AUG 05 2014

Antonio Azevedo
Antonio Azevedo Dairy
7618 S. Highway 59
El Nido, CA 95317

Re: **Notice of Preliminary Decision - Authority to Construct**
Facility Number: N-6096
Project Number: N-1130683

Dear Mr. Azevedo:

Enclosed for your review and comment is the District's analysis of Antonio Azevedo Dairy's application for an Authority to Construct for the construction of two Saudi-style freestall barns, the construction of an additional storage pond and lagoon, and expanding the herd size to 7,766 total animals, at 2025 W. El Nido, El Nido.

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. John Yoshimura of Permit Services at (559) 230- 5887.

Sincerely,

Arnaud Marjollet
Director of Permit Services

AM:jy

Enclosures

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

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

Facility Name:	Antonio Azevedo Dairy	Date:	7/22/14
Mailing Address:	7618 S. Highway 59 El Nido, CA 95317	Engineer: Lead Engineer:	John Yoshimura Brian Clements
Contact Person:	Kevin Abernathy		
Telephone:	(209) 678-0666		
Application #s:	N-6096-1-4, '-2-5, '-3-3, '-4-3, and '-5-3		
Project #:	N-1130683		
Deemed Complete:	7/17/14		

I. Proposal

Antonio Azevedo Dairy (Azevedo Dairy) is applying for an Authority to Construct (ATC) to modify its dairy operation. The modifications will include the construction of two Saudi-style freestall barns (Barn #2 and Barn #3), the addition of 1,179 milk cows and 2,126 support stock, and the removal of 227 dry cows. The table below shows the existing and proposed herd size based on individual age categories:

Existing Herd Size		Proposed Herd Size	
PTO	**Flushed Saudi-style Freestalls**	**ATC**	**Flushed Saudi-style Freestalls**
Milk Cows	2,926	Milk Cows	4,105
Dry Cows	792	Dry Cows	565
Large Heifers	0	Large Heifers	1,160
Medium Heifers	553	Medium Heifers	1,026
Small Heifers	357	Small Heifers	350
Calves	0	Calves	500
Bulls	60	Bulls	60

The facility has also proposed to construct a storage pond (330'x350'x25') and an additional lagoon (300'x700'x25'). These proposed additions will ensure the dairy has sufficient volume to adequately treat the additional waste (see Appendix C – Anaerobic Treatment Lagoon Design Check).

Azevedo Dairy previously submitted ATC applications (N-1110346 and N-1123687) to modify the facility by installing shade structures over existing cow housing. These projects were processed with the false assumption that there would be no physical expansion of the dairy or footprint; however, Azevedo Dairy expanded the capacity of their footprint and herd size by constructing a Saudi-style freestall barn (Barn #2). As a result, the District cancelled both projects and the corresponding ATCs were voided. To resolve this issue, the facility has proposed to use this project to correctly permit the Saudi-style barn (Barn #2) and herd expansion along with the additional modifications listed above.

II. Applicable Rules

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 (6/18/98)
Rule 4101	Visible Emissions (2/17/05)
Rule 4102	Nuisance (12/17/92)
Rule 4550	Conservation Management Practices (CMP) (8/19/04)
Rule 4570	Confined Animal Facilities (CAF) (10/21/10)
CH&SC 41700	Health Risk Assessment
CH&SC 42301.6	School Notice

Senate Bill 700 (SB 700)
California Environmental Quality ACT (CEQA)

III. Project Location

The facility is located at 2025 W. El Nido Road, El Nido, in Merced County. The equipment 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 Antonio Azevedo Dairy is the production of milk, which is used to make dairy 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. Baby calves are raised at another facility and some are returned as mature cows.

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.

<u>Milking Parlors</u>
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. 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, dry cows, and support stock at this dairy will be housed in three Saudi-Style freestall barns with flushed lanes. The design of a Saudi style barn was originally crafted for hot weather conditions in desert climates. These structures feature very high ceilings, with a ventilation gap running the length of the barn. The sides of the structure are open, and the high peak (typically 14-18 feet) enhances air flow. Saudi barns are very similar to freestall barns with the exception of the freestalls.

Liquid Manure handling System

The liquid manure handling system at this dairy will consist of one settling basin and one lagoon.

Settling Basin

The liquid manure from the flushed lanes will flow to the settling basin 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.

