and other silage crops; manage silage material delivery such that no more than 6 inches of materials are uncompacted on top of the pile; and incorporate the applicable Theoretical Length of Chop (TLC) and roller opening for the crop being harvested. Implement two of the following:	39%	39%

		Manage Exposed Silage. a) manage silage piles such that only one silage pile has an uncovered face and the uncovered face has a total exposed surface area of less than 2,150 sq. ft., or b) manage multiple uncovered silage piles such that the total exposed surface area of all silage piles is less than 4,300 sq ft. Maintain Silage Working Face. a) use a shaver/facer to remove silage from the silage pile, or b) maintain a smooth vertical surface on the working face of the silage pile Silage Additive: a) inoculate silage with homolactic acid bacteria in accordance with manufacturer recommendations to achieve a concentration of at least 100,000 colony forming units per gram of wet forage or apply proprionic acid, benzoic acid, sorbic acid, sodium benzoate, or potassium sorbate at a rate specified by the manufacturer to reduce yeast counts when forming silage pile; or b) apply other additives at specified rates that have been demonstrated to reduce alcohol concentrations in silage and/or VOC emissions from silage and have been approved by the District and EPA.		
		Total Control Efficiency*	39.00%	39.00%

*Assumes 25% control for density mitigation measures and 10% each for the two optional measures, resulting in an overall control of 39%. The same conservative control efficiency will be applied to the sealed feed storage system (Ag-Bag).

		TMR Mitigations		
☑ TRUE	☑ TRUE	Push feed so that it is within 3 feet of feedlane fence within 2 hrs of putting out the feed or use a feed trough or other feeding structure designed to maintain feed within reach of the cows.	10%	10%
☑ TRUE	☐	Begin feeding total mixed rations within 2 hrs of grinding and mixing rations. Note: If selected for dairies > 999 milk cows, control efficiency already included in EF.	0%	0%
☐	☐	Feed steam-flaked, dry rolled, cracked or ground corn or other ground cereal grains.	0%	0%
☑ TRUE	☑ TRUE	Remove uneaten wet feed from feed bunks within 24 hrs after then end of a rain event.	10%	10%
☐	☐	For total mixed rations that contain at least 30% by weight of silage, feed animals total mixed rations that contain at least 45% moisture.	0%	0%
		Total Control Efficiency	19.00%	19.00%

lb/hd-yr Dairy Emissions Factors for Holstein Cows

			Milk Cows				Dry Cows				Large Heifers (15 to 24 months)			
			Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled	
			<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2
Milking Parlor	VOC	Enteric Emissions in Milking Parlors	0.43	0.41	0.37	0.37	-	-	-	-	-	-	-	-
		Milking Parlor Floor	0.04	0.03	0.03	0.03	-	-	-	-	-	-	-	-
		Total	**0.47**	**0.44**	**0.40**	**0.40**	-	-	-	-	-	-	-	-
	NH3	**Total**	**0.19**	**0.19**	**0.19**	**0.19**	-	-	-	-	-	-	-	-
Cow Housing	VOC	Enteric Emissions in Cow Housing	3.89	3.69	3.32	3.32	2.33	2.23	2.01	2.01	1.81	1.71	1.54	1.54
		Corrals/Pens	10.00	6.60	5.08	5.08	5.40	3.59	2.76	2.76	4.20	2.76	2.12	2.12
		Bedding	1.05	1.00	0.81	0.81	0.57	0.54	0.44	0.44	0.44	0.42	0.34	0.34
		Lanes	0.84	0.80	0.65	0.65	0.45	0.44	0.35	0.35	0.35	0.33	0.27	0.27
		Total	**15.78**	**12.09**	**9.86**	**9.86**	**8.75**	**6.80**	**5.57**	**5.57**	**6.81**	**5.22**	**4.27**	**4.27**
	NH3	Enteric Emissions in Cow Housing	-	-	-	-	-	-	-	-	-	-	-	-
		Corrals/Pens	41.90	41.90	41.90	41.90	21.20	21.20	21.20	21.20	11.00	11.00	11.00	11.00
		Bedding	6.30	6.30	6.30	6.30	3.20	3.20	3.20	3.20	1.70	1.70	1.70	1.70
		Lanes	5.10	5.10	5.10	5.10	2.60	2.60	2.60	2.60	1.30	1.30	1.30	1.30
		Total	**53.30**	**53.30**	**53.30**	**53.30**	**27.00**	**27.00**	**27.00**	**27.00**	**14.00**	**14.00**	**14.00**	**14.00**
Liquid Manure Handling	VOC	Lagoons/Storage Ponds	1.52	1.30	1.17	0.70	0.82	0.71	0.64	0.38	0.64	0.54	0.49	0.29
		Liquid Manure Land Application	1.64	1.40	1.26	0.76	0.89	0.76	0.69	0.41	0.69	0.58	0.53	0.32
		Total	**3.16**	**2.70**	**2.43**	**1.46**	**1.71**	**1.47**	**1.33**	**0.79**	**1.33**	**1.13**	**1.02**	**0.61**
	NH3	Lagoons/Storage Ponds	8.20	8.20	8.20	8.20	4.20	4.20	4.20	4.20	2.20	2.20	2.20	2.20
		Liquid Manure Land Application	8.90	8.90	8.90	8.90	4.50	4.50	4.50	4.50	2.30	2.30	2.30	2.30
		Total	**17.10**	**17.10**	**17.10**	**17.10**	**8.70**	**8.70**	**8.70**	**8.70**	**4.50**	**4.50**	**4.50**	**4.50**
Solid Manure Handling	VOC	Solid Manure Storage	0.16	0.15	0.14	0.14	0.09	0.08	0.07	0.07	0.07	0.06	0.06	0.06
		Separated Solids Piles	0.06	0.06	0.05	0.05	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02
		Solid Manure Land Application	0.39	0.33	0.30	0.18	0.21	0.18	0.16	0.10	0.16	0.14	0.12	0.07
		Total	**0.61**	**0.54**	**0.48**	**0.36**	**0.33**	**0.29**	**0.26**	**0.20**	**0.26**	**0.23**	**0.20**	**0.15**
	NH3	Solid Manure Storage	0.95	0.95	0.95	0.95	0.48	0.48	0.48	0.48	0.25	0.25	0.25	0.25
		Separated Solids Piles	0.38	0.38	0.38	0.38	0.19	0.19	0.19	0.19	0.10	0.10	0.10	0.10
		Solid Manure Land Application	2.09	2.09	2.09	2.09	1.06	1.06	1.06	1.06	0.55	0.55	0.55	0.55
		Total	**3.42**	**3.42**	**3.42**	**3.42**	**1.73**	**1.73**	**1.73**	**1.73**	**0.80**	**0.90**	**0.90**	**0.90**

			Medium Heifers (7 to 14 months)				Small Heifers (3 to 6 months)				Calves (0 - 3 months)				Bulls			
			Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled	
			<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2
Milking Parlor	VOC	Enteric Emissions in Milking Parlors	-	-	-	-		-	-	-		-	-	-		-	-	-
		Milking Parlor Floor	-	-	-	-		-	-	-		-	-	-		-	-	-
		Total	-	-	-	-		-	-	-		-	-	-		-	-	-
	NH3	**Total**	-	-	-	-		-	-	-		-	-	-		-	-	-
Cow Housing	VOC	Enteric Emissions in Cow Housing	1.23	1.17	1.05	1.05	0.69	0.65	0.58	0.58	0.32	0.31	0.28	0.28	1.10	1.04	0.94	0.94
		Corrals/Pens	2.85	1.88	1.45	1.45	1.60	1.04	0.80	0.80	0.75	0.50	0.39	0.39	2.55	1.67	1.29	1.29
		Bedding	0.30	0.28	0.23	0.23	0.17	0.16	0.13	0.13	0.08	0.08	0.06	0.06	0.27	0.25	0.20	0.20
		Lanes	0.24	0.23	0.18	0.18	0.13	0.13	0.10	0.10	0.06	0.06	0.05	0.05	0.21	0.20	0.16	0.16
		Total	**4.62**	**3.56**	**2.91**	**2.91**	**2.59**	**1.99**	**1.62**	**1.62**	**1.22**	**0.95**	**0.78**	**0.78**	**4.13**	**3.16**	**2.59**	**2.59**
	NH3	Enteric Emissions in Cow Housing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Corrals/Pens	7.90	7.90	7.90	7.90	6.00	6.00	6.00	6.00	1.80	1.80	1.80	1.80	15.30	15.30	15.30	15.30
		Bedding	1.20	1.20	1.20	1.20	0.90	0.90	0.90	0.90	0.30	0.30	0.30	0.30	2.30	2.30	2.30	2.30
		Lanes	1.00	1.00	1.00	1.00	0.70	0.70	0.70	0.70	0.20	0.20	0.20	0.20	1.90	1.90	1.90	1.90
		Total	**10.10**	**10.10**	**10.10**	**10.10**	**7.60**	**7.60**	**7.60**	**7.60**	**2.30**	**2.30**	**2.30**	**2.30**	**19.50**	**19.50**	**19.50**	**19.50**
Liquid Manure Handling	VOC	Lagoons/Storage Ponds	0.43	0.37	0.33	0.20	0.24	0.21	0.19	0.11	0.11	0.10	0.09	0.05	0.40	0.33	0.30	0.18
		Liquid Manure Land Application	0.47	0.40	0.36	0.22	0.26	0.22	0.20	0.12	0.12	0.11	0.10	0.06	0.42	0.35	0.32	0.19
		Total	**0.90**	**0.77**	**0.69**	**0.42**	**0.51**	**0.43**	**0.38**	**0.23**	**0.24**	**0.21**	**0.18**	**0.11**	**0.82**	**0.68**	**0.61**	**0.37**
	NH3	Lagoons/Storage Ponds	1.50	1.50	1.50	1.50	1.20	1.20	1.20	1.20	0.35	0.35	0.35	0.35	3.00	3.00	3.00	3.00
		Liquid Manure Land Application	1.70	1.70	1.70	1.70	1.30	1.30	1.30	1.30	0.37	0.37	0.37	0.37	3.23	3.23	3.23	3.23
		Total	**3.20**	**3.20**	**3.20**	**3.20**	**2.50**	**2.50**	**2.50**	**2.50**	**0.72**	**0.72**	**0.72**	**0.72**	**6.23**	**6.23**	**6.23**	**6.23**
Solid Manure Handling	VOC	Solid Manure Storage	0.05	0.04	0.04	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.04	0.04	0.04	0.04
		Separated Solids Piles	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02
		Solid Manure Land Application	0.11	0.09	0.08	0.05	0.06	0.05	0.05	0.03	0.03	0.03	0.02	0.01	0.10	0.08	0.07	0.04
		Total	**0.17**	**0.15**	**0.14**	**0.10**	**0.10**	**0.09**	**0.08**	**0.06**	**0.05**	**0.04**	**0.04**	**0.03**	**0.16**	**0.14**	**0.12**	**0.10**
	NH3	Solid Manure Storage	0.18	0.18	0.18	0.18	0.13	0.13	0.13	0.13	0.04	0.04	0.04	0.04	0.35	0.35	0.35	0.35
		Separated Solids Piles	0.07	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.14	0.14	0.14	0.14
		Solid Manure Land Application	0.39	0.39	0.39	0.39	0.30	0.30	0.30	0.30	0.09	0.09	0.09	0.09	0.76	0.76	0.76	0.76
		Total	**0.64**	**0.64**	**0.64**	**0.64**	**0.48**	**0.48**	**0.48**	**0.48**	**0.15**	**0.15**	**0.15**	**0.15**	**1.25**	**1.25**	**1.25**	**1.25**

Silage and TMR (Total Mixed Ration) Emissions (μg/m^2-min)

		Silage Type	Uncontrolled	EF1	EF2
Feed Storage and Handling	VOC	Corn Silage	34,681	21,155	21,155
		Alfalfa Silage	17,458	10,649	10,649
		Wheat Silage	43,844	26,745	26,745
		TMR	13,056	10,575	10,575

Assumptions: 1) Each silage pile is completely covered except for the front face and 2) Rations are fed within 48 hours.

PM_{10} Emission Factors (lb/hd-yr)

Type of Cow	Uncontrolled Dairy EF	Source
Cows in Freestalls	1.37	Based on a Summer 2003 study by Texas A&M ASAE at a West Texas Dairy
Milk/Dry in Corrals	5.46	Based on a Summer 2003 study by Texas A&M ASAE at a West Texas Dairy
Heifers/Bulls in Open Corrals	10.55	Based on a USDA/UC Davis report quantifying dairy and feedlot emissions in Tulare & Kern Counties (April '01)
Calf (under 3 mo.) open corrals	1.37	SJVAPCD
Calf on-ground hutches	0.343	SJVAPCD
Calf above-ground flushed	0.069	SJVAPCD
Calf above-ground scraped	0.206	SJVAPCD

The controlled PM10 emission factors will be calculated based on the specific PM10 mitigation measures, if any, for each freestall, corral, or calf hutch area.

lb/hd-yr Dairy Emissions Factors for Jersey Cows																														
			Milk Cows				Dry Cows				Large Heifers (15 to 24 months)				Medium Heifers (7 to 14 months)				Small Heifers (3 to 6 months)				Calves (0 - 3 months)				Bulls			
			Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled	
			<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2
Milking Parlor	VOC	Enteric Emissions in Milking Parlors	0.31	0.29	0.26	0.26	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-		-	-	-		-	-	-
		Milking Parlor Floor	0.03	0.02	0.02	0.02	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-		-	-	-		-	-	-
		Total	**0.34**	**0.31**	**0.28**	**0.28**	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-		-	-	-		-	-	-
	NH3	**Total**	**0.13**	**0.13**	**0.13**	**0.13**	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-		-	-	-		-	-	-
Cow Housing	VOC	Enteric Emissions in Cow Housing	2.76	2.62	2.36	2.36	1.66	1.58	1.43	1.43	1.29	1.22	1.09	1.09	0.87	0.83	0.75	0.75	0.49	0.46	0.41	0.41	0.23	0.22	0.20	0.20	0.78	0.74	0.66	0.66
		Corrals/Pens	7.10	4.69	3.61	3.61	3.83	2.55	1.96	1.96	2.98	1.96	1.51	1.51	2.02	1.33	1.03	1.03	1.14	0.74	0.57	0.57	0.53	0.36	0.27	0.27	1.81	1.19	0.91	0.91
		Bedding	0.75	0.71	0.58	0.58	0.40	0.39	0.31	0.31	0.31	0.30	0.24	0.24	0.21	0.20	0.16	0.16	0.12	0.11	0.09	0.09	0.06	0.05	0.04	0.04	0.19	0.18	0.14	0.14
		Lanes	0.60	0.57	0.46	0.46	0.32	0.31	0.25	0.25	0.25	0.24	0.19	0.19	0.17	0.16	0.13	0.13	0.10	0.09	0.07	0.07	0.04	0.04	0.03	0.03	0.15	0.14	0.12	0.12
		Total	**11.20**	**8.58**	**7.00**	**7.00**	**6.21**	**4.83**	**3.95**	**3.95**	**4.83**	**3.71**	**3.03**	**3.03**	**3.28**	**2.53**	**2.07**	**2.07**	**1.84**	**1.40**	**1.15**	**1.15**	**0.86**	**0.67**	**0.55**	**0.55**	**2.93**	**2.24**	**1.84**	**1.84**
	NH3	Enteric Emissions in Cow Housing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Corrals/Pens	29.75	29.75	29.75	29.75	15.05	15.05	15.05	15.05	7.81	7.81	7.81	7.81	5.61	5.61	5.61	5.61	4.26	4.26	4.26	4.26	1.28	1.28	1.28	1.28	10.86	10.86	10.86	10.86
		Bedding	4.47	4.47	4.47	4.47	2.27	2.27	2.27	2.27	1.21	1.21	1.21	1.21	0.85	0.85	0.85	0.85	0.64	0.64	0.64	0.64	0.21	0.21	0.21	0.21	1.63	1.63	1.63	1.63
		Lanes	3.62	3.62	3.62	3.62	1.85	1.85	1.85	1.85	0.92	0.92	0.92	0.92	0.71	0.71	0.71	0.71	0.50	0.50	0.50	0.50	0.14	0.14	0.14	0.14	1.35	1.35	1.35	1.35
		Total	**37.84**	**37.84**	**37.84**	**37.84**	**19.17**	**19.17**	**19.17**	**19.17**	**9.94**	**9.94**	**9.94**	**9.94**	**7.17**	**7.17**	**7.17**	**7.17**	**5.40**	**5.40**	**5.40**	**5.40**	**1.63**	**1.63**	**1.83**	**1.63**	**13.65**	**13.65**	**13.85**	**13.85**
Liquid Manure Handling	VOC	Lagoons/Storage Ponds	1.08	0.92	0.83	0.50	0.58	0.50	0.45	0.27	0.45	0.39	0.35	0.21	0.31	0.26	0.24	0.14	0.17	0.15	0.13	0.08	0.08	0.07	0.06	0.04	0.28	0.23	0.21	0.13
		Liquid Manure Land Application	1.16	0.99	0.89	0.54	0.63	0.54	0.49	0.29	0.49	0.42	0.37	0.22	0.33	0.28	0.25	0.15	0.19	0.16	0.14	0.08	0.09	0.08	0.07	0.04	0.30	0.25	0.22	0.13
		Total	**2.24**	**1.92**	**1.72**	**1.04**	**1.21**	**1.04**	**0.94**	**0.56**	**0.94**	**0.60**	**0.72**	**0.43**	**0.64**	**0.55**	**0.49**	**0.29**	**0.36**	**0.30**	**0.27**	**0.16**	**0.17**	**0.15**	**0.13**	**0.06**	**0.56**	**0.48**	**0.43**	**0.26**
	NH3	Lagoons/Storage Ponds	5.82	5.82	5.82	5.82	2.98	2.98	2.98	2.98	1.56	1.56	1.56	1.56	1.07	1.07	1.07	1.07	0.85	0.85	0.85	0.85	0.25	0.25	0.25	0.25	2.13	2.13	2.13	2.13
		Liquid Manure Land Application	6.32	6.32	6.32	6.32	3.20	3.20	3.20	3.20	1.63	1.63	1.63	1.63	1.21	1.21	1.21	1.21	0.92	0.92	0.92	0.92	0.26	0.26	0.26	0.26	2.29	2.29	2.29	2.29
		Total	**12.14**	**12.14**	**12.14**	**12.14**	**6.18**	**6.16**	**6.18**	**6.18**	**3.20**	**3.20**	**3.20**	**3.20**	**2.27**	**2.27**	**2.27**	**2.27**	**1.78**	**1.78**	**1.76**	**1.78**	**0.51**	**0.51**	**0.51**	**0.51**	**4.42**	**4.42**	**4.42**	**4.42**
Solid Manure Handling	VOC	Solid Manure Storage	0.11	0.11	0.10	0.10	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.03	0.03	0.03	0.03
		Separated Solids Piles	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
		Solid Manure Land Application	0.28	0.23	0.21	0.13	0.15	0.13	0.11	0.07	0.12	0.10	0.09	0.05	0.08	0.07	0.06	0.04	0.04	0.04	0.03	0.02	0.02	0.02	0.02	0.01	0.07	0.06	0.05	0.03
		Total	**0.43**	**0.38**	**0.34**	**0.25**	**0.23**	**0.21**	**0.19**	**0.14**	**0.18**	**0.16**	**0.14**	**0.11**	**0.12**	**0.11**	**0.10**	**0.07**	**0.07**	**0.06**	**0.05**	**0.04**	**0.03**	**0.03**	**0.03**	**0.02**	**0.11**	**0.10**	**0.09**	**0.07**
	NH3	Solid Manure Storage	0.67	0.67	0.67	0.67	0.34	0.34	0.34	0.34	0.18	0.18	0.18	0.18	0.13	0.13	0.13	0.13	0.09	0.09	0.09	0.09	0.03	0.03	0.03	0.03	0.25	0.25	0.25	0.25
		Separated Solids Piles	0.27	0.27	0.27	0.27	0.13	0.13	0.13	0.13	0.07	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.10	0.10	0.10	0.10
		Solid Manure Land Application	1.48	1.48	1.48	1.48	0.75	0.75	0.75	0.75	0.39	0.39	0.39	0.39	0.28	0.28	0.28	0.28	0.21	0.21	0.21	0.21	0.06	0.06	0.06	0.06	0.54	0.54	0.54	0.54
		Total	**2.43**	**2.43**	**2.43**	**2.43**	**1.23**	**1.23**	**1.23**	**1.23**	**0.64**	**0.64**	**0.64**	**0.64**	**0.45**	**0.45**	**0.45**	**0.45**	**0.34**	**0.34**	**0.34**	**0.34**	**0.11**	**0.11**	**0.11**	**0.11**	**0.89**	**0.89**	**0.89**	**0.89**

Silage and TMR (Total Mixed Ration) Emissions (μg/m^2-min)					
		Silage Type	Uncontrolled	EF1	EF2
Feed Storage and Handling	VOC	Corn Silage	34,681	21,155	21,155
		Alfalfa Silage	17,458	10,649	10,649
		Wheat Silage	43,844	26,745	26,745
		TMR	13,056	10,575	10,575

Assumptions: 1) Each silage pile is completely covered except for the front face and 2) Rations are fed within 48 hours.

PM_{10} Emission Factors (lb/hd-yr)		
Type of Cow	Dairy EF	Source
Cows in Freestalls	1.37	Based on a Summer 2003 study by Texas A&M ASAE at a West Texas Dairy
Milk/Dry in Corrals	5.46	Based on a Summer 2003 study by Texas A&M ASAE at a West Texas Dairy
Heifers/Bulls in Open Corrals	10.55	Based on a USDA/UC Davis report quantifying dairy and feedlot emissions in Tulare & Kern Counties (April '01)
Calf (under 3 mo.) open corrals	1.37	SJVAPCD
Calf on-ground hutches	0.343	SJVAPCD
Calf above-ground flushed	0.069	SJVAPCD
Calf above-ground scraped	0.206	SJVAPCD

The controlled PM10 EF will be calculated based on the specific PM10 mitigation measures, if any, for each freestall, corral, or calf hutch area.

PM10 Mitigation Measures and Control Efficiencies

Control Measure	PM10 Control Efficiency
Shaded corrals (milk and dry cows)	16.7
Shaded corrals (heifers and bulls)	8.3
Downwind shelterbelts	12.5
Upwind shelterbelts	10
Freestall with no exercise pens and non-manure based bedding	90
Freestall with no exercise pens and manure based bedding	80
Fibrous layer in dusty areas (i.e. hay, etc.)	10
Bi-weekly corral/exercise pen scraping and/or manure removal using a pull type manure harvesting equipment in morning hours when moisture in air except during periods of rainy weather	15
Sprinkling of open corrals/exercise pens	15
Feeding young stock (heifers and calves) near dusk	10

Section 1: Complete the following tables for an existing dairy. Then go to Section 2. For a new dairy, skip Section 1 and go straight to Section 2.

Pre-Project PM10 Mitigation Measures for Freestalls

	Freestall #(s) or Name(s)	Type of cow	Total # of cows	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk
1	1	milk cows	560	N/A	☐	☐	☐	☐	☐	☐	☐	☐
2	2	milk cows	560	N/A	☐	☐	☐	☐	☐	☐	☐	☐
3	3	milk cows	560	N/A	☐	☐	☐	☐	☐	☐	☐	☐
4	4	milk cows	220	N/A	☐	☐	☐	☐	☐	☐	☐	☐
5	5	milk cows	220	N/A	☐	☐	☐	☐	☐	☐	☐	☐
6	6	milk cows	220	N/A	☐	☐	☐	☐	☐	☐	☐	☐
7	7	milk cows	220	N/A	☐	☐	☐	☐	☐	☐	☐	☐
8	8	milk cows	740	N/A	☐	☐	☐	☐	☐	☐	☐	☐
9				N/A	☐	☐	☐	☐	☐	☐	☐	☐
10				N/A	☐	☐	☐	☐	☐	☐	☐	☐
11				N/A	☐	☐	☐	☐	☐	☐	☐	☐
12				N/A	☐	☐	☐	☐	☐	☐	☐	☐
	Total # of cows in freestalls		3,300									

Pre-Project PM10 Mitigation Measures for Corrals

	Corral #(s) or Name(s)	Type of cow	Total # of cows	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk
1	Dry 1	dry cows	90	☑	☐	☐	N/A	N/A	☐	☐	☐	☐
2	Dry 2	dry cows	90	☑	☐	☐	N/A	N/A	☐	☐	☐	☐
3	Dry 3	dry cows	120	☑	☐	☐	N/A	N/A	☐	☐	☐	☐
4	Large 1	large heifers	555	☐	☐	☐	N/A	N/A	☐	☐	☐	☐
5	Large 2	large heifers	555	☑	☐	☐	N/A	N/A	☐	☐	☐	☐
6	Large 3	large heifers		☐	☐	☐	N/A	N/A	☐	☐	☐	☐
7	Large 8	large heifers		☐	☐	☐	N/A	N/A	☐	☐	☐	☐
8	Medium 4	medium heifers	400	☐	☐	☐	N/A	N/A	☐	☐	☐	☐
9	Medium 5	medium heifers	400	☑	☐	☐	N/A	N/A	☐	☐	☐	☐
10	Medium 9	medium heifers		☐	☐	☐	N/A	N/A	☐	☐	☐	☐
11	Medium 10	medium heifers		☐	☐	☐	N/A	N/A	☐	☐	☐	☐
12	Small 6	small heifers	400	☐	☐	☐	N/A	N/A	☐	☐	☐	☐
13	Small 7	small heifers	400	☑	☐	☐	N/A	N/A	☐	☐	☐	☐
14	Small 11	small heifers		☐	☐	☐	N/A	N/A	☐	☐	☐	☐
15	Small 12	small heifers		☐	☐	☐	N/A	N/A	☐	☐	☐	☐
	Total # of cows in corrals		3,010									

Pre-Project PM10 Mitigation Measures for Calf Hutches

Type of Hutches	Type of cow	Total # of calves	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk
On Ground			N/A	☐	☐	N/A	N/A	N/A	N/A	N/A	N/A
Aboveground Flush	calves	1,500	N/A	☐	☐	N/A	N/A	N/A	N/A	N/A	N/A
Aboveground Scrape			N/A	☐	☐	N/A	N/A	N/A	N/A	N/A	N/A
Total # of calves in hutches		1,500									

Pre-Project PM10 Control Efficiencies and Emission Factors for Freestalls

Freestall #(s)	Type of cow	Uncontrolled EF (lb/hd-yr)	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk	Controlled EF (lb/hd-yr)
1	milk cows	1.37	N/A									1.37
2	milk cows	1.37	N/A									1.37
3	milk cows	1.37	N/A									1.37
4	milk cows	1.37	N/A									1.37
5	milk cows	1.37	N/A									1.37
6	milk cows	1.37	N/A									1.37
7	milk cows	1.37	N/A									1.37
8	milk cows	1.37	N/A									1.37
			N/A									
			N/A									
			N/A									
			N/A									

Pre-Project PM10 Control Efficiencies and Emission Factors for Corrals

Corral #	Type of cow	Uncontrolled EF (lb/hd-yr)	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk	Controlled EF (lb/hd-yr)
Dry 1	dry cows	5.46	16.7%			N/A	N/A					4.55
Dry 2	dry cows	5.46	16.7%			N/A	N/A					4.55
Dry 3	dry cows	5.46	16.7%			N/A	N/A					4.55
Large 1	large heifers	10.55				N/A	N/A					10.55
Large 2	large heifers	10.55	8.3%			N/A	N/A					9.67
Large 3	large heifers	10.55				N/A	N/A					10.55
Large 8	large heifers	10.55				N/A	N/A					10.55
Medium 4	medium heifers	10.55				N/A	N/A					10.55
Medium 5	medium heifers	10.55	8.3%			N/A	N/A					9.67
Medium 9	medium heifers	10.55				N/A	N/A					10.55
Medium 10	medium heifers	10.55				N/A	N/A					10.55
Small 6	small heifers	10.55				N/A	N/A					10.55
Small 7	small heifers	10.55	8.3%			N/A	N/A					9.67
Small 11	small heifers	10.55				N/A	N/A					10.55
Small 12	small heifers	10.55				N/A	N/A					10.55

Pre-Project PM10 Control Efficiencies and Emission Factors for Calf Hutches

Type of Hutches	Type of cow	Uncontrolled EF (lb/hd-yr)	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk	Controlled EF (lb/hd-yr)

Type of Hutches	Type of cow	Uncontrolled EF (lb/hd-yr)	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk	Controlled EF (lb/hd-yr)
On Ground			N/A			N/A	N/A	N/A	N/A	N/A	N/A	
Aboveground Flush	calves	0.069	N/A			N/A	N/A	N/A	N/A	N/A	N/A	0.070
Aboveground Scrape			N/A			N/A	N/A	N/A	N/A	N/A	N/A	

Section 2: Complete the following tables for a brand new dairy or for existing freestalls, existing corrals, or existing calf hutches at an existing dairy. For new freestalls, new corrals, or new calf hutches at an existing dairy, use Section 3.

Post-Project PM10 Mitigation Measures for Freestalls

	Freestall #(s)	Type of cow	Total # of cows	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk
1	1	milk cows	620	N/A	☐	☐	☐	☑	☐	☐	☐	☐
2	2	milk cows	620	N/A	☐	☐	☐	☐	☐	☑	☐	☐
3	3	milk cows	620	N/A	☐	☐	☐	☐	☐	☑	☐	☐
4	4	milk cows	250	N/A	☐	☐	☐	☐	☐	☑	☐	☐
5	5	milk cows	250	N/A	☐	☐	☐	☑	☐	☐	☐	☐
6	6	milk cows	250	N/A	☐	☐	☐	☐	☐	☑	☐	☐
7	7	milk cows	250	N/A	☐	☐	☐	☐	☐	☑	☐	☐
8	8	milk cows	820	N/A	☐	☐	☐	☑	☐	☐	☐	☐
9				N/A	☐	☐	☐	☐	☐	☐	☐	☐
10				N/A	☐	☐	☐	☐	☐	☐	☐	☐
11				N/A	☐	☐	☐	☐	☐	☐	☐	☐
12				N/A	☐	☐	☐	☐	☐	☐	☐	☐
		Total # of cows in freestalls	3,680									

Post-Project PM10 Mitigation Measures for Corrals

	Corral #(s)	Type of cow	# of cows	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk
1	Dry 1	dry cows	400	☑	☐	☐	N/A	N/A	☐	☑	☐	☐
2	Dry 2	dry cows	400	☑	☐	☐	N/A	N/A	☐	☑	☐	☐
3	Dry 3	dry cows	200	☑	☑	☐	N/A	N/A	☐	☑	☐	☐
4	Large 1	large heifers	712	☑	☑	☐	N/A	N/A	☐	☑	☐	☑
5	Large 2	large heifers	852	☑	☑	☐	N/A	N/A	☐	☑	☐	☑
6	Large 3	large heifers	568	☑	☑	☐	N/A	N/A	☐	☑	☐	☑
7	Large 8	large heifers	568	☑	☑	☐	N/A	N/A	☐	☑	☐	☑
8	Medium 4	medium heifers	189	☑	☑	☐	N/A	N/A	☐	☑	☐	☑
9	Medium 5	medium heifers	237	☑	☑	☐	N/A	N/A	☐	☑	☐	☑
10	Medium 9	medium heifers	237	☑	☑	☐	N/A	N/A	☐	☑	☐	☑
11	Medium 10	medium heifers	237	☑	☑	☐	N/A	N/A	☐	☑	☐	☑
12	Small 6	small heifers	173	☑	☑	☐	N/A	N/A	☐	☑	☐	☑
13	Small 7	small heifers	440	☑	☑	☐	N/A	N/A	☐	☑	☐	☑
14	Small 11	small heifers	134	☑	☑	☐	N/A	N/A	☐	☑	☐	☑
15	Small 12	small heifers	153	☑	☑	☐	N/A	N/A	☐	☑	☐	☑
		Total # of cows in corrals	5,500									

Post-Project PM10 Mitigation Measures for Calf Hutches

Type of Hutches	Type of cow	Total # of calves	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk
On Ground			N/A	☐	☐	N/A	N/A	N/A	N/A	N/A	N/A
Aboveground Flush	calves	1,500	N/A	☐	☐	N/A	N/A	N/A	N/A	N/A	N/A
Aboveground Scrape			N/A	☐	☐	N/A	N/A	N/A	N/A	N/A	N/A
	Total # of calves in hutches	1,500									

Post-Project PM10 Control Efficiencies and Emission Factors for Freestalls

Freestall #(s)	Type of cow	Uncontrolled EF (lb/hd-yr)	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk	Controlled EF (lb/hd-yr)
1	milk cows	1.37	N/A				80%					0.27
2	milk cows	1.37	N/A						15%			1.17
3	milk cows	1.37	N/A						15%			1.17
4	milk cows	1.37	N/A						15%			1.17
5	milk cows	1.37	N/A				80%					0.27
6	milk cows	1.37	N/A						15%			1.17
7	milk cows	1.37	N/A						15%			1.17
8	milk cows	1.37	N/A				80%					0.27
			N/A									
			N/A									
			N/A									
			N/A									

Post-Project PM10 Control Efficiencies and Emission Factors for Corrals

Corral #	Type of cow	Uncontrolled EF (lb/hd-yr)	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk	Controlled EF (lb/hd-yr)
Dry 1	dry cows	5.46	16.7%			N/A	N/A		15%			3.87
Dry 2	dry cows	5.46	16.7%			N/A	N/A		15%			3.87
Dry 3	dry cows	5.46	16.7%	12.5%		N/A	N/A		15%			3.38
Large 1	large heifers	10.55	8.3%	12.5%		N/A	N/A		15%		10%	6.48
Large 2	large heifers	10.55	8.3%	12.5%		N/A	N/A		15%		10%	6.48
Large 3	large heifers	10.55	8.3%	12.5%		N/A	N/A		15%		10%	6.48
Large 8	large heifers	10.55	8.3%	12.5%		N/A	N/A		15%		10%	6.48
Medium 4	medium heifers	10.55	8.3%	12.5%		N/A	N/A		15%		10%	6.48
Medium 5	medium heifers	10.55	8.3%	12.5%		N/A	N/A		15%		10%	6.48
Medium 9	medium heifers	10.55	8.3%	12.5%		N/A	N/A		15%		10%	6.48
Medium 10	medium heifers	10.55	8.3%	12.5%		N/A	N/A		15%		10%	6.48
Small 6	small heifers	10.55	8.3%	12.5%		N/A	N/A		15%		10%	6.48
Small 7	small heifers	10.55	8.3%	12.5%		N/A	N/A		15%		10%	6.48
Small 11	small heifers	10.55	8.3%	12.5%		N/A	N/A		15%		10%	6.48
Small 12	small heifers	10.55	8.3%	12.5%		N/A	N/A		15%		10%	6.48

Post-Project PM10 Control Efficiencies and Emission Factors for Calf Hutches

Type of Hutches	Type of cow	Uncontrolled EF (lb/hd-yr)	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk	Controlled EF (lb/hd-yr)
On Ground			N/A			N/A	N/A	N/A	N/A	N/A	N/A	
Aboveground Flush	calves	0.069	N/A			N/A	N/A	N/A	N/A	N/A	N/A	0.069
Aboveground Scrape			N/A			N/A	N/A	N/A	N/A	N/A	N/A	

Section 3: Complete the following tables for new freestalls, new corrals, or new calf hutches at an existing dairy.