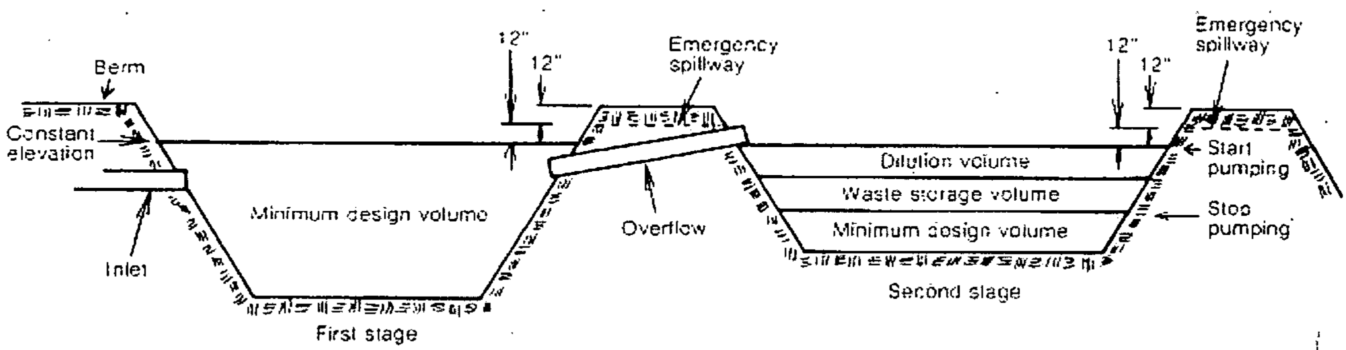
Anaerobic Treatment Lagoons

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 575 ft x 165 ft x 13 ft lagoon, one 300 ft x 700 ft x 25 ft anaerobic treatment lagoon, followed by one storage pond. The two 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 C, the volume of the two anaerobic treatment lagoons is as follows:

Total Lagoon Treatment Volume		
Lagoon 1 (575'x165'x13')	=	1,111,244 ft^3
Lagoon 2 (330'x700'x25')	=	5,152,083 ft^3
Total Lagoon Volume	=	**6,263,327 ft^3**

And the minimum treatment volume is as follows:

Minimum Treatment Volume		
Minimum Treatment Volume	=	2,899,504 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 proposed to construct one storage pond. The storage pond is 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 settling basin and lagoon. 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 (Existing PTO):

N-6096-1-3: 2,926 COW MILKING OPERATION WITH ONE 50 STALL ROTARY MILK PARLOR

N-6096-2-3: COW HOUSING - 2,926 MILK COWS NOT TO EXCEED A COMBINED TOTAL OF 3,718 MATURE COWS (MILK AND DRY COWS); 970 TOTAL SUPPORT STOCK (HEIFERS AND BULLS); AND FREESTALLS WITH FLUSH SYSTEM

N-6096-3-2: LIQUID MANURE HANDLING SYSTEM CONSISTING OF ONE SETTLING BASIN; AND ONE LAGOON; MANURE LAND APPLIED THROUGH FLOOD IRRIGATION

N-6096-4-2: SOLID MANURE HANDLING CONSISTING OF MANURE STOCK PILES; WINDROW STATIC PILE COMPOSTING; SOLID MANURE APPLICATION TO LAND AND HAULED OFFSITE

N-6096-5-2: FEED STORAGE AND HANDLING CONSISTING OF COMMODITY BARNS AND SILAGE PILES

<u>ATC Equipment Description</u>:

N-6096-1-4: MODIFICATION OF 2,926 COW MILKING OPERATION WITH ONE 50 STALL ROTARY MILK PARLOR: ADDITION OF 1,179 MILK COWS

N-6096-2-5: MODIFICATION OF COW HOUSING - 2,926 MILK COWS NOT TO EXCEED A COMBINED TOTAL OF 3,718 MATURE COWS (MILK AND DRY COWS); 970 TOTAL SUPPORT STOCK (HEIFERS AND BULLS); AND FREESTALLS WITH FLUSH SYSTEM: ADD 1,179 MILK COWS; REMOVE 227 DRY COWS; ADD 2,126 SUPPORT STOCK; INSTALL TWO SAUDI-STYLE FREESTALL BARNS AND 500 CALF HUTCHES

N-6096-3-3: MODIFICATION OF LIQUID MANURE HANDLING SYSTEM CONSISTING OF ONE SETTLING BASIN; AND ONE LAGOON; MANURE LAND APPLIED THROUGH FLOOD IRRIGATION): INCREASE LIQUID MANURE DUE TO THE INCREASE IN HERD SIZE; INSTALL AN ANAEROBIC TREATMENT LAGOON SYSTEM AND A STORAGE POND

N-6096-4-3: MODIFICATION OF SOLID MANURE HANDLING CONSISTING OF MANURE STOCK PILES; WINDROW STATIC PILE COMPOSTING; SOLID MANURE APPLICATION TO LAND AND HAULED OFFSITE: INCREASE THE SOLID MANURE DUE TO THE INCREASE IN HERD SIZE

N-6096-5-3: MODIFICATION OF FEED STORAGE AND HANDLING CONSISTING OF COMMODITY BARNS AND SILAGE PILES: INCREASE FEED THROUGHPUT DUE TO THE INCREASE IN HERD SIZE