Post-Project PM10 Mitigation Measures for New Freestalls at an Expanding Dairy

Freestall #(s)	Type of cow	Total # of cows	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk
9	milk cows	820	N/A	☐	☐	☐	☑	☐	☐	☐	☐
10	milk cows	820	N/A	☐	☐	☐	☑	☐	☐	☐	☐
			N/A	☐	☐	☐	☐	☐	☐	☐	☐
			N/A	☐	☐	☐	☐	☐	☐	☐	☐
			N/A	☐	☐	☐	☐	☐	☐	☐	☐
Total # of cows in freestalls		1,640									

Post-Project PM10 Mitigation Measures for Corrals at an Expanding Dairy

Corral #(s)	Type of cow	# of cows	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk
milk cow corral	milk cows	58	☑	☑	☐	N/A	N/A	☐	☑	☐	☐
			☐	☐	☐	N/A	N/A	☐	☐	☐	☐
			☐	☐	☐	N/A	N/A	☐	☐	☐	☐
			☐	☐	☐	N/A	N/A	☐	☐	☐	☐
			☐	☐	☐	N/A	N/A	☐	☐	☐	☐
			☐	☐	☐	N/A	N/A	☐	☐	☐	☐
			☐	☐	☐	N/A	N/A	☐	☐	☐	☐
			☐	☐	☐	N/A	N/A	☐	☐	☐	☐
			☐	☐	☐	N/A	N/A	☐	☐	☐	☐
			☐	☐	☐	N/A	N/A	☐	☐	☐	☐
Total # of cows in corrals		1,698									

Post-Project PM10 Mitigation Measures for Calf Hutches at an Expanding Dairy

Type of Hutches	Type of cow	Total # of calves	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk
On Ground			N/A	☐	☐	N/A	N/A	N/A	N/A	N/A	N/A
Aboveground Flush	calves	600	N/A	☐	☐	N/A	N/A	N/A	N/A	N/A	N/A
Aboveground Scrape			N/A	☐	☐	N/A	N/A	N/A	N/A	N/A	N/A
Total # of calves in hutches		600									

NOTE: The milk cow corral is an existing, vacant corral at the dairy. For the presentation of these calculations only, it will be grouped as a new corral. However, no new corrals are proposed.

Post-Project PM10 Control Efficiencies and Emission Factors for Freestalls

Freestall #(s)	Type of cow	Uncontrolled EF (lb/hd-yr)	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk	Controlled EF (lb/hd-yr)
9	milk cows	1.37	N/A				80%					0.27
10	milk cows	1.37	N/A				80%					0.27
			N/A									
			N/A									
			N/A									

Post-Project PM10 Control Efficiencies and Emission Factors for Corrals

Corral #	Type of cow	Uncontrolled EF (lb/hd-yr)	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk	Controlled EF (lb/hd-yr)
milk cow corral	milk cows	5.46	16.7%	12.5%		N/A	N/A		15%			3.38
						N/A	N/A					
						N/A	N/A					
						N/A	N/A					
						N/A	N/A					
						N/A	N/A					
						N/A	N/A					
						N/A	N/A					
						N/A	N/A					
						N/A	N/A					

Post-Project PM10 Control Efficiencies and Emission Factors for Calf Hutches

Type of Hutches	Type of cow	Uncontrolled EF (lb/hd-yr)	Shaded Corrals	Downwind Shelterbelts	Upwind Shelterbelts	No exercise pens, non-manure bedding	No exercise pens, manure bedding	Fibrous layer	Bi-weekly scraping Corrals/Pens	Sprinkling Corrals/Pens	Feed Young Stock Near Dusk	Controlled EF (lb/hd-yr)
On Ground			N/A			N/A	N/A	N/A	N/A	N/A	N/A	
Aboveground Flush	calves	0.069	N/A			N/A	N/A	N/A	N/A	N/A	N/A	0.069
Aboveground Scrape			N/A			N/A	N/A	N/A	N/A	N/A	N/A	

Pre-Project Potential to Emit - Cow Housing

Pre-Project Potential to Emit - Cow Housing: Freestalls											
Freestall #(s)/ Name(s)	Type of Cow	# of Cows	Controlled VOC EF (lb/hd-yr)	Controlled NH3 EF (lb/hd-yr)	Controlled PM10 EF (lb/hd-yr)	VOC (lb/day)	VOC (lb/yr)	NH3 (lb/day)	NH3 (lb/yr)	PM10 (lb/day)	PM10 (lb/yr)
1	milk cows	560	9.86	53.3	1.37	15.1	5,522	81.8	29,848	2.1	767
2	milk cows	560	9.86	53.3	1.37	15.1	5,522	81.8	29,848	2.1	767
3	milk cows	560	9.86	53.3	1.37	15.1	5,522	81.8	29,848	2.1	767
4	milk cows	220	9.86	53.3	1.37	5.9	2,169	32.1	11,726	0.8	301
5	milk cows	220	9.86	53.3	1.37	5.9	2,169	32.1	11,726	0.8	301
6	milk cows	220	9.86	53.3	1.37	5.9	2,169	32.1	11,726	0.8	301
7	milk cows	220	9.86	53.3	1.37	5.9	2,169	32.1	11,726	0.8	301
8	milk cows	740	9.86	53.3	1.37	20.0	7,296	108.1	39,442	2.8	1,014
Total - Freestalls		3,300				89.1	32,538	481.9	175,890	12.4	4,521

Pre-Project Potential to Emit - Cow Housing: Corrals											
Corral #(s)/ Name(s)	Type of Cow	# of Cows	Controlled VOC EF (lb/hd-yr)	Controlled NH3 EF (lb/hd-yr)	Controlled PM10 EF (lb/hd-yr)	VOC (lb/day)	VOC (lb/yr)	NH3 (lb/day)	NH3 (lb/yr)	PM10 (lb/day)	PM10 (lb/yr)
Dry 1	dry cows	90	5.57	27	4.55	1.4	501	6.7	2,430	1.1	410
Dry 2	dry cows	90	5.57	27	4.55	1.4	501	6.7	2,430	1.1	410
Dry 3	dry cows	120	5.57	27	4.55	1.8	668	8.9	3,240	1.5	546
Large 1	large heifers	555	4.27	14	10.55	6.5	2,370	21.3	7,770	16.0	5,855
Large 2	large heifers	555	4.27	14	9.67	6.5	2,370	21.3	7,770	14.7	5,367
Large 3	large heifers	0	4.27	14	10.55	0.0	0	0.0	0	0.0	0
Large 8	large heifers	0	4.27	14	10.55	0.0	0	0.0	0	0.0	0
Medium 4	medium heifers	400	2.91	10.1	10.55	3.2	1,164	11.1	4,040	11.6	4,220
Medium 5	medium heifers	400	2.91	10.1	9.67	3.2	1,164	11.1	4,040	10.6	3,868
Medium 9	medium heifers	0	2.91	10.1	10.55	0.0	0	0.0	0	0.0	0
Medium 10	medium heifers	0	2.91	10.1	10.55	0.0	0	0.0	0	0.0	0
Small 6	small heifers	400	1.62	7.6	10.55	1.8	648	8.3	3,040	11.6	4,220
Small 7	small heifers	400	1.62	7.6	9.67	1.8	648	8.3	3,040	10.6	3,868
Small 11	small heifers	0	1.62	7.6	10.55	0.0	0	0.0	0	0.0	0
Small 12	small heifers	0	1.62	7.6	10.55	0.0	0	0.0	0	0.0	0
Total - Corrals		3,010				27.5	10,035	103.6	37,800	78.8	28,763

Pre-Project Potential to Emit - Cow Housing: Calf Hutches											
Type of Hutches	Type of Cow	# of Cows	Controlled VOC EF (lb/hd-yr)	Controlled NH3 EF (lb/hd-yr)	Controlled PM10 EF (lb/hd-yr)	VOC (lb/day)	VOC (lb/yr)	NH3 (lb/day)	NH3 (lb/yr)	PM10 (lb/day)	PM10 (lb/yr)
On Ground											
Aboveground Flush	calves	1,500	0.78	2.3	0.07	3.2	1,170	9.5	3,450	0.3	105
Aboveground Scrape											
Total - Calf Hutches		1,500				3.2	1,170	9.5	3,450	0.3	105

Pre-Project Totals						
Total # of Cows	VOC (lb/day)	VOC (lb/yr)	NH3 (lb/day)	NH3 (lb/yr)	PM10 (lb/day)	PM10 (lb/yr)
7,810	119.8	43,743	594.9	217,140	91.5	33,389

Calculations:

Annual PE 1 for each pollutant (lb/yr) = Controlled EF (lb/hd-yr) x # of cows (hd)
Daily PE1 for each pollutant (lb/day) = [Controlled EF (lb/hd-yr) x # of cows (hd)] ÷ 365 (day/yr)

Post-Project Potential to Emit - Cow Housing

Post-Project Potential to Emit - Cow Housing: Freestalls

Freestall #(s)/ Name(s)	Type of Cow	# of Cows	Controlled VOC EF (lb/hd-yr)	Controlled NH3 EF (lb/hd-yr)	Controlled PM10 EF (lb/hd-yr)	VOC (lb/day)	VOC (lb/yr)	NH3 (lb/day)	NH3 (lb/yr)	PM10 (lb/day)	PM10 (lb/yr)
1	milk cows	620	7	37.84	0.27	11.9	4,340	64.3	23,461	0.5	170
2	milk cows	620	7	37.84	1.17	11.9	4,340	64.3	23,461	2.0	722
3	milk cows	620	7	37.84	1.17	11.9	4,340	64.3	23,461	2.0	722
4	milk cows	250	7	37.84	1.17	4.8	1,750	25.9	9,460	0.8	291
5	milk cows	250	7	37.84	0.27	4.8	1,750	25.9	9,460	0.2	69
6	milk cows	250	7	37.84	1.17	4.8	1,750	25.9	9,460	0.8	291
7	milk cows	250	7	37.84	1.17	4.8	1,750	25.9	9,460	0.8	291
8	milk cows	820	7	37.84	0.27	15.7	5,740	85.0	31,029	0.6	225
Total - Freestalls		**3,680**				**70.6**	**25,760**	**381.5**	**139,251**	**7.6**	**2,781**

Post-Project Potential to Emit - Cow Housing: Corrals

Corral #(s)/ Name(s)	Type of Cow	# of Cows	Controlled VOC EF (lb/hd-yr)	Controlled NH3 EF (lb/hd-yr)	Controlled PM10 EF (lb/hd-yr)	VOC (lb/day)	VOC (lb/yr)	NH3 (lb/day)	NH3 (lb/yr)	PM10 (lb/day)	PM10 (lb/yr)
Dry 1	dry cows	400	3.95	19.17	3.87	4.3	1,580	21.0	7,668	4.2	1,548
Dry 2	dry cows	400	3.95	19.17	3.87	4.3	1,580	21.0	7,668	4.2	1,548
Dry 3	dry cows	200	3.95	19.17	3.38	2.2	790	10.5	3,834	1.9	676
Large 1	large heifers	712	3.03	9.94	6.48	5.9	2,157	19.4	7,077	12.6	4,614
Large 2	large heifers	852	3.03	9.94	6.48	7.1	2,582	23.2	8,469	15.1	5,521
Large 3	large heifers	568	3.03	9.94	6.48	4.7	1,721	15.5	5,646	10.1	3,681
Large 8	large heifers	568	3.03	9.94	6.48	4.7	1,721	15.5	5,646	10.1	3,681
Medium 4	medium heifers	189	2.07	7.17	6.48	1.1	391	3.7	1,355	3.4	1,225
Medium 5	medium heifers	237	2.07	7.17	6.48	1.3	491	4.7	1,699	4.2	1,536
Medium 9	medium heifers	237	2.07	7.17	6.48	1.3	491	4.7	1,699	4.2	1,536
Medium 10	medium heifers	237	2.07	7.17	6.48	1.3	491	4.7	1,699	4.2	1,536
Small 6	small heifers	173	1.15	5.396	6.48	0.5	199	2.6	934	3.1	1,121
Small 7	small heifers	440	1.15	5.396	6.48	1.4	506	6.5	2,374	7.8	2,851
Small 11	small heifers	134	1.15	5.396	6.48	0.4	154	2.0	723	2.4	868
Small 12	small heifers	153	1.15	5.396	6.48	0.5	176	2.3	826	2.7	991
Total - Corrals		**5,500**				**41.2**	**15,029**	**157.0**	**57,317**	**90.2**	**32,932**

Post-Project Potential to Emit - Cow Housing: Calf Hutches

Corral #(s)/ Name(s)	Type of Cow	# of Cows	Controlled VOC EF (lb/hd-yr)	Controlled NH3 EF (lb/hd-yr)	Controlled PM10 EF (lb/hd-yr)	VOC (lb/day)	VOC (lb/yr)	NH3 (lb/day)	NH3 (lb/yr)	PM10 (lb/day)	PM10 (lb/yr)
On Ground											
Aboveground Flush	calves	1,500	0.78	2.3	0.07	3.2	1,170	9.5	3,450	0.3	104
Aboveground Scrape											
Total - Calf Hutches		**1,500**				**3.2**	**1,170**	**9.5**	**3,450**	**0.3**	**104**

Post-Project Potential to Emit - Cow Housing: New Freestalls at Existing Dairy

Freestall #(s)/ Name(s)	Type of Cow	# of Cows	Controlled VOC EF (lb/hd-yr)	Controlled NH3 EF (lb/hd-yr)	Controlled PM10 EF (lb/hd-yr)	VOC (lb/day)	VOC (lb/yr)	NH3 (lb/day)	NH3 (lb/yr)	PM10 (lb/day)	PM10 (lb/yr)
9	milk cows	820	7	37.84	0.27	15.7	5,740	85.0	31,029	0.6	225
10	milk cows	820	7	37.84	0.27	15.7	5,740	85.0	31,029	0.6	225
Total - Freestalls		**1,640**				**31.5**	**11,480**	**170.0**	**62,058**	**1.2**	**449**

Post-Project Potential to Emit - Cow Housing: New Corrals at Existing Dairy

Corral #(s)/ Name(s)	Type of Cow	# of Cows	Controlled VOC EF (lb/hd-yr)	Controlled NH3 EF (lb/hd-yr)	Controlled PM10 EF (lb/hd-yr)	VOC (lb/day)	VOC (lb/yr)	NH3 (lb/day)	NH3 (lb/yr)	PM10 (lb/day)	PM10 (lb/yr)
milk cow corral	milk cows	58	7	37.84	3.38	1.1	406	6.0	2,195	0.5	196
Total - Corrals		**58**				**1.1**	**406.0**	**6.0**	**2,194.7**	**0.5**	**196.0**

Post-Project Potential to Emit - Cow Housing: New Calf Hutches at Existing Dairy

Corral #(s)/ Name(s)	Type of Cow	# of Calves	Controlled VOC EF (lb/hd-yr)	Controlled NH3 EF (lb/hd-yr)	Controlled PM10 EF (lb/hd-yr)	VOC (lb/day)	VOC (lb/yr)	NH3 (lb/day)	NH3 (lb/yr)	PM10 (lb/day)	PM10 (lb/yr)
On Ground											
Aboveground Flush	calves	600	0.78	2.3	0.07	1.3	468	3.8	1,380	0.1	41
Aboveground Scrape											
Total - Calf Hutches		**600**				**1.3**	**468**	**3.8**	**1,380**	**0.1**	**41**

Post-Project Totals

Total # of Cows	VOC (lb/day)	VOC (lb/yr)	NH3 (lb/day)	NH3 (lb/yr)	PM10 (lb/day)	PM10 (lb/yr)
12,978	**148.8**	**54,313**	**727.8**	**265,651**	**100.0**	**36,504**

Calculations:

Annual PE 2 for each pollutant (lb/yr) = Controlled EF (lb/hd-yr) x # of cows (hd)

Daily PE2 for each pollutant (lb/day) = [Controlled EF (lb/hd-yr) x # of cows (hd)] ÷ 365 (day/yr)

BACT Applicability

Milking Parlor

VOC Emissions	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Milk Cows	4.1	3.6	0.28	0.40	1.6
				Total	1.6

NH3 Emissions	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Milk Cows	1.9	1.7	0.13	0.19	0.7
				Total	0.7

Cow Housing

See detailed cow housing AIPE calculations on following pages.

Liquid Manure Handling

VOC Emissions - Lagoon/Storage Pond(s)	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Milk Cows	10.3	10.6	0.50	1.17	5.8
Dry Cows	1.0	0.5	0.27	0.64	0.8
Support Stock (Heifers and Bulls)	0.0	0.0	0.21	0.49	0.0
Large Heifers	2.1	1.5	0.21	0.49	1.5
Medium Hefiers	0.5	0.7	0.14	0.33	0.2
Small Heifers	0.3	0.4	0.08	0.19	0.1
Calves	0.3	0.4	0.04	0.09	0.1
Bulls	0.0	0.0	0.13	0.30	0.0
BACT triggered for VOC for Lagoon/Storage Ponds				Total	8.5

VOC Emissions - Land Application	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Milk Cows	11.1	11.4	0.54	1.26	6.2
Dry Cows	1.1	0.6	0.29	0.69	0.8
Support Stock (Heifers and Bulls)	0.0	0.0	0.22	0.53	0.0
Large Heifers	2.3	1.6	0.22	0.53	1.6
Medium Hefiers	0.5	0.8	0.15	0.36	0.2
Small Heifers	0.3	0.4	0.08	0.20	0.1
Calves	0.3	0.4	0.04	0.10	0.1
Bulls	0.0	0.0	0.13	0.32	0.0
BACT triggered for VOC for Liquid Manure Land Application				Total	9.0

NH3 Emissions - Lagoon/Storage Pond(s)	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Milk Cows	120.8	74.1	5.82	8.20	68.2
Dry Cows	11.5	3.5	2.98	4.20	9.0
Support Stock (Heifers and Bulls)	0.0	0.0	1.56	2.20	0.0
Large Heifers	16.3	6.7	1.56	2.20	11.5
Medium Hefiers	3.7	3.3	1.07	1.50	1.4
Small Heifers	3.0	2.6	0.85	1.20	1.2
Calves	2.0	1.4	0.25	0.35	1.0
Bulls	0.0	0.0	2.13	3.00	0.0
BACT triggered for NH3 for Lagoon/Storage Ponds				Total	92.3

NH3 Emissions - Land Application	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Milk Cows	131.1	80.5	6.32	8.90	73.9
Dry Cows	12.3	3.7	3.20	4.50	9.7
Support Stock (Heifers and Bulls)	0.0	0.0	1.63	2.30	0.0
Large Heifers	17.0	7.0	1.63	2.30	12.0
Medium Hefiers	4.2	3.7	1.21	1.70	1.6
Small Heifers	3.2	2.8	0.92	1.30	1.2
Calves	2.1	1.5	0.26	0.37	1.0
Bulls	0.0	0.0	2.29	3.23	0.0
BACT triggered for NH3 for Liquid Manure Land Application				Total	99.4

H2S Emissions - Lagoon/Storage Pond(s)	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Milk Cows	8.6	8.6	0.82	0.82	0.0
Dry Cows	0.9	0.9	0.42	0.42	0.0
Support Stock (Heifers and Bulls)	0.0	0.0	0.22	0.22	0.0
Large Heifers	1.2	1.2	0.22	0.22	0.0
Medium Heifers	0.3	0.3	0.15	0.15	0.0
Small Heifers	0.2	0.2	0.12	0.12	0.0
Calves	0.1	0.1	0.04	0.04	0.0
Bulls	0.0	0.0	0.30	0.30	0.0
				Total	0.0

Solid Manure Handling

VOC Emissions - Solid Manure Storage/Separated Solids Piles	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Milk Cows	2.0	1.2	0.13	0.18	1.2
Dry Cows	0.2	0.1	0.07	0.10	0.1
Support Stock (Heifers and Bulls)	0.0	0.0	0.05	0.08	0.0
Large Heifers	0.4	0.2	0.05	0.08	0.3
Medium Hefiers	0.1	0.1	0.04	0.05	0.0
Small Heifers	0.1	0.0	0.02	0.03	0.1
Calves	0.1	0.0	0.01	0.01	0.1
Bulls	0.0	0.0	0.04	0.05	0.0
				Total	1.8

VOC Emissions - Land Application	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Milk Cows	2.6	2.7	0.13	0.30	1.4
Dry Cows	0.3	0.1	0.07	0.16	0.3
Support Stock (Heifers and Bulls)	0.0	0.0	0.05	0.12	0.0
Large Heifers	0.6	0.4	0.05	0.12	0.4
Medium Hefiers	0.1	0.2	0.04	0.08	0.0
Small Heifers	0.1	0.1	0.02	0.05	0.1
Calves	0.1	0.1	0.01	0.02	0.1
Bulls	0.0	0.0	0.03	0.07	0.0
BACT triggered for VOC for Solid Manure Land Application				Total	2.3

NH3 Emissions - Solid Manure Storage/Separated Solids Piles	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Milk Cows	14.0	8.6	0.94	1.33	7.9
Dry Cows	1.3	0.4	0.48	0.67	1.0
Support Stock (Heifers and Bulls)	0.0	0.0	0.25	0.35	0.0
Large Heifers	1.8	0.8	0.25	0.35	1.2
Medium Hefiers	0.4	0.4	0.18	0.25	0.1
Small Heifers	0.3	0.3	0.13	0.18	0.1
Calves	0.2	0.2	0.04	0.06	0.1
Bulls	0.0	0.0	0.35	0.49	0.0
BACT triggered for NH3 for Solid Manure Storage				Total	10.4

NH3 Emissions - Land Application	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Milk Cows	30.8	18.9	1.48	2.09	17.4
Dry Cows	2.9	0.9	0.75	1.06	2.3
Support Stock (Heifers and Bulls)	0.0	0.0	0.39	0.55	0.0
Large Heifers	4.1	1.7	0.39	0.55	2.9
Medium Hefiers	1.0	0.9	0.28	0.39	0.4
Small Heifers	0.7	0.7	0.21	0.30	0.2
Calves	0.5	0.4	0.06	0.09	0.2
Bulls	0.0	0.0	0.54	0.76	0.0
BACT triggered for NH3 for Solid Manure Land Application				Total	23.4

Feed Storage and Handling

VOC Emissions - Silage	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Corn Silage	7.8	7.8	21,155	21,155	0.0
Alfalfa Silage	0.0	0.0	10,649	10,649	0.0
Wheat Silage	9.8	9.8	26,745	26,745	0.0
				Total	0.0

VOC Emissions - TMR	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
TMR	239.8	139.1	10,575	10,575	100.7
BACT triggered for VOC for TMR				Total	100.7

Total Change in Emissions

Total Daily Change in Emissions (lb/day)	NOx	SOx	PM10	CO	VOC	NH3	H2S
Milking Parlor	0.0	0.0	0.0	0.0	0.5	0.2	0.0
Cow Housing	0.0	0.0	8.5	0.0	29.0	132.9	0.0
Liquid Manure	0.0	0.0	0.0	0.0	-7.6	41.4	0.0
Solid Manure	0.0	0.0	0.0	0.0	-0.5	8.3	0.0
Feed Handling	0.0	0.0	0.0	0.0	100.7	0.0	0.0
Total	0.0	0.0	8.5	0.0	122.1	182.8	0.0

Total Annual Change in Emissions (lb/yr)	NOx	SOx	PM10	CO	VOC	NH3	H2S
Milking Parlor	0	0	0	0	186	72	0
Cow Housing	0	0	3,115	0	10,570	48,511	0
Liquid Manure	0	0	0	0	-2,789	15,150	0
Solid Manure	0	0	0	0	-198	3,044	0
Feed Handling	0	0	0	0	36,756	0	0
Total	0	0	3,115	0	44,525	66,777	0

Total Annual Change in Non-Fugitive Emissions (Major Source Emissions) (lb/yr)	NOx	SOx	PM10	CO	VOC	NH3	H2S
Milking Parlor	0	0	0	0	0	0	0
Cow Housing	0	0	0	0	0	0	0
Liquid Manure	0	0	0	0	-1,340	0	0
Solid Manure	0	0	0	0	0	0	0
Feed Handling	0	0	0	0	0	0	0
Total	0	0	0	0	-1,340	0	0

Cow Housing AIPE - VOC Emissions						
Freestalls						
Freestall #(s)/ Name(s)	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)	BACT Triggered?
1	11.9	15.1	7.00	9.86	1.2	No
2	11.9	15.1	7.00	9.86	1.2	No
3	11.9	15.1	7.00	9.86	1.2	No
4	4.8	5.9	7.00	9.86	0.6	No
5	4.8	5.9	7.00	9.86	0.6	No
6	4.8	5.9	7.00	9.86	0.6	No
7	4.8	5.9	7.00	9.86	0.6	No
8	15.7	20.0	7.00	9.86	1.5	No
Freestalls - Expansion to Existing Dairy						
9	15.7	0.0	7.00	0.00	15.7	Yes
10	15.7	0.0	7.00	0.00	15.7	Yes
Corrals						
Corral #(s)/ Name(s)	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)	BACT Triggered?
Dry 1	4.3	1.4	3.95	5.57	3.4	Yes
Dry 2	4.3	1.4	3.95	5.57	3.4	Yes
Dry 3	2.2	1.8	3.95	5.57	0.9	No
Large 1	5.9	6.5	3.03	4.27	1.3	No
Large 2	7.1	6.5	3.03	4.27	2.5	Yes
Large 3	4.7	0.0	3.03	4.27	4.7	Yes
Large 8	4.7	0.0	3.03	4.27	4.7	Yes
Medium 4	1.1	3.2	2.07	2.91	-1.2	No
Medium 5	1.3	3.2	2.07	2.91	-0.9	No
Medium 9	1.3	0.0	2.07	2.91	1.3	No
Medium 10	1.3	0.0	2.07	2.91	1.3	No
Small 6	0.5	1.8	1.15	1.62	-0.7	No
Small 7	1.4	1.8	1.15	1.62	0.1	No
Small 11	0.4	0.0	1.15	1.62	0.4	No
Small 12	0.5	0.0	1.15	1.62	0.5	No
Corrals - Expansion to Existing Dairy						
milk cow corral	1.1	0.0	7	0.00	1.1	No
Calf Hutches						
Type of Hutches	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)	BACT Triggered?
On Ground						
Aboveground Flush	3.2	3.2	0.78	0.78	0.0	No
Aboveground Scrape						
Calf Hutches - New Calf Hutch Area						
Type of Hutches	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)	BACT Triggered?
On Ground						
Aboveground Flush	1.3	0.0	0.78	0.00	1.3	No
Aboveground Scrape						

Cow Housing AIPE - NH3 Emissions						
Freestalls						
Freestall #(s)/ Name(s)	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)	BACT Triggered?
1	64.3	81.8	37.84	53.30	6.2	Yes
2	64.3	81.8	37.84	53.30	6.2	Yes
3	64.3	81.8	37.84	53.30	6.2	Yes
4	25.9	32.1	37.84	53.30	3.1	Yes
5	25.9	32.1	37.84	53.30	3.1	Yes
6	25.9	32.1	37.84	53.30	3.1	Yes
7	25.9	32.1	37.84	53.30	3.1	Yes
8	85.0	108.1	37.84	53.30	8.3	Yes
Freestalls - Expansion to Existing Dairy						
9	85.0	0.0	37.84	0.00	85.0	Yes
10	85.0	0.0	37.84	0.00	85.0	Yes
Corrals						
Corral #(s)/ Name(s)	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)	BACT Triggered?
Dry 1	21.0	6.7	19.17	27	16.3	Yes
Dry 2	21.0	6.7	19.17	27	16.3	Yes
Dry 3	10.5	8.9	19.17	27	4.2	Yes
Large 1	19.4	21.3	9.94	14	4.3	Yes
Large 2	23.2	21.3	9.94	14	8.1	Yes
Large 3	15.5	0.0	9.94	14	15.5	Yes
Large 8	15.5	0.0	9.94	14	15.5	Yes
Medium 4	3.7	11.1	7.17	10.1	-4.1	No
Medium 5	4.7	11.1	7.17	10.1	-3.2	No
Medium 9	4.7	0.0	7.17	10.1	4.7	Yes
Medium 10	4.7	0.0	7.17	10.1	4.7	Yes
Small 6	2.6	8.3	5.396	7.6	-3.4	No
Small 7	6.5	8.3	5.396	7.6	0.6	No
Small 11	2.0	0.0	5.396	7.6	2.0	No
Small 12	2.3	0.0	5.396	7.6	2.3	Yes
Corrals - Expansion to Existing Dairy						
milk cow corral	6.0	0.0	37.84	0.00	6.0	Yes
Calf Hutches						
Type of Hutches	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)	BACT Triggered?
On Ground						
Aboveground Flush	9.5	9.5	2.3	2.3	0.0	No
Aboveground Scrape						
Calf Hutches - New Calf Hutch Area						
Type of Hutches	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)	BACT Triggered?
On Ground						
Aboveground Flush	3.8	0.0	2.3	0.00	3.8	Yes
Aboveground Scrape						

Cow Housing AIPE - PM10 Emissions

Freestall #(s)/ Name(s)	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)	BACT Triggered?
Freestalls						
1	0.5	2.1	0.27	1.37	0.0	No
2	2.0	2.1	1.17	1.37	0.2	No
3	2.0	2.1	1.17	1.37	0.2	No
4	0.8	0.8	1.17	1.37	0.1	No
5	0.2	0.8	0.27	1.37	0.0	No
6	0.8	0.8	1.17	1.37	0.1	No
7	0.8	0.8	1.17	1.37	0.1	No
8	0.6	2.8	0.27	1.37	0.1	No
Freestalls - Expansion to Existing Dairy						
9	0.6	0.0	0.27	0.00	0.6	No
10	0.6	0.0	0.27	0.00	0.6	No

Corral #(s)/ Name(s)	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)	BACT Triggered?
Corrals						
Dry 1	4.2	1.1	3.87	4.55	3.3	Yes
Dry 2	4.2	1.1	3.87	4.55	3.3	Yes
Dry 3	1.9	1.5	3.38	4.55	0.7	No
Large 1	12.6	16.0	6.48	10.55	2.8	Yes
Large 2	15.1	14.7	6.48	9.67	5.3	Yes
Large 3	10.1	0.0	6.48	10.55	10.1	Yes
Large 8	10.1	0.0	6.48	10.55	10.1	Yes
Medium 4	3.4	11.6	6.48	10.55	-3.7	No
Medium 5	4.2	10.6	6.48	9.67	-2.9	No
Medium 9	4.2	0.0	6.48	10.55	4.2	Yes
Medium 10	4.2	0.0	6.48	10.55	4.2	Yes
Small 6	3.1	11.6	6.48	10.55	-4.0	No
Small 7	7.8	10.6	6.48	9.67	0.7	No
Small 11	2.4	0.0	6.48	10.55	2.4	Yes
Small 12	2.7	0.0	6.48	10.55	2.7	Yes
Corrals - Expansion to Existing Dairy						
milk cow corral	0.5	0.0	3.38	0.00	0.5	No

Corral #(s)/ Name(s)	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)	BACT Triggered?
Calf Hutches						
On Ground						
Aboveground Flush	0.3	0.3	0.069	0.07	0.0	No
Aboveground Scrape						

Type of Hutches	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)	BACT Triggered?
Calf Hutches - New Calf Hutch Area						
On Ground						
Aboveground Flush	0.1	0.0	0.069	0.00	0.1	No
Aboveground Scrape						

Pre-Project Potential to Emit (PE1)

Pre-Project Herd Size							
Herd	Flushed Freestalls	Scraped Freestalls	Flushed Corrals	Scraped Corrals	Total # of Animals		
Milk Cows	3,300	0	0	0	3,300		
Dry Cows	0	0	300	0	300		
Support Stock (Heifers and Bulls)	0	0	0	0	0		
Large Heifers	0	0	1,110	0	1,110		
Medium Heifers	0	0	800	0	800		
Small Heifers	0	0	800	0	800		
Bulls	0	0	0	0	0		
	Calf Hutches				Calf Corrals		
	Aboveground Flushed	Aboveground Scraped	On-Ground Flushed	On-Ground Scraped	Flushed	Scraped	Total # of Calves
Calves	1,500	0	0	0	0	0	1,500

Silage Information				
Feed Type	Maximum # Open Piles	Maximum Height (ft)	Maximum Width (ft)	Open Face Area (ft^2)
Corn	1	25	60	1,246
Alfalfa	0	0	0	
Wheat	1	25	60	1,246

Milking Parlor				
Cow	VOC		NH3	
	lb/day	lb/yr	lb/day	lb/yr
Milk Cows	3.6	1,320	1.7	627

Cow Housing(1)						
Cow	VOC		NH3		PM10	
	lb/day	lb/yr	lb/day	lb/yr	lb/day	lb/yr
Total	119.8	43,743	594.9	217,140	91.5	33,389

Liquid Manure Handling						
Cow	VOC		NH3		H2S*	
	lb/day	lb/yr	lb/day	lb/yr	lb/day	lb/yr
Milk Cows	22.0	8,019	154.6	56,430	8.6	3,131
Dry Cows	1.1	399	7.2	2,610	0.9	331
Support Stock (Heifers and Bulls)	0.0	0	0.0	0	0	0
Large Heifers	3.1	1,132	13.7	4,995	1.2	422
Medium Heifers	1.5	552	7.0	2,560	0.3	96
Small Heifers	0.8	304	5.5	2,000	0.2	77
Calves	0.7	270	3.0	1,080	0.1	52
Bulls	0.0	0	0.0	0	0	0
Total	29.2	10,676	191.0	69,675	11.3	4,109

Solid Manure Handling				
Cow	VOC		NH3	
	lb/day	lb/yr	lb/day	lb/yr
Milk Cows	4.3	1,584	30.9	11,286
Dry Cows	0.2	78	1.4	519
Support Stock (Heifers and Bulls)	0.0	0	0.0	0
Large Heifers	0.6	222	2.7	999
Medium Heifers	0.3	112	1.4	512
Small Heifers	0.2	64	1.1	384
Calves	0.2	60	0.6	225
Bulls	0.0	0	0.0	0
Total	5.8	2,120	38.1	13,925

Feed Handling and Storage		
	Daily PE (lb-VOC/day)	Annual PE (lb-VOC/yr)
Corn Emissions	7.8	2,832
Alfalfa Emissions	0.0	0
Wheat Emissions	9.8	3,581
TMR	139.1	50,772
Total	156.7	57,186

Calculations for milking parlor:

Annual PE = (# milk cows) x (EF1 lb-pollutant/hd-yr)

Daily PE = (Annual PE lb/yr) ÷ (365 day/yr)

Calculations for all other permits:

Annual PE = [(# milk cows) x (EF1 lb-pollutant/hd-yr)] + [(# dry cows) x (EF1 lb-pollutant/hd-yr)] + [(# large heifers) x (EF1 lb-pollutant/hd-yr)] + [(# medium heifers) x (EF1 lb-pollutant/hd-yr)] + [(# small heifers) x (EF1 lb-pollutant/hd-yr)] + [(# calves) x (EF1 lb-pollutant/hd-yr)] + [(# bulls) x (EF1 lb-pollutant/hd-yr)]

Daily PE = (Annual PE lb/yr) ÷ (365 day/yr)

Calculations for silage emissions:

Annual PE = (EF1) x (area ft^2) x (0.0929 m^2/ft^2) x (8,760 hr/yr) x (60 min/hr) x 2.20E-9 lb/μg

Daily PE = (Annual PE lb/yr) ÷ (365 day/yr)

Calculation for TMR emissions:

Annual PE = (# cows) x (EF1) x (0.658 m^2) x (525,600 min/yr) x (2.20E-9 lb/μg)

Daily PE = (Annual PE lb/yr) ÷ (365 day/yr)

Calves are not included in TMR calculation.