<u>Post Project Equipment Description:</u>

N-6096-1-4: 4,105 COW MILKING OPERATION WITH ONE 50 STALL ROTARY MILK PARLOR

N-6096-2-5: 4,105 MILK COWS NOT TO EXCEED A COMBINED TOTAL OF 4,670 MATURE COWS (MILK AND DRY COWS); 3,096 TOTAL SUPPORT STOCK (HEIFERS, CALVES, AND BULLS) HOUSED IN SAUDI-STYLE FREESTALL BARNS AND 500 CALF HUTCHES WITH FLUSH SYSTEM

N-6096-3-3: LIQUID MANURE HANDLING SYSTEM CONSISTING OF ONE SETTLING BASIN; ANAEROBIC TREATMENT SYSTEM WITH TWO LAGOONS AND A STORAGE POND; MANURE LAND APPLIED THROUGH FLOOD IRRIGATION

N-6096-4-3: SOLID MANURE HANDLING CONSISTING OF MANURE STOCK PILES; WINDROW STATIC PILE COMPOSTING; SOLID MANURE APPLICATION TO LAND AND HAULED OFFSITE

N-6096-5-3: 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 (N-6096-1)

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 (N-6096-2)

The cows at the facility will be housed in a combination of Saudi-style freestall barns 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.

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
The surfaces of the freestall exercise pens will be scraped in the morning hours on a biweekly basis, except during wet conditions. Frequent scraping of the freestall exercise 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.

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 (N-6096-3)

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 N-1111055. This project does not involve any change to the mitigation measures practiced at the facility. Furthermore, the facility will implement the current mitigation measures for their proposed expansion.

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.
- Pre-Project Emissions (PE1) will be based on 2,926 milk cows, 792 dry cows, 553 medium heifers, 357 small heifers, and 60 bulls (per applicant).
    - Jersey herd: 1,697 milk cows, 459 dry cows, 321 medium heifers, and 207 small heifers
    - Holstein herd: 1,229 milk cows, 333 dry cows, 232 medium heifers, and 150 small heifers

- The increase in Post Project Emissions (PE2) will result from the addition of 1,179 milk cows and 2,126 support stock in two Saudi-style freestall barns (per applicant).
  - Jersey herd increase: 684 milk cows and 1,237 support stock
  - Holstein herd increase: 495 milk cows and 896 large heifers
- Only emissions from the agricultural gasoline tank (N-6096-6), and lagoon (N-6096-3) at the dairy will be used to determine if the facility is a major source since these units are considered to be the only sources of non-fugitive emissions at dairies, as discussed in section VII.C.5.
- The facility has already implemented Rule 4570 mitigation measures. Pre- and Post Emission Factors are referenced from project N-1111055.
- 47.7% NH3 control efficiency for Cow Housing (Final Staff Report of Rule 4570, App. C)
- 28% NH3 control efficiency for Feed (Final Staff Report of Rule 4570, App. C)
- All H2S 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 NH3 emissions from the lagoon/storage ponds.

B. Emission Factors

The facility implemented District Rule 4570 mitigation measures (project N-1111055). The facility has not proposed to modify the existing emission factors; therefore, EF1 = EF2.

The facility stated that 58% of their herd is Jersey and 42% of their herd is Holstein. Therefore, Jersey and Holstein Emission Factors will be listed as follows:

NH_3

Dairy EF2 ($lb\text{-}NH_3/hd\text{-}yr$) - Jersey				
		Milk Cow	**Dry Cow**	**Support Stock***
N-6096-1-4: **Milking Parlor**	**Milking Parlor Total**	**0.09**	-	-
N-6096-2-5: **Cow Housing**	Enteric Emissions in Cow Housing	-	-	-
	Corrals/Pens	11.20	5.67	2.94
	Bedding	1.68	0.86	0.45
	Lanes	1.36	0.70	0.35
	Cow Housing Total	**14.25**	**7.22**	**3.74**
N-6096-3-3: **Liquid Manure Handling**	Lagoons/Storage Ponds	5.82	2.98	1.56
	Liquid Manure Land Application	4.55	2.30	1.17
	Liquid Manure Handling Total	**10.37**	**5.28**	**2.73**
N-6096-4-3: **Solid Manure Handling**	Solid Manure Storage	0.67	0.34	0.18
	Separated Solids Piles	0.27	0.13	0.07
	Solid Manure Land Application	1.07	0.54	0.28
	Solid Manure Handling Total	**2.01**	**1.01**	**0.53**

*In order to calculate worst case emissions, the emission factor for the large, heifers will be used.

Dairy EF2 (lb-NH_3/hd-yr) - Holstein				
		Milk Cow	Dry Cow	Support Stock*
N-6096-1-4: **Milking Parlor**	**Milking Parlor Total**	**0.14**	-	-
N-6096-2-5: **Cow Housing**	Enteric Emissions in Cow Housing	-	-	-
	Corrals/Pens	15.78	7.98	4.14
	Bedding	2.37	1.20	0.64
	Lanes	1.92	0.98	0.49
	Cow Housing Total	**20.07**	**10.17**	**5.27**
N-6096-3-3: **Liquid Manure Handling**	Lagoons/Storage Ponds	8.20	4.20	2.20
	Liquid Manure Land Application	6.41	3.24	1.66
	Liquid Manure Handling Total	**14.61**	**7.44**	**3.86**
N-6096-4-3: **Solid Manure Handling**	Solid Manure Storage	0.95	0.48	0.25
	Separated Solids Piles	0.38	0.19	0.10
	Solid Manure Land Application	1.50	0.76	0.40
	Solid Manure Handling Total	**2.83**	**1.43**	**0.75**

VOC

Dairy EF2 (lb-VOC/hd-yr) - Holstein				
		Milk Cow	Dry Cow	Support Stock*
N-6096-1-4: **Milking Parlor**	Enteric Emissions in Milking Parlors	0.39	-	-
	Milking Parlor Floor	0.03	-	-
	Milking Parlor Total	**0.42**	-	-
N-6096-2-5: **Cow Housing**	Enteric Emissions in Cow Housing	3.50	2.01	1.63
	Corrals/Pens	4.78	2.58	2.01
	Bedding	0.85	0.46	0.36
	Lanes	0.68	0.37	0.29
	Cow Housing Total	**9.81**	**5.51**	**4.28**
N-6096-3-3: **Liquid Manure Handling**	Lagoons/Storage Ponds	1.23	0.66	0.52
	Liquid Manure Land Application	1.33	0.72	0.56
	Liquid Manure Handling Total	**2.56**	**1.38**	**1.08**
N-6096-4-3: **Solid Manure Handling**	Solid Manure Storage	0.13	0.07	0.05
	Separated Solids Piles	0.05	0.03	0.02
	Solid Manure Land Application	0.32	0.17	0.13
	Solid Manure Handling Total	**0.49**	**0.27**	**0.21**

*In order to calculate worst case emissions, the emission factor for the large, heifers will be used.

Dairy EF2 (lb-VOC/hd-yr) - Jersey				
		Milk Cow	Dry Cow	Support Stock*
N-6096-1-4: **Milking Parlor**	Enteric Emissions in Milking Parlors	0.28	-	-
	Milking Parlor Floor	0.02	-	-
	Milking Parlor Total	**0.30**	-	-
N-6096-2-5: **Cow Housing**	Enteric Emissions in Cow Housing	2.48	1.49	1.16
	Corrals/Pens	3.40	1.83	1.43
	Bedding	0.60	0.33	0.25
	Lanes	0.48	0.26	0.20
	Cow Housing Total	**6.97**	**3.91**	**3.04**
N-6096-3-3: **Liquid Manure Handling**	Lagoons/Storage Ponds	0.87	0.47	0.37
	Liquid Manure Land Application	0.94	0.51	0.40
	Liquid Manure Handling Total	**1.82**	**0.98**	**0.76**
N-6096-4-3: **Solid Manure Handling**	Solid Manure Storage	0.09	0.05	0.04
	Separated Solids Piles	0.04	0.02	0.02
	Solid Manure Land Application	0.22	0.12	0.09
	Solid Manure Handling Total	**0.35**	**0.19**	**0.15**

*In order to calculate worst case emissions, the emission factor for the large, heifers will be used.

Silage and TMR (Total Mixed Ration) EF2 (N-6096-5-3)		
Type of Silage	**VOC EF (μg/m^2-min)**	**Source**
Corn Silage[1]	21,155	SJVAPCD
Alfalfa Silage[1]	10,649	SJVAPCD
Wheat Silage[1]	26,745	SJVAPCD
TMR[2]	10,575	SJVAPCD

[1] Assuming pile is completely covered except for the front face
[2] Assuming rations are fed within 48 hours

Cow Housing PM_{10} EF2 (lbs- PM_{10}/hd-yr) (N-6096-2-5)			
Type of Cow	**Type of Housing**	**EF**	**Source**
Milk, Dry Cow	Freestalls w/Exercise Pens	1.37	SJVAPCD
Support Stock	Freestalls with Exercise Pens	1.37	CARB/SJVAPCD
Calf	Hutches – above ground flushed	0.069	SJVAPCD

C. Calculations

1. Pre-Project Potential to Emit (PE1)

N-6096-1-3:

VOC
= [# Milk Cows - Jersey] x [EF] + [# Milk Cows - Holstein] x [EF]
= 1,697 x 0.30 lb-VOC/hd-yr + 1,229 x 0.42 lb-VOC/hd-yr = **1,025 lb-VOC/yr**