Notes:

*Since there will be no change to the lagoons/storage ponds surface area, no change in H2S emissions is expected. Therefore, it will be assumed that PE1 for H2S emissions is equal to PE2 for H2S emissions.

Total Daily Pre-Project Potential to Emit (lb/day)							
Permit	NOx	SOx	PM10	CO	VOC	NH3	H2S
Milking Parlor	0.0	0.0	0.0	0.0	3.6	1.7	0.0
Cow Housing	0.0	0.0	91.5	0.0	119.8	594.9	0.0
Liquid Manure	0.0	0.0	0.0	0.0	29.2	191.0	11.3
Solid Manure	0.0	0.0	0.0	0.0	5.8	38.1	0.0
Feed Handling	0.0	0.0	0.0	0.0	156.7	0.0	0.0
Total	0.0	0.0	91.5	0.0	315.1	825.7	11.3

Major Source Emissions (lb/yr)					
Permit	NOx	SOx	PM10	CO	VOC
Milk Parlor	0	0	0	0	0
Cow Housing	0	0	0	0	0
Liquid Manure	0	0	0	0	5,142
Solid Manure	0	0	0	0	0
Feed Handling	0	0	0	0	0
Total	0	0	0	0	5,142

Total Annual Pre-Project Potential to Emit (lb/yr)							
Permit	NOx	SOx	PM10	CO	VOC	NH3	H2S
Milking Parlor	0	0	0	0	1,320	627	0
Cow Housing	0	0	33,389	0	43,743	217,140	0
Liquid Manure	0	0	0	0	10,676	69,675	4,109
Solid Manure	0	0	0	0	2,120	13,925	0
Feed Handling	0	0	0	0	57,186	0	0
Total	0	0	33,389	0	115,044	301,367	4,109

Post-Project Potential to Emit (PE2)

Post-Project Herd Size							
Herd	Flushed Freestalls	Scraped Freestalls	Flushed Corrals	Scraped Corrals	Total # of Animals		
Milk Cows	5,320	0	58	0	5,378		
Dry Cows	0	0	1,000	0	1,000		
Support Stock (Heifers and Bulls)	0	0	0	0	0		
Large Heifers	0	0	2,700	0	2,700		
Medium Heifers	0	0	900	0	900		
Small Heifers	0	0	900	0	900		
Bulls	0	0	0	0	0		
	Calf Hutches				Calf Corrals		
	Aboveground Flushed	Aboveground Scraped	On-Ground Flushed	On-Ground Scraped	Flushed	Scraped	Total # of Calves
Calves	2,100	0	0	0	0	0	2,100

Silage Information				
Feed Type	Maximum # Open Piles	Maximum Height (ft)	Maximum Width (ft)	Open Face Area (ft^2)
Corn	1	25	60	1,246
Alfalfa	0	0	0	
Wheat	1	25	60	1,246

Milking Parlor				
Cow	VOC		NH3	
Milk Cows	lb/day	lb/yr	lb/day	lb/yr
Total	4.1	1,506	1.9	699

Cow Housing						
	VOC		NH3		PM10	
	lb/day	lb/yr	lb/day	lb/yr	lb/day	lb/yr
Total	148.8	54,313	727.8	265,651	100.0	36,504

Liquid Manure Handling						
Cow	VOC		NH3		H2S	
	lb/day	lb/yr	lb/day	lb/yr	lb/day	lb/yr
Milk Cows	15.3	5,593	178.9	65,289	8.6	3,131
Dry Cows	1.5	560	16.9	6,180	0.9	331
Support Stock (Heifers and Bulls)	0.0	0	0.0	0	0	0
Large Heifers	3.2	1,161	23.7	8,640	1.2	422
Medium Heifers	0.7	261	5.6	2,043	0.3	96
Small Heifers	0.4	144	4.4	1,602	0.2	77
Calves	0.5	168	2.9	1,071	0.1	52
Bulls	0.0	0	0.0	0	0	0
Total	21.6	7,887	232.4	84,825	11.3	4,109

Solid Manure Handling				
Cow	VOC		NH3	
	lb/day	lb/yr	lb/day	lb/yr
Milk Cows	3.7	1,345	35.8	13,069
Dry Cows	0.4	140	3.4	1,230
Support Stock (Heifers and Bulls)	0.0	0	0.0	0
Large Heifers	0.8	297	4.7	1,728
Medium Heifers	0.2	63	1.1	405
Small Heifers	0.1	36	0.8	306
Calves	0.1	42	0.6	231
Bulls	0.0	0	0.0	0
Total	5.3	1,923	46.4	16,969

Feed Handling and Storage		
	Daily PE (lb-VOC/day)	Annual PE (lb-VOC/yr)
Corn Emissions	7.8	2,832
Alfalfa Emissions	0.0	0
Wheat Emissions	9.8	3,581
TMR	239.8	87,528
Total	257.4	93,941

Calculations for milking parlor:

Annual PE = (# milk cows) x (EF2 lb-pollutant/hd-yr)

Daily PE = (Annual PE lb/yr) ÷ (365 day/yr)

Calculations for all other permits:

Annual PE = [(# milk cows) x (EF1 lb-pollutant/hd-yr)] + [(# dry cows) x (EF2 lb-pollutant/hd-yr)] + [(# large heifers) x (EF2 lb-pollutant/hd-yr)] + [(# medium heifers) x (EF2 lb-pollutant/hd-yr)] + [(# small heifers) x (EF2 lb-pollutant/hd-yr)] + [(# calves) x (EF2 lb-pollutant/hd-yr)] + [(# bulls) x (EF2 lb-pollutant/hd-yr)]

Daily PE = (Annual PE lb/yr) ÷ (365 day/yr)

The H2S emission factor is assumed to be 10% of the NH3 lagoon/storage pond(s) emission factor, for each respective herd size.

Calculations for silage emissions:

Annual PE = (EF2) x (area ft^2) x (0.0929 m^2/ft^2) x (8,760 hr/yr) x (60 min/hr) x 2.20E-9 lb/μg

Daily PE = (Annual PE lb/yr) ÷ (365 day/yr)

Calculation for TMR emissions:

Annual PE = (# cows) x (EF2) x (0.658 m^2) x (525,600 min/yr) x (2.20E-9 lb/μg)

Daily PE = (Annual PE lb/yr) ÷ (365 day/yr)

Calves are not included in TMR calculation.

Total Daily Post-Project Potential to Emit (lb/day)							
Permit	NOx	SOx	PM10	CO	VOC	NH3	H2S
Milking Parlor	0.0	0.0	0.0	0.0	4.1	1.9	0.0
Cow Housing	0.0	0.0	100.0	0.0	148.8	727.8	0.0
Liquid Manure	0.0	0.0	0.0	0.0	21.6	232.4	11.3
Solid Manure	0.0	0.0	0.0	0.0	5.3	46.4	0.0
Feed Handling	0.0	0.0	0.0	0.0	257.4	0.0	0.0
Total	0.0	0.0	100.0	0.0	437.2	1,008.5	11.3

Major Source Emissions (lb/yr)					
Permit	NOx	SOx	PM10	CO	VOC
Milk Parlor	0	0	0	0	0
Cow Housing	0	0	0	0	0
Liquid Manure	0	0	0	0	3,802
Solid Manure	0	0	0	0	0
Feed Handling	0	0	0	0	0
Total	0	0	0	0	3,802

Total Annual Post-Project Potential to Emit (lb/yr)							
Permit	NOx	SOx	PM10	CO	VOC	NH3	H2S
Milking Parlor	0	0	0	0	1,506	699	0
Cow Housing	0	0	36,504	0	54,313	265,651	0
Liquid Manure	0	0	0	0	7,887	84,825	4,109
Solid Manure	0	0	0	0	1,923	16,969	0
Feed Handling	0	0	0	0	93,941	0	0
Total	0	0	36,504	0	159,570	368,144	4,109

Appendix D

Emissions Calculations for Unit S-4712-10-0

S-4712-10-0:

The emission factors for NOx, PM10, CO, and VOC are taken from the initial permitting project for this engine, processed under District project S-1042304. The SOx emission factor is based on a permit requirement that the engine shall only be fired on diesel fuel containing not more than 0.0015% sulfur by weight.

The current permit limits the engine to 100 hours of non-emergency operation per year.

Diesel-fired IC Engine Emission Factors		
	g/hp·hr*	Source
NO_X	7.0	Manufacturer's Specifications
SO_X	0.005	Mass Balance Equation Below
PM_{10}	0.2	Manufacturer's Specifications
CO	0.85	Manufacturer's Specifications
VOC	0.11	Manufacturer's Specifications

$$0.0015\%S \times \frac{7.1\,lb \cdot fuel}{gallon} \times \frac{2\,lb \cdot SO_2}{1\,lb \cdot S} \times \frac{1\,gal}{137{,}000\,Btu} \times \frac{1\,hp\,input}{0.35\,hp\,out} \times \frac{2{,}542.5\,Btu}{hp \cdot hr} \times \frac{453.6\,g}{lb} = 0.005\ \frac{g \cdot SO_x}{hp \cdot hr}$$

Annual Potential to Emit								
NO_x	7.0	(g/hp·hr) x	430	(hp) x	100	(hr/yr) ÷ 453.6 (g/lb) =	664	(lb/yr)
SO_x	0.005	(g/hp·hr) x	430	(hp) x	100	(hr/yr) ÷ 453.6 (g/lb) =	0	(lb/yr)
PM_{10}	0.2	(g/hp·hr) x	430	(hp) x	100	(hr/yr) ÷ 453.6 (g/lb) =	19	(lb/yr)
CO	0.85	(g/hp·hr) x	430	(hp) x	100	(hr/yr) ÷ 453.6 (g/lb) =	81	(lb/yr)
VOC	0.11	(g/hp·hr) x	430	(hp) x	100	(hr/yr) ÷ 453.6 (g/lb) =	10	(lb/yr)

Appendix E

CO2e Calculations

Greenhouse Gas Emissions - PSD

Uncontrolled GHG Emission Factors (lbs/hd-yr)						
Animal Type	CH4 (Anaerobic Treatment Lagoon)	CH4 (Lagoon)	CH4 (Manure Spreading)*	CH4 (Solid Manure Storage)*	CH4 (Enteric)*	CO2 Equivalent Multiplier for CH4
Milk Cows	513	307.8	0	0	0	21
Dry Cows	513	307.8	0	0	0	21
Support Stock*	110.4	110.4	0	--	0	21
Large Heifers	110.4	110.4	0	--	0	21
Medium Heifers	110.4	110.4	0	--	0	21
Small Heifers	110.4	110.4	0	--	0	21
Calves	--	--	--	--	--	--
Bulls*	110.4	110.4	0	--	0	21

Uncontrolled GHG Emission Factors (lbs/hd-yr)					
Animal Type	N2O (Anaerobic Treatment Lagoon)	N2O (Manure Spreading)	N2O (Solid Manure Storage)*	N2O (Enteric)	CO2 Equivalent Multiplier for N2O
Milk Cows	1.5	0	0	0	310
Dry Cows	1.5	0	0	0	310
Support Stock*	1.4	0	--	0	310
Large Heifers	1.4	0	--	0	310
Medium Heifers	1.4	0	--	0	310
Small Heifers	1.4	0	--	0	310
Calves	--	0	--	0	--
Bulls*	1.4	0	--	0	310

Notes:

Emission facters for Suppet Stock and Bulls are assumed to be the same as Large Heifers.

Fugitive emissions from dairies (non-lagoon) shall be excluded in determining if a source is a major source for PSD purposes.

Calculations:

CO2e from Lagoons = # Cows (hd) x CH4/N2O Lagoon (lb/hd-yr) x Multiplier ÷ 2000 lb/ton

CO2e from Non-Lagoons = # Cows (hd) x [CH4/N2O Manure Spreading (lb/hd-yr) + CH4/N2O Solid Manure Storage (lb/hd-yr) + CH4/N2O Enteric (lb/hd-yr)] x Multiplier ÷ 2000 lb/ton

Pre-Project CO2e Emissions

Pre-Project Lagoon CO2e Emissions from CH4 (short tons/yr)				
Animal Type	Number of Cows with Manure Flushed to Lagoon	EF CH4 Lagoons (lb/hd-yr)	CO2e Multiplier	CO2e Lagoons (short tons/yr)
Milk Cows	3300	307.8	21	10,665
Dry Cows	300	307.8	21	970
Support Stock	0	110.4	21	0
Large Heifers	1110	110.4	21	1,287
Medium Heifers	800	110.4	21	927
Small Heifers	800	110.4	21	927
Calves	1500	--	--	0
Bulls	0	110.4	21	0

Pre-Project Non-Lagoons CO2e Emissions from CH4 (short tons/yr)						
Animal Type	Number of Cows	EF CH4 Manure Spreading (lb/hd-yr)	EF CH4 Solid Manure Storage (lb/hd-yr)	EF CH4 Enteric (lb/hd-yr)	CO2e Multiplier	CO2e Non-Lagoons (short tons/yr)
Milk Cows	3,300	0.0	0.0	0.0	21	0
Dry Cows	300	0.0	0.0	0.0	21	0
Support Stock	0	0.0	--	0.0	21	0
Large Heifers	1,110	0.0	--	0.0	21	0
Medium Heifers	800	0.0	--	0.0	21	0
Small Heifers	800	0.0	--	0.0	21	0
Calves	1,500	--	--	--	--	0
Bulls	0	0.0	--	0.0	21	0

Pre-Project Lagoon CO2e Emissions from N2O (short tons/yr)				
Animal Type	Number of Cows	EF N2O Anaerobic Treatment Lagoon (lb/hd-yr)	CO2e Multiplier	CO2e Lagoons (short tons/yr)
Milk Cows	3300	0.0	310	0
Dry Cows	300	0.0	310	0
Support Stock	0	0.0	310	0
Large Heifers	1110	0.0	310	0
Medium Heifers	800	0.0	310	0
Small Heifers	800	0.0	310	0
Calves	1500	0.0	--	0
Bulls	0	0.0	310	0

Pre-Project Non-Lagoons CO2e Emissions from N2O (short tons/yr)						
Animal Type	Number of Cows	EF N2O Manure Spreading (lb/hd-yr)	EF N2O Solid Manure Storage (lb/hd-yr)	N2O Enteric (lb/hd-yr)	CO2e Multiplier	CO2e Non-Lagoons (short tons/yr)
Milk Cows	3,300	0.0	0.0	0.0	310	0
Dry Cows	300	0.0	0.0	0.0	310	0
Support Stock	0	0.0	--	0.0	310	0
Large Heifers	1,110	0.0	--	0.0	310	0
Medium Heifers	800	0.0	--	0.0	310	0
Small Heifers	800	0.0	--	0.0	310	0
Calves	1,500	0.0	--	0.0	--	0
Bulls	0	0.0	--	0.0	310	0

Total Pre-Project CO2e Emissions (short tons/yr)			
Animal Type	CO2e from CH4	CO2e from N2O	Total
Milk Cows	10,665	0	10,665
Dry Cows	970	0	970
Support Stock	0	0	0
Large Heifers	1,287	0	1,287
Medium Heifers	927	0	927
Small Heifers	927	0	827
Calves	0	0	0
Bulls	0	0	0
		Total	14,776

Post-Project CO2e Emissions

Post-Project Lagoon CO2e Emissions from CH4 (short tons/yr)				
Animal Type	Number of Cows with Manure Flushed to Lagoon	EF CH4 Anaerobic Treatement Lagoon (lb/hd-yr)	CO2e Multiplier	CO2e Lagoons (short tons/yr)
Milk Cows	5378	513.0	21	28,969
Dry Cows	1000	513.0	21	5,387
Support Stock	0	110.4	21	0
Large Heifers	2700	110.4	21	3,130
Medium Heifers	900	110.4	21	1,043
Small Heifers	900	110.4	21	1,043
Calves	2100	--	--	0
Bulls	0	110.4	21	0

Post-Project Non-Lagoons CO2e Emissions from CH4 (short tons/yr)						
Animal Type	Number of Cows	EF CH4 Manure Spreading (lb/hd-yr)	EF CH4 Solid Manure Storage (lb/hd-yr)	EF CH4 Enteric (lb/hd-yr)	CO2e Multiplier	CO2e Non-Lagoons (short tons/yr)
Milk Cows	5,378	0.0	0.0	0.0	21	0
Dry Cows	1,000	0.0	0.0	0.0	21	0
Support Stock	0	0.0	--	0.0	21	0
Large Heifers	2,700	0.0	--	0.0	21	0
Medium Heifers	900	0.0	--	0.0	21	0
Small Heifers	900	0.0	--	0.0	21	0
Calves	2,100	--	--	--	--	0
Bulls	0	0.0	--	0.0	21	0

Post-Project Lagoon CO2e Emissions from N2O (metric tons/yr)				
Animal Type	Number of Cows	EF N2O Anaerobic Treatment Lagoon (lb/hd-yr)	CO2e Multiplier	CO2e Lagoons (metric tons/yr)
Milk Cows	5378	1.5	310	1,250
Dry Cows	1000	1.5	310	233
Support Stock	0	1.4	310	0
Large Heifers	2700	1.4	310	586
Medium Heifers	900	1.4	310	195
Small Heifers	900	1.4	310	195
Calves	2100	--	--	0
Bulls	0	1.4	310	0

Post-Project Non-Lagoons CO2e Emissions from N2O (short tons/yr)						
Animal Type	Number of Cows	EF N2O Manure Spreading (lb/hd-yr)	EF N2O Solid Manure Storage (lb/hd-yr)	EF N2O Enteric (lb/hd-yr)	CO2e Multiplier	CO2e Non-Lagoons (short tons/yr)
Milk Cows	5,378	0.0	0.0	0.0	310	0
Dry Cows	1,000	0.0	0.0	0.0	310	0
Support Stock	0	0.0	--	0.0	310	0
Large Heifers	2,700	0.0	--	0.0	310	0
Medium Heifers	900	0.0	--	0.0	310	0
Small Heifers	900	0.0	--	0.0	310	0
Calves	2,100	0.0	--	0.0	--	0
Bulls	0	0.0	--	0.0	310	0

Total Post-Project CO2e Emissions (short tons/yr)			
Animal Type	CO2e from CH4	CO2e from N2O	Total
Milk Cows	28,969	1,250	30,219
Dry Cows	5,387	233	5,618
Support Stock	0	0	0
Large Heifers	3,130	586	3,716
Medium Heifers	1,043	195	1,239
Small Heifers	1,043	195	1,239
Calves	0	0	0
Bulls	0	0	0
		Total	42,031

Change in CO2e Emissions

Change in Project GHG Emissions			
Animal Type	Pre-Project CO2e (short tons/yr)	Post-Project CO2e (short tons/yr)	Change (short tons/yr)
Milk Cows	10,665	30,219	19,554
Dry Cows	970	5,619	4,849
Support Stock	0	0	0
Large Heifers	1,287	3,716	2,429
Medium Heifers	927	1,239	311
Small Heifers	927	1,239	311
Calves	0	0	0
Bulls	0	0	0
		Total	27,265

S-4712-10-0

Basis and Assumptions

- The engine is a compression-ignited unit fueled with diesel in agricultural equipment service.
- The engine operates at full rated power.
- Specific fuel consumption is 220 g/kWh (typical for engine type).
- Density of diesel fuel is 7.0 lb/gallon.
- Higher Heating Value (HHV) of diesel is 138,700 Btu/gallon.
- Engine operates 100 hours per year.
- Emission factors and global warming potentials (GWP) for diesel fuel are taken from the California Climate Change Action Registry (CCAR), Version 3.1, January, 2009 (Appendix C, Tables C.1, C.3 and C.6) :

CO2 10.15 kg/gallon (22.3 lb/gallon)
CH4 1.44 g/gallon (0.006 lb/gal)
N2O 0.26 g/gallon (0.001 lb/gal)

GWP for CH4 = 21 lb-CO_2e per lb-CH4
GWP for N2O = 310 lb-CO_2e per lb-N2O

Calculations

Diesel fuel consumption rate at full rated horsepower:

$$\frac{430}{\text{bhp}} \times \frac{0.7456\text{ kW}}{\text{hp}} \times \frac{220\text{ g}}{\text{kWh}} \times \frac{1\text{ lb}}{453.6\text{ g}} \times \frac{\text{gal}}{7\text{ lb}} = \frac{22.21}{\text{gal/hour}}$$

Hourly Emissions

CO2 Emissions = 22.21 gal/hr x 22.3 lb/gal = 495.3 lb-CO_2e/hour
CH4 Emissions = 22.21 gal/hr x 0.006 lb/gal x 21 lb-CO_2e per lb-CH4 = 2.8 lb-CO_2e/hour
N2O Emissions = 22.21 gal/hr x 0.001 lb/gal x 310 lb-CO_2e per lb-N2O = 6.9 lb-CO_2e/hour

Total = 495.3 + 2.8 + 6.9 = 505.0 lb-CO_2e/hour

Annual Emissions

505.0 lb-CO_2e/hour x 100 hr/year ÷ 2,000 lb/ton = **25 short tons-CO_2e/year**

Metric Conversion

25 short tons-CO_2e/year x 0.9072 metric tons/short ton = **22.7 metric tons-CO_2e/year**

Pre-Project CO2e Emissions for PSD Determination

Fugitive emissions from dairies are excluded in determining if the facility is a major source for PSD. Therefore, only CO2e emissions from the lagoons and IC engine are calculated.

Pre-Project Facility CO2e Emissions for PSD Determination	
	CO2e (short tons/yr)
S-4712-1-2 (Milk Parlor)	0
S-4712-2-3 (Cow Housing)	0
S-4712-3-3 (Liquid Manure Handling)	14,776
S-4712-4-2 (Solid Manure Handling)	0
S-4712-10-0 (Diesel Emergency IC Engine)	25
S-4712-11-1 (Feed Storage and Handling)	0
Pre-Project Facility CO2e emissions	**14,801**

CO2e Emissions for PSD Determination From Modified Units

CO2e Emissions from Modified Units for PSD Determination	
	CO2e (short tons/yr)
S-4712-1-2 (Milk Parlor)	0
S-4712-2-3 (Cow Housing)	0
S-4712-3-3 (Liquid Manure Handling)	42,031
S-4712-4-2 (Solid Manure Handling)	0
S-4712-11-1 (Feed Storage and Handling)	0
Post-Project CO2e emissions	**42,031**

Appendix F

QNEC

Quarterly Net Emissions Change (QNEC)

The Quarterly Net Emissions Change is used to complete the emission profile screen for the District's PAS database. The QNEC shall be calculated as follows:

QNEC = PE2 - PE1, where:

QNEC = Quarterly Net Emissions Change for each emissions unit, lb/qtr.
PE2 = Post Project Potential to Emit for each emissions unit, lb/qtr.
PE1 = Pre-Project Potential to Emit for each emissions unit, lb/qtr.

Using the values in Sections VII.C.1 and VII.C.2 in the evaluation above, quarterly PE1 and quarterly PE2 can be calculated as follows:

Milking Parlor					
	PE2 (lb/yr)	PE2 (lb/qtr)	PE1 (lb/yr)	PE1 (lb/qtr)	QNEC (lb/qtr)
NOx	0	0.0	0	0.0	0.0
SOx	0	0.0	0	0.0	0.0
PM10	0	0.0	0	0.0	0.0
CO	0	0.0	0	0.0	0.0
VOC	1,506	376.5	1,320	330.0	46.5
NH3	699	174.8	627	156.8	18.0

Cow Housing					
	PE2 (lb/yr)	PE2 (lb/qtr)	PE1 (lb/yr)	PE1 (lb/qtr)	QNEC (lb/qtr)
NOx	0	0.0	0	0.0	0.0
SOx	0	0.0	0	0.0	0.0
PM10	36,504	9125.9	33,389	8347.3	778.7
CO	0	0.0	0	0.0	0.0
VOC	54,313	13578.3	43,743	10935.7	2642.6
NH3	265,651	66412.7	217,140	54285.0	12127.7

Liquid Manure					
	PE2 (lb/yr)	PE2 (lb/qtr)	PE1 (lb/yr)	PE1 (lb/qtr)	QNEC (lb/qtr)
NOx	0	0.0	0	0.0	0.0
SOx	0	0.0	0	0.0	0.0
PM10	0	0.0	0	0.0	0.0
CO	0	0.0	0	0.0	0.0
VOC	7,887	1971.8	10,676	2669.1	-697.3
NH3	84,825	21206.2	69,675	17418.8	3787.5
H2S	4,109	1027.3	4,109	1027.3	0.0

Solid Manure					
	PE2 (lb/yr)	PE2 (lb/qtr)	PE1 (lb/yr)	PE1 (lb/qtr)	QNEC (lb/qtr)
NOx	0	0.0	0	0.0	0.0
SOx	0	0.0	0	0.0	0.0
PM10	0	0.0	0	0.0	0.0
CO	0	0.0	0	0.0	0.0
VOC	1,923	480.6	2,120	530.0	-49.4
NH3	16,969	4242.1	13,925	3481.3	760.9

Feed Storage and Handling					
	PE2 (lb/yr)	PE2 (lb/qtr)	PE1 (lb/yr)	PE1 (lb/qtr)	QNEC (lb/qtr)
NOx	0	0.0	0	0.0	0.0
SOx	0	0.0	0	0.0	0.0
PM10	0	0.0	0	0.0	0.0
CO	0	0.0	0	0.0	0.0
VOC	93,941	23485.3	57,186	14296.4	9188.9
NH3	0	0.0	0	0.0	0.0

Appendix G

BACT Analysis

Pursuant to Section 5.2 of the Settlement Agreement between the District and the Western United Dairyman and the Alliance of Western Milk Producers Inc, signed September 20, 2004, "... *the District will not make any Achieved in Practice BACT determinations for individual dairy permits or for the dairy BACT guidance until the final BACT guidance has been adopted by the APCO....*".[1] Therefore, a cost effectiveness analysis will be performed for all the technologies, which have not been proposed by the applicant.

The U.S. Environmental Protection Agency (USEPA) RACT/BACT/LAER Clearinghouse, the California Air Pollution Control Officers Association (CAPCOA) BACT Clearinghouse, the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) BACT Clearinghouse, the Bay Area Air Quality Management District (BAAQMD), and the South Coast Air Quality Management District (SCAQMD) BACT Guidelines were reviewed to determine potential control technologies for this class and category of operation. No BACT guidelines were found for this class and category of source.

Pollutants Emitted from Dairies

1. PM Emissions from Dairies

The National Ambient Air Quality Standards currently regulate concentrations of particulate matter with an aerodynamic diameter of 10 micrometers or less (PM_{10}) and particulate matter with an aerodynamic diameter of 2.5 micrometers or less ($PM_{2.5}$). Studies have shown that particles in the smaller size fractions contribute most to human health effects. The $PM_{2.5}$ standard was published in 1997, but is only recently beginning to be implemented because of the time that was required to resolve litigation regarding the standard. On April 5, 2005, EPA finalized classification of areas for the $PM_{2.5}$ standard. On April 21, 2011 District Rule 2201 – New and Modified Stationary Source Review Rule was amended to incorporate PM2.5 new and modified source review requirements.

All animal confinement facilities are sources of particulate matter emissions. However, the composition of these emissions will vary. Dust emissions from unpaved surfaces, dry manure storage sites, and land application sites are potential particulate matter emission sources. Sources of particulate matter emissions at a dairy include feed, bedding materials, dry manure, animal dander, and unpaved soil surfaces such as corrals.

The mass of particulate matter emitted from totally or partially enclosed confinement facilities, as well as the particle size distribution, depend on type of ventilation and ventilation rate. Particulate matter emissions from naturally ventilated buildings will be lower than those from mechanically ventilated buildings.

2. VOC Formation and Emissions from Manure:

Volatile Organic Compounds (VOCs) result from ruminant digestive processes and are formed as intermediate metabolites when organic matter manure decomposes. Under aerobic conditions, any VOCs formed in the manure are rapidly oxidized to carbon dioxide and water. Under anaerobic conditions, complex organic compounds are microbially decomposed to volatile organic acids and other volatile organic compounds, which in turn are mostly converted to methane and carbon dioxide by methanogenic bacteria. When the activity of the methanogenic bacteria is not inhibited, virtually all of the VOCs are metabolized to simpler compounds, and the potential for VOC emissions is minimized. However, the inhibition of methane formation results in a buildup of VOCs in the manure and ultimately to volatilization to the air. Inhibition of methane formation typically is caused by low temperatures or excessive loading rates, which both create an imbalance between the populations of microorganisms responsible for the formation of VOC and methane. VOC emissions will vary with temperature because the rate of VOC formation, reduction to methane, and volatilization and the solubility of individual compounds vary with temperature.[1] VOC emissions from manure and the associated field application site can be minimized by a properly designed and operated stabilization process (such as an anaerobic treatment lagoon). In contrast, VOC emissions will be higher from storage tanks, ponds, overloaded anaerobic lagoons, and the land application sites associated with these systems.

3. VOC Emissions from Silage and Total Mixed Ration (TMR):

Volatile Organic Compounds (VOCs) are created during the process that is used to create silage, which is preserved, fermented plant matter that is fed to cattle. The purpose of silage production is to move the ensiled plant material from an aerobic phase to an anaerobic phase as quickly as possible and achieve a rapid drop in pH that will hinder further microbial decomposition in order to preserve the nutritive value of the forage. The rapid drop in pH is primarily caused by conversion of soluble carbohydrates to nonvolatile lactic acid. In addition to lactic acid, alcohols (primarily ethanol), volatile fatty acids (primarily acetic acid), and other VOC compounds (primarily oxygenated VOCs) are also formed during the process. These VOCs largely remain trapped in the silage piles until the silage is exposed to the surrounding atmosphere at the open face of the silage pile from where silage is removed, during mixing, or when placed in feed lanes for the cattle to consume as a Total Mixed Ration (TMR). Once exposed to the surrounding air much of the VOCs contained in the silage and TMR will begin to be rapidly emitted to the atmosphere and the concentration of the VOCs in the silage and TMR will decrease. Loss of VOCs from the silage and TMR can be reduced by minimizing the area exposed to the atmosphere and good silage management practices that will reduce the formation of these VOCs in the silage reduce aerobic deterioration, which leads to heating of the open faces of silage piles and of the TMR placed in the feed lanes.

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[1] EPA Document "Emissions from Animal Feeding Operations" (Draft, August 15, 2001), pg. 2-10

4. Ammonia Emissions from Dairies

When sulfur dioxide and nitrogen oxides are present, ammonia is a precursor for the secondary formation of $PM_{2.5}$ in the atmosphere. Ammonia reacts with sulfuric and nitric acids, which are produced from sulfur dioxide and nitrogen oxides in the ambient air, to form ammonium sulfate, ammonium nitrate, and other fine particulates.[2] Exposure to high levels of ammonia can cause irritation to the skin, throat, lungs, and eyes.

Ammonia volatilization is the result of the microbial decomposition of nitrogenous compounds in manure. The primary nitrogenous compound in dairy manure is urea, but nitrogenous compounds also occur in the form of undigested organic nitrogen in animal feces. Whenever urea comes in contact with the enzyme urease, which is excreted in animal feces, the urea will hydrolyze rapidly to 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 manure. Because ammonia is highly soluble in water, ammonia will accumulate in manure handled as liquids and semi-solids or slurries, but will volatize rapidly with drying from manure handled as solids.

The potential for ammonia volatilization exists wherever manure is present, and ammonia will be emitted from confinement buildings, open lots, stockpiles, anaerobic lagoons, and land application from both wet and dry handling systems. The rate of ammonia volatilization is influenced by a number of factors including the concentrations of nitrogenous compounds in the manure, temperature, air velocity, surface area, moisture, and pH. Because of its high solubility in water, the loss of ammonia to the atmosphere will be more rapid when drying of manure occurs. However, there the difference in total ammonia emissions between solid and liquid manure handling systems may not be great if liquid manure is stored over extended periods of time prior to land application.[3]

5. Hydrogen Sulfide Emissions from Dairies

Hydrogen Sulfide (H_2S) is produced from the anaerobic decomposition of organic sulfur compounds. In the absence of oxygen, sulfur reducing bacteria in the lagoons and storage ponds reduce sulfate ions in the manure into sulfide. Aqueous sulfide exists in three different forms: molecular (un-dissociated) hydrogen sulfide (H_2S) and the bisulfide (HS^-) and sulfide (S^{2-}) ions. In aqueous solutions molecular H_2S exists in equilibrium with the bisulfide (HS-) and sulfide (S^{2-}) ions but only molecular H_2S, not the ionized forms, can be transferred across the gas-liquid interface and emitted to the atmosphere. The fractional amount of the form of sulfide present in a solution is a function of temperature and pH. Under acidic conditions ($pH < 7$) greater

[2] Workshop Review Draft for EPA Regional Priority AFO Science Question Synthesis Document - Air Emission Characterization and Management, pg. 2

[3] Emissions From Animal Feeding Operations – Draft, US EPA – Emissions Standards Division, August 15, 2001, pgs. 2-6 and 2-7

amounts of sulfide will be in the form of molecular H_2S and the potential for H_2S emissions will increase. As the pH increases, a greater proportion of sulfide will be in the ionic form and the potential for H_2S emissions will decrease.

In a dairy, the conditions for the production of hydrogen sulfide exist in small amounts such as wet indentions in corrals, manure piles, and separated solids piles. However, the most significant sources are the liquid manure lagoons and storage ponds.

BACT Analysis for Emissions from the Cow Housing Permit Unit:

1. BACT Analysis for VOC Emissions from the Cow Housing Permit Unit

a. Identify all control technologies

Since specific VOC emissions control efficiencies have not been identified in the literature for dairy cow housing areas, the control efficiencies will be estimated based on the control efficiencies of similar processes and engineering judgment.

The following options were identified as possible controls for VOC emissions from the cow housing (cow housing permit unit):

1) Confining Animals in Enclosed Buildings and Venting Emissions to a Control Device (e.g. incinerator, biofilter, eg.)

Description of Dairy Housing

In a freestall barn, cows are grouped in large pens with free access to feed bunks, water, and stalls for resting. In the mild climate of the San Joaquin Valley, the typical freestall barn is an open structure (roof but no sides). The primary freestall design consists of a roof that provides shade with all sides open to allow air to flow through, which keeps the cows cool. The open freestall barns take advantage of natural summer winds in the San Joaquin Valley that are generally greater than four mph. The natural winds result in an excellent summer ventilation rate that is equivalent to 1,000 cfm per cow more, which is why open dairy barns are generally recommended in the San Joaquin Valley. In colder climates enclosed or partially enclosed barns may be utilized to protect cows from winter extremes.