NH_3
= [# Milk Cows - Jersey] x [EF] + [# Milk Cows - Holstein] x [EF]
= 1,697 x 0.09 lb-NH_3/hd-yr + 1,229 x 0.14 lb-NH_3/hd-yr = **325 lb-NH_3/yr**

N-6096-2-3:

VOC
= [# Milk Cows] x [EF] + [# Dry Cows] x [EF] + [# Support Stock] x [EF] + [#Bulls] x [EF]
= (1,697 x 6.97 lb-VOC/hd-yr) + (459 x 3.91 lb-VOC/hd-yr) + (528 x 3.04 lb-VOC/hd-yr) + (1,229 x 9.81 lb-VOC/hd-yr) + (333 x 5.51 lb-VOC/hd-yr) + (382 x 4.28 lb-VOC/hd-yr) + (60 x 1.84 lb-VOC/hd-yr) = **30,865 lb-VOC/yr**

PM10
= [# milk cows] x [EF] + [# dry cows] x [EF] + [# Support Stock] x [EF] + [# Bulls] x [EF]
= (1,697 x 1.37 lb-PM10/hd-yr) + (459 x 1.37 lb-PM10/hd-yr) + (528 x 1.37 lb-PM10/hd-yr) + (1,229 x 1.37 lb-PM10/hd-yr) + [333 x 1.37 lb-PM10/hd-yr) + (382 x 1.37 lb-PM10/hd-yr) x (60 x 1.37 lb-PM10/hd-yr) = **6,423 lb-PM10/yr**

NH_3
= [# Milk Cows] x [EF] + [# Dry Cows] x [EF] + [# Support Stock] x [EF] + [#Bulls] x [EF]
= (1,697 x 14.25 lb-NH_3/hd-yr) + (459 x 7.22 lb-NH_3/hd-yr) + (528 x 3.74 lb-NH_3/hd-yr) + (1,229 x 20.07 lb-NH_3/hd-yr) + (333 x 10.17 lb-NH_3/hd-yr) + (382 x 5.27 lb-NH_3/hd-yr) + (60 x 5.21 lb-NH_3/hd-yr) = **59,849 lb-NH_3/yr**

N-6096-3-2:

VOC
= [# Milk Cows] x [EF] + [# Dry Cows] x [EF] + [# Support Stock] x [EF] + [#Bulls] x [EF]
= (1,697 x 1.82 lb-VOC/hd-yr) + (459 x 0.98 lb-VOC/hd-yr) + (528 x 0.76 lb-VOC/hd-yr) + (1,229 x 2.56 lb-VOC/hd-yr) + (333 x 1.38 lb-VOC/hd-yr) + (382 x 1.08 lb-VOC/hd-yr) + (60 x 0.47 lb-VOC/hd-yr) = **7,986 lb-VOC/yr**

NH_3
= [# Milk Cows] x [EF] + [# Dry Cows] x [EF] + [# Support Stock] x [EF] + [#Bulls] x [EF]
= (1,697 x 10.37 lb-NH_3/hd-yr) + (459 x 5.28 lb-NH_3/hd-yr) + (528 x 2.73 lb-NH_3/hd-yr) + (1,229 x 14.61 lb-NH_3/hd-yr) + (333 x 7.44 lb-NH_3/hd-yr) + (382 x 3.86 lb-NH_3/hd-yr) + (60 x 3.18 lb-NH_3/hd-yr) = **43,562 lb-NH_3/yr**

H_2S
= NH_3 PE x 10%
= (43,562 lb-NH_3/yr) x 10% = **4,356 lb- H_2S/yr**

N-6096-4-2:

VOC
= [# Milk Cows] x [EF] + [# Dry Cows] x [EF] + [# Support Stock] x [EF] + [#Bulls] x [EF]
= (1,697 x 0.35 lb-VOC/hd-yr) + (459 x 0.19 lb-VOC/hd-yr) + (528 x 0.15 lb-VOC/hd-yr) + (1,229 x 0.49 lb-VOC/hd-yr) + (333 x 0.27 lb-VOC/hd-yr) + (382 x 0.21 lb-VOC/hd-yr) + (60 x 0.09 lb-VOC/hd-yr) = **1,538 lb-VOC/yr**

NH_3
= [# Milk Cows] x [EF] + [# Dry Cows] x [EF] + [# Support Stock] x [EF] + [#Bulls] x [EF]
= (1,697 x 1.07 lb-NH_3/hd-yr) + (459 x 0.54 lb-NH_3/hd-yr) + (528 x 0.28 lb-NH_3/hd-yr) + (1,229 x 2.83 lb-NH_3/hd-yr) + (333 x 1.43 lb-NH_3/hd-yr) + (382 x 0.75 lb-NH_3/hd-yr) + (60 x 0.65 lb-NH_3/hd-yr) = **6,491 lb-NH_3/yr**