Although the potential to enclose cows in a barn may exist, the feasibility of reasonably collecting the gas through a stack, chimney, or vent remains in question considering the extremely large amounts of airflow going through the barns needed to keep the cows cool. The airflow requirements would be even higher in the San Joaquin valley, where temperatures can exceed 110° F in the hot summer. If the barn exhaust can be properly captured it may be possible to vent it to a VOC control device. It is estimated that up to 80% of the gases emitted from enclosed freestall barns can be captured by the mechanical ventilation system and sent to a control device, such as an incinerator or biofilter.

Thermal incineration is a well-established VOC control technique. During combustion, gaseous hydrocarbons are oxidized to form CO_2 and water. In addition to the difficulty of capturing all of the gases in a freestall barn, a disadvantage of thermal incineration is that when concentrations of combustible VOCs in the gas stream are very low very large amounts of supplemental fuel must be used to sufficiently increase the temperature of all of the ventilation air in order to incinerate these VOCs. This generally renders incineration cost prohibitive for large flows of dilute VOCs, such as in the ventilation air from a freestall barn. Because of this biofilters have generally been found to be more cost-effective for handling dilute streams of biodegradable VOCs. A biofilter is a device for removing contaminants from a gas in which the gas is passed through a media that supports microbial activity by which pollutants are degraded by biological oxidation. During biofiltration microorganisms oxidize the gaseous organic contaminants, ammonia, and sulfur compounds in the exhaust air resulting in carbon dioxide, nitrogen, water, salt, and biomass. Additional information on biofiltration is given below in the analysis for enclosed freestall barns vented to a control device. One of the disadvantages related to the use of a biofilter to control emissions from enclosed livestock barns is the large space requirement for the traditional biofilter design. To illustrate this, a low-cost natural bed biofilter designed to treat the VOC emissions from 1,000 milk cows and 180 dry cows with no support stock would cover more than 5.4 acres and would need to be maintained free of pests and approved by the appropriate permitting agencies. To avoid such expansive land requirements, the dairy would likely need to use much more expensive bio-trickling filters or bio-scrubbers.

Although many questions remain about the feasibility of requiring animals to be confined in buildings and capturing the exhaust gas and venting it to a control device, it will be considered for purposes of this analysis.

2) <u>Feed and Manure Management Practices</u>

- Concrete feed lanes and walkways
- Feed lanes and walkways for mature cows (milk and dry cows) flushed four times per day. Feed lanes and walkways for support stock (heifers) flushed at least once per day;
- All animals fed in accordance with National Research Council (NRC) or other District-approved guidelines
- Exercise pens and open corrals properly sloped to promote drainage (minimum of 3% slope where the available space for each animal is 400 square feet or less and minimum of 1.5% where the available space for each animal is more than 400 square feet per animal), or managed to maintain a dry surface (except during periods of rainy weather)
- Scraping of exercise pens and open corrals at least every two weeks using a pull-type scraper in the morning hours except when prevented by wet conditions.
- VOC mitigation measures required by District Rule 4570

Concrete Feed Lanes and Walkways

Dairy animals spend a large amount of time on the feed lanes and walkways. Constructing these areas of concrete will reduce particulate matter emissions by having the animals spend more time on a paved surface rather than dry dirt. The concrete lanes and walkways create an avenue for the flush or scrape manure removal systems. The flush system will further reduce particulate matter emissions and will also reduce VOC and ammonia emissions (see below). Although concrete feed lanes and walkways are necessary for an effective manure removal system, they do not individually reduce emissions of gaseous pollutants; therefore, no VOC control efficiency is assigned for this practice.

Frequent Cleaning of Feed Lanes and Walkways

Many dairy operations use a flush system to remove manure from the corral and freestall feed lanes and walkways. The flush system introduces a large volume of water at the head of the paved area of the corrals or freestalls, and the cascading water removes the manure. The required volume of flush water varies with the size and slope of the area to be flushed. The freestall and corral lanes are for milk and dry cows are typically flushed twice per day, but the flushing frequency can vary between one to four times per day. The lanes for support stock are usually flushed once per day or less frequently.

In addition to cleaning the corral and freestall feed lanes and walkways, the flush, scrape, and vacuum systems also serve as an emission control for reducing VOC emissions. The manure deposited in the lanes, which is a source of VOC emissions, is removed from the cow housing area by the flush system. Flush systems also reduce PM_{10} and ammonia emissions. Additionally, many of the VOCs emitted from fresh cow manure, such as alcohols (ethanol and methanol) and many Volatile Fatty Acids (VFAs), are highly soluble in water. Therefore, when a flush system is used, a large percentage of these compounds will dissolve in the flush water and will not be emitted from the cow housing permit unit. The flush water can then carry the manure and the dissolved volatile compounds to an anaerobic treatment lagoon or other manure stabilization process for treatment.

It must be noted that the system for cleaning the lanes and walkways will only control the VOCs emitted from the manure it will have little or no effect on enteric emissions produced from the cows' digestive processes. As stated above, the feed lanes and walkways in the cow housing areas are typically cleaned twice per day. Cleaning the lanes four times per day will increase the frequency that manure is removed from the cow housing permit unit. Although the control efficiency for VOCs may actually be much higher, increasing the cleaning frequency of the lanes will be conservatively assumed to have a control efficiency of 10% for VOCs emitted from manure until better data becomes available.

Animals fed in accordance with (NRC) or other District-approved Guidelines

Nutritional management of dairy feed is routinely practiced to improve milk production and herd health. The potential for VOC emissions can be reduced by reducing the quantity of undigested nutrients in the manure. Many of the VOCs emitted from Confined Animal Facilities, including dairies, originate from the decomposition of undigested protein in animal waste.[7] This undigested protein also produces ammonia and hydrogen sulfide emissions. The level of microbial action in the manure corresponds to the level of organic nitrogen content in the manure; the lower the level of nitrogen the lower the level of microbial action and the lower the production of VOCs, ammonia, and hydrogen sulfide.

A diet that is formulated to feed proper amounts of ruminantly degradable protein will result in improved nitrogen utilization by the animal and corresponding reduction in urea and organic nitrogen content of the manure, which will reduce the production of VOCs and ammonia. The latest National Research Council (NRC) guidelines for the selection of an optimal bovine diet should be followed to the maximum extent possible. The diet recommendations made in this publication seek to achieve the maximum uptake of protein by the animal and the minimum carryover of nitrogen into the manure.

Based on very limited data (Klaunser, 1998, *J Prod Agric),* diet manipulation decreased nitrogen excretion by 34% while improving milk production. Up to 70% of excess nitrogen is lost off of the farm through volatilization, denitrification and leaching. Because of limited research, feeding dairy animals in accordance with National Research Council (NRC) or other District-approved guidelines will be assumed to have a conservative control efficiency of only 5-10% for both enteric VOC emissions from dairy animals and VOC emissions from manure.

Scraping of Exercise Pens and Open Corrals with a Pull-Type Scraper

Many dairies use equipment pulled by tractors to periodically scrape the surfaces of corrals. Frequent scraping the freestall exercise pens and corrals will reduce the amount of manure on the corral surfaces, which will reduce VOC and ammonia emissions resulting from decomposition of this manure. This practice will also provide a uniform surface, reducing anaerobic conditions on the corral surface, which will reduce gaseous pollutants from this area. The frequency that corrals are scraped at dairies can vary from as little as once a year to every few days.

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[7] "Emissions of Volatile Organic Compounds Originating from UK Livestock Agriculture", Hobbs, P.J. 2004 – Journal of the Science of Food and Agriculture

Increasing the frequency that corrals are scraped is expected to reduce emissions of PM and gaseous pollutants from the corral surface; however, requiring an excessively high frequency may negate these emission reductions because of the NO_X and PM emitted from combustion of fuel for the tractor and PM emissions resulting from use of the tractor on the corral surface.

b. Eliminate technologically infeasible options

There are no technologically infeasible options to eliminate.

c. Rank remaining options by control effectiveness

1) Confining Animals in Enclosed Buildings and Venting Emissions to a Control Device (e.g. incinerator, biofilter, e.g) (approx. 64-72%; 80% Capture and 80-90% Control of emissions from cow housing and total mixed ration (TMR) feed placed in the cow housing unit)
2) Feed and Manure Management Practices
   - Concrete feed lanes and walkways
   - Feed lanes and walkways for mature cows (milk and dry cows) flushed four times per day. Feed lanes and walkways for support stock (heifers) flushed at least once per day; or
   - All animals fed in accordance with National Research Council (NRC) or other District-approved guidelines
   - Exercise pens and open corrals properly sloped to promote drainage (minimum of 3% slope where the available space for each animal is 400 square feet or less and minimum of 1.5% where the available space for each animal is more than 400 square feet per animal), or managed to maintain a dry surface (except during periods of rainy weather)
   - Scraping of exercise pens and open corrals every two weeks using pull-type scraper in the morning hours except when prevented by wet conditions.
   - VOC mitigation measures required by District Rule 4570

d. Cost Effectiveness Analysis

1) <u>Confining Animals in Enclosed Buildings and Venting Emissions to a Control Device (Biofilter)</u>

   The analysis below is based on the Analysis for Confining Livestock in Enclosed Buildings and Venting Emissions to a Control Device contained in the District document Final Staff Report – Revised Proposed Amendments to Rule 4570 (Confined Animal Facilities), Appendix E – Analysis of Class Two Mitigation Measures for Revised Proposed Amendments to Rule 4570 (Confined Animal Facilities) dated October 21, 2010. Additional details regarding the cost analysis can be found in the referenced report for the amendments to District Rule 4570.

This analysis does not quantify all of the costs or examine all of the potential issues that make requiring this option infeasible but it is intended to more accurately reflect the actual costs to implement this measure. The use of a biofilter as a control device for VOCs is expected to result in much lower costs than other control options, such as incineration. The U.S. Environmental Protection Agency (US EPA), Clean Air Technology Center (CATC) document "Using Bioreactors to Control Air Pollution" states, "*The capital cost of a bioreaction installation is usually just a fraction of the cost of a traditional control device installation. Operating costs are usually considerably less than the costs of traditional technology, too.*"[8] Therefore, this analysis will evaluate the use of a biofilter to determine the minimum cost of the emission reductions that would be achieved by venting enclosed animal housing to a control device.

The following analysis is based on the cost of emission reductions for confining 5,378 milk cows in enclosed freestall buildings vented to a biofilter and venting the milking parlor to the same biofilter. Costs for larger dairies would be proportional.

Description of Control Technology

A biofilter is a device for removing contaminants from a gas in which the gas is passed through a media that supports microbial activity by which pollutants are degraded by biological oxidation. During biofiltration, exhaust air containing pollutants passes through a media that contains an established, diverse population of aerobic microorganisms. These microorganisms oxidize the gaseous organic contaminants, ammonia, and sulfur compounds in the exhaust air resulting in carbon dioxide, nitrogen, water, salt, and biomass. The bacterial cultures (microorganisms that typically consist of several species coexisting in a colony) that use oxygen to biodegrade organics are called aerobic cultures. These aerobic cultures are usually supported by organic material contained in the biofilter, such as compost, wood chips, soil, peat, etc. Biofilters must maintain sufficient porosity to allow the contaminated air stream to pass through for treatment and to minimize anaerobic conditions. The moisture content of biofilter beds must also be regulated to ensure that there is sufficient moisture to maintain the microorganisms needed for treatment while avoiding excess moisture that can cause anaerobic conditions. A filtration system may be required upstream of a biofilter to remove particular matter which will clog the biofilter over time. Biofilters must be maintained free of rodents and weeds to avoid

[8] U.S. Environmental Protection Agency , The Clean Air Technology Center (CATC), "Using Bioreactors to Control Air Pollution" EPA-456/R-03-003, (E143-03), September 2003, http://www.epa.gov/ttn/catc/dir1/fbiorect.pdf

channeling of gases through the filter media and a loss of performance. The filter media of natural biofilters needs to be replaced periodically because of deterioration and loss of porosity.

Since biofilters rely on living organisms to function, a biofilter's performance will be affected by several factors, including: ambient temperature; temperature of the air stream being treated; the pollutant concentrations in the air stream; moisture content of the filter and air stream, and pH of the filter media. These parameters should be monitored to ensure optimum operating conditions for the biofilter.

Advantages and Disadvantages of Using a Biofilter to Control Emissions

Some of the general advantages related to the use of biofilters include: low installation costs for traditional biofilter designs; generally low operating costs in comparison to other control technologies; high control efficiencies for some compounds such as aldehydes, organic acids, hydrogen sulfide, and certain water-soluble organic compounds.

Some of the general disadvantages of the use of biofilters include: large land requirements for traditional biofilter designs; difficulty in determining the control efficiency for traditional open biofilter designs; for biofilters that use inexpensive natural bed media, the filter bed media must be replaced every 2 to 5 years; biofilters usually require some time to reach optimum control efficiency after initial startup and after periods of nonuse because of the need to establish or re-establish the microbial population; and biofilters can also be a source of nitrous oxide emissions due to denitrification.

Additional disadvantages specifically related to the use of biofilters to control emissions from livestock include: facilities that currently use natural ventilation would incur additional costs because of the need to convert to mechanical ventilation; facilities that currently use mechanical ventilation systems may need to upgrade these systems to overcome the increased pressure drop across the biofiltration system; greater energy usage for all facilities to push air through the biofilter; few reported cases where a biofilter has been shown to be economically viable when applied to animal feeding operations[9]; a very large biofilter system must be used to handle these huge flow rates while maintaining adequate contact time for treatment of emissions. Finally, because of the extremely large airflow rates needed to provide adequate ventilation for livestock it is not practical to treat all of the ventilation air from large confined animal housing units.

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[9] U.S. Environmental Protection Agency, "Emissions from Animal Feeding Operations" (Draft), EPA Contract No. 68-D6-0011, August 15, 2001, pg. 9-20, http://www.epa.gov/ttn/chief/ap42/ch09/draft/draftanimalfeed.pdf

Biofilter VOC Control Efficiency

It is assumed that 80% of the gasses emitted from the enclosed animal housing will be captured by the mechanical ventilation system and that a properly functioning biofilter will eliminate 85% of the captured VOC emissions[10]; therefore, the total control for VOCs from the enclosed animal housing = 0.80 x 0.85 = 68%.

Cost Estimates for Enclosed Freestall Barns for this Analysis

Based on the information contained in the District Staff Report for the Revised Proposed Amendments to Rule 4570 (Confined Animal Facilities) dated October 21, 2010, the following cost estimates for enclosed freestall barns will be used in this analysis.

Capital Cost for Enclosed Freestall Barn (2010): $1,700-2,700/cow
Estimated Adjusted Capital Cost: $1,275-2,025/cow (capital cost estimate was reduced by 25% because it may be possible to use the existing concrete work and some of the existing freestall infrastructure with the new building shell)

Capitol cost estimate: $1,275-2,025/cow

Increased Operating Costs[11]: $74- 98/cow more

Capital Cost for Freestall Barn Enclosure for 5,378 Milk Cows

Low capital cost estimate: $1,275/cow x 5,378 cows = $6,856,950
High capital cost estimate: $2,025/cow x 5,378 cows = $10,890,450

Increased Operating Costs for Enclosed Freestall Barns for 5,378 Milk Cows

Low operating cost estimate: $74/cow-yr x 5,378 cows = $397,972/yr
High operating cost estimate: $98/cow-yr x 5,378 cows = $527,044/yr

Cost Estimate for Biofilters

Several reference documents were consulted to determine the expected capital and operating costs of using a biofilter to control VOC emissions from

[10] The SCAQMD Rule 1133.2 staff report (page 18) indicates control efficiencies of 80-90% for VOC for existing biofilter composting applications and that a well-designed, well-operated, and well-maintained biofilter is capable of achieving 80 percent control efficiency for VOC, http://www.aqmd.gov/rules/doc/r1133/r1133_staffreport.pdf

[11] Increased operating costs were based on information from following document, adjusted to 2010 dollars assuming 3% annual inflation: Dhuyvetter, Kevin C., Harner, Joe P., Smith, John F., & Bradford, Barry J., Kansas State University Department of Agricultural Economics, "Economic Considerations of Low-Profile Cross-Ventilated Freestall Barns", Presented at Dairy Housing of the Future, Sioux Falls, South Dakota. September 10-11, 2008, http://www.agmanager.info/Faculty/dhuyvetter/presentations/2008/LPCV%20Conference(Sep2008).pdf

enclosed animal housing for evaluation of the Class Two Mitigation Measures contained in the District Staff Report for the Revised Proposed Amendments to Rule 4570 (Confined Animal Facilities) dated October 21, 2010. Several companies that specialize in building and supplying biofilters and bio-scrubbers for the control of VOC emissions were also contacted to request capital cost estimates for biofilter systems specifically for the treatment of VOC emissions from dairy cows housed in enclosed barns. The resulting cost estimates from the District staff report are summarized below. Based on the information reviewed, it was also determined that there would not be any additional cost reduction benefit related to economy of scale for biofilters handling the large flow rates from freestall barns. For purposes of this analysis, the following biofilter cost estimates will be used.

Capital Cost (2010): $3-35/cfm
Operating Costs (2010): $2.12-20/cfm

The cost is largely dependent on the airflow rate that the biofilter must handle. Biofilters used to treat exhaust air should be sized to treat the maximum ventilation rate, which is typically the warm weather rate. The higher cost estimate is representative of a biotrickling filter, which may be necessary to handle the high air flow rates from the barns.

Required Airflow Rate of the Freestall Barns

In order to calculate the costs of this control option, the airflow rate required for the freestall barns must be determined. The University of Minnesota's publication "Improving Mechanical Ventilation in Dairy Barns" [12], gives minimum ventilation rates for dairy cattle, which are listed in the table below.

Minimum Ventilation Rates for Dairy Cows (cfm/cow)			
Age	Winter	Mild Weather	Summer
Baby Calf	15	50	100
Heifer (2-12 months)	20	60	130
Heifer (12-24 months)	30	80	180
Mature Cow	50	170	500 – 1,000

The minimum summer ventilation rate listed for mature cows is 500 cfm per cow. However, according to the University of Minnesota publication and Cornell University's publication "Natural or Tunnel Ventilation of Freestall Structures: What is Right for Your Dairy Facility?" [13], the minimum required

[12] "Improving Mechanical Ventilation in Dairy Barns", J.P. Chastain, http://www.milkproduction.com/Library/Articles/Improving_mechanical_ventilation.htm
[13] Natural or Tunnel Ventilation of Freestall Structures: What is Right for Your Dairy Facility?, C.A. Gooch, http://www.ansci.cornell.edu/pdfs/nattunnel.pdf

airflow rate in the summer increases to 1,000 cfm per cow if tunnel ventilation is used to provide additional cooling.

The climate in the San Joaquin Valley is characterized by mild winters and hot summers. Because of the warmer climate, it is expected that tunnel ventilation or a similar system would need to be employed in an enclosed freestall barn to prevent excessive heat stress. Additionally, tunnel ventilation systems are more representative of the types of systems that would be required to capture and control emissions.

<u>Minimum Summer Air Requirements for Freestall Barns Vented to a Biofilter for 5,378 Milk Cows</u>

The minimum required summer airflow rate for housing 5,378 milk cows is calculated as below:

Low Summer Ventilation Rate: 5,378 milk cows x 500 cfm/cow = 2,689,000 cfm

High Summer Ventilation Rate: 5,378 milk cows x 1,000 cfm/cow = 5,378,000 cfm

<u>Capital Cost of a Biofilter for 5,378 Milk Cows</u>

The lower cost estimate does not include installation of the required ductwork. As stated above, the estimated capital costs for a biofilter range of between \$3.00 per cfm and \$35.00 per cfm. The capital cost estimates of a biofilter for enclosed freestall barns housing 5,378 milk cows:

Low capital cost estimate: \$3.00/cfm x 2,689,000 cfm = \$8,067,000
High capital cost estimate: \$35.00/cfm x 5,378,000 cfm = \$188,230,000

<u>Operating Costs for a Biofilter for 5,378 Milk Cows</u>

Low operating cost estimate: \$2.12/cfm-yr x 2,689,000 cfm = \$5,700,680/yr
High operating cost estimate: \$20.00/cfm-yr x 5,378,000 cfm = \$107,560,000/yr

<u>Annualized Capital Costs for Biofilter for 5,378 Milk Cows</u>

Pursuant to District Policy APR 1305, Section X (11/09/99), the cost for the purchase of the biofilter will be spread over the expected life of the system using the capital recovery equation. The expected life of the entire system (fans, media, plenum, etc.) will be estimated at 10 years. A 10% interest rate is assumed in the equation and the assumption will be made that the equipment has no salvage value at the end of the ten-year cycle.

$$A = [P \times I(I+1)^n]/[(I+1)^n - 1]$$

Where: A = Annual Cost
P = Present Value (freestall enclosure and biofilter)
I = Interest Rate (10%)
N = Equipment Life (10 years)

Low Annualized Capital Cost Estimate =
$[(\$6,856,950 + \$8,067,000) \times 0.1(1.1)^{10}]/[(1.1)^{10}-1] = \$2,428,805/\text{year}$

High Annualized Capital Cost Estimate =
$[(\$10,890,450 + \$188,230,000) \times 0.1(1.1)^{10}]/[(1.1)^{10}-1] = \$32,405,946/\text{year}$

Total Annual Cost Estimates

The total annualized capital costs and operating costs for a freestall enclosure vented to a biofilter are given below. For the least expensive biofilters, the biofilter media (e.g., soil, compost, wood chips) must be replaced after 3-5 years in order to remain effective. This may be an additional cost because it may not have been included in the least expensive operating cost estimates provided above.

Total annual cost estimate = (total annualized capital cost) + (increased operating cost for an enclosed freestall barn) + (biofilter operating cost)

Low total annual cost estimate = ($2,428,805/yr) + ($397,972/yr) + ($5,700,680/yr)
= $8,527,457/year

High total annual cost estimate = ($32,405,946/yr) + ($527,044/yr) + ($107,560,000/yr)
= $140,492,990/year

Potential Income from Increased Milk Production

Cooling milk cows in enclosed freestall barns may reduce heat stress and result in increased milk production. Because dairy cows in California already have some of the highest milk production rates in the nation, it is questionable regarding whether enclosing the milk cows will result in any significant increases in milk production. This is because heat stress is related to both temperature and humidity and it is likely that the increased temperatures in California relative to other states are mitigated by the much lower humidity. Although questions remain about the potential to increase milk production in the San Joaquin Valley by reducing heat stress, this potential benefit will be quantified for this analysis.

Potential Increased Daily Milk Production: 4-6 lb/cow-day (District 4570 Staff Report, June 2006)

Potential Increased Annual Milk Production: 1,460-2,190 lb/cow-yr
Class 4b Price of milk[14] for September 2012: $17.50/cwt
Income from increased milk production: $255.50-383.25/cow-yr

Max Income from increased milk production for 5,378 milk cows:
5,378 milk cows x $383.25/cow-yr = $2,061,119/yr

Low total annual cost estimate – income from increased milk production = ($8,527,457/yr) - ($2,061,119/yr) = $6,466,338/year

<u>VOC Emission Reductions for 5,378 Milk Cows</u>

The annual VOC Emission reductions for enclosed freestall barns for 5,378 milk cows vented to a biofilter are calculated as follows:

VOC Emissions from Cows (Enteric) and Manure:
[Number of cows] x [Uncontrolled Cow Housing VOC EF (lb/cow-year)] x [Capture Efficiency] x [Biofilter Control Efficiency]

VOC Reductions from Jersey Cows Housed in Enclosed Freestall Barns Vented to a Biofilter (Cows, Stalls, & Lanes)

Type of Cow	# of cows	x	Housing EF* (lb/cow-yr)	x	Capture (%)	x	Control (%)	=	lb-VOC/yr
Milk Cow (enteric)*	5,378	x	2.91	x	80%	x	85%	=	10,642
Stalls and Lanes	5,378	x	1.28	x	80%	x	85%	=	4,681
Milking Parlor Floor	5,378	x	0.02	x	80%	x	85%	=	73
								Total (lb-VOC/yr)	**15,396**

*Includes emissions in the milk parlor(s)

VOC Emissions from TMR:
[Number of cows] x [Area of TMR (ft^2/cow)] x [Uncontrolled TMR Flux Rate (lb-VOC/ft^2-day)] x [365/day/year)]x [Capture Efficiency] x [Biofilter Control Efficiency]

[14] http://www.cdfa.ca.gov/dairy/pdf/Prices_Grid.pdf; The Class 4b milk price was because dairy industry representatives state that increased production is purchased at the lowest price. Additionally, sufficient increased production will cause the price to fall

VOC Reductions from TMR (Feed) for Cows Housed in Enclosed Freestall Barns Vented to a Biofilter																
Type of Cow	**# of cows**	**x**	**TMR Area* (ft^2/cow)**	**x**	**TMR Flux (lb/ft^2-day)**	**x**	**365 day/yr**	**x**	**Capture (%)**	**x**	**Control (%)**	**=**	**lb-VOC/yr**			
Milk Cow	5,378	x	7.08	x	3.85E-03	x	365	x	80%	x	85%	=	**36,385**			

Total VOC Emission Reductions from Milk Parlor, Cow Housing, and TMR = 15,396 lb-VOC/yr + 36,385 lb-VOC/yr = 51,781 lb-VOC/yr

Cost of VOC Emission Reductions

Low Estimate[15] = (\$6,466,338/year)/[(51,781 lb-VOC/year)(1 ton/2000 lb)]
= \$249,759/ton of VOC reduced

High Estimate = (\$140,492,990/year)/[(51,781 lb-VOC/year)(1 ton/2000 lb)]
= \$5,426,430/ton of VOC reduced

As shown above, the costs for a freestall enclosure and biofilter would cause the cost of the VOC reductions to be at least \$249,759/ton. There are additional costs related to increased electricity use, and regulatory compliance and testing that have not been quantified in this analysis. Even without these costs, it is clear that the cost of the VOC emission reductions achieved would be far greater than the \$17,500/ton-VOC cost effectiveness threshold of the District BACT policy. The equipment is therefore not cost effective and is being removed from consideration at this time.

2) Feed and Manure Management Practices

The applicant has proposed this option; therefore a cost effectiveness analysis is not required.

e. Select BACT

The facility is proposing the following feed and manure management practices:

1) Concrete feed lanes and walkways;
2) Flushing the feed lanes and walkways for the milk and dry cows four times per day and flushing feed lanes and walkways for the remaining animals one time per day;
3) Feeding all animals in accordance with National Research Council (NRC) or other District-approved guidelines;
4) Properly sloping corrals (minimum of 3% slope where the available space for each animal is 400 square feet or less and minimum of 1.5% where the

[15] Includes reduction in overall annual costs because of potential additional revenue from maximum supposed increase in milk production.

available space for each animal is more than 400 square feet per animal) or managing corrals to maintain a dry surface; and

5) Scraping corrals and exercise pens every two weeks
6) VOC mitigation measures required by District Rule 4570

2. BACT Analysis for NH_3 Emissions from the Cow Housing Permit Unit:

a. Identify all control technologies

A cost effectiveness threshold has not been established for ammonia. Therefore, only options that meet the District's definition of Achieved-in-Practice controls will be evaluated.

The following management practices have been identified as possible control options for the NH_3 emissions from the cow housing permit unit:

1) Feed and Manure Management Practices

- Concrete feed lanes and walkways
- Feed lanes and walkways for mature cows (milk and dry cows) flushed four times per day. Feed lanes and walkways for support stock (heifers) flushed at least once per day;
- All animals fed in accordance with National Research Council (NRC) or other District-approved guidelines
- Exercise pens and open corrals properly sloped to promote drainage (minimum of 3% slope where the available space for each animal is 400 square feet or less and minimum of 1.5% where the available space for each animal is more than 400 square feet per animal), or managed to maintain a dry surface (except during periods of rainy weather)
- Scraping of exercise pens and open corrals at least every two weeks using a pull-type scraper in the morning hours except when prevented by wet conditions.

Concrete Feed Lanes and Walkways

Dairy animals spend a large amount of time on the feed lanes and walkways. Constructing these areas of concrete will reduce particulate matter emissions by having the animals spend more time on a paved surface rather than dry dirt. The concrete lanes and walkways create an avenue for the flush or scrape manure removal systems. The flush system will further reduce particulate matter emissions and will also reduce VOC and ammonia emissions (see below).

Frequent Cleaning of Feed Lanes and Walkways

Many dairy operations use a flush system to remove manure from the corral and freestall feed lanes and walkways. The flush system introduces a large volume of water at the head of the paved area of the corrals or freestalls, and the cascading water removes the manure. The required volume of flush water varies with the size and slope of the area to be flushed. The freestall and corral lanes are for milk and dry cows are typically flushed twice per day, but the flushing frequency can vary between one to four times per day. The lanes for support stock are usually flushed once per day or less frequently.

In addition to cleaning the corral and freestall feed lanes and walkways, the flush systems also serve as an emission control for reducing NH_3 emissions. The manure deposited in the lanes, which is a source of NH_3 emissions, is removed from the cow housing area by the flush system. Additionally, ammonia is highly soluble in water. Therefore, when a flush system is used, a large portion of ammonia will be flushed away with the flush water and will not be emitted from the cow housing permit unit.

<u>Animals fed in accordance with (NRC) or other District-approved Guidelines</u>

Nutritional management of dairy feed is routinely practiced to improve milk production and herd health. The potential for ammonia emissions can be reduced by reducing the amount of undigested nitrogen compounds in the manure. The level of microbial action in the manure corresponds to the level of organic nitrogen content in the manure; the lower the level of nitrogen the lower the level of microbial action and the lower the production of ammonia and VOCs.

A diet that is formulated to feed proper amounts of ruminantly degradable protein will result in improved nitrogen utilization by the animal and corresponding reduction in urea and organic nitrogen content of the manure, which will reduce the production of VOCs and ammonia. The latest National Research Council (NRC) guidelines for the selection of an optimal bovine diet should be followed to the maximum extent possible. The diet recommendations made in this publication seek to achieve the maximum uptake of protein by the animal and the minimum carryover of nitrogen into the manure.

<u>Scraping of Exercise Pens and Open Corrals with a Pull-Type Scraper</u>

Frequent scraping the freestall exercise pens and corrals will reduce the amount of manure on the corral surfaces, which will reduce VOC and ammonia emissions resulting from decomposition of this manure. This practice will also provide a uniform surface, reducing anaerobic conditions on the corral surface, which will reduce gaseous pollutants from this area.

Increasing the frequency that corrals are scraped is expected to reduce emissions of PM and gaseous pollutants from the corral surface; however, requiring an excessively high frequency may negate these emission reductions because of the NO_X and PM emitted from combustion of fuel for the tractor and PM emissions resulting from use of the tractor on the corral surface.

b. Eliminate technologically infeasible options

There are no technologically infeasible options to eliminate.

c. Rank remaining options by control effectiveness

After eliminating the technologically infeasible options, the remaining options are ranked according to their control efficiency.

1) Feed and Manure Management Practices
    - Concrete feed lanes and walkways
    - Feed lanes and walkways for mature cows (milk and dry cows) flushed four times per day. Feed lanes and walkways for support stock (heifers) flushed at least once per day; or
    - All animals fed in accordance with National Research Council (NRC) or other District-approved guidelines
    - Exercise pens and open corrals properly sloped to promote drainage (minimum of 3% slope where the available space for each animal is 400 square feet or less and minimum of 1.5% where the available space for each animal is more than 400 square feet per animal), or managed to maintain a dry surface (except during periods of rainy weather)
    - Scraping of exercise pens and open corrals every two weeks using pull-type scraper in the morning hours except when prevented by wet conditions.

d. Cost Effectiveness Analysis

The applicant has proposed the only option listed; therefore a cost effectiveness analysis is not required.

e. Select BACT

The facility is proposing the following feed and manure management practices:
1) Concrete feed lanes and walkways;
2) Flushing the feed lanes and walkways for the milk and dry cows four times per day and flushing feed lanes and walkways for the remaining animals one time per day;
3) Feeding all animals in accordance with National Research Council (NRC) or other District-approved guidelines;
4) Properly sloping corrals (minimum of 3% slope where the available space for each animal is 400 square feet or less and minimum of 1.5% where the available space for each animal is more than 400 square feet per animal) or managing corrals to maintain a dry surface; and
5) Scraping corrals and exercise pens every two weeks

Additionally, District Rule 2201 defines BACT as including the most stringent emission limitation or control technique, including process and equipment changes, that has been found by the APCO to be cost effective and technologically feasible for such class or category of sources or for a specific source. The District has found that the mitigation measures required by District Rule 4570 are technologically feasible for confined animal facilities and the applicant has proposed these options. Although District Rule 4570 is only intended to reduce VOC emissions, many of these measures also reduce ammonia emissions. Therefore, in addition to the BACT requirements determined in the Top-Down BACT Analysis above, implementation of the mitigation measures that the applicant has selected to comply with Rule 4570 will also be required as part of BACT for NH_3 emissions from the cow housing permit.

3. BACT Analysis for PM10 Emissions from the Cow Housing Permit Unit

a. Identify all control technologies

1) Design and Management Practices

- Scraping of exercise pens and open corrals every two weeks using pull-type scraper in the morning hours except when prevented by wet conditions.
- Concrete feed lanes and walkways for all cows
- Shade structures in open corrals
- Feeding heifers near (within 1 hour of) dusk
- Windbreaks/Shelterbelts
- Above-ground calf hutches for baby calves under three months
- Application of water (sprinklers) in heifer corrals

Scraping of Exercise Pens and Open Corrals with a Pull-Type Scraper

Dairy animals are typically housed in freestall barns or open corrals. In a freestall barn, the milk cows are grouped in large pens with free access to feed bunks, water, and stalls for resting, and exercise corral areas. An open corral is a large open area where cows are confined with unlimited access to feed and water. The corral surface is composed of earth and deposited manure, both of which have the potential for particulate matter emissions either as a result of wind or animal movement. Frequent scraping of corral surfaces will reduce the amount of dry manure on the corral surfaces that may be pulverized by the cows' hooves and emitted as PM_{10}.

Concrete all feedlanes

Constructing the feed lanes and walkways of concrete causes the dairy animals to spend an increased amount of time on a paved surface rather than dry dirt, thus reducing PM_{10} emissions. Additionally, the manure that is deposited in the lanes and walkways will be flushed, which will prevent PM_{10} emissions from drying manure.

Shade Structures in corrals

Installing shade structures in corral areas helps to decrease PM_{10} emissions. Dairy animals are easily susceptible to heat stress and will tend to seek out shade to reduce the effects of heat, particularly in the warmer months when higher PM_{10} emissions are expected because of drier conditions. PM_{10} emissions are reduced because the cows will spend less time walking on the dry corral surface.

Feeding heifers near (within 1 hour of) dusk

Feeding the heifers near dusk will reduce their activity during this time, which is the time when the corral surface is the driest and there is greater chance for particulate matter from the corral to be entrained into the atmosphere.

Shelterbelts/Windbreaks

A windbreak or shelterbelt is composed of one or more rows of trees or shrubs, which are planted in a manner that breaks up wind and reduces the force of wind on downwind of the windbreak. Windbreaks can be used to prevent soil erosion, improve air quality by intercepting dust, chemicals, and odors, to protect crops, and to provide habitat for wildlife. The NRCS requires that a 3-row shelterbelt be installed, the first row consisting of shrubs, second row consisting of a medium size tree and the last row consisting of an evergreen (larger tree). NRCS also requires that an irrigation system be maintained so that there is greater survivability and rapid growth of the trees and shrubs. A windbreak/shelterbelt will reduce the amount of particulate matter entrained into the atmosphere.

Water Application

A sprinkler system can be installed to reduce PM_{10} emissions. The sprinkler system reduces dust by maintaining adequate moisture in the layer of manure and earth on the corral surface. Studies have shown that increasing the moisture of the corral surface greatly reduces the entrainment of PM_{10} into the atmosphere as a result of animal movement. Installation of a sprinkler system for dust control is an effective mitigation measure that reduces PM_{10} emissions. However, because of concerns for animal health and welfare, water application is not commonly used. Excess moisture from sprinkling systems can potentially accumulate in shaded areas where the cows lie down, which will lead to a breeding ground for pathogens and vermin, which will increase nuisance conditions and instances of disease. For this reason, sprinkler systems are not used.

b. Eliminate technologically infeasible options

Application of Water in Corrals

Mastitis is a common and costly disease of dairy cattle. Mastitis is the inflammation of the mammary gland caused by microorganisms, usually bacteria that invade the udder, multiply, and produce toxins that are harmful to the mammary gland. Mastitis is commonly considered to be more prevalent in mature, lactating cows. However, investigations have identified significant problems with mastitis in unbred, and bred heifers[16]. Environmental Mastitis is

[16] Heifer Mastitis, Fact Sheet, Sheila M. Andrew, Department of Animal Science, University of Connecticut

contracted from bacteria that may breed in the environment of the cow. Bacteria breeds in the bedding depending on the available nutrients, amount of contamination, moisture and temperature. Water sprinkling systems can potentially cause excess moisture in bedding areas where the heifers lie down. The moist resting areas create a breeding ground for the environmental mastitis bacteria which infect the teats of the resting heifers. Due to concerns for animal health and welfare, this mitigation measure/control will be removed from consideration at this time.

c. Rank remaining options by control effectiveness

After eliminating the technologically infeasible options, the remaining options are ranked according to their control efficiency.

1) Design and Management Practices

- Scraping of exercise pens and open corrals every two weeks using pull-type scraper in the morning hours except when prevented by wet conditions.
- Concrete feed lanes and walkways for all cows
- Shade structures in open corrals
- Feeding heifers near (within 1 hour of) dusk
- Windbreaks/Shelterbelts
- Above-ground calf hutches for baby calves under three months

d. Cost Effectiveness Analysis

The applicant has proposed the only option listed; therefore a cost effectiveness analysis is not required.

e. Select BACT

The facility is proposing the following design and management practices:

- Scraping of exercise pens and open corrals every two weeks using pull-type scraper in the morning hours except when prevented by wet conditions.
- Concrete feed lanes and walkways for all cows
- Shade structures in open corrals
- Feeding heifers near (within 1 hour of) dusk
- Windbreaks/Shelterbelts
- Above-ground calf hutches for baby calves under three months

BACT Analysis for Emissions from Liquid Manure Handling

1. BACT for VOC Emissions from the Lagoon & Storage Ponds

a. Identify all control technologies

1) <u>Aerobic Treatment Lagoon or Mechanically Aerated Lagoon</u>

An aerobic lagoon is a waste treatment lagoon that is designed to facilitate the decomposition of wastewater by microbes in the presence of oxygen (O_2). The process of aerobic decomposition results in the conversion of organic compounds in the wastewater into carbon dioxide (CO_2), and (H_2O), nitrates, sulfates, and inert biomass (sludge). The process of aerobic digestion is sometimes referred to as nitrification (especially when discussing NH_3 transformation). Complete aerobic digestion (100% aeration) removes nearly all malodors and also virtually eliminates VOCs, H_2S, and NH_3 emissions from liquid waste.

In completely aerated lagoons sufficient oxygen must be provided to sustain the aerobic microorganisms. NRCS Practice Standard Code 359 specifies that naturally aerobic lagoons have a minimum surface area determined by regional climate and daily Biological Oxygen Demand (BOD_5) and requires the depth of naturally aerobic lagoons have a maximum depth no greater than five feet. For mechanically aerated lagoons NRCS Practice Standard Code 359 specifies that the aeration equipment shall provide a minimum of 1 pound of oxygen for each pound of daily BOD_5 loading. The mechanical aerators that provide the required oxygen may float on the lagoon surface or be submerged in the lagoon. Aeration can also be performed by injection of tiny air bubbles into the lagoon water, mixing of the lagoon water, or spraying of the water into the air. According to Dr. Ruihong Zhang, a researcher at the University of California, Davis, at least 95% VOC control can be achieved if the dissolved oxygen (DO) concentration of the liquid manure is 2.0 mg/L or more. However, the DO concentrations achieved in mechanically aerated lagoons treating manure are typically much less than this and will therefore have lower control efficiencies.

2) <u>Covered Lagoon Digester Vented to a Control Device</u>

Pursuant to Section 5.3 of the Settlement Agreement (9/20/2004) between the District and the Western United Dairyman and the Alliance of Western Milk Producers Inc, installation of an anaerobic digester will only be required if this technology is proven effective in reducing emissions and is required by the final Dairy BACT Guideline.

Covered treatment lagoons are one type of anaerobic digester. An anaerobic digester is an enclosed basin or tank that is designed to facilitate the decomposition of wastewater by microbes in the absence of oxygen. The process of anaerobic decomposition results in the preferential conversion of organic compounds in the wastewater into methane (CH_4), carbon dioxide (CO_2), and water rather than intermediate metabolites (VOCs). The gas generated by this process is known as biogas, waste gas or digester gas. In addition to methane and carbon dioxide, biogas also contains small amounts of Nitrogen (N_2), Oxygen (O_2), Hydrogen Sulfide (H_2S), and Ammonia (NH_3). Biogas will also include trace amounts of various Volatile Organic Compounds (VOCs) that remain from incomplete digestion of the volatile solids in the incoming wastewater. The small amounts of undigested solids that remain after digestion are removed from the digester as sludge. Because biogas is mostly composed of methane, the main component of natural gas, the gas produced in the digester can be cleaned to remove H_2S and other impurities and used as fuel. The captured biogas can be combusted in a flare or may be sent to a boiler or internal combustion engine, where the gas can be used to generate useful heat or electrical energy.

As stated above, the gas generated in the covered lagoon anaerobic digester can be captured and then sent to a suitable combustion device. During combustion, gaseous hydrocarbons are oxidized to form CO_2 and water. The VOCs emitted from the liquid manure in the covered lagoon can be reduced by 95% with the use of an appropriate combustion device. Therefore, installation of the digester will lower the total VOCs emitted from the liquid manure from the liquid manure handling system. Although the control efficiency of the gas captured from the primary lagoon is expected to be 95% or more, the overall control efficiency is expected to be less since VOCs will also be emitted from the storage pond and as fugitive emissions. For this analysis, the overall control efficiency is assumed to be 80% of the emissions that would have been emitted from the lagoon system.

3) Anaerobic Treatment Lagoon Designed to Meet Natural Resources Conservation Service (NRCS) Standards

An anaerobic treatment lagoon is a waste treatment lagoon that is designed to facilitate the decomposition of manure by microbes in the absence of oxygen. The process of anaerobic decomposition results in the preferential conversion of organic compounds in the wastewater into methane (CH_4), carbon dioxide (CO_2), and water rather than intermediate metabolites (VOCs). The National Resource Conservation Service (NRCS) California Field Office Technical Guide Code 359 - Waste Treatment Lagoon specifies the following criteria for the design of anaerobic treatment lagoons:

- Required volume: The minimum design volume should account for all potential sludge, treatment, precipitation, and runoff volumes.

- Treatment period: retention time of the material in the lagoon shall be the time required to provide environmentally safe utilization of waste. The minimum hydraulic retention time for a covered lagoon in the San Joaquin Valley is about 38 days.

- Waste loading: shall be based on the maximum daily loading considering all waste sources that will be treated by the lagoon. The loading rate is typically based on volatile solids (VS) loading per unit of volume. The suggested loading rate for the San Joaquin Valley is 6.5-11 lb-VS/1000 ft^3/day depending on separation and type of system.

- The operating depth of the lagoon shall be 12 feet or greater. Maximizing the depth of the lagoon minimizes the surface area, which in turn minimizes the cover size and cost. Increasing the lagoon depth has the following advantages:

    - Minimizes surface area in contact with the atmosphere, thus reducing surface available to convection, evaporation
    - Smaller surface areas provide a more favorable and stable environment for methane bacteria
    - Better mixing of lagoon due to rising gas bubbles
    - Requires less land
    - More efficient for mechanical mixing

The lagoon design shall also consider location, soils and foundation, erosion, and depth to groundwater as required by the regional water control board.

The NRCS guideline suggests that this system consist of two cells, a treatment lagoon (primary lagoon) and a storage pond (secondary lagoon). The first stage of the lagoon system is the biological treatment stage and is designed with a constant liquid level to stabilize the anaerobic digestion. The effluent from the first stage overflows into a second lagoon designed for liquid storage capacity. Effluent from the second lagoon is used in the flush lanes and for the irrigation of cropland. The secondary (overflow) lagoon acts as the storage pond, which can be emptied when necessary. However, a single lagoon can also be considered an anaerobic lagoon as long as all the criteria are met and that the liquid manure is not drawn less than 6 feet at any time.

A properly designed anaerobic treatment lagoon will reduce the Volatile Solids (VS) by at least 50% and will reduce the biological oxygen demand (BOD), which will result in greater efficiency in degrading compounds that contain carbon into methane and carbon dioxide rather than VOCs. Although, the VS reduction is expected to be at least 50%, a conservative control efficiency of 40% will be assumed for anaerobic treatment lagoons, until better data becomes available.

4) Solids Removal/Separation

Mechanical Separation

Mechanical separators separate solids out from the liquid/slurry stream. There are many different versions of separators on the market. The percentage of separation varies depending on screen size and type of separation system. However, a 50% solid removal efficiency is used as a general rule of thumb. Although the separation efficiency can be improved by better separation or addition of separators or screens, it does not necessarily result in an increase in VOC emission reduction. The type of solids removed are generally non-digestible (lignins, cellulose, etc.) materials that do not easily digest in the lagoons; the amount of volatiles solids that end up in the lagoon will most likely not change even though there is an increase in solid removal efficiency. In addition, there is no data that links higher removal efficiency with an increase in VOC emission reduction.

Settling Basin Separation

The purpose of settling basin separation is to remove the fibrous materials prior to the liquid manure entering the lagoon. By removing the most fibrous material from the liquid stream prior to entering the pond, it is anticipated that the amount of intermediate metabolites released during digestion in the pond may be reduced. Removal of the fibrous material allows for more complete digestion in the pond and lower emissions.

Solids remaining in the settling basin are left to dry and then are removed. The separated solids can be immediately incorporated into cropland or spread in thin layers, harrowed, and dried.

The control efficiency of settling basins is not known at this time. Separation systems in general have the potential of reducing emissions from the lagoon system by allowing for more complete digestion to take place in the lagoon through the prior removal of indigestible solids. Settling basins dewater predominantly through draining. Some evaporation can occur (depending on weather), but the settling basin is drained, thereby creating a biofilter (crust) over the top of the basin.

Weeping Wall Separation

The purpose of weeping wall separation is to remove the fibrous materials prior to the liquid manure entering the lagoon and enhance the dewatering surface when compared to any other separation pit, basin, or pond. By removing the most fibrous material from the liquid stream prior to entering the pond, it is anticipated that the amount of intermediate metabolites released during digestion in the pond will be reduced. Removal of the fibrous material allows for more complete digestion in the pond and lower emissions. With weeping walls the effluent is allowed to weep through the slots between boards or screens while the solids are retained. Liquid manure enters the structure and slowly drains through the solids in the structure to dewater at a face. Solids from the structure can be hauled directly out of the structure if farming practices permit or they can be further dried for future use. Weeping wall systems can remove 60% of the solids in manure.

The emissions control efficiency of weeping walls is not known at this time. Separation systems in general have the potential of reducing emissions from the lagoon system by allowing for more complete digestion to take place through the removal of indigestible solids.

5) Phototropic Lagoon

Phototropic lagoons or red water lagoons can be identified by their characteristic purple, pink or rose color. Phototropic are the result of naturally occurring phenomena that lead to higher concentrations of purple sulfur and purple non-sulfur bacteria in municipal wastewater lagoons, lagoons treating animal waste, as well as natural lagoons and estuaries, etc. Purple sulfur bacteria utilize hydrogen sulfide and volatile organic acids as an electron source for anoxygenic photosynthesis. Under anaerobic conditions purple sulfur bacteria utilize volatile organic acids and alcohols as a carbon source and ammonia as a nitrogen source for cell growth. This reduces the concentration of these compounds at the surface of the lagoons and reduces the rate of volatilization of these compounds to the atmosphere. A number of studies have found reduced odors and emissions of volatile organic acids from lagoons with higher concentrations of phototropic bacteria. Some of these studies have also found reduced emissions of ammonia from phototropic lagoons.

In nature blooms of purple sulfur and purple non-sulfur bacteria are transitory. These blooms occur when the appropriate conditions are present to promote the growth of these bacteria (e.g. limited oxygen availability, sufficient light penetration, generally warmer temperatures, dilute nutrient loading, etc.). Although phototropic lagoons have shown promise for reduction of emissions from lagoons, there remain limitations to the continuous use of this option. As mentioned above, blooms of phototropic bacteria are generally transitory and the blooms cannot reliably be predicted in different lagoons, even when the lagoons are operated under similar conditions. Phototropic lagoons depend on living organisms to function; therefore, the effectiveness of the system is affected by several factors that are not always under the operator control. Establishment of an effective concentration of phototropic can take several months to more than a year and if this population dies off for any reason it can take the same amount of time for a population of phototropic bacteria to become re-established. Because of uncertainty related to successful establishment of an effective population of phototropic bacteria and the other difficulties related to the continuous use of this option, phototropic lagoons will not be required as BACT at this time; however, phototropic lagoons will remain an option that may be proposed by the operator.

b. Eliminate technologically infeasible options

A phototropic lagoon will be removed as an option.

c. Rank remaining options by control effectiveness

1) Aerobic Treatment Lagoon or Mechanically Aerated Lagoon (95% VOC control efficiency)
2) Covered Lagoon Digester Vented to a Control Device (80% VOC control efficiency)
3) Anaerobic Treatment Lagoon Designed to Meet Natural Resources Conservation Service (NRCS) Standards (40% VOC control efficiency)
4) Solids Removal/Separation

d. Cost Effectiveness Analysis

1) <u>Aerobic Treatment Lagoon or Mechanically Aerated Lagoon</u>

This control can be used to control VOC emissions from the lagoons/storage ponds as well as from liquid manure land application because liquid manure applied to land will come from the lagoons/storage ponds. Since BACT for this project is triggered from both the lagoons/storage ponds and from liquid manure land application, the following cost effectiveness analysis will look at VOC emissions reductions achieved from this control technology for both lagoons/storage ponds and liquid manure land application.

The following analysis is based on the treatment of manure from 5,378 milk cows in naturally aerobic lagoons and mechanically aerated lagoons.

<u>Space Requirement for a Naturally Aerobic Lagoon Treating Manure from 5,378 Dairy Cows</u>

NRCS Practice Standard Code 359 requires that naturally aerobic lagoons be designed to have a minimum treatment surface area as determined on the basis of daily BOD5 loading per unit of lagoon surface. The standard specifies that the maximum loading rate of naturally aerobic lagoons shall not exceed the loading rate indicated by the NRCS Agricultural Waste Management Field Handbook (AWMFH) or the maximum loading rate according to state regulatory requirements, whichever is more stringent. According to Figure 10-30 (August 2009) of the latest version of the AWMFH, the maximum aerobic lagoon loading rate for the San Joaquin Valley is 45 -

55 lb-BOD_5/acre-day. According to Table 4-5 (March 2008) of the NRCS AWMFH, the total daily manure produced by a milk cow will have 2.9 lb-BOD_5/day. Assuming that 80% of the manure will be flushed to the lagoon system, the minimum lagoon surface area required for a naturally aerobic lagoon treating manure from 5,378 milk cows in the San Joaquin Valley can be calculated as follows:

BOD_5 loading (lb/day) = 5,378 milk cows x 2.9 lb-BOD_5/cow-day x 0.80
= 12,477 lb-BOD_5/day

Minimum Surface Area (acres) in areas of the San Joaquin Valley with a maximum loading rate of 55 lb-BOD_5/acre-day =
12,477 lb-BOD_5/day ÷ 55 lb-BOD_5/acre-day = 227 acres

Minimum Surface Area (acres) in areas of the San Joaquin Valley with a maximum loading rate of 45 lb-BOD_5/acre-day =
12,477 lb-BOD_5/day ÷ 45 lb-BOD_5/acre-day = 277 acres

As shown above the minimum surface area required for a naturally aerobic lagoon treating manure from 5,378 milk cows in the San Joaquin Valley would range from approximately 227 to 277 acres. This does not include the additional surface area that would be required to treat manure from dry cows or support stock onsite. Based on the space requirements alone it is clear that this option cannot reasonably be required and no further analysis is needed.

Analysis for a Mechanically Aerated Lagoon Treating Manure from 5,378 Dairy Cows

As discussed above, the very large space requirements for naturally aerobic lagoons cause this option to be infeasible for most confined animal facilities. Mechanically aerating a lagoon can achieve some of the benefits of a naturally aerobic lagoon without the large space requirements. However, the costs of energy for complete aeration have also caused this option to be infeasible. The amount of energy required for aeration is based on the amount of volatile solids excreted by animals that must be treated; thus, this cost will be directly proportional to the number of animals at a site. The following analysis will determine the cost of emission reductions that can be achieved from a mechanically aerated lagoon treating manure from 5,378 milk cows.

Biological Oxygen Demand (BOD_5)

In order to effectively calculate the costs of this control option, the energy requirement for complete aeration must be determined. It should be noted that approximately 1.5 to 2.5 pounds of oxygen is required to digest 1 pound of Biological Oxygen Demand (BOD_5) with additional oxygen required for conversion of ammonia to nitrate (nitrification). It is generally accepted that at least twice the BOD should be provided for complete aeration. According to Dr. Ruihong Zhang of the University of California, Davis, 2.4 lbs (1.1 kg) of oxygen (O2) per cow must be provided each day for removal of BOD and an additional 3 lbs (1.4 kg) per cow for oxidation of 70% of the nitrogen. 22

The proposed rule specifies that an aerobic lagoon be designed and operated in accordance with NRCS Practice Standard Code 359. NRCS Practice Standard Code 359 requires that mechanically aerated lagoons use aeration equipment that provides a minimum of one pound of oxygen for each pound of daily BOD_5 loading. As discussed above, the total daily manure produced by a milk cow will have a BOD_5 of 2.9 lb/day and a lagoon handling flushed manure from 5,378 milk cows will have a loading rate of approximately 12,477 lb-BOD5/day (5,660 kg-BOD_5/day).

Energy Requirement a Mechanically Aerated Lagoon Treating Manure from 5,378 Milk cows:

Based on the data gathered in a UC Davis study on aerator performance for wastewater lagoons, aeration efficiencies for mechanical aerators ranged from 0.10 to 0.68 kg of oxygen provided per kW-hr of energy utilized. The most efficient aerator tested that had been installed in dairy lagoons had an aeration efficiency of 0.49 kg-O2/kW-hr. These efficiency tests were performed in clean water and lower aeration efficiencies are expected in liquid manure because of the significant amount of solids that it contains. The yearly energy requirement mechanically aerated lagoon treating flushed manure from 5,378 milk cows is calculated as follows:

High Efficiency Aerator
5,660 kg-BOD_5/day ÷ (0.68 kg-O2/kW-hr) x (365 day/year) = 3,038,088 kW-hr/year

Low Efficiency Aerator
5,660 kg-BOD_5/day ÷ (0.10 kg-O2/kW-hr) x (365 day/year) = 20,659,000 kW-hr/year

Cost of Electricity for a Mechanically Aerated Lagoon Treating Manure from 5,378 Milk cows:

The cost for electricity will be based upon the average price for industrial electricity in California as of September 2013, as taken from the Energy Information Administration (EIA) Website:
(http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_06_b)

Average Cost for electricity = $0.1115/kW-hr

The electricity costs for complete aeration are calculated as follows:

Low Cost Estimate (High Efficiency Aerator)
3,038,088 kW-hr/year x $0.1115/kW-hr = $338,747/year

High Cost Estimate (Low Efficiency Aerator)
20,659,000 kW-hr/year x $0.1115/kW-hr = $2,303,479/year

VOC Emission Reductions from a Mechanically Aerated Lagoon Treating Manure from 5,378 Milk Cows That Will Also Be Applied to Land:

It will be conservatively assumed that a mechanically aerated lagoon providing 1 lb of oxygen for every 1 lb of BOD_5 loading will control 90% of the VOC emissions from the lagoon/storage pond. However, as noted above, it is generally accepted that the oxygen provided should be twice the BOD_5 loading rate for complete aeration; therefore, the actual control from providing 1 lb of oxygen for every 1 lb of BOD_5 loading is probably closer to 50%.

The annual VOC Emission Reductions for mechanically aerated lagoon(s) treating the manure from 5,378 Jersey milk cows are calculated as follows and shown in the table below:

[Number of cows] x [Lagoon/Storage Pond VOC EF (lb/cow-year)] x [Complete Aeration Control Efficiency for Lagoon/Storage Pond]

VOC Reductions for a Mechanically Aerated Lagoon – Lagoon/Storage Ponds							
Type of Animal	**# of cows**	**x**	**Lagoon EF (lb/cow-yr)**	**x**	**Control (%)**	**=**	**lb-VOC/yr**
Milk Cow (freestall)	5,378	x	0.92	x	90%	=	**4,453**

The annual VOC Emission Reductions for a mechanically aerated lagoon treating land applied manure from 5,378 Jersey milk cows are calculated as follows and shown in the table below:

[Number of cows] x [Liquid Manure Land Application VOC EF (lb/cow-year)] x [Complete Aeration Control Efficiency for Lagoon/Storage Pond]

VOC Reductions for a Mechanically Aerated Lagoon – Land Application							
Type of Animal	**# of cows**	**x**	**Liquid Manure Land Application EF (lb/cow-yr)**	**x**	**Control (%)**	**=**	**lb-VOC/yr**
Milk Cow (freestall)	5,378	x	0.99	x	90%	=	**4,792**

Total VOC Emissions Reductions
Total VOC Reduced = 4,453 lb-VOC/yr + 4,792 lb-VOC/yr
= 9,245 lb-VOC/yr

Cost of VOC Emission Reductions
Low Estimate = ($338,747/year)/[(9,245 lb-VOC/year)(1 ton/2000 lb)]
= $73,282/ton of VOC reduced

High Estimate = ($2,303,479/year)/[(9,245 lb-VOC/year)(1 ton/2000 lb)]
= $498,319/ton of VOC reduced

As shown above, the electricity cost alone for a mechanically aerated lagoon would cause the cost of the VOC reductions to be greater than $73,282/ton. This cost does not include the additional electricity cost for nitrification that would naturally occur as the lagoons were aerated or equipment costs. Additionally, this does not include the costs incurred from handling any of the support stock at the facility. Even without these costs, this control technology would not be cost effective.

2) Covered Lagoon Digester Vented to a Control Device

This control can be used to control VOC emissions from the lagoons/storage ponds as well as from liquid manure land application because liquid manure applied to land will come from the lagoons/storage ponds. Since BACT for this project is triggered from both the lagoons/storage ponds and from liquid manure land application, the following cost effectiveness analysis will look at VOC emissions reductions achieved from this control technology for both lagoons/storage ponds and liquid manure land application.

The costs associated with treating the manure excreted by milk cows in a covered lagoon digester vented to a control device are analyzed below. Because it may be possible to generate power from the system to offset some of the costs associated with installation, this potential benefit is included in the analysis below. The following analysis is based on the treatment of manure from 5,378 milk cows in a covered lagoon anaerobic digester with power generation.

Capital Cost for Installation of a Covered Lagoon Digester for Dairy Cows

The capital cost estimates for installation of a covered lagoon digester are based on information from the United States EPA AgSTAR publication "Anaerobic Digestion Capital Costs for Dairy Farms" (May 2010) and the California Energy Commission (CEC) Public Interest Energy Research (PIER) Program Dairy Methane Digester System Program Evaluation Report (Feb 2009). The formula in the AgSTAR publication results in a capitol cost of $1,032 per cow for a covered lagoon anaerobic digester treating manure from

1,000 cows. This estimate excludes costs of solids separation after digestion, hydrogen sulfide removal, and utility charges including line upgrades and interconnection costs and fees. Based on information from installations in California, the CEC PIER Dairy Methane Digester Program Evaluation Report gives an average cost of $585 per cow for installation of covered lagoon anaerobic digesters (see Table 9 - Total Project Costs and Cost per Cow and per kW). Therefore, for purposes of this analysis the capital cost for installation of a covered lagoon digester system for 5,378 milk cows will be assumed to be between $585/cow and $1,032/cow. The capital cost estimates of a covered lagoon digester treating the manure of 5,378 milk cows is calculated as follows:

Low capital cost estimate: $585/cow x 5,378 cows = $2,689,000
High capital cost estimate: $1,032/cow x 5,378 cows = $5,550,096

The annualized capital cost estimates will be calculated below. The capital cost for the installation of the covered lagoon digester will be spread over the expected life of the system using the capital recovery equation. The expected life of the entire system will be estimated at 10 years though the cover may require replacement during this period. A 10% interest rate is assumed in the equation and the assumption will be made that the equipment has no salvage value at the end of the ten-year cycle.

$A = [P \times I(I+1)^n]/[(I+1)^n-1]$

Low Annual Capital Cost Estimate = $[\$2,689,000 \times 0.1(1.1)^{10}]/[(1.1)^{10}-1]$
= $437,622/year

High Annual Capital Cost Estimate = $[\$5,550,096 \times 0.1(1.1)^{10}]/[(1.1)^{10}-1]$
= $903,252/year

<u>Potential Production of Electricity from a Covered Lagoon Digester Treating Manure from 5,378 Milk Cows</u>:

It may be possible to offset some of the installation costs of a covered lagoon anaerobic digester with revenue from generation of electricity. Based on the information given in the CEC PIER Dairy Methane Digester Program Evaluation Report, Table 7 – Actual Generation per Cow Comparisons, California dairies that used a covered lagoon digester to produce electricity generated between 429.1 and 1,031.8 kW-hr/yr per lactating cow with an overall per facility average generation rate of 670.3 kW-hr/yr per lactating cow. This average annual generation rate is actually higher than all the facilities included in the average except one that had a very high generation rate. In addition, this average may overestimate the per-cow generation potential because the contributions of support stock to the digesters were not accounted for. However, for more conservative calculations, this average will be used to calculate the potential annual savings in electricity costs. The potential production of electricity from a covered lagoon digester treating manure from 5,378 milk cows is calculated as follows:

Electrical Production: 670.3 kW-hr/(milk cow-yr) x 5,378 milk cows = 3,604,873 kW-hr/yr

Potential Cost Savings from Production of Electricity from a Covered Lagoon Digester Treating Manure from 5,378 Milk Cows:

Based on the reference given above, the value of electricity used for this analysis will be = $0.1115/kW-hr

The potential annual cost savings from electricity generation from a covered lagoon digester treating manure from 5,378 milk cows is calculated as follows:

Potential Annual Cost Savings from Electrical Production:
3,604,873 kW-hr/yr x $0.1115/kW-hr = $401,943/yr

Annualized Capital Cost for a Covered Lagoon Digester Treating Manure from 5,378 Milk Cows minus Potential Savings from Generation of Electricity:

Low Annual Capital Cost Estimate minus Savings from Potential Generation = $437,622/yr - $401,943/yr = $35,679/year

High Annual Capital Cost Estimate minus Savings from Potential Generation = $903,252/yr - $401,943/yr = $501,309/year

VOC Emission Reductions from a Covered Lagoon Anaerobic Digester Treating Manure from 5,378 Milk Cows That Will Also Be Applied to Land:

The annual VOC Emission Reductions for covered lagoon anaerobic digester treating the manure from 5,378 Jersey milk cows are calculated as follows and shown in the table below:

[Number of cows] x [Lagoon/Storage Pond VOC EF (lb/cow-year)] x [Covered Lagoon Digester Control Efficiency for Lagoon/Storage Pond]

VOC Reductions for a Covered Lagoon Vented to Control Device – Lagoon/Storage Ponds							
Type of Cow	**# of cows**	**x**	**Lagoon EF (lb/cow-yr)**	**x**	**Control (%)**	**=**	**lb-VOC/yr**
Milk Cow (freestall)	5,378	x	0.92	x	80%	=	**3,958**

The annual VOC Emission Reductions for a covered lagoon anaerobic digester treating land applied manure from 5,378 Jersey milk cows are calculated as follows and shown in the table below:

[Number of cows] x [Liquid Manure Land Application VOC EF (lb/cow-year)] x [Covered Lagoon Digester Control Efficiency for Lagoon/Storage Pond]

VOC Reductions for a Covered Lagoon Vented to Control Device – Land Application							
Type of Animal	**# of cows**	**x**	**Liquid Manure Land Application EF (lb/cow-yr)**	**x**	**Control (%)**	**=**	**lb-VOC/yr**
Milk Cow (freestall)	5,378	x	0.99	x	80%	=	**4,259**

<u>Total VOC Emissions Reductions</u>
Total VOC Reduced = 3,958 lb-VOC/yr + 4,259 lb-VOC/yr
= 8,217 lb-VOC/yr

<u>Cost of VOC Emission Reductions</u>
Low Estimate = ($35,679/year)/[(8,217 lb-VOC/year)(1 ton/2000 lb)]
= $8,684/ton of VOC reduced

High Estimate = ($501,309/year)/[(8,217 lb-VOC/year)(1 ton/2000 lb)]
= $122,017/ton of VOC reduced

As shown above, the capital cost alone for a covered lagoon digester for a dairy would cause the cost of the VOC reductions to be greater than $8,684/ton. This is a conservatively low estimate, with a high end estimate of upwards of $122,017/ton. This cost includes the potential revenue generated by electrical production but does not include the additional maintenance required for the system. Additionally, this analysis did not consider the additional pollution that would be generated by any combustion equipment that would utilize the gas, which may offset any reductions in VOCs. Finally, this analysis did not include additional VOC reductions required by District Rule 4570 mitigation measures, resulting in a lower VOC emission factor and fewer emissions reductions achieved from this control technology. Therefore, this control technology would not be cost effective.

3) <u>Anaerobic Treatment Lagoon Designed to Meet Natural Resources Conservation Service (NRCS) Standards</u>

The applicant has proposed this option; therefore a cost effectiveness analysis is not required.

4) Solids Removal/Separation

The applicant has proposed this option; therefore a cost effectiveness analysis is not required.

e. Select BACT

The facility is proposing an Anaerobic Treatment Lagoon designed according to Natural Resources Conservation Service (NRCS) Guidelines. Additionally, the facility currently utilizes, and has proposed to continue utilizing, a mechanical separator for solids separation.

Additionally, District Rule 2201 defines BACT as including the most stringent emission limitation or control technique, including process and equipment changes; that has been found by the APCO to be cost effective and technologically feasible for such class or category of sources or for a specific source. The District has found that the mitigation measures required by District Rule 4570 are cost effective and technologically feasible for confined animal facilities and the applicant has proposed these options. Therefore, in addition to the BACT requirements determined in the Top-Down BACT Analysis above, implementation of the mitigation measures that the applicant has selected to comply with Rule 4570 will also be required as part of BACT for VOC emissions from liquid manure land application.

2. BACT for NH3 Emissions from the Lagoon & Storage Ponds

a. Identify all control technologies

A cost effectiveness threshold has not been established for ammonia. Therefore, although there is ongoing research for multiple ammonia control technologies, only options that meet the District's definition of Achieved-in-Practice controls will be considered for ammonia at this time.

The following practice has been identified as a possible control option for NH3 emissions from the lagoon and storage pond(s). No other control technologies that meet the definition of Achieved-in-Practice have been identified for the lagoon or storage pond(s).

1) <u>Animals fed in accordance with National Research Council (NRC) or other District-approved Guidelines</u>

   Nutritional management of dairy feed is routinely practiced to improve milk production and herd health. The potential for ammonia emissions can be reduced by reducing the amount of undigested nitrogen compounds in the manure. The level of microbial action in the manure corresponds to the level of organic nitrogen content in the manure; the lower the level of nitrogen the lower the level of microbial action and the lower the production of ammonia and VOCs.

   A diet that is formulated to feed proper amounts of ruminantly degradable protein will result in improved nitrogen utilization by the animal and corresponding reduction in urea and organic nitrogen content of the manure, which will reduce the production of VOCs and ammonia. The latest National Research Council (NRC) guidelines for the selection of an optimal bovine diet should be followed to the maximum extent possible. The diet recommendations made in this publication seek to achieve the maximum uptake of protein by the animal and the minimum carryover of nitrogen into the manure, which will reduce ammonia emissions from liquid manure applied to cropland.

b. Step 2 - Eliminate technologically infeasible options

There are no technologically infeasible options to eliminate from step 1.

c. Step 3 - Rank remaining options by control effectiveness

All options are ranked according to their control efficiency.

1) Animals fed in accordance with National Research Council (NRC) or other District-approved Guidelines

d. Cost Effectiveness Analysis

The applicant has proposed the only option listed; therefore a cost effectiveness analysis is not required.

e. Select BACT

The facility is proposing to feed all animals in accordance with National Research Council (NRC) or other District-approved guidelines utilizing routine nutritional analysis for rations, which satisfies the BACT requirements.

Additionally, District Rule 2201 defines BACT as including the most stringent emission limitation or control technique, including process and equipment changes, that has been found by the APCO to be cost effective and technologically feasible for such class or category of sources or for a specific source. The District has found that the mitigation measures required by District Rule 4570 are technologically feasible for confined animal facilities and the applicant has proposed these options. Although District Rule 4570 is only intended to reduce VOC emissions, many of these measures also reduce ammonia emissions. Therefore, in addition to the BACT requirements determined in the Top-Down BACT Analysis above, implementation of the mitigation measures that the applicant has selected to comply with Rule 4570 will also be required as part of BACT for NH3 emissions from liquid manure land application.

BACT Analysis for Liquid/Slurry Manure Land Application

1. BACT for VOC Emissions from Liquid/Slurry Manure Land Application

a. Identify all control technologies

1) <u>Irrigation of crops using liquid/slurry manure from an aerobic treatment lagoon or mechanically aerated lagoon</u>

An aerobic lagoon is a waste treatment lagoon that is designed to facilitate the decomposition of wastewater by microbes in the presence of oxygen (O_2). The process of aerobic decomposition results in the conversion of organic compounds in the wastewater into carbon dioxide (CO_2), and (H_2O), nitrates, sulfates, and inert biomass (sludge). The process of aerobic digestion is sometimes referred to as nitrification (especially when discussing NH_3 transformation). Complete aerobic digestion (100% aeration) removes nearly all malodors and also virtually eliminates VOCs, H_2S, and NH_3 emissions from liquid waste.