N-6096-5-2:

Open Face Area:

= [#open face piles] x [height] x (([width] + ([width]/(0.1667 x ([width]/[height]) + 1.111))) / 2)

Corn Area
= 1 x 18 ft x ((65 ft + (65 ft / (0.1667 x (65 ft /18 ft) + 1.111 ft))) / 2)
= 927 ft^2

Alfalfa Area
= 0 x 0 ft x ((0 ft + (0 ft / (0.1667 x 0 ft /0 ft) + 1.111 ft)) / 2)
= 0 ft^2

Wheat Area
= 1 x 15 ft x ((60 ft + (60 ft / (0.1667 x 60 ft /15 ft) + 1.111 ft)) / 2)
= 703.1218 ft^2

Silage Annual PE:

Corn Emissions
= emission factor x area x 0.0929 m^2/ft^2 x 8,760 hr/yr x 60 min/hr x 2.20E-9 lb/µg
= 21,155 x 927x 0.0929 x 8760 x 60 x 2.20E-9 lb/µg
= **2,107 lb-VOC/yr**

Alfalfa Emissions
= emission factor x area x 0.0929 m^2/ft^2 x 4,380 hr/yr x 60 min/hr x 2.20E-9 lb/µg
= 10,649 x 0 x 0.0929 x 4,380 x 60 x 2.20E-9 lb/µg
= **0 lb-VOC/yr**

Wheat Emissions
= emission factor x area x 0.0929 m^2/ft^2 x 8,760 hr/yr x 60 min/hr x 2.20E-9 lb/µg
= 26,745 x 703.1218 x 0.0929 x 8760 x 60 x 2.20E-9 lb/µg
= **2,020 lb-VOC/yr**

TMR Annual PE:
TMR emissions should not include calves. However, the number of calves will be included in the total cow count as a worst-case scenario since the number of calves can vary.

= [# of cows] x [emission factor] x [area] x [min/yr] x [lb/µg]
= 4,688 x 10,575 µg/m^2-min x 0.658 m^2 x 525,600 min/yr x 2.20E-9 lb/µg
= **37,720 lb-VOC/yr**

2. Post Project Potential to Emit (PE2)

N-6096-1-4:

VOC
= [# Milk Cows - Jersey] x [EF] + [# Milk Cows - Holstein] x [EF]
= (2,381 x 0.30 lb-VOC/hd-yr) + (1,724 x 0.42 lb-VOC/hd-yr) = **1,438 lb-VOC/yr**

NH_3
= [# Milk Cows - Jersey] x [EF] + [# Milk Cows - Holstein] x [EF]
= (2,381 x 0.09 lb-NH_3/hd-yr) + (1,724 x 0.14 lb-NH_3/hd-yr) = **456 lb-NH_3/yr**

N-6096-2-5:

VOC
= [# Milk Cows] x [EF] + [# Dry Cows] x [EF] + [# Support Stock] x [EF] + [#Bulls] x [EF]
= (2,381 x 6.97 lb-VOC/hd-yr) + (328 x 3.91 lb-VOC/hd-yr) + (1,761 x 3.04 lb-VOC/hd-yr) + (1,724 x 9.81 lb-VOC/hd-yr) + (237 x 5.51 lb-VOC/hd-yr) + (1,275 x 4.28 lb-VOC/hd-yr) + (60 x 1.84 lb-VOC/hd-yr) = **47,017 lb-VOC/yr**

PM10
= [# milk cows] x [EF] + [# dry cows] x [EF] + [# Support Stock] x [EF] + [# Bulls] x [EF]
= (2,381 x 1.37 lb-PM10/hd-yr) + (328 x 1.37 lb-PM10/hd-yr) + (1,761 x 1.37 lb-PM10/hd-yr) + (1,724 x 1.37 lb-PM10/hd-yr) + (237 x 1.37 lb-PM10/hd-yr) + (1,275 x 1.37 lb-PM10/hd-yr) + (60 x 1.37 lb-PM10/hd-yr) = **10,639 lb-PM10/yr**

NH_3
= [# Milk Cows] x [EF] + [# Dry Cows] x [EF] + [# Support Stock] x [EF] + [#Bulls] x [EF]
= (2,381 x 14.25 lb-NH_3/hd-yr) + (328 x 7.22 lb-NH_3/hd-yr) + (1,761 x 3.74 lb-NH_3/hd-yr) + (1,724 x 20.07 lb-NH_3/hd-yr) + (237 x 10.17 lb-NH_3/hd-yr) + (1,275 x 5.27 lb-NH_3/hd-yr) + (60 x 3.18 lb-NH_3/hd-yr) = **86,805 lb-NH_3/yr**

N-6096-3-3:

VOC
= [# Milk Cows] x [EF] + [# Dry Cows] x [EF] + [# Support Stock] x [EF] + [#Bulls] x [EF]
= (2,381 x 1.82 lb-VOC/hd-yr) + (328 x 0.98 lb-VOC/hd-yr) + (1,761 x 0.76 lb-VOC/hd-yr) + (1,724 x 2.56 lb-VOC/hd-yr) + (237 x 1.38 lb-VOC/hd-yr) + (1,275 x 1.08 lb-VOC/hd-yr) + (60 x 0.47 lb-VOC/hd-yr) = **12,139 lb-VOC/yr**

NH_3
= [# Milk Cows] x [EF] + [# Dry Cows] x [EF] + [# Support Stock] x [EF] + [#Bulls] x [EF]
= (2,381 x 10.37 lb-NH_3/hd-yr) + (328 x 5.28 lb-NH_3/hd-yr) + (1,796 x 2.73 lb-NH_3/hd-yr) + (1,724 x 14.61 lb-NH_3/hd-yr) + (237 x 7.44 lb-NH_3/hd-yr) + (1,300 x 3.86 lb-NH_3/hd-yr) + (60 x 3.18 lb-NH_3/hd-yr) = **63,294 lb-NH_3/yr**

H_2S
= NH_3 PE x 10%
= (63,294 lb-NH_3/yr) x 10% = **6,329 lb- H_2S/yr**

N-6096-4-3:

VOC
= [# Milk Cows] x [EF] + [# Dry Cows] x [EF] + [# Support Stock] x [EF] + [#Bulls] x [EF]
= (2,381 x 0.35 lb-VOC/hd-yr) + (328 x 0.19 lb-VOC/hd-yr) + (1,796 x 0.15 lb-VOC/hd-yr) + (1,724 x 0.49 lb-VOC/hd-yr) +(237 x 0.27 lb-VOC/hd-yr) + (1,300 x 0.21 lb-VOC/hd-yr) + (60 x 0.09 lb-VOC/hd-yr) = **2,342 lb-VOC/yr**

NH_3
= [# Milk Cows] x [EF] + [# Dry Cows] x [EF] + [# Support Stock] x [EF] + [#Bulls] x [EF]
= (2,381 x 2.01 lb-NH_3/hd-yr) + (328 x 1.01 lb-NH_3/hd-yr) + (1,724 x 0.53 lb-NH_3/hd-yr) + (1,724 x 2.83 lb-NH_3/hd-yr) + (237 x 1.43 lb-NH_3/hd-yr) + (1,275 x 0.75 lb-NH_3/hd-yr) + (60 x 0.65 lb-NH_3/hd-yr)= **12,264 lb-NH_3/yr**

N-6096-5-3:

Open Face Area:

= [#open face piles] x [height] x
(([width] + ([width]/(0.1667 x ([width]/[height]) + 1.111))) / 2)

Corn Area
= 1 x 18 ft x ((65 ft + (65 ft / (0.1667 x (65 ft /18 ft) + 1.111 ft))) / 2)
= 927 ft^2

Alfalfa Area
= 0 x 0 ft x ((0 ft + (0 ft / (0.1667 x 0 ft /0 ft) + 1.111 ft)) / 2)
= 0 ft^2

Wheat Area
= 1 x 15 ft x ((60 ft + (60 ft / (0.1667 x 60 ft /15 ft) + 1.111 ft)) / 2)
= 703.1218 ft^2

Silage Annual PE:

Corn Emissions
= emission factor x area x 0.0929 m^2/ft^2 x 8,760 hr/yr x 60 min/hr x 2.20E-9 lb/µg
= 21,155 x 927x 0.0929 x 8760 x 60 x 2.20E-9 lb/µg
= **2,107 lb-VOC/yr**

Alfalfa Emissions
= emission factor x area x 0.0929 m^2/ft^2 x 4,380 hr/yr x 60 min/hr x 2.20E-9 lb/µg
= 10,649 x 0 x 0.0929 x 4,380 x 60 x 2.20E-9 lb/µg
= **0 lb-VOC/yr**

Wheat Emissions
= emission factor x area x 0.0929 m^2/ft^2 x 8,760 hr/yr x 60 min/hr x 2.20E-9 lb/μg
= 26,745 x 703.1218 x 0.0929 x 8760 x 60 x 2.20E-9 lb/μg
= 2,020 lb-VOC/yr

TMR Annual PE:

TMR emissions should not include calves. However, the number of calves will be included in the total cow count as a worst-case scenario since the number of calves can vary.

= [# of cows] x [emission factor] x [area] x [min/yr] x [lb/μg]
= 7,766 x 10,575 μg/m^2-min x 0.658 m^2 x 525,600 min/yr x 2.20E-9 lb/μg
= 62,486 lb-VOC/yr

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

Pursuant to Section 4.9 of 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.