In completely aerated lagoons, sufficient oxygen must be provided to sustain the aerobic microorganisms. NRCS Practice Standard Code 359 specifies that naturally aerobic lagoons have a minimum surface area determined by regional climate and daily Biological Oxygen Demand (BOD_5) and requires the depth of naturally aerobic lagoons have a maximum depth no greater than five feet. For mechanically aerated lagoons NRCS Practice Standard Code 359 specifies that the aeration equipment shall provide a minimum of 1 pound of oxygen for each pound of daily BOD_5 loading. The mechanical aerators that provide the required oxygen may float on the lagoon surface or be submerged in the lagoon. Aeration can also be performed by injection of tiny air bubbles into the lagoon water, mixing of the lagoon water, or spraying of the water into the air. According to Dr. Ruihong Zhang, a researcher at the University of California, Davis, at least 95% VOC control can be achieved if the dissolved oxygen (DO) concentration of the liquid manure is 2.0 mg/L or more. However, the DO concentrations achieved in mechanically aerated lagoons treating manure are typically much less than this and will therefore have lower control efficiencies.

2) <u>Irrigation of crops using liquid/slurry manure from a holding/storage pond after being treated in a covered lagoon/digester</u>

Pursuant to Section 5.3 of the Settlement Agreement (9/20/2004) between the District and the Western United Dairyman and the Alliance of Western Milk Producers Inc, installation of an anaerobic digester will only be required if this technology is proven effective in reducing emissions and is required by the final Dairy BACT Guideline.

This practice would only allow the irrigation of liquid manure to cropland from the secondary lagoon after proper treatment has taken place in a covered lagoon/anaerobic digester. Covered treatment lagoons are one type of anaerobic digester. An anaerobic digester is an enclosed basin or tank that is designed to facilitate the decomposition of wastewater by microbes in the absence of oxygen. The process of anaerobic decomposition results in the preferential conversion of organic compounds in the wastewater into methane (CH4), carbon dioxide (CO2), and water rather than intermediate metabolites (VOCs). The gas generated by this process is known as biogas, waste gas or digester gas. In addition to methane and carbon dioxide, biogas also contains small amounts of Nitrogen (N2), Oxygen (O2), Hydrogen Sulfide (H2S), and Ammonia (NH3). Biogas will also include trace amounts of various Volatile Organic Compounds (VOCs) that remain from incomplete digestion of the volatile solids in the incoming wastewater. The small amounts of undigested solids that remain after digestion are removed from the digester as sludge.

Assumptions:

- 80% of the Volatile Solids (VS) can be removed from the covered anaerobic digestion process.
- 20% of the remaining VS will be assumed to be in the manure during land application. This will be considered worst-case because further digestion of the VS is likely to occur from the secondary lagoon.
- As a worst-case scenario, it will be assumed that all remaining VS will be emitted as VOCs during land application.

Since 80% of the VS is removed or digested in the covered lagoon and the remaining VS have been assumed to be emitted as VOCs, a control efficiency of 80% can be applied when applying liquid manure to land from a holding/storage pond after a covered lagoon.

3) <u>Irrigation of crops using liquid/slurry manure from the secondary lagoon/holding/storage pond where preceded by an uncovered anaerobic treatment lagoon designed to meet Natural Resources Conservation Service (NRCS) standards</u>

This practice would only allow the irrigation of liquid manure to cropland from the secondary lagoon after going through a treatment phase in an anaerobic treatment lagoon, or the primary lagoon.

An anaerobic treatment lagoon is a waste treatment lagoon that is designed to facilitate the decomposition of manure by microbes in the absence of oxygen. The process of anaerobic decomposition results in the preferential conversion of organic compounds in the wastewater into methane (CH_4), carbon dioxide (CO_2), and water rather than intermediate metabolites (VOCs).

The National Resource Conservation Service (NRCS) California Field Office Technical Guide Code 359 - Waste Treatment Lagoon specifies the following criteria for the design of anaerobic treatment lagoons:

- Required volume: The minimum design volume should account for all potential sludge, treatment, precipitation, and runoff volumes.

- Treatment period: retention time of the material in the lagoon shall be the time required to provide environmentally safe utilization of waste. The minimum hydraulic retention time for a covered lagoon in the San Joaquin Valley is about 38 days.

- Waste loading: shall be based on the maximum daily loading considering all waste sources that will be treated by the lagoon. The loading rate is typically based on volatile solids (VS) loading per unit of volume. The suggested loading rate for the San Joaquin Valley is 6.5-11 lb-VS/1000 ft^3/day depending on separation and type of system.

- The operating depth of the lagoon shall be 12 feet or greater. Maximizing the depth of the lagoon minimizes the surface area, which in turn minimizes the cover size and cost. Increasing the lagoon depth has the following advantages:

    - Minimizes surface area in contact with the atmosphere, thus reducing surface available to convection, evaporation
    - Smaller surface areas provide a more favorable and stable environment for methane bacteria
    - Better mixing of lagoon due to rising gas bubbles
    - Requires less land
    - More efficient for mechanical mixing

The lagoon design shall also consider location, soils and foundation, erosion, and depth to groundwater as required by the regional water control board.

The NRCS guideline suggests that this system consist of two cells, a treatment lagoon (primary lagoon) and a storage pond (secondary lagoon). The first stage of the lagoon system is the biological treatment stage and is designed with a constant liquid level to stabilize the anaerobic digestion. The effluent from the first stage overflows into a second lagoon designed for liquid storage capacity. Effluent from the second lagoon is used in the flush lanes and for the irrigation of cropland. The secondary (overflow) lagoon acts as the storage pond, which can be emptied when necessary.

A properly designed anaerobic treatment lagoon will reduce the Volatile Solids (VS) by at least 50% and will reduce the biological oxygen demand (BOD), which will result in greater efficiency in degrading compounds that contain carbon into methane and carbon dioxide rather than VOCs. Since 50% of the Volatile Solids in the liquid manure will have been removed or digested in the lagoon, there will be less Volatile Solids remaining in the effluent to decompose into VOCs. Although, the Volatile Solids reduction will be at least 50%, to be conservative a 40% control will be applied to irrigation from a storage pond after an anaerobic treatment lagoon.

4) Irrigation of crops using liquid/slurry manure from the primary lagoon and/or secondary lagoon

Currently, this is the practice for many existing dairies, especially dairies that only have one lagoon at their facility. However, some dairies with multiple lagoons still flush their cropland with liquid manure from either of their lagoons including the primary lagoon.

Control efficiency is unknown at this time and is expected to depend on treatment volume in the lagoon and residence time (digestion time) prior to application, as well as overall loading rate (dilution). However, control efficiency may be much lower from this system than a two-stage anaerobic treatment lagoon system.

5) Land application of lagoon water such that there is no standing water

During land application, minimize or eliminate standing water in an irrigated field within 24 hours, which reduces the potential to volatilize into the atmosphere and/or emit due to anaerobic conditions.

Control efficiency is unknown at this time and additional study will be required. While emission rates are not well known for land application practices, new data may be available soon from on-going research in California. In the absence of emission rates, emission reductions could potentially be assumed to occur where practices are used that decrease the time, temperature or area of water surface from which VOCs could be emitted.

6) Injection of liquid and slurry manure

Liquid and slurry manure is used to irrigate crops on land farmed by dairies. Manure can either be injected into the soil or left on the surface of the soil and allowed to soak in. Because the liquid and slurry manure is high in Nitrogen, Phosphorus, and Potassium (N-P-K), it supplies nutrients needed by crops. Dairies have nutrient management programs to regulate the amount of liquid and slurry manure applied to cropland. This program is used to balance the specific nutrients applied to the crops, such as nitrogen, with the amount of nutrients that the crops can utilize. Balancing the needs of the crop with what is supplied helps to minimize contamination of ground water. During the process of liquid and slurry manure application to the crops, VOC and NH_3 are emitted. Injecting manure hinders volatilization and speeds the uptake of nutrients that would degrade into gaseous pollutants. It is estimated that injection of manure will reduce VOC emissions from land application of manure by 50%.

The manure can only be injected during the time when the crop is not fully mature. This is because a tractor must be used to pull a cultivator with the liquid and slurry manure shanks. Once the crop is planted and grown to a certain height, it is no longer feasible for the tractor to get into the field due to the potential of damaging the crop. Ron Prong of Till-Tech Systems [(519) 775-2575] states that his company's liquid and slurry manure injection system can be used up to four weeks after planting of the crops without causing damage. Therefore, injection of slurry manure can only be required until the crops become so tall that damage will occur.

b. Eliminate technologically infeasible options

Injection of Liquid and Slurry Manure

The Dairy Permitting Advisory Group (DPAG) found that injection of flushed manure was not be a feasible BACT option in their report of BACT options for dairies in the San Joaquin Valley.[17]

Injection is typically restricted to slurry manure that has been vacuumed from the cow housing or that has been removed from settling basins and/or weeping walls. Injection of flushed liquid manure from the lagoons is not considered feasible because the additional water from flushing increases the amount of liquid that must be transported by the trucks or honeywagons, which will generate more emissions. Because of the added time and expense, injection is not used for flushed liquid manure; therefore, this option will be removed from consideration at this time.

c. Rank remaining options by control effectiveness

1) Irrigation of crops using liquid/slurry manure from an aerobic treatment lagoon or mechanically aerated lagoon (95% VOC control efficiency)
2) Irrigation of crops using liquid/slurry manure from a holding/storage pond after being treated in a covered lagoon/digester (80% VOC control efficiency)
3) Irrigation of crops using liquid/slurry manure from the secondary lagoon/holding/storage pond where preceded by an uncovered anaerobic treatment lagoon designed to meet Natural Resources Conservation Service (NRCS) standards (40% VOC control efficiency)
4) Irrigation of crops using liquid/slurry manure from the primary lagoon and/or secondary lagoon
5) Land application of lagoon water such that there is no standing water

[17] Page 150 of the Final DPAG Report - "Recommendations to the San Joaquin Valley Air Pollution Control Officer Regarding Best Available Control Technology for Dairies in the San Joaquin Valley" January 31, 2006 (http://www.valleyair.org/busind/pto/dpag/dpag_idx.htm)

d. Cost Effectiveness Analysis

1) Irrigation of crops using liquid/slurry manure from an aerobic treatment lagoon or mechanically aerated lagoon

This control can be used to control VOC emissions from the lagoons/storage ponds as well as from liquid manure land application because liquid manure applied to land will come from the lagoons/storage ponds. Since BACT for this project is triggered from both the lagoons/storage ponds and from liquid manure land application, the following cost effectiveness analysis will look at VOC emissions reductions achieved from this control technology for both lagoons/storage ponds and liquid manure land application.

The following analysis is based on the treatment of manure from 5,378 milk cows in naturally aerobic lagoons and mechanically aerated lagoons.

Space Requirement for a Naturally Aerobic Lagoon Treating Manure from 5,378 Dairy Cows

NRCS Practice Standard Code 359 requires that naturally aerobic lagoons be designed to have a minimum treatment surface area as determined on the basis of daily BOD_5 loading per unit of lagoon surface. The standard specifies that the maximum loading rate of naturally aerobic lagoons shall not exceed the loading rate indicated by the NRCS Agricultural Waste Management Field Handbook (AWMFH) or the maximum loading rate according to state regulatory requirements, whichever is more stringent. According to Figure 10-30 (August 2009) of the latest version of the AWMFH, the maximum aerobic lagoon loading rate for the San Joaquin Valley is 45 - 55 lb-BOD_5/acre-day. According to Table 4-5 (March 2008) of the NRCS AWMFH, the total daily manure produced by a milk cow will have 2.9 lb-BOD_5/day. Assuming that 80% of the manure will be flushed to the lagoon system, the minimum lagoon surface area required for a naturally aerobic lagoon treating manure from 5,378 milk cows in the San Joaquin Valley can be calculated as follows:

BOD_5 loading (lb/day) = 5,378 milk cows x 2.9 lb-BOD_5/cow-day x 0.80
= 12,477 lb-BOD_5/day

Minimum Surface Area (acres) in areas of the San Joaquin Valley with a maximum loading rate of 55 lb-BOD_5/acre-day =
12,477 lb-BOD_5/day ÷ 55 lb-BOD_5/acre-day = 227 acres

Minimum Surface Area (acres) in areas of the San Joaquin Valley with a maximum loading rate of 45 lb-BOD_5/acre-day =
12,477 lb-BOD_5/day ÷ 45 lb-BOD_5/acre-day = 277 acres

As shown above the minimum surface area required for a naturally aerobic lagoon treating manure from 5,378 milk cows in the San Joaquin Valley would range from approximately 227 to 277 acres. This does not include the additional surface area that would be required to treat manure from dry cows or support stock onsite. Based on the space requirements alone it is clear that this option cannot reasonably be required and no further analysis is needed.

Analysis for a Mechanically Aerated Lagoon Treating Manure from 5,378 Dairy Cows

As discussed above, the very large space requirements for naturally aerobic lagoons cause this option to be infeasible for most confined animal facilities. Mechanically aerating a lagoon can achieve some of the benefits of a naturally aerobic lagoon without the large space requirements. However, the costs of energy for complete aeration have also caused this option to be infeasible. The amount of energy required for aeration is based on the amount of volatile solids excreted by animals that must be treated; thus, this cost will be directly proportional to the number of animals at a site. The following analysis will determine the cost of emission reductions that can be achieved from a mechanically aerated lagoon treating manure from 5,378 milk cows.

Biological Oxygen Demand (BOD_5)

In order to effectively calculate the costs of this control option, the energy requirement for complete aeration must be determined. It should be noted that approximately 1.5 to 2.5 pounds of oxygen is required to digest 1 pound of Biological Oxygen Demand (BOD_5) with additional oxygen required for conversion of ammonia to nitrate (nitrification). It is generally accepted that at least twice the BOD should be provided for complete aeration. According to Dr. Ruihong Zhang of the University of California, Davis, 2.4 lbs (1.1 kg) of oxygen (O2) per cow must be provided each day for removal of BOD and an additional 3 lbs (1.4 kg) per cow for oxidation of 70% of the nitrogen. 22

The proposed rule specifies that an aerobic lagoon be designed and operated in accordance with NRCS Practice Standard Code 359. NRCS Practice Standard Code 359 requires that mechanically aerated lagoons use aeration equipment that provides a minimum of one pound of oxygen for each pound of daily BOD_5 loading. As discussed above, the total daily manure produced by a milk cow will have a BOD_5 of 2.9 lb/day and a lagoon handling flushed manure from 5,378 milk cows will have a loading rate of approximately 12,477 lb-BOD_5/day (5,660 kg-BOD_5/day).

Energy Requirement a Mechanically Aerated Lagoon Treating Manure from 5,378 Milk cows:

Based on the data gathered in a UC Davis study on aerator performance for wastewater lagoons, aeration efficiencies for mechanical aerators ranged from 0.10 to 0.68 kg of oxygen provided per kW-hr of energy utilized. The most efficient aerator tested that had been installed in dairy lagoons had an aeration efficiency of 0.49 kg-O2/kW-hr. These efficiency tests were performed in clean water and lower aeration efficiencies are expected in liquid manure because of the significant amount of solids that it contains. The yearly energy requirement mechanically aerated lagoon treating flushed manure from 5,378 milk cows is calculated as follows:

High Efficiency Aerator
5,660 kg-BOD_5/day ÷ (0.68 kg-O2/kW-hr) x (365 day/year) = 3,038,088 kW-hr/year

Low Efficiency Aerator
5,660 kg-BOD_5/day ÷ (0.10 kg-O2/kW-hr) x (365 day/year) = 20,659,000 kW-hr/year

Cost of Electricity for a Mechanically Aerated Lagoon Treating Manure from 5,378 Milk cows:

The cost for electricity will be based upon the average price for industrial electricity in California as of September 2013, as taken from the Energy Information Administration (EIA) Website:
(http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_06_b)

Average Cost for electricity = $0.1115/kW-hr

The electricity costs for complete aeration are calculated as follows:

Low Cost Estimate (High Efficiency Aerator)
3,038,088 kW-hr/year x $0.1115/kW-hr = $338,747/year

High Cost Estimate (Low Efficiency Aerator)
20,659,000 kW-hr/year x $0.1115/kW-hr = $2,303,479/year

VOC Emission Reductions from a Mechanically Aerated Lagoon Treating Manure from 5,378 Milk Cows That Will Also Be Applied to Land:

It will be conservatively assumed that a mechanically aerated lagoon providing 1 lb of oxygen for every 1 lb of BOD_5 loading will control 90% of the VOC emissions from the lagoon/storage pond. However, as noted above, it is generally accepted that the oxygen provided should be twice the BOD_5 loading rate for complete aeration; therefore, the actual control from providing 1 lb of oxygen for every 1 lb of BOD_5 loading is probably closer to 50%.

The annual VOC Emission Reductions for mechanically aerated lagoon(s) treating the manure from 5,378 Jersey milk cows are calculated as follows and shown in the table below:

[Number of cows] x [Lagoon/Storage Pond VOC EF (lb/cow-year)] x [Complete Aeration Control Efficiency for Lagoon/Storage Pond]

VOC Reductions for a Mechanically Aerated Lagoon – Lagoon/Storage Ponds							
Type of Animal	**# of cows**	**x**	**Lagoon EF (lb/cow-yr)**	**x**	**Control (%)**	**=**	**lb-VOC/yr**
Milk Cow (freestall)	5,378	x	0.92	x	90%	=	**4,453**

The annual VOC Emission Reductions for a mechanically aerated lagoon treating land applied manure from 5,378 Jersey milk cows are calculated as follows and shown in the table below:

[Number of cows] x [Liquid Manure Land Application VOC EF (lb/cow-year)] x [Complete Aeration Control Efficiency for Lagoon/Storage Pond]

VOC Reductions for a Mechanically Aerated Lagoon – Land Application							
Type of Animal	**# of cows**	**x**	**Liquid Manure Land Application EF (lb/cow-yr)**	**x**	**Control (%)**	**=**	**lb-VOC/yr**
Milk Cow (freestall)	5,378	x	0.99	x	90%	=	**4,792**

<u>Total VOC Emissions Reductions</u>
Total VOC Reduced = 4,453 lb-VOC/yr + 4,792 lb-VOC/yr
= 9,245 lb-VOC/yr

<u>Cost of VOC Emission Reductions</u>
Low Estimate = ($338,747/year)/[(9,245 lb-VOC/year)(1 ton/2000 lb)]
= $73,282/ton of VOC reduced

High Estimate = ($2,303,479/year)/[(9,245 lb-VOC/year)(1 ton/2000 lb)]
= $498,319/ton of VOC reduced

As shown above, the electricity cost alone for a mechanically aerated lagoon would cause the cost of the VOC reductions to be greater than $73,282/ton. This cost does not include the additional electricity cost for nitrification that would naturally occur as the lagoons were aerated or equipment costs. Additionally, this does not include the costs incurred from handling any of the support stock at the facility. Even without these costs, this control technology would not be cost effective.

2) Irrigation of crops using liquid/slurry manure from a holding/storage pond after being treated in a covered lagoon/digester

This control can be used to control VOC emissions from the lagoons/storage ponds as well as from liquid manure land application because liquid manure applied to land will come from the lagoons/storage ponds. Since BACT for this project is triggered from both the lagoons/storage ponds and from liquid manure land application, the following cost effectiveness analysis will look at VOC emissions reductions achieved from this control technology for both lagoons/storage ponds and liquid manure land application.

The costs associated with treating the manure excreted by milk cows in a covered lagoon digester vented to a control device are analyzed below. Because it may be possible to generate power from the system to offset some of the costs associated with installation, this potential benefit is included in the analysis below. The following analysis is based on the treatment of manure from 5,378 milk cows in a covered lagoon anaerobic digester with power generation.

Capital Cost for Installation of a Covered Lagoon Digester for Dairy Cows

The capital cost estimates for installation of a covered lagoon digester are based on information from the United States EPA AgSTAR publication "Anaerobic Digestion Capital Costs for Dairy Farms" (May 2010)[18] and the California Energy Commission (CEC) Public Interest Energy Research (PIER) Program Dairy Methane Digester System Program Evaluation Report (Feb 2009)[19]. The formula in the AgSTAR publication results in a capitol cost of $1,032 per cow for a covered lagoon anaerobic digester treating manure from 1,000 cows. This estimate excludes costs of solids separation after digestion, hydrogen sulfide removal, and utility charges including line upgrades and interconnection costs and fees. Based on information from installations in California, the CEC PIER Dairy Methane Digester Program Evaluation Report gives an average cost of $585 per cow for installation of covered lagoon anaerobic digesters (see Table 9 - Total Project Costs and Cost per Cow and per kW). Therefore, for purposes of this analysis the capital cost for installation of a covered lagoon digester system for 5,378 cows will be assumed to be between $585/cow and $1,032/cow. The capital cost

[18] "Anaerobic Digestion Capital Costs for Dairy Farms" (May 2010), EPA AgSTAR http://www.epa.gov/agstar/pdf/digester_cost_fs.pdf

[19] "Dairy Power Production Program – Dairy Methane System Program Evaluation Report" (February 2009). Western United Resource Development, Inc prepared for the California Energy Commission (CEC) Public Interest Energy Research Program. (CEC-500-2009-009) http://www.energy.ca.gov/2009publications/CEC-500-2009-009/CEC-500-2009-009.PDF

estimates of a covered lagoon digester treating the manure of 5,378 milk cows is calculated as follows:

Low capital cost estimate: \$585/cow x 5,378 cows = \$2,689,000
High capital cost estimate: \$1,032/cow x 5,378 cows = \$5,550,096

The annualized capital cost estimates will be calculated below. The capital cost for the installation of the covered lagoon digester will be spread over the expected life of the system using the capital recovery equation. The expected life of the entire system will be estimated at 10 years though the cover may require replacement during this period. A 10% interest rate is assumed in the equation and the assumption will be made that the equipment has no salvage value at the end of the ten-year cycle.

$A = [P \times I(I+1)^n]/[(I+1)^n-1]$

Low Annual Capital Cost Estimate = $[\$2,689,000 \times 0.1(1.1)^{10}]/[(1.1)^{10}-1]$
= \$437,622/year

High Annual Capital Cost Estimate = $[\$5,550,096 \times 0.1(1.1)^{10}]/[(1.1)^{10}-1]$
= \$903,252/year

Potential Production of Electricity from a Covered Lagoon Digester Treating Manure from 5,378 Milk Cows:

It may be possible to offset some of the installation costs of a covered lagoon anaerobic digester with revenue from generation of electricity. Based on the information given in the CEC PIER Dairy Methane Digester Program Evaluation Report, Table 7 – Actual Generation per Cow Comparisons, California dairies that used a covered lagoon digester to produce electricity generated between 429.1 and 1,031.8 kW-hr/yr per lactating cow with an overall per facility average generation rate of 670.3 kW-hr/yr per lactating cow. This average annual generation rate is actually higher than all the facilities included in the average except one that had a very high generation rate. In addition, this average may overestimate the per-cow generation potential because the contributions of support stock to the digesters were not accounted for. However, for more conservative calculations, this average will be used to calculate the potential annual savings in electricity costs. The potential production of electricity from a covered lagoon digester treating manure from 5,378 milk cows is calculated as follows:

Electrical Production: 670.3 kW-hr/(milk cow-yr) x 5,378 milk cows = 3,604,873 kW-hr/yr

Potential Cost Savings from Production of Electricity from a Covered Lagoon Digester Treating Manure from 5,378 Milk Cows:

Based on the reference given above, the value of electricity used for this analysis will be = $0.1115/kW-hr

The potential annual cost savings from electricity generation from a covered lagoon digester treating manure from 5,378 milk cows is calculated as follows:

Potential Annual Cost Savings from Electrical Production:
3,604,873 kW-hr/yr x $0.1115/kW-hr = $401,943/yr

Annualized Capital Cost for a Covered Lagoon Digester Treating Manure from 5,378 Milk Cows minus Potential Savings from Generation of Electricity:

Low Annual Capital Cost Estimate minus Savings from Potential Generation = $437,622/yr - $401,943/yr = $35,679/year

High Annual Capital Cost Estimate minus Savings from Potential Generation = $903,252/yr - $401,943/yr = $501,309/year

VOC Emission Reductions from a Covered Lagoon Anaerobic Digester Treating Manure from 5,378 Milk Cows That Will Also Be Applied to Land:

The annual VOC Emission Reductions for covered lagoon anaerobic digester treating the manure from 5,378 Jersey milk cows are calculated as follows and shown in the table below:

[Number of cows] x [Lagoon/Storage Pond VOC EF (lb/cow-year)] x [Covered Lagoon Digester Control Efficiency for Lagoon/Storage Pond]

VOC Reductions for a Covered Lagoon Vented to Control Device – Lagoon/Storage Ponds							
Type of Cow	**# of cows**	**x**	**Lagoon EF (lb/cow-yr)**	**x**	**Control (%)**	**=**	**lb-VOC/yr**
Milk Cow (freestall)	5,378	x	0.92	x	80%	=	**3,958**

The annual VOC Emission Reductions for a covered lagoon anaerobic digester treating land applied manure from 5,378 Jersey milk cows are calculated as follows and shown in the table below:

[Number of cows] x [Liquid Manure Land Application VOC EF (lb/cow-year)] x [Covered Lagoon Digester Control Efficiency for Lagoon/Storage Pond]

VOC Reductions for a Covered Lagoon Vented to Control Device – Land Application							
Type of Animal	**# of cows**	**x**	**Liquid Manure Land Application EF (lb/cow-yr)**	**x**	**Control (%)**	**=**	**lb-VOC/yr**
Milk Cow (freestall)	5,378	x	0.99	x	80%	=	**4,259**

<u>Total VOC Emissions Reductions</u>
Total VOC Reduced = 3,958 lb-VOC/yr + 4,259 lb-VOC/yr
= 8,217 lb-VOC/yr

<u>Cost of VOC Emission Reductions</u>
Low Estimate = ($35,679/year)/[(8,217 lb-VOC/year)(1 ton/2000 lb)]
= $8,684/ton of VOC reduced

High Estimate = ($501,309/year)/[(8,217 lb-VOC/year)(1 ton/2000 lb)]
= $122,017/ton of VOC reduced

As shown above, the capital cost alone for a covered lagoon digester for a dairy would cause the cost of the VOC reductions to be greater than $8,684/ton. This is a conservatively low estimate, with a high end estimate of upwards of $122,017/ton. This cost includes the potential revenue generated by electrical production but does not include the additional maintenance required for the system. Additionally, this analysis did not consider the additional pollution that would be generated by any combustion equipment that would utilize the gas, which may offset any reductions in VOCs. Finally, this analysis did not include additional VOC reductions required by District Rule 4570 mitigation measures, resulting in a lower VOC emission factor and fewer emissions reductions achieved from this control technology. Therefore, this control technology would not be cost effective.

3) <u>Irrigation of crops using liquid/slurry manure from the secondary lagoon/holding/storage pond where preceded by an uncovered anaerobic treatment lagoon designed to meet Natural Resources Conservation Service (NRCS) standards</u>

The applicant has proposed this option; therefore a cost effectiveness analysis is not required.

4) Irrigation of crops using liquid/slurry manure from the primary lagoon and/or secondary lagoon

The applicant has proposed a more effective control technology listed above; therefore a cost effectiveness analysis is not required.

5) Land application of lagoon water such that there is no standing water

The applicant has proposed a more effective control technology listed above; therefore a cost effectiveness analysis is not required.

e. Select BACT

The facility is proposing irrigation of crops using liquid manure from the secondary lagoon/holding/storage pond where preceded by an uncovered anaerobic treatment lagoon designed to meet Natural Resources Conservation Service (NRCS) standards.

Additionally, District Rule 2201 defines BACT as including the most stringent emission limitation or control technique, including process and equipment changes; that has been found by the APCO to be cost effective and technologically feasible for such class or category of sources or for a specific source. The District has found that the mitigation measures required by District Rule 4570 are cost effective and technologically feasible for confined animal facilities and the applicant has proposed these options. Therefore, in addition to the BACT requirements determined in the Top-Down BACT Analysis above, implementation of the mitigation measures that the applicant has selected to comply with Rule 4570 will also be required as part of BACT for VOC emissions from liquid manure land application.

2. BACT for NH3 Emissions from the Liquid/Slurry Manure Land Application

a. Identify all control technologies

A cost effectiveness threshold has not been established for ammonia. Therefore, although there is ongoing research for multiple ammonia control technologies, only options that meet the District's definition of Achieved-in-Practice controls will be considered for ammonia at this time.

The following practice has been identified as a possible control option for NH3 emissions from the lagoon and storage pond(s). No other control technologies that meet the definition of Achieved-in-Practice have been identified for the lagoon or storage pond(s).

1) Animals fed in accordance with National Research Council (NRC) or other District-approved Guidelines

   Nutritional management of dairy feed is routinely practiced to improve milk production and herd health. The potential for ammonia emissions can be reduced by reducing the amount of undigested nitrogen compounds in the manure. The level of microbial action in the manure corresponds to the level of organic nitrogen content in the manure; the lower the level of nitrogen the lower the level of microbial action and the lower the production of ammonia and VOCs.

   A diet that is formulated to feed proper amounts of ruminantly degradable protein will result in improved nitrogen utilization by the animal and corresponding reduction in urea and organic nitrogen content of the manure, which will reduce the production of VOCs and ammonia. The latest National Research Council (NRC) guidelines for the selection of an optimal bovine diet should be followed to the maximum extent possible. The diet recommendations made in this publication seek to achieve the maximum uptake of protein by the animal and the minimum carryover of nitrogen into the manure, which will reduce ammonia emissions from liquid manure applied to cropland.

b. Eliminate technologically infeasible options

There are no technologically infeasible options to eliminate from step 1.

c. Rank remaining options by control effectiveness

All options are ranked according to their control efficiency.

1) Animals fed in accordance with National Research Council (NRC) or other District-approved Guidelines

d. Cost Effectiveness Analysis

The applicant has proposed the only option listed; therefore a cost effectiveness analysis is not required.

e. Select BACT

The facility is proposing to feed all animals in accordance with National Research Council (NRC) or other District-approved guidelines utilizing routine nutritional analysis for rations, which satisfies the BACT requirements.

Additionally, District Rule 2201 defines BACT as including the most stringent emission limitation or control technique, including process and equipment changes, that has been found by the APCO to be cost effective and technologically feasible for such class or category of sources or for a specific source. The District has found that the mitigation measures required by District Rule 4570 are technologically feasible for confined animal facilities and the applicant has proposed these options. Although District Rule 4570 is only intended to reduce VOC emissions, many of these measures also reduce ammonia emissions. Therefore, in addition to the BACT requirements determined in the Top-Down BACT Analysis above, implementation of the mitigation measures that the applicant has selected to comply with Rule 4570 will also be required as part of BACT for NH3 emissions from liquid manure land application.

BACT Analysis for Solid Manure Land Application

1. BACT for VOC Emissions from Solid Manure Land Application

a. Identify all control technologies

1) Rapid incorporation of solid manure into the soil after land application

Various types of spreading techniques, such as box spreaders, flail type spreaders, side discharge spreaders, and spinner spreaders, are used to apply solid manure to cropland. Regardless of which technique is used, this practice requires the immediate incorporation of the manure into the soil, reducing emissions and surface run-off while minimizing the loss of nitrogen into the atmosphere. Based on a study by a local Valley dairy, there is a great potential of reducing emissions by incorporating slurry manure rapidly into the soil. A similar reduction may be obtained by the rapid incorporation of solid manure. This technology is expected to yield a VOC control efficiency of up to 58%.[24]

2) Land Application of Solid Manure Processed by an Open Negatively-Aerated Static Piles (ASP) (With Thick Layer of Bulking Agent or Equivalent)

Aerated static piles are piles that are aerated directly with forced or drawn air systems to speed up the compost process. The aerated static pile is constructed to allow forced airflow (low pressure-high volume blowers and a piping system) so that the oxygen supply can be more accurately controlled. The material is piled over perforated pipes connected to a blower to withdraw air from the pile. The result is improved control of aerobic degradation or decomposition of organic waste and biomass bulking agents. This is considered a more efficient composting method than the industry standard of windrow composting.

VOC emissions primarily occur during the active and curing phases of the composting. To ensure consistent temperatures and prevent escape of odors and VOCs, the piles should be covered with a thick layer (12 to 18 inches) of finished compost or bulking agent.

With positive pressure aeration, contaminated air is pushed through the pile to the outer surface; therefore, making it difficult to be collected for odor treatment. However, positive pressure aeration is more effective at cooling the pile because it provides better airflow.

With negative aeration, air is pulled through the pile from the outer surface.

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24 Page 87 of "Recommendations to the San Joaquin Valley Air Pollution Control Officer Regarding Best Available Control Technology for Dairies in the San Joaquin Valley" January 31, 2006 (http://www.valleyair.org/busind/pto/dpag/dpag_idx.htm).

Contaminated air is collected in the aeration pipes and can be directed to an odor treatment system. To avoid clogging, condensed moist air drawn from the pile must be removed before reaching the blower. Negative aeration might create uneven drying of the pile due to its airflow patterns.

A study conducted by City of Columbus, Ohio, demonstrated that the weighted-average odor emissions from an outdoor negative aeration pile is approximately 67% lower than those from an outdoor positive aeration pile. Negative aeration is usually used during the beginning of the composting process to greatly reduce odors. In enclosed active composting area, negative pressure aeration also reduces moisture released into the building, and thus, reduces fogging. Positive aeration is used mostly near the end of the composting cycle for more efficient drying of the compost.[25]

An odor and emissions study done at the City of Philadelphia biosolids co-composting facility by the Department of Water[26] also concluded that controlling the temperature by controlling the oxygen availability using negative aeration composting is expected to result in lower emissions than those from open windrow composting.

The control efficiency can be estimated from the Technology Assessment for SCAQMD Proposed Rule 1133 Table 3-2 which uses a capture efficiency of 25 to 33% from an open ASP and multiplies it by a conservative 80% control equipment efficiency. The average control efficiency for open aerated static piles based on the Technology Assessment is 23.2%. Additional emission reduction potential from open ASPs cannot be quantified at this time. Therefore, a conservative control efficiency of 23.2% will be applied to the ASP.

No control is expected from the land application of the manure since the manure is not being injected or incorporated into the soil. However, since the manure has gone through a pre-control system, the control efficiency of that system would carry over to land application

3) <u>Land Application of Solid Manure Processed by an Open Negatively-Aerated Static Piles (ASP) (With Thick Layer of Bulking Agent or Equivalent) Vented to a Biofilter (or Equivalent)</u>

This technology is the same as that described above for negatively aerated static piles except that the exhaust gases are vented to a biofilter. As discussed above negative aeration appears to be more efficient in reducing odors and emissions than positive aeration.

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[25] Technology Assessment for SCAQMD proposed Rule 1133 Table 3-2

[26] Conclusion # 2, "Measurement and Control of Odor and VOC emissions from the largest municipal aerated-static pile biosolids composting facility in the United States". William Toffey, Philadelphia Water Department; Lawrence Hentz, Post, Buckley, Shuh and Jerigan.

Biofiltration is an air pollution control technology that uses a solid media to absorb and adsorb compounds in the air stream and retains them for subsequent biological oxidation. A biofilter consists of a series of perforated pipes laid in a bed of gravel and covered with an organic media. As the air stream flows up through the media, the odorous compounds are removed by a combination of physical, chemical and biological processes. However, depending upon the airflow from the composting material and the design and material selection for the biofilter, the organic matter could quickly deteriorate.

In the biofiltration process, live bacteria biodegrade organic contaminants from air into carbon dioxide and water. Bacterial cultures (microorganisms that typically consist of several species coexisting in a colony) that use oxygen to biodegrade organics are called aerobic cultures. These bacteria are found in soil, peat, compost and natural water bodies including ponds, lakes, rivers and oceans. They are environmentally friendly and non-harmful to humans unless ingested. Chemically, the biodegradation reaction for aerobic cultures is written as:

Organic(s) + Oxygen + Nutrients + Microorganisms => CO_2 + H_2O + Microorganisms

The organic(s) are air contaminants, the oxygen is in air, the nutrients are nitrogen and phosphorus mineral salts needed for microbial growth and the microorganisms are live bacteria on the biofilter media.

Biofiltration is a well-established emission and control technology in Europe where over two hundred biofilters were in use as of 1984 and even more are expected today. In the United States, biofilters have been mainly utilized for the treatment of odors as well as VOCs in wastewater treatment plants. Based on the information collected by SCAQMD, existing biofilter composting applications have achieved control efficiencies of about 80% to 90% for VOC and 70% to over 90% for ammonia (one of this composting applications reported an initial control efficiency of 65 percent for VOC but was later improved to achieve an 80 percent control efficiency). This specific field example along with other available data presented in SCAQMD's Technology Assessment Report demonstrates that a well-designed, well-operated, and well-maintained biofilter is capable of achieving 80% control efficiency for VOC and ammonia.[27]

No control is expected from the land application of the manure since the manure is not being injected or incorporated into the soil. However, since the manure has gone through an ASP vented to biofilter, the 80% control efficiency of that system would carry over to land application.

[27] SCAQMD Final Staff Report for Rule 1133, page 18

4) Land Application of Solid Manure Processed by an Enclosed Aerated Static Piles (AgBag, Gore Cover, or Equivalent)

An enclosed aerated static pile uses the same forced aeration principle of an open ASP, except that the entire pile is fully enclosed, either inside a building or with a tarp around it.

There are a few companies that are promoting this type of system. In this analysis, the following two companies will be discussed: AgBag International Ltd and the Gore Cover. Both technologies are briefly described below:

AgBag International Ltd.

The AgBag system was developed by Compost Technology International and is based in Oregon. The system has controlled aeration capabilities and has minimal space requirements. It is suited for small to mid-size composting. The system is comprised of the following components:

- Large sealed bags (pods) of adjustable length up to 200 ft, either 5 ft or 10 ft diameter
- 9 mm recyclable plastic (not re-usable)
- Adjustable aeration system with inserted valved vents
- Hopper, mixer & compost compactor

The Ag-Bag Environmental system provides a cycle time of as little as 8 weeks. Curing adds another 30 to 60 days. AgBag states that three annual composting cycles could be obtained. The area needed to compost is determined by the volume of waste material.

Mixing – A composite mix of materials needs to be balanced for proper carbon to nitrogen (C:N) ratio. This means a mix of greens (nitrogen sources) to browns (carbon sources). The best ratio that AgBag recommends is between 20 to 40:1, with 30:1 being ideal.

The oxygen supply is replenished by forced aeration. This eliminates the labor-intensive need to turn piles. Temperature monitors indicate when the airflow needs adjusting to maintain proper temperatures. Moisture is adjusted at time of filling or added to the total mixture upon blending. The compost matrix is sufficient in size to maintain heat, even in cold climates. The system contains vents throughout to allow air to escape. These vents are controlled by the operator. Ag-Bag is considered an in-vessel system.

After 8-12 weeks of composting, the compost cycle is completed. The "Pod", as AgBag likes to call it, is opened and the material is static piled for 30-60 days to cure or mature.

A representative of AgBag has claimed very high control efficiencies for both VOCs and ammonia and has claimed that the system acts as its own biofilter, thus reducing emissions. However, VOC and ammonia control efficiencies are not readily available at this time. Furthermore, AgBag has not provided any technical information to support their claimed level of control.

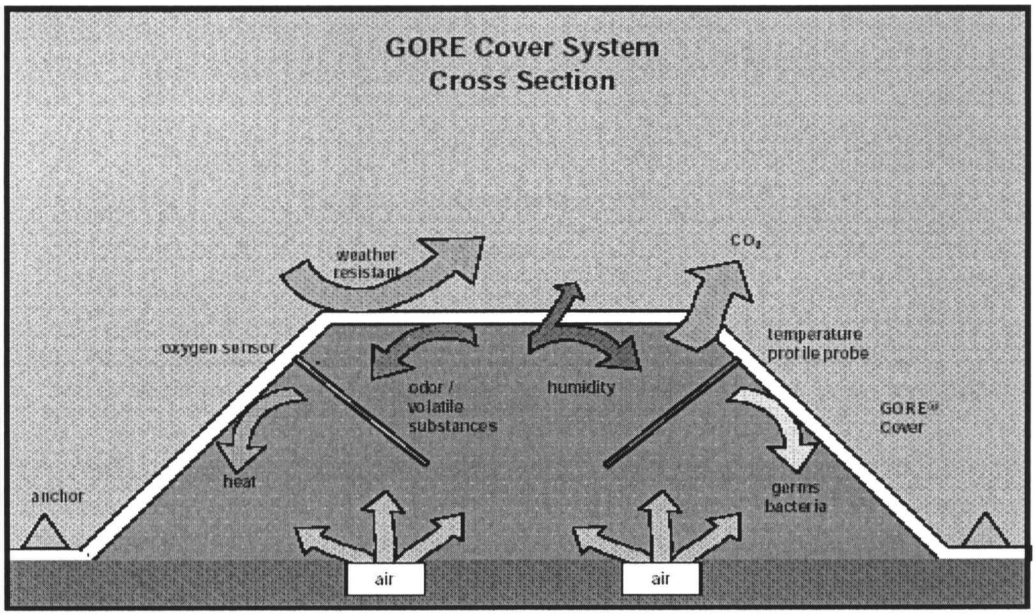
AgBag is working closely with SCAQMD and the Milk Producers Council to perform a pilot study to evaluate the efficiency of this technology. Until the study is completed, this technology will be conservatively assumed to control emissions by at least 10% more than open aerated static piles, with a minimum control efficiency of 33.2%. Once the study is completed, the District will be able to more accurately determine the control efficiency for this technology.

Gore Cover

The Gore Cover, manufactured by Gore Creative Technologies Worldwide, utilizes positive aeration and a specially designed cover to create an enclosed system that controls odors, microorganisms and creates a consistent product unaffected by outside environmental conditions. Medium pressure aerators connect to aeration pipes on the floor or aeration ducts in the floor. Stainless steel probes inserted into the pile monitor oxygen and temperature parameters. The data is relayed to and stored in a computer. This data controls the aerators to keep pile conditions consistent. The Gore Cover system can significantly reduce odors by the controlled use of a semi permeable membrane that is permeable to oxygen but impermeable to large molecules. The cover protects the pile from weather conditions, but allows release of CO_2. These controlled conditions allow consistent product to be produced without risk of damp pockets that may create anaerobic conditions and increased odors.

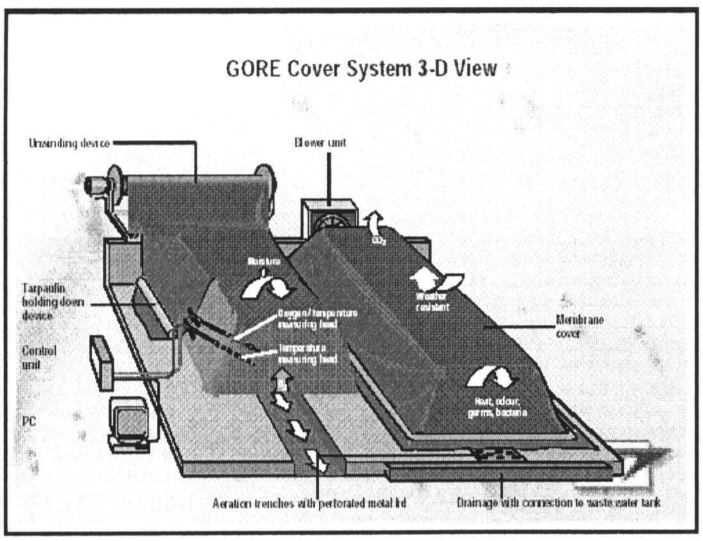
In addition to the membrane, which covers the organic material during composting, the system includes a concrete floor and wall, blowers for aeration, and a winder for efficient movement of the cover. The system also requires consistent management including preparation of materials to achieve a homogenous mixture with moisture content of 55-60% and monitoring of temperature and oxygen levels. With this system, the composting process takes eight weeks. The "heap" of organic material is covered by the membrane, which is secured to the ground, allowed to compost for four weeks, then moved and re-covered for two weeks for stabilization. During the final two weeks of curing, the heap is uncovered.

A fine film of condensation develops during the composting process that collects on the inside cover. According to the manufacturer, the moisture helps to dissolve the gases. The condensation then drips back onto the pile, where they can continue to be broken down by the composting process.



The system, according to Gore Cover, shortens the time required to produce finished, premium compost, as follows:

- First zone – Four weeks – Material stays on the initial placement zone in-vessel
- Second zone – Two weeks – Material moved to another in-vessel zone with minimizing addition of water. Water addition is nominal because the in-vessel system retains the initial moisture within the system and only releases minimal amounts.
- Third zone – Two weeks – the final move is to a third uncovered zone.
- Screening – Material will be screened then ready to sell within 15 days.



There is no control efficiency available at this time for enclosed aerated static piles. A study is under way by SQAQMD and the Milk Producers Council to determine the control efficiencies for VOC and ammonia emissions from enclosed aerated composting systems. Until the study is completed, this technology will be conservatively assumed to control emissions by 10% more than open aerated static piles, with a minimum control efficiency of 33.2% until additional data are available.

No control is expected from the land application of the manure since the manure is not being injected or incorporated into the soil. However, since the manure has gone through a pre-control system, the control efficiency of that system would carry over to land application

5) <u>Land Application of Solid Manure Processed by an In-Vessel/Enclosed (Building, AgBag, Gore Cover, or Equivalent) Negatively-Aerated Static Piles Vented to a Biofilter</u>

An in-vessel aerated static pile uses the same forced aeration principle of an open ASP, except that the entire pile is fully enclosed, either inside of a building or with a tarp around it. In addition to the in-vessel ASP, the biogas must be sent to a biofilter capable of reducing at least 80% emissions.

According to the SCAQMD Rule 1133.2 final staff report (page 18) "Technology Assessment Report states a well-designed, well operated, and well-maintained biofilter is capable of achieving 80% destruction efficiency for VOC and NH3." The overall control efficiency of this technology is equal to the combined control efficiencies of the enclosed aerated system (33.2% - calculated above in section 19) and the biofilter (80%), calculated as follows:

CE = (0.332) + (1-0.332)*0.8 = 86.6%

No control is expected from the land application of the manure since the manure is not being injected or incorporated into the soil. However, since the manure has gone through a pre-control system, the control efficiency of that system would carry over to land application.

6) <u>Land Application of Solid Manure Processed by Open Negatively-Aerated Static Piles (ASP) (With Thick Layer of Bulking Agent or Equivalent) With Rapid Incorporation of the Manure Into the Soil After Land Application</u>

This technology is the same as described in Option 3 above but with the added control of rapid incorporation of the manure into the soil.

As discussed in Option 1, the VOC control efficiency from immediate incorporation is up to 58%. The overall control efficiency of the combination of both practices is equal to the combined control efficiencies of the open aerated system (23%) and the control efficiency of immediate incorporation.

VOC Overall Control efficiency (0.23) + (1-0.23)*(58%) = 67.7%

7) Land Application of Solid Manure Processed by Either an Open or Enclosed Negatively-Aerated Static Pile (ASP) Vented to a Biofilter With Rapid Incorporation of the Manure Into the Soil After Land Application

This technology is the same as described in Options 4 and 6 above but with the added control of rapid incorporation of the manure into the soil.

As discussed in Option 1, the VOC control efficiency from immediate incorporation is up to 58%. The overall control efficiency of the combination of both practices is equal to the combined control efficiencies of the ASP and biofilter system (80%) and the control efficiency of immediate incorporation.

VOC Overall Control efficiency (0.80) + (1-0.80)*(58%) = 91.6%

b. Eliminate technologically infeasible options

There are no technologically infeasible options to eliminate in Step 1.

c. Rank remaining options by control effectiveness

1) Land Application of Solid Manure Processed by Either an Open or Enclosed Negatively-Aerated Static Pile (ASP) Vented to a Biofilter With Rapid Incorporation of the Manure Into the Soil After Land Application (91.6%)
2) Land Application of Solid Manure Processed by In-Vessel/Enclosed Negatively-Aerated Static Piles vented to biofilter ≥ 80% destruction efficiency for both active and curing phases (or a combination of controls) (≈86.6%)
3) Land Application of Solid Manure Processed by Open Negatively-Aerated Static Piles vented to biofilter ≥ 80% destruction efficiency for both active and curing phases (or a combination of controls) (≈80%)
4) Land Application of Solid Manure Processed by an Open Negatively-Aerated Static Piles (ASP) (With Thick Layer of Bulking Agent or Equivalent) With Rapid Incorporation of the Manure Into the Soil After Land Application (67.7%)
5) Rapid incorporation of solid manure into the soil after land application (58%)
6) Land Application of Solid Manure Processed by Enclosed Negatively-Aerated Static Pile (≈33.2%)
7) Land Application of Solid Manure Processed by Open Negatively-Aerated Static Pile (ASP) (≈23.2%)

d. Cost Effectiveness Analysis

1) Options 1, 2, and 3: Land Application of In-Vessel/Enclosed Negatively-Aerated Static Piles Vented to Biofilter or Open Negatively-Aerated Static Piles Vented to Biofilter (With Rapid Incorporation of the Manure Into the Soil After Land Application)

The following costs are taken from the final staff report for District Rule 4565 - Biosolids, Animal Manure, and Poultry Litter Operations (May 30, 2007).[28] The cost information is based on a large composting facility with a throughput of 200,000 wet tons per year. On a per ton basis the costs for smaller composting facilities would be higher since there would not be the economies of scale for building and operations created by large composting facilities.

Low Cost Scenario: ASP & Biofilter (200,000 wet ton/yr)	
Total Capital Cost	$7,775,000
Annualized capital cost (10% interest - 10 years)	$1,265,345
Total Annual O & M Cost	$124,305
Total Annualized Cost - ASP & Biofilter (Low-Estimate of Annual Costs) ($/yr/facility)	**$1,389,650**

High Cost Scenario: In-Vessel and RTO (200,000 wet ton/yr)	
Total Capital Cost	$21,185,000
Annualized capital cost (10% interest - 10 years)	$3,447,761
Total Annual O & M Cost	$285,910
Total Annualized Cost - In-Vessel & RTO (High-Estimate of Annual Costs) ($/yr/facility)	**$3,733,671**

The final staff report for District Rule 4565 stated that the use of ASPs and in-vessel composting would have unreasonably high costs for facilities that have a throughput of less than 100,000 wet tons per year. The costs given above are for a facility with a throughput of 200,000 wet tons per year. It will conservatively be assumed that the cost for a facility with a throughput of 100,000 wet tons per year will be half of the values given above. Therefore, the cost estimates for a facility with a throughput of 100,000 are as follows:

[28] The capitol and operation costs for ASP and in-vessel composting given in the final staff report were taken from: United States Environmental Protection Agency, "Biosolids Technology Fact Sheet: Use of Composting for Biosolids Management" EPA 832-F-02-024, September 2002, http://water.epa.gov/scitech/wastetech/upload/2002_10_15_mtb_combioman.pdf. These costs were not adjusted for inflation

Low Annual Capital Cost Estimate (100,000 wet ton/yr) = $694,825/year

High Annual Capital Cost Estimate (100,000 wet ton/yr) = $1,866,836/year

Because it has been determined that composting or storing solid manure removed from dairy cow housing in an ASP or enclosure vented to a control device would not be cost-effective for a facility with a throughput of less than 100,000 tons per year, this analysis will be based on a dairy facility that can produce 100,000 tons of solid manure per year.

Number of Cows to Produce 100,000 ton/yr of Solid Manure

According to the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Agricultural Waste Management Field Handbook (AWMFH), Chapter 4 - Agricultural Waste Characteristics (March 2008), dairy cows in scraped open corrals produce approximately 77 lb per day of solid manure that can be removed and transferred for storage or composting. The amount of solid manure removed for dairy cows housed in corrals or freestall barns with a flush system would be much less. The number of cows needed to produce 100,000 ton/year of solid manure is calculated as follows:

(100,000 ton/year x 2,000 lb/ton) ÷ (77 lb/cow-day x 365 day/yr) = 7,116 cows

The facility is proposing 5,378 milk cows and 12,978 total head. Although the total head consists of support stock, including calves, all 12,978 total head will conservatively be assumed to be milk cows for the following calculations.

VOC Emission Reductions from an ASP or Enclosure Handling Solid Manure from 12,978 Cows:

The annual VOC Emission Reductions for ASP or in-vessel enclosure handling the solid manure from 7,116 milk cows are calculated as follows and shown in the table below:

[Number of cows] x [Solid Manure VOC EF (lb/cow-year)] x [ASP/In-Vessel Capture Efficiency] x [Control Device VOC Control Efficiency]

VOC Reductions for Dairy Solid Manure in ASP or Enclosure Vented to a Biofilter

Type of Animal	# of cows	x	Solid Manure Land Application EF (lb/cow-yr)	x	Capture (%)*	x	Control (%)	=	lb-VOC/yr
Milk Cow	12,978	x	0.23	x	50%	x	80%	=	1,194

*The capture efficiency is conservatively assumed to be 50%. The technical assessment of SCAQMD Rule 1133.2 and the staff report for District Rule 4565 give a capture efficiency of 33% for composting facilities, which would result in lower emission reductions.

Cost of VOC Emission Reductions

Low Estimate = ($694,825/year)/[(1,194 lb-VOC/year)(1 ton/2000 lb)]
= $1,163,861/ton of VOC reduced

High Estimate = ($1,866,836/year)/[(1,194 lb-VOC/year)(1 ton/2000 lb)]
= $3,127,028/ton of VOC reduced

As shown above, the cost alone of an ASP or in-vessel enclosure vented to a biofilter to handle the solid manure at a dairy would cause the cost of the VOC reductions to be greater than $1,163,861/ton. The excessively high costs of this option make it impractical for most confined animal facilities. Therefore, this control technology is not cost effective.

2) Options 4, 7, and 8: Land Application of Solid Manure Processed by an Open Negatively-Aerated Static Pile (ASP) or Enclosed Negatively-Aerated Static Pile (With Rapid Incorporation of the Manure Into the Soil After Land Application)

A cost effectiveness was evaluated by SCAQMD for a variety of controls for new and existing co-composting facilities based on implementation of several possible scenarios. The cost effectiveness for new co-composting facilities was estimated to be about $24,000 to $27,000 per ton of VOC reduced or $11,000 to $12,000 per ton of VOC and ammonia reduced based on fabric or concrete type of enclosure for the active phase of composting and forced aeration system for the active and curing phases vented to a bio-filter.[29]

For existing co-composting operations, SCAQMD analyzed a few different scenarios. Under one of the scenarios, assuming enclosure without an aeration system for active phase of composting and a forced aeration system for curing phase (both vented to a biofilter) and depending on the type of enclosure, the cost-effectiveness ranged from $11,400 to $15,400 per ton of VOC and ammonia reduced, or $30,000 to $40,000 per ton of VOC reduced. Under another scenario, using enclosure and aeration system for active phase, and aeration system for curing phase, both vented to biofilter, the cost effectiveness ranged from $8,700 to $10,000 per ton of VOC and ammonia reduced or $23,000 to $26,500 per ton of VOC reduced (depending on the type of enclosure). Under another scenario, assuming that forced aeration system (in combination with process controls, optimized feedstock mix ratios, and best management practices) for both active and curing phases (combined with a biofiltration system) could achieve the required reductions (i.e., 70% for VOC and ammonia), the cost-effectiveness could be as low as $6,500 per ton of VOC and ammonia reduced or $17,000 per ton of VOC

[29] Final Staff report for proposed Rule 1133, 1133.1, and 1133.2)

reduced. However, SCAQMD stated that additional test data would be necessary to validate the efficiency of such control methods.[30]

The VOC and ammonia baseline emission factors, used in determining the cost effective analysis (also included in Rule 1133.2), were developed based on the AQMD source tests conducted in 1995 and 1996 for three windrow co-composting facilities (1.78 pounds of VOC and 2.93 pounds of ammonia per ton of throughput). These emission factors do not accurately represent the baseline emissions of manure storage piles from dairy/calf facilities. The emission factor for manure piles may in fact be lower.

Enclosed ASP or in-vessel systems with control equipment, while feasible and effective at significantly reducing emissions, are costly. There may be additional emission reductions associated with ASP systems that have not been quantified in this evaluation. Additional testing of ASP systems, such as the ones discussed in this evaluation would allow the emission reduction potential of all control scenarios to be refined.

Therefore, these aerated static composting systems will be eliminated at this time.

3) <u>Rapid incorporation of solid manure into the soil after land application</u>

The applicant has proposed this option; therefore a cost effectiveness analysis is not required.

e. Select BACT

The facility is proposing rapid incorporation of solid manure into the soil after land application.

Additionally, District Rule 2201 defines BACT as including the most stringent emission limitation or control technique, including process and equipment changes; that has been found by the APCO to be cost effective and technologically feasible for such class or category of sources or for a specific source. The District has found that the mitigation measures required by District Rule 4570 are cost effective and technologically feasible for confined animal facilities and the applicant has proposed these options. Therefore, in addition to the BACT requirements determined in the Top-Down BACT Analysis above, implementation of the mitigation measures that the applicant has selected to comply with Rule 4570 will also be required as part of BACT for VOC emissions from solid manure land application.

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[30] The cost assumptions used in this analysis (capital and operating cost) are included in the Technology Assessment Report for SCAQMD PR1133 (Attachment A to the Final Staff Report)

2. BACT for NH3 Emissions from Solid Manure Land Application

a. Identify all control technologies

A cost effectiveness threshold has not been established for ammonia. Therefore, although there is ongoing research for multiple ammonia control technologies, only options that meet the District's definition of Achieved-in-Practice controls will be considered for ammonia at this time.

The following practices have been identified as possible control options for NH3 emissions from solid manure land application. No other control technologies that meet the definition of Achieved-in-Practice have been identified for solid manure land application.

1) Rapid incorporation of solid manure into the soil after land application

Various types of spreading techniques, such as box spreaders, flail type spreaders, side discharge spreaders, and spinner spreaders, are used to apply solid manure to cropland. Regardless of which technique is used, this practice requires the immediate incorporation of the manure into the soil, reducing emissions and surface run-off while minimizing the loss of nitrogen into the atmosphere. Based on a study by a local Valley dairy, there is a great potential of reducing emissions by incorporating slurry manure rapidly into the soil. A similar reduction may be obtained by the rapid incorporation of solid manure. This technology is expected to yield a NH3 control efficiency ranging from 49% to upwards of 98%.[31]

2) All animals fed in accordance with National Research Council (NRC) or other District-approved guidelines

Nutritional management of dairy feed is routinely practiced to improve milk production and herd health. The potential for ammonia emissions can be reduced by reducing the amount of undigested nitrogen compounds in the manure. The level of microbial action in the manure corresponds to the level of organic nitrogen content in the manure; the lower the level of nitrogen the lower the level of microbial action and the lower the production of ammonia and VOCs.

A diet that is formulated to feed proper amounts of ruminantly degradable protein will result in improved nitrogen utilization by the animal and corresponding reduction in urea and organic nitrogen content of the manure, which will reduce the production of VOCs and ammonia. The latest National

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[31] Page 81 of "Recommendations to the San Joaquin Valley Air Pollution Control Officer Regarding Best Available Control Technology for Dairies in the San Joaquin Valley" January 31, 2006 (http://www.valleyair.org/busind/pto/dpag/dpag_idx.htm).

Research Council (NRC) guidelines for the selection of an optimal bovine diet should be followed to the maximum extent possible. The diet recommendations made in this publication seek to achieve the maximum uptake of protein by the animal and the minimum carryover of nitrogen into the manure, which will reduce ammonia emissions from solid manure.

b. Eliminate technologically infeasible options

There are no technologically infeasible options to eliminate from step 1.

c. Rank remaining options by control effectiveness

1) Rapid incorporation of solid manure into the soil after land application
2) All animals fed in accordance with National Research Council (NRC) or other District-approved guidelines

d. Cost Effectiveness Analysis

1) Rapid incorporation of solid manure into the soil after land application

   The applicant has proposed this option; therefore a cost effectiveness analysis is not required.

2) All animals fed in accordance with National Research Council (NRC) or other District-approved guidelines

   The applicant has proposed this option; therefore a cost effectiveness analysis is not required.

e. Select BACT

The facility is proposing rapid incorporation of solid manure into the soil after land application, and to feed all animals at the dairy in accordance with National Research Council (NRC) or other District-approved guidelines. Therefore, BACT requirements are satisfied.

Additionally, District Rule 2201 defines BACT as including the most stringent emission limitation or control technique, including process and equipment changes, that has been found by the APCO to be cost effective and technologically feasible for such class or category of sources or for a specific source. The District has found that the mitigation measures required by District Rule 4570 are technologically feasible for confined animal facilities and the applicant has proposed these options. Although District Rule 4570 is only intended to reduce VOC emissions, many of these measures also reduce ammonia emissions. Therefore, in addition to the BACT requirements determined in the Top-Down BACT Analysis above, implementation of the mitigation measures that the applicant has selected to comply with Rule 4570 will also be required as part of BACT for NH_3 emissions from liquid manure land application.

BACT Analysis for Feed Storage and Handling – Total Mixed Ration (TMR)

1. BACT for VOC Emissions from TMR

a. Identify all control technologies

1) <u>Enclosed Buildings for Animals and TMR with Emissions Vented to a Control Device</u>

Total Mixed Ration (TMR) refers to feed (primarily silage with grains, oils, minerals, and other additives) that has been mixed to meet the nutritional needs of dairy animals and placed in the feeding areas of the cow housing unit for consumption by the cattle. Because the TMR is placed in the cow housing areas, if emissions from enclosed freestall barns could be captured and vented to a control device, emissions from the TMR could also be controlled.

<u>Description of Dairy Housing</u>

In a freestall barn, cows are grouped in large pens with free access to feed bunks, water, and stalls for resting. In the mild climate of the San Joaquin Valley, the typical freestall barn is an open structure (roof but no sides). The primary freestall design consists of a roof that provides shade with all sides open to allow air to flow through, which keeps the cows cool. The open freestall barns take advantage of natural summer winds in the San Joaquin Valley that are generally greater than four mph. The natural winds result in an excellent summer ventilation rate that is equivalent to 1,000 cfm per cow more, which is why open dairy barns are generally recommended in the San Joaquin Valley. In colder climates enclosed or partially enclosed barns may be utilized to protect cows from winter extremes.

Although the potential to enclose cows and TMR in a barn may exist, the feasibility of reasonably collecting the gas through a stack, chimney, or vent remains in question considering the extremely large amounts of airflow going through the barns needed to keep the cows cool. The airflow requirements would be even higher in the San Joaquin valley, where temperatures can exceed 110° F in the hot summer. If the barn exhaust can be properly captured it may be possible to vent it to a VOC control device. It is estimated that up to 80% of the gases emitted from enclosed freestall barns can be captured by the mechanical ventilation system and sent to a control device, such as an incinerator or biofilter.

Thermal incineration is a well-established VOC control technique. During combustion, gaseous hydrocarbons are oxidized to form CO_2 and water. In addition to the difficulty of capturing all of the gases in a freestall barn, a disadvantage of thermal incineration is that when concentrations of combustible

VOCs in the gas stream are very low very large amounts of supplemental fuel must be used to sufficiently increase the temperature of all of the ventilation air in order to incinerate these VOCs. This generally renders incineration cost prohibitive for large flows of dilute VOCs, such as in the ventilation air from a freestall barn. Because of this biofilters have generally been found to be more cost-effective for handling dilute streams of biodegradable VOCs. A biofilter is a device for removing contaminants from a gas in which the gas is passed through a media that supports microbial activity by which pollutants are degraded by biological oxidation. During biofiltration microorganisms oxidize the gaseous organic contaminants, ammonia, and sulfur compounds in the exhaust air resulting in carbon dioxide, nitrogen, water, salt, and biomass. Additional information on biofiltration is given above in the analysis for the cow housing permit unit for enclosed freestall barns vented to a control device. One of the disadvantages related to the use of a biofilter to control emissions from enclosed livestock barns is the large space requirement for the traditional biofilter design. To illustrate this, a low-cost natural bed biofilter designed to treat the VOC emissions from 1,000 milk cows and 180 dry cows with no support stock would cover more than 5.4 acres and would need to be maintained free of pests and approved by the appropriate permitting agencies. To avoid such expansive land requirements, the dairy would likely need to use much more expensive bio-trickling filters or bio-scrubbers.

Although many questions remain about the feasibility of requiring animals and TMR to be confined in buildings and capturing the exhaust gas and venting it to a control device, it will be considered for purposes of this analysis.

2) District Rule 4570 Management Practices for TMR

District Rule 4570 requires the implementation of various management practices to reduce VOC emissions from TMR. These practices include pushing feed so that it is within three feet of feedlane fence within two hours of putting out the feed or use a feed trough or other feeding structure designed to maintain feed within reach of the animals, so the area of the feed is minimized and the feed can be consumed by the cows in a shorter time period instead of continuing to emit VOCs; beginning feeding total mixed rations within two hours of grinding and mixing rations, reducing the time that fresh feed emits VOCs; storing grain in a weatherproof storage structure or under a weatherproof covering from October through May; feeding stream-flaked, dry rolled, cracked or ground corn or other ground cereal grains; removal of uneaten wet feed from feeding areas; and preparing TMR with a minimum mooisture content, which reduces VOCs since most of the compounds emitted are higly soluable in water. More details about these management practices are included in the District document Final Staff Report – Revised Proposed Amendments to Rule 4570 (Confined Animal Facilities), dated October 21, 2010.

b. Eliminate technologically infeasible options

There are no technologically infeasible options to eliminate from step 1.

c. Rank remaining options by control effectiveness

1) Enclosed Buildings for Animals and TMR with Emissions Vented to a Control Device
2) District Rule 4570 Management Practices for TMR

d. Cost Effectiveness Analysis

1) Enclosed Buildings for Animals and TMR with Emissions Vented to a Control Device

The preceding cost analysis performed for the BACT analysis for VOC emissions from the cow housing permit demonstrated that this option exceeded the District VOC cost effective threshold by a significant amount. This analysis included VOC reductions from Total Mixed Ration (TMR) as well as the cow housing since enclosed freestall barns vented to a control device would control emissions from both sources because the TMR is placed in the cow housing areas to feed the cows. Therefore, no further cost analysis is required for enclosed freestall barns to control emissions from TMR.

2) District Rule 4570 Management Practices for TMR

The applicant has proposed this option; therefore a cost effectiveness analysis is not required.

e. Select BACT

The facility is proposing District Rule 4570 management practices to reduce VOC emissions from the TMR. Therefore, BACT requirements are satisfied.

Additionally, District Rule 4570 management practices to reduce VOC emissions from silage piles will also be required, as this will also affect the TMR.

Appendix H

RMR/AAQA Summary

San Joaquin Valley Air Pollution Control District
Risk Management Review

To:	Jerry Sandhu – Permit Services
From:	Cheryl Lawler – Technical Services
Date:	July 9, 2013
Facility Name:	Curtimade Dairy Inc.
Location:	18337 Road 24, Tulare
Application #(s):	S-4712-1-3, 2-5, 3-5, 4-3, & 11-2
Project #:	S-1124291

A. RMR SUMMARY

RMR Summary					
Categories	**Dairy Milking Parlor (Unit 1-3)**	**Dairy Cow Housing (Unit 2-5)**	**Dairy Lagoons & Liquid Manure Land Application (Unit 3-5)**	**Dairy Solid Manure Storage & Land Application (Unit 4-3)**	**Facility Totals**
Prioritization Score	**0.57**[1]	28.8	27.9	2.18	>1.0
Acute Hazard Index	N/A	0.50	0.03	0.01	0.53
Chronic Hazard Index	N/A	0.19	0.02	0.00	0.21
Maximum Individual Cancer Risk	N/A	**4.80E-06**	**3.95E-06**	**N/A***	8.75E-06
T-BACT Required?	**No**	**Yes**	**Yes**	**No**	
Special Permit Conditions?	**No**	**Yes**	**Yes**	**No**	

[1]The unit passed on prioritization with a score of less than 1, therefore, no further analysis was required.
[2]The Maximum Individual Cancer Risk was not calculated since there are no risk factors associated with any of the Hazardous Air Pollutants (HAPs) under analysis.

Proposed Permit Conditions

To ensure that human health risks will not exceed District allowable levels; the following permit conditions must be included for:

Units 1-3 & 2-5

1. The unit shall only be occupied by Jersey cows.

Unit 2-5

1. The number of cows housed in Freestalls 1-3 shall not exceed 620 cows (each freestall).
2. The number of cows housed in Freestalls 4-7 shall not exceed 250 cows (each freestall).
3. The number of cows housed in Freestalls 8-10 shall not exceed 820 cows (each freestall).
4. The number of cows housed in the two dry cow corrals shall not exceed 400 cows (each corral).
5. The number of calves in the north calf hutch area shall not exceed 1,500 calves.
6. The number of calves in the south calf hutch area shall not exceed 600 calves.
7. The number of cows in open corrals shall not exceed 4,758 cows.

B. RMR REPORT

I. Project Description

Technical Services performed an Ambient Air Quality Analysis and a Risk Management Review for an existing dairy proposing to modify their existing dairy permits. The dairy is proposing to switch from Holstein cows to Jersey cows and expand the number of cows and calves. H_2S analysis will not be required because the size and configuration of the lagoons will not change.

II. Analysis

Technical Services performed prioritizations using the District's HEARTs database. Emissions were calculated using District-developed spreadsheets for dairies and were input into the HEARTs database, along with emission factors specific to Jersey cows, increased PM10 rates, and the increases in the number of cows in each freestall, corral, or calf hutch area. In accordance with the District's *Risk Management Policy for Permitting New and Modified Sources* (APR 1905-1, March 2, 2001), risks from the proposed project were prioritized using the procedures in the 1990 CAPCOA Facility Prioritization Guidelines and incorporated in the District's HEART's database.

Because the project's prioritization scores totaled to greater than 1.0, a refined health risk assessment was required and performed for Units 2-5, 3-5, & 4-3. AERMOD was used, with area source parameters and 3-year meteorological data from Lemoore to determine maximum dispersion factors at the nearest on-site residential and off-site receptors. These dispersion factors were input into the HARP model to calculate the chronic and acute hazard indices and the carcinogenic risk for each unit.

No prioritization or further review was required for Unit 11-2 (feed storage & handling).

The following parameters were used for the review:

Analysis Parameters S-4712, Project S-1124291			
Total Increase of Cows	5,168	**Receptor Distance (m)**	On-Site Residence
Annual NH3 (lbs)	152,688	**Hourly NH3 (lbs)**	17.43
Annual PM10 (lbs)	3,105*	**Hourly PM10 (lbs)**	0.35*

*Per District policy, PM2.5 is 15 percent of the PM10 amounts.

H2S emissions analysis was not required for Unit 3-5 (lagoons), because the surface area of the existing lagoons is not changing.

Technical Services also performed Ambient Air Quality Analysis for Unit 2-5 (cow housing). The modeling was performed for the criteria pollutants PM_{10} and $PM_{2.5}$ using AERMOD. The emission rate used was 3,105 lb PM_{10}/year. The results from the Criteria Pollutant Modeling are as follows:

PM_{10} Pollutant Modeling Results
Values are in $\mu g/m^3$

Category PM_{10}	24 Hours
Proposed Dairy Increase	8.99
Interim Significance Level	10.4[1]
Result	Pass

[1]The District has decided on an interim basis to use a threshold for fugitive dust sources of 10.4 $\mu g/m^3$ for the 24-hour average concentration.

$PM_{2.5}$ Pollutant Modeling Results
Values are in $\mu g/m^3$

Category $PM_{2.5}$	24 Hours
Proposed Dairy Increase	1.35
Interim Significance Level	2.5[1]
Result	Pass

[1]The District has decided on an interim basis to use a threshold for fugitive dust sources of 2.5 $\mu g/m^3$ for the 24-hour average concentration.

III. Conclusions

The ambient air quality impacts at the dairy do not exceed the District's 24-hour interim threshold for fugitive dust sources or cause/contribute significantly to a violation of the State or National AAQS.

Unit 1-3

The prioritization score for the unit is not above 1.0. In accordance with the District's Risk Management Policy, the unit is approved **without** Toxic Best Available Control Technology (T-BACT).

<u>Unit 2-5</u>

The acute and chronic indices are below 1.0; and the maximum individual cancer risk associated with the unit is **4.80E-06**, which is greater than the 1 in a million threshold. In accordance with the District's Risk Management Policy, the unit is approved **with** Toxic Best Available Control Technology (T-BACT).

<u>Unit 3-5</u>

The acute and chronic indices are below 1.0; and the maximum individual cancer risk associated with the unit is **3.95E-06**, which is greater than the 1 in a million threshold. In accordance with the District's Risk Management Policy, the unit is approved **with** Toxic Best Available Control Technology (T-BACT).

<u>Unit 4-3</u>

The acute and chronic indices are below 1.0; and there is no Cancer Risk associated with any of the HAPs under review. In accordance with the District's Risk Management Policy, the unit is approved **without** Toxic Best Available Control Technology (T-BACT).

These conclusions are based on the data provided by the applicant and the project engineer. Therefore, this analysis is valid only as long as the proposed data and parameters do not change.

<u>Attachments</u>:

RMR Request Form & Related Documents
Dairy Operations Emissions Worksheets
Prioritizations
Risk Results
AAQA Results
Facility Summary

Appendix I

Draft ATCs

San Joaquin Valley
Air Pollution Control District

AUTHORITY TO CONSTRUCT

PERMIT NO: S-4712-1-3 **ISSUANCE DATE:** DRAFT

LEGAL OWNER OR OPERATOR: CURTIMADE DAIRY INC
MAILING ADDRESS: 18337 ROAD 24
TULARE, CA 93274

LOCATION: 18337 ROAD 24
TULARE, CA 93274

EQUIPMENT DESCRIPTION:
MODIFICATION OF 3,300 COW MILKING OPERATION WITH TWO DOUBLE 22 HERRINGBONE (88 STALLS) MILKING PARLOR: INCREASE MAXIMUM NUMBER OF MILK COWS FROM 3,300 TO 5,378 JERSEY COWS; COMPLETE BUILD-OUT OF EXISTING MILKING PARLOR TO 184 STALLS; CONSTRUCT ONE 10 STALL HERRINGBONE HOSPITAL MILKING PARLOR

CONDITIONS

1. {3215} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
2. {3216} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]
3. {4452} If a licensed veterinarian or a certified nutritionist determines that any VOC mitigation measure will be required to be suspended as a detriment to animal health or necessary for the animal to molt, the owners/operators must notify the District in writing within forty-eight (48) hours of the determination including the duration and the specific health condition requiring the mitigation measure to be suspended. If the situation is expected to exist longer than a thirty-day (30) period, the owner/operator shall submit a new emission mitigation plan designating a mitigation measure to be implemented in lieu of the suspended mitigation measure. [District Rule 4570]
4. {4484} Permittee shall flush or hose milk parlor immediately prior to, immediately after, or during each milking. [District Rule 4570]
5. {4485} Permittee shall provide verification that milk parlors are flushed or hosed prior to, immediately after, or during each milking. [District Rule 4570]

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (661) 392-5500 WHEN CONSTRUCTION IS COMPLETED AND PRIOR TO OPERATING THE EQUIPMENT OR MODIFICATIONS AUTHORIZED BY THIS AUTHORITY TO CONSTRUCT. This is NOT a PERMIT TO OPERATE. Approval or denial of a PERMIT TO OPERATE will be made after an inspection to verify that the equipment has been constructed in accordance with the approved plans, specifications and conditions of this Authority to Construct, and to determine if the equipment can be operated in compliance with all Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District. Unless construction has commenced pursuant to Rule 2050, this Authority to Construct shall expire and application shall be cancelled two years from the date of issuance. The applicant is responsible for complying with all laws, ordinances and regulations of all other governmental agencies which may pertain to the above equipment.

Seyed Sadredin, Executive Director / APCO

DRAFT

DAVID WARNER, Director of Permit Services

Southern Regional Office • 34946 Flyover Court • Bakersfield, CA 93308 • (661) 392-5500 • Fax (661) 392-5585

6. {4453} Permittee shall keep and maintain all records for a minimum of five (5) years and shall make records available to the APCO and EPA upon request. [District Rule 4570]

7. {3658} This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]

San Joaquin Valley
Air Pollution Control District

AUTHORITY TO CONSTRUCT

PERMIT NO: S-4712-2-5 **ISSUANCE DATE:** DRAFT

LEGAL OWNER OR OPERATOR: CURTIMADE DAIRY INC
MAILING ADDRESS: 18337 ROAD 24
TULARE, CA 93274

LOCATION: 18337 ROAD 24
TULARE, CA 93274

EQUIPMENT DESCRIPTION:
MODIFICATION OF COW HOUSING - 3,300 MILK COWS NOT TO EXCEED A COMBINED TOTAL OF 3,600 MATURE COWS (MILK AND DRY COWS); 2,710 SUPPORT STOCK (HEIFERS AND BULLS); 1,500 CALVES (0-3 MONTHS) IN ABOVEGROUND HUTCHES; AND 8 FREESTALLS WITH FLUSH/SCRAPE SYSTEM: CONSTRUCT TWO NEW FREESTALLS WITH A FLUSH SYSTEM, ADD 600 ABOVEGROUND CALF HUTCHES, AND ESTABLISH WINDBREAKS AS PART OF AN EXPANSION THAT WILL INCREASE THE MAXIMUM HERD SIZE TO 5,378 JERSEY MILK COWS, 1,000 DRY COWS, 4,500 SUPPORT STOCK (HEIFERS AND BULLS), AND 2,100 CALVES

CONDITIONS

1. {3215} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
2. {3216} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]
3. {4452} If a licensed veterinarian or a certified nutritionist determines that any VOC mitigation measure will be required to be suspended as a detriment to animal health or necessary for the animal to molt, the owners/operators must notify the District in writing within forty-eight (48) hours of the determination including the duration and the specific health condition requiring the mitigation measure to be suspended. If the situation is expected to exist longer than a thirty-day (30) period, the owner/operator shall submit a new emission mitigation plan designating a mitigation measure to be implemented in lieu of the suspended mitigation measure. [District Rule 4570]

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (661) 392-5500 WHEN CONSTRUCTION IS COMPLETED AND PRIOR TO OPERATING THE EQUIPMENT OR MODIFICATIONS AUTHORIZED BY THIS AUTHORITY TO CONSTRUCT. This is NOT a PERMIT TO OPERATE. Approval or denial of a PERMIT TO OPERATE will be made after an inspection to verify that the equipment has been constructed in accordance with the approved plans, specifications and conditions of this Authority to Construct, and to determine if the equipment can be operated in compliance with all Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District. Unless construction has commenced pursuant to Rule 2050, this Authority to Construct shall expire and application shall be cancelled two years from the date of issuance. The applicant is responsible for complying with all laws, ordinances and regulations of all other governmental agencies which may pertain to the above equipment.

Seyed Sadredin, Executive Director / APCO

DRAFT

DAVID WARNER, Director of Permit Services

S-4712-2-5 : Jan 7 2014 1:42PM -- SANDHUG : Joint Inspection NOT Required

4. The total number of cattle housed at this dairy at any one time shall not exceed any of the following: 5,378 Jersey milk cows; 1,000 dry cows; 2,700 large heifers (15-24 months); 900 medium heifers (7-14 months); 900 small heifers (3-6 months); and 2,100 calves (0-3 months). [District Rule 2201]

5. All animals at this dairy shall be fed in accordance with the National Research Council (NRC) guidelines utilizing routine dairy nutritionist analyses of rations. [District Rule 2201]

6. Permittee shall maintain records of feed content, formulation, and quantity of feed additive utilized, to demonstrate compliance with National Research Council (NRC) guidelines. Records such as feed company guaranteed analyses (feed tags), ration sheets, or feed purchase records may be used to meet this requirement. [District Rule 2201]

7. All open corrals shall be equipped with at least one shade structure. [District Rule 2201]

8. Calves shall be housed in individual calf hutches. [District Rule 2201]

9. The feed lanes and walkways at this dairy shall be constructed of concrete. [District Rule 2201]

10. At least one of the feedings of the support stock at this dairy shall be near (within one hour of) dusk. [District Rule 2201]

11. Freestalls 1, 5, 8, 9, and 10 shall not have exercise pens. [District Rule 2201]

12. The maximum number of cows housed in Freestalls 1, 2, and 3 shall not exceed 620 cows per each freestall. [District Rule 4102]

13. The maximum number of cows housed in Freestalls 4, 5, 6, and 7 shall not exceed 250 cows per each freestall. [District Rule 4102]

14. The maximum number of cows housed in Freestalls 8, 9, and 10 shall not exceed 820 cows per each freestall. [District Rule 4102]

15. The total number of cows housed in the western corrals directly adjacent to Freestall 1 shall not exceed 400 cows. [District Rule 4102]

16. The total number of cows housed in the eastern corrals directly adjacent to Freestall 1 shall not exceed 400 cows. [District Rule 4102]

17. The total number of calves in the north calf hutch area shall not exceed 1,500 calves. [District Rule 4102]

18. The total number of calves in the south calf hutch area shall not exceed 600 calves. [District Rule 4102]

19. The total number of cows housed in the open corrals located west of the lagoons/storage ponds shall not exceed 4,758 cows. [District Rule 4102]

20. Permittee shall establish windbreaks along the south and southeast corner of the open corral housing area. Windbreaks shall consist of Italian Cypress trees and be located in the following areas: Area 1) Rows 1 and 2 - Both rows starting from the most southwest corral and going southeast (parallel to the adjacent canal) for at least 261 feet. Trees shall be spaced 9 feet apart. Each row should be offset from the adjacent row. Spacing between rows shall be sufficient to accommodate cultivation equipment, but shall not exceed 24 feet; Area 2) Rows 1 and 2 - Both starting from the end of Area 1 and going east. Row 1 shall extend east toward the southernmost lagoon for at least 819 feet. Row 2 shall run parallel to Row 1, with a break of no more than 20 feet allowed in Row 2 for equipment travel. Trees shall be spaced 9 feet apart. Each row should be offset from the adjacent row. Spacing between rows shall be sufficient to accommodate cultivation equipment, but shall not exceed 24 feet; Area 3) Rows 1 and 2 - Starting from the southeast corner of the corral housing area and going north for at least 441 feet. Trees shall be spaced 5 feet apart. Each row should be offset from the adjacent row. Spacing between rows shall be sufficient to accommodate cultivation equipment, but shall not exceed 10 feet. An alternative windbreak proposal must be approved by the District. [District Rule 2201]

21. Windbreaks shall be irrigated and maintained for survivability and rapid growth. Dead trees shall be replaced as necessary to maintain a windbreak density of 65%. [District Rule 2201]

22. Density is the percentage of the background view that is obscured or hidden when viewing through the windbreak from 60 ft to 100 ft upwind of the rows. [District Rule 2201]

23. The feed lanes and walkways for mature cows at this dairy shall be flushed at least four times per day. The feed lanes and walkways for support stock at this dairy shall be flushed at least once per day. [District Rules 2201 and 4570]

CONDITIONS CONTINUE ON NEXT PAGE

24. Permittee shall keep records or maintain an operating plan that requires the feed lanes and walkways for mature cows to be flushed at least four times per day and the feed lanes and walkways for support stock to be flushed at least once per day. [District Rules 2201 and 4570]

25. Open corrals and exercise pens shall be scraped at least once every other week using a pull-type scraper in the morning hours, except when this is prevented by wet conditions. [District Rule 2201]

26. Permittee shall maintain records of dates open corrals and exercise pens are scraped. [District Rule 2201]

27. Permittee shall pave feedlanes, where present, for a width of at least 8 feet along the corral side of the feedlane fence for milk and dry cows and at least 6 feet along the corral side of the feedlane for heifers. [District Rules 2201 and 4570]

28. Permittee shall remove manure that is not dry from individual cow freestall beds or shall rake, harrow, scrape, or grade freestall bedding at least once every seven (7) days. [District Rules 2201 and 4570]

29. Permittee shall record either of the following: 1) the dates when manure that is not dry is removed from individual cow freestall beds or 2) the dates when the freestall bedding is raked, harrowed, scraped, or graded. [District Rules 2201 and 4570]

30. Permittee shall inspect water pipes and troughs and repair leaks at least once every seven (7) days. [District Rules 2201 and 4570]

31. Permittee shall maintain records demonstrating that water pipes and troughs are inspected and leaks are repaired at least once every seven (7) days. [District Rules 2201 and 4570]

32. Permittee shall implement at least one of the following corral mitigation measures: 1) slope the surface of the corrals at least 3% where the available space for each animal is 400 square feet or less and shall slope the surface of the corrals at least 1.5% where the available space for each animal is more than 400 square feet per animal; 2) maintain corrals to ensure proper drainage preventing water from standing more than forty-eight hours; or 3) harrow, rake, or scrape pens sufficiently to maintain a dry surface except during periods of rainy weather. [District Rules 2201 and 4570]

33. Permittee shall either 1) maintain sufficient records to demonstrate that corrals are maintained to ensure proper drainage preventing water from standing for more than forty-eight hours or 2) maintain records of dates pens are groomed (i.e., harrowed, raked, or scraped, etc.). [District Rules 2201 and 4570]

34. Shade structures shall be installed in any of the following ways: 1) constructed with a light permeable roofing material; 2) uphill of any slope in the corral; 3) installed so that the structure has a North/South orientation. OR Permittee shall clean manure from under corral shades at least once every fourteen (14) days, when weather permits access into the corral. [District Rules 2201 and 4570]

35. If permittee has selected to comply using shades constructed with a light permeable roofing material, then permittee shall maintain records, such as design specifications, demonstrating that the shade structures are equipped with such roofing material or if Permittee has selected to comply by cleaning the manure from under the corral shades, then Permittee shall maintain records demonstrating that manure is cleaned from under the shades at least once every fourteen (14) days, as long as weather permits access to corrals. [District Rules 2201 and 4570]

36. Permittee shall manage corrals such that the manure depth in the corral does not exceed twelve (12) inches at any time or point, except for in-corral mounding. Manure depth may exceed 12 inches when corrals become inaccessible due to rain events. However, permittee must resume management of the manure depth of 12 inches or lower immediately upon the corral becoming accessible. [District Rules 2201 and 4570]

37. Permittee shall measure and document the depth of manure in the corrals at least once every ninety (90) days. [District Rules 2201 and 4570]

38. Permittee shall maintain a record of the number of animals of each species and production group at the facility and shall maintain quarterly records of any changes to this information. [District Rules 2201 and 4570]

39. Permittee shall keep and maintain all records for a minimum of five (5) years and shall make records available to the APCO and EPA upon request. [District Rules 1070 and 4570]

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CONDITIONS CONTINUE ON NEXT PAGE

40. {3658} This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]

San Joaquin Valley
Air Pollution Control District

AUTHORITY TO CONSTRUCT

PERMIT NO: S-4712-3-5 **ISSUANCE DATE:** DRAFT

DRAFT

LEGAL OWNER OR OPERATOR: CURTIMADE DAIRY INC
MAILING ADDRESS: 18337 ROAD 24
TULARE, CA 93274

LOCATION: 18337 ROAD 24
TULARE, CA 93274

EQUIPMENT DESCRIPTION:
MODIFICATION OF LIQUID MANURE HANDLING SYSTEM CONSISTING OF THREE SETTLING BASINS AND TWO SEPARATION PITS; MECHANICAL SEPARATOR(S); FOUR NORTH STORAGE PONDS AND FOUR SOUTH STORAGE PONDS; MANURE IS LAND APPLIED THROUGH FLOOD AND FURROW IRRIGATION: ALLOW FOR INCREASE IN LIQUID MANURE HANDLED DUE TO HERD SIZE EXPANSION; UTILIZE THREE EXISTING STORAGE PONDS AS THREE ANAEROBIC TREATMENT LAGOONS (280' X 235' X 20', 280' X 225' X 20', AND 280' X 215' X 20'); INSTALL ONE MECHANICAL SEPARATOR

CONDITIONS

1. {3215} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
2. {3216} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]
3. {4452} If a licensed veterinarian or a certified nutritionist determines that any VOC mitigation measure will be required to be suspended as a detriment to animal health or necessary for the animal to molt, the owners/operators must notify the District in writing within forty-eight (48) hours of the determination including the duration and the specific health condition requiring the mitigation measure to be suspended. If the situation is expected to exist longer than a thirty-day (30) period, the owner/operator shall submit a new emission mitigation plan designating a mitigation measure to be implemented in lieu of the suspended mitigation measure. [District Rule 4570]
4. All animals at this dairy shall be fed in accordance with the National Research Council (NRC) guidelines utilizing routine dairy nutritionist analyses of rations. [District Rule 2201]

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (661) 392-5500 WHEN CONSTRUCTION IS COMPLETED AND PRIOR TO OPERATING THE EQUIPMENT OR MODIFICATIONS AUTHORIZED BY THIS AUTHORITY TO CONSTRUCT. This is NOT a PERMIT TO OPERATE. Approval or denial of a PERMIT TO OPERATE will be made after an inspection to verify that the equipment has been constructed in accordance with the approved plans, specifications and conditions of this Authority to Construct, and to determine if the equipment can be operated in compliance with all Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District. Unless construction has commenced pursuant to Rule 2050, this Authority to Construct shall expire and application shall be cancelled two years from the date of issuance. The applicant is responsible for complying with all laws, ordinances and regulations of all other governmental agencies which may pertain to the above equipment.

Seyed Sadredin, Executive Director / APCO

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DAVID WARNER, Director of Permit Services
S-4712-3-5 : Jan 2 2014 2:29PM -- SANDHUG : Joint Inspection NOT Required

5. Permittee shall maintain records of feed content, formulation, and quantity of feed additive utilized, to demonstrate compliance with National Research Council (NRC) guidelines. Records such as feed company guaranteed analyses (feed tags), ration sheets, or feed purchase records may be used to meet this requirement. [District Rule 2201]
6. The liquid manure handling system shall handle flush manure from no more than 5,378 Jersey milk cows; 1,000 dry cows; 2,700 large heifers (15-24 months); 900 medium heifers (7-14 months); 900 small heifers (3-6 months); and 2,100 calves (0-3 months). [District Rule 2201]
7. Permittee shall use an anaerobic treatment lagoon system designed according to NRCS Guideline No. 359. [District Rule 2201]
8. Permittee shall maintain records, such as design specifications, calculations, including Minimum Treatment Volume (MTV), Hydraulic Retention Time (HRT) demonstrating that the anaerobic treatment lagoon meets the requirements listed in the NRCS Field Office Technical Guide Code 359. [District Rule 2201]
9. Permittee shall remove solids with a solid separator system prior to the manure entering the lagoons. [District Rules 2201 and 4570]
10. Permittee shall only land apply liquid manure that has been treated with an anaerobic treatment lagoon. [District Rule 2201]
11. Permittee shall maintain records that only liquid manure treated with an anaerobic treatment lagoon is applied to fields. [District Rule 2201]
12. Permittee shall not allow liquid manure to stand in the fields for more than twenty-four (24) hours after irrigation. [District Rules 2201 and 4570]
13. Permittee shall maintain records to demonstrate liquid manure did not stand in the fields for more than twenty-four (24) hours after irrigation. [District Rules 2201 and 4570]
14. Permittee shall maintain records to demonstrate liquid/slurry manure is applied via injection with drag hose or similar apparatus. [District Rules 2201 and 4570]
15. Permittee shall keep and maintain all records for a minimum of five (5) years and shall make records available to the APCO and EPA upon request. [District Rules 1070 and 4570]
16. {3658} This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]

San Joaquin Valley
Air Pollution Control District

AUTHORITY TO CONSTRUCT

PERMIT NO: S-4712-4-3 **ISSUANCE DATE:** DRAFT

LEGAL OWNER OR OPERATOR: CURTIMADE DAIRY INC
MAILING ADDRESS: 18337 ROAD 24
TULARE, CA 93274

LOCATION: 18337 ROAD 24
TULARE, CA 93274

EQUIPMENT DESCRIPTION:
MODIFICATION OF SOLID MANURE HANDLING CONSISTING OF MANURE STOCK PILES; SOLID MANURE APPLICATION TO LAND AND/OR HAULED OFFSITE: ALLOW FOR INCREASE IN SOLID MANURE HANDLED DUE TO HERD SIZE EXPANSION

CONDITIONS

1. {3215} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
2. {3216} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]
3. {4452} If a licensed veterinarian or a certified nutritionist determines that any VOC mitigation measure will be required to be suspended as a detriment to animal health or necessary for the animal to molt, the owners/operators must notify the District in writing within forty-eight (48) hours of the determination including the duration and the specific health condition requiring the mitigation measure to be suspended. If the situation is expected to exist longer than a thirty-day (30) period, the owner/operator shall submit a new emission mitigation plan designating a mitigation measure to be implemented in lieu of the suspended mitigation measure. [District Rule 4570]
4. All animals at this dairy shall be fed in accordance with the National Research Council (NRC) guidelines utilizing routine dairy nutritionist analyses of rations. [District Rule 2201]
5. Permittee shall maintain records of feed content, formulation, and quantity of feed additive utilized, to demonstrate compliance with National Research Council (NRC) guidelines. Records such as feed company guaranteed analyses (feed tags), ration sheets, or feed purchase records may be used to meet this requirement. [District Rule 2201]

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (661) 392-5500 WHEN CONSTRUCTION IS COMPLETED AND PRIOR TO OPERATING THE EQUIPMENT OR MODIFICATIONS AUTHORIZED BY THIS AUTHORITY TO CONSTRUCT. This is NOT a PERMIT TO OPERATE. Approval or denial of a PERMIT TO OPERATE will be made after an inspection to verify that the equipment has been constructed in accordance with the approved plans, specifications and conditions of this Authority to Construct, and to determine if the equipment can be operated in compliance with all Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District. Unless construction has commenced pursuant to Rule 2050, this Authority to Construct shall expire and application shall be cancelled two years from the date of issuance. The applicant is responsible for complying with all laws, ordinances and regulations of all other governmental agencies which may pertain to the above equipment.

Seyed Sadredin, Executive Director / APCO

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DAVID WARNER, Director of Permit Services

6. Within seventy two (72) hours of removal of separated solids from the drying process, permittee shall either 1) remove separated solids from the facility, or 2) cover separated solids 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. [District Rules 2201 and 4570]
7. Permittee shall keep records of dates when separated solids are removed from the facility or permittee shall maintain records to demonstrate that separated solids piles outside the pens are covered with a weatherproof covering from October through May. [District Rules 2201 and 4570]
8. Permittee shall maintain records, such as manufacturer warranties or other documentation, demonstrating that the weatherproof covering over separated solids are installed, used, and maintained in accordance with manufacturer recommendations and applicable standards listed in NRCS Field Office Technical Guide Code 313 or 367, or any other applicable standard approved by the APCO, ARB, and EPA. [District Rules 2201 and 4570]
9. Solid manure applied to fields shall be incorporated into the soil immediately (within two hours) after application. [District Rules 2201 and 4570]
10. Permittee shall maintain records to demonstrate that all solid manure has been incorporated within two hours of land application. [District Rules 2201 and 4570]
11. Permittee shall keep and maintain all records for a minimum of five (5) years and shall make records available to the APCO and EPA upon request. [District Rules 1070 and 4570]
12. {3658} This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]

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San Joaquin Valley
Air Pollution Control District

AUTHORITY TO CONSTRUCT

PERMIT NO: S-4712-11-2 **ISSUANCE DATE:** DRAFT

LEGAL OWNER OR OPERATOR: CURTIMADE DAIRY INC
MAILING ADDRESS: 18337 ROAD 24
TULARE, CA 93274

LOCATION: 18337 ROAD 24
TULARE, CA 93274

EQUIPMENT DESCRIPTION:
MODIFICATION OF FEED STORAGE AND HANDLING CONSISTING OF COMMODITY BARNS AND SILAGE PILES: CONSTRUCT THREE NEW HAYBARNS AND ALLOW FOR INCREASE IN FEED THROUGHPUT DUE TO HERD SIZE EXPANSION

CONDITIONS

1. {3215} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 1070]
2. {3216} Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 1070]
3. {4452} If a licensed veterinarian or a certified nutritionist determines that any VOC mitigation measure will be required to be suspended as a detriment to animal health or necessary for the animal to molt, the owners/operators must notify the District in writing within forty-eight (48) hours of the determination including the duration and the specific health condition requiring the mitigation measure to be suspended. If the situation is expected to exist longer than a thirty-day (30) period, the owner/operator shall submit a new emission mitigation plan designating a mitigation measure to be implemented in lieu of the suspended mitigation measure. [District Rule 4570]
4. Permittee shall feed all animals according to National Research Council (NRC) guidelines. [District Rules 2201 and 4570]

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (661) 392-5500 WHEN CONSTRUCTION IS COMPLETED AND PRIOR TO OPERATING THE EQUIPMENT OR MODIFICATIONS AUTHORIZED BY THIS AUTHORITY TO CONSTRUCT. This is NOT a PERMIT TO OPERATE. Approval or denial of a PERMIT TO OPERATE will be made after an inspection to verify that the equipment has been constructed in accordance with the approved plans, specifications and conditions of this Authority to Construct, and to determine if the equipment can be operated in compliance with all Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District. Unless construction has commenced pursuant to Rule 2050, this Authority to Construct shall expire and application shall be cancelled two years from the date of issuance. The applicant is responsible for complying with all laws, ordinances and regulations of all other governmental agencies which may pertain to the above equipment.

Seyed Sadredin, Executive Director / APCO

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DAVID WARNER, Director of Permit Services

S-4712-11-2 : Jan 2 2014 2:29PM -- SANDHUG : Joint Inspection NOT Required

5. Permittee shall maintain records of feed content, formulation, and quantity of feed additive utilized, to demonstrate compliance with National Research Council (NRC) guidelines. Records such as feed company guaranteed analyses (feed tags), ration sheets, or feed purchase records may be used to meet this requirement. [District Rules 2201 and 4570]

6. Permittee shall push feed so that it is within three feet of feedlane fence within two hours of putting out the feed or use a feed trough or other feeding structure designed to maintain feed within reach of the animals. [District Rules 2201 and 4570]

7. Permittee shall maintain an operating plan/record that requires feed to be pushed within three feet of feedlane fence within two hours of putting out the feed, or use of a feed trough or other structure designed to maintain feed within reach of the animals. [District Rules 2201 and 4570]

8. Permittee shall begin feeding total mixed rations within two hours of grinding and mixing rations. [District Rules 2201 and 4570]

9. Permittee shall maintain an operating plan/record of when feeding of total mixed rations began within two hours of grinding and mixing rations. [District Rules 2201 and 4570]

10. Permittee shall store grain in a weatherproof storage structure or under a weatherproof covering from October through May. [District Rules 2201 and 4570]

11. Permittee shall maintain records demonstrating grain is/was stored in a weatherproof storage structure or under a weatherproof covering from October through May. [District Rules 2201 and 4570]

12. Permittee shall remove uneaten wet feed from feed bunks within twenty-four (24) hours after the end of a rain event. [District Rules 2201 and 4570]

13. Permittee shall maintain records demonstrating that uneaten wet feed was removed from feed bunks within twenty-four (24) hours after the end of a rain event. [District Rules 2201 and 4570]

14. {4468} For bagged silage/feedstuff, permittee shall utilize a sealed feed storage system (e.g., ag bag). [District Rule 4570]

15. {4469} Permittee shall cover all silage piles, except for the area where feed is being removed from the pile, with a plastic tarp that is at least five (5) mils (0.005 inches) thick, multiple plastic tarps with a cumulative thickness of at least 5 mils (0.005 inches), or an oxygen barrier film covered with a UV resistant material. Silage piles shall be covered within seventy-two (72) hours of last delivery of material to the pile. Sheets of material used to cover silage shall overlap so that silage is not exposed where the sheets meet. [District Rule 4570]

16. {4470} Permittee shall maintain records of the thickness and type of cover used to cover each silage pile. Permittee shall also maintain records of the date of the last delivery of material to each silage pile and the date each pile is covered. [District Rule 4570]

17. {4471} Permittee shall select and implement one of the following mitigation measures for building each silage pile at the facility: Option 1) build the silage pile such that the average bulk density is at least 44 lb/cu ft for corn silage and 40 lb/cu ft for other silage types, as measured in accordance with Section 7.11 of District Rule 4570; Option 2) Adjust filling parameters when creating the silage pile to achieve an average bulk density of at least 44 lb/cu ft for corn silage and at least 40 lb/cu ft for other silage types as determined using a District-approved spreadsheet; or Option 3) build silage piles using crops harvested with the applicable minimum moisture content, maximum Theoretical Length of Chop (TLC), and roller opening identified in District Rule 4570, Table 4.1, 1.d and manage silage material delivery such that the thickness of the layer of un-compacted material delivered on top of the pile is no more than six (6) inches. Records of the option chosen as a mitigation measure for building each silage pile shall be maintained. [District Rule 4570]

18. {4472} For each silage pile that Option 1 (Measured Bulk Density) is chosen as a mitigation measure for building the pile, records of the measured bulk density shall be maintained. [District Rule 4570]

19. {4473} For each silage pile that Option 2 (Bulk Density Determined by Spreadsheet) is chosen as a mitigation measure for building the pile, records of the filling parameters entered into the District-approved spreadsheet to determine the bulk density shall be maintained. [District Rule 4570]

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CONDITIONS CONTINUE ON NEXT PAGE

20. {4474} For each silage pile that Option 3 (Moisture, TLC, Roller Opening, & Material Delivery) is chosen as a mitigation measure for building the pile, the permittee shall harvest corn used for the pile at an average moisture content of at least 65% and harvest other silage crops for the pile at an average moisture content of at least 60%. [District Rule 4570]

21. {4475} For each silage pile that Option 3 (Moisture, TLC, Roller Opening, & Material Delivery) is chosen as a mitigation measure for building the pile, records of the average percent moisture of crops harvested for silage shall be maintained. [District Rule 4570]

22. {4476} For each silage pile that Option 3 (Moisture, TLC, Roller Opening, & Material Delivery) is chosen as a mitigation measure for building the pile, the permittee shall adjust setting of equipment used to harvest crops for the pile to incorporate the following parameters for Theoretical Length of Chop (TLC) and roller opening, as applicable: 1) Corn with no processing: TLC not exceeding 1/2 inch, 2) Processed Corn: TLC not exceeding 3/4 inch and roller opening of 1-4 mm, 3) Alfalfa/Grass: TLC not exceeding 1.0 inch, 4) Other silage crops: TLC not exceeding 1/2 inch. [District Rule 4570]

23. {4477} For each silage pile that Option 3 (Moisture, TLC, Roller Opening, & Material Delivery) is chosen as a mitigation measure for building the pile, records that equipment used to harvest crops for the pile was set to the required TLC and roller opening for the type of crop harvested shall be maintained. [District Rule 4570]

24. {4478} For each silage pile that Option 3 (Moisture, TLC, Roller Opening, & Material Delivery) is chosen as a mitigation measure for building the pile, the permittee shall manage silage material delivery such that the thickness of the layer of un-compacted material delivered on top of the pile is no more than six (6) inches. [District Rule 4570]

25. {4479} For each silage pile that Option 3 (Moisture, TLC, Roller Opening, & Material Delivery) is chosen as a mitigation measure for building the pile, the permittee shall maintain a plan that requires that the thickness of the layer of un-compacted material delivered on top of the pile is no more than six (6) inches. [District Rule 4570]

26. {4480} Permittee shall select and implement at least two of the following mitigation measures for management of silage piles at the facility: Option 1) manage silage piles such that only one silage pile has an uncovered face and the total exposed surface area is less than 2,150 square feet, or manage multiple uncovered silage piles such that the total exposed surface area of all uncovered silage piles is less than 4,300 square feet; Option 2) use a shaver/facer to remove silage from the silage pile, or shall use another method to maintain a smooth vertical surface on the working face of the silage pile; or Option 3) inoculate silage with homolactic lactic acid bacteria in accordance with manufacturer recommendations to achieve a concentration of at least 100,000 colony forming units per gram of wet forage, apply propionic acid, benzoic acid, sorbic acid, sodium benzoate, or potassium sorbate at the rate specified by the manufacturer to reduce yeast counts when forming silage piles, or apply other additives at rates that have been demonstrated to reduce alcohol concentrations in silage and/or VOC emissions from silage and have been approved by the District and EPA. Records of the options chosen for managing each silage pile shall be maintained. [District Rule 4570]

27. {4481} If Option 1 (Limiting Exposed Area of Silage) is chosen as a mitigation measure for managing silage piles, the permittee shall calculate and record the maximum (largest part of pile) total exposed area of each silage pile. Records of the maximum calculated area shall be maintained. [District Rule 4570]

28. {4482} For each silage pile that Option 2 (Shaver/Facer or Smooth Face) is chosen as a mitigation measure for building the pile, the permittee shall maintain records that a shaver/facer was used to remove silage from the pile or shall visually inspect the pile at least daily to verify that the working face was smooth and maintain records of the visual inspections. [District Rule 4570]

29. {4483} For each silage pile that Option 3 (Silage Additives) is chosen as a mitigation measure for building the pile, records shall be maintained of the type additive (e.g. inoculants, preservative, other District & EPA-approved additive), the quantity of the additive applied to the pile, and a copy of the manufacturers instructions for application of the additive. [District Rule 4570]

30. Permittee shall keep and maintain all records for a minimum of five (5) years and shall make records available to the APCO and EPA upon request. [District Rules 1070 and 4570]

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CONDITIONS CONTINUE ON NEXT PAGE

31. {3658} This permit does not authorize the violation of any conditions established for this facility in the Conditional Use Permit (CUP), Special Use Permit (SUP), Site Approval, Site Plan Review (SPR), or other approval documents issued by a local, state, or federal agency. [Public Resources Code 21000-21177: California Environmental Quality Act]