Pre-Project Stationary Source Potential to Emit [SSPE1] (lb/year)							
	NO_X	SO_X	PM_{10}	CO	VOC	NH_3	H_2S
N-6096-1-3 (Milk Parlor)	0	0	0	0	1,025	325	0
N-6096-2-3 (Cow Housing)	0	0	6,423	0	30,865	59,849	0
N-6096-3-2 (Liquid Manure Handling)	0	0	0	0	7,986	43,562	4,356
N-6096-4-2 (Solid Manure Handling)	0	0	0	0	1,538	6,491	0
N-6096-5-2 (Feed Storage and Handling)	0	0	0	0	41,847	0	0
N-6096-7-0 (Gasoline Tank)	475	1	10	54	17	0	0
Pre-Project SSPE (SSPE1)	**475**	**1**	**6,433**	**54**	**83,278**	**110,227**	**4,356**

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

Pursuant to Section 4.10 of District Rule 2201, the Post Project Stationary Source Potential to Emit (SSPE2) 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.

Post-Project Stationary Source Potential to Emit [SSPE2] (lb/year)							
	NO_X	SO_X	PM_{10}	CO	VOC	NH_3	H_2S
N-6096-1-4	0	0	0	0	1,438	456	0
N-6096-2-5	0	0	10,639	0	47,017	86,805	0
N-6096-3-3	0	0	0	0	12,139	63,294	6,329
N-6096-4-3	0	0	0	0	2,342	12,264	0
N-6096-5-3	0	0	0	0	62,486	0	0
N-6096-7-0	475	1	10	54	17	0	0
Post-Project SSPE (SSPE2)	**475**	**1**	**10,649**	**54**	**125,439**	**162,819**	**6,329**

5. Major Source Determination

Rule 2201 Major Source Determination:
Pursuant to Section 3.25 of 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 following threshold values. However, Section 3.25.2 states, "for the purposes of determining major source status, the SSPE2 shall not include 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.

Since emissions at a 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 partially 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 hot 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.

It must also be noted that EPA has determined that emissions from open-air cattle feedlots are fugitive in nature.[1] In the District's judgment, this determination for emissions from open feedlots necessitates a similar determination for the open-sided freestalls (usually with open access to corrals or pens and free movement of cattle in and out of the covered area) typical of the San Joaquin Valley since the typical open freestall barn in the San Joaquin Valley bears a far greater resemblance to an extensive shade structure located in a large open lot than an actual enclosed building. Therefore, emissions from open freestall barns are most appropriately treated as fugitive.

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 some of these piles are covered, the emissions cannot reasonably 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 in 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 Ag-bag. 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.

[1] Letter from William Wehrum, EPA Acting Administrator, to Terry Stokes, Chief Executive Officer – National Cattlemen's Beef Association (November 2, 2006) (http://www.epa.gov/Region7/programs/artd/air/nsr/nsrmemos/cowdust.pdf)

As discussed above, the VOC emissions from the milking center, cows housing, manure storage areas, land application of manure and feed handling and storage are considered fugitive. The District has determined that control technology to capture emissions from lagoons (biogas collection systems, for instance) is in use; therefore, these emissions can be reasonably collected and are not fugitive. Therefore, only emissions from the non-fugitive sources, such as lagoons, storage ponds, IC engines, and gasoline tanks, will be used to determine if dairies are major sources.

The emissions are calculated as follows:

Lagoon Emissions (Flushed Freestalls & Flushed Corrals)				
Daily Potential to Emit				
Type of Cow	Number of Cows		lb-VOC/hd-yr	lbs-VOC/yr
Milking Cow (Jersey)	2,381	x	0.87	2,071
Milking Cow (Holstein)	1,724	x	1.23	2,121
Dry Cow (Jersey)	328	x	0.47	154
Dry Cow (Holstein)	237	x	0.66	156
Support Stock (Jersey)	1,796	x	0.37	665
Support Stock (Holstein)	1,300	x	0.52	676
Total				**5,843**

Major Source Determination (lb/year)					
	NO_X	SO_X	PM_{10}	CO	VOC
N-6096-1-4, '-2-5, '-3-3, '-4-3, and '-5-3	0	0	0	0	5,843
N-6096-6-0	475	1	10	54	17
Stationary Source Potential to Emit	475	1	10	54	5,860
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.

<u>Rule 2410 Major Source Determination:</u>
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.

PSD Major Source Determination (tons/year)							
	NO2	VOC	SO2	CO	PM	PM10	CO2e*
Estimated Facility PE before Project Increase	0.2	39.6	0	0	3.2	3.2	13,141
PSD Major Source Thresholds	250	250	250	250	250	250	100,000
PSD Major Source ? (Y/N)	N	N	N	N	N	N	N

*See Appendix G for Dairy GHG/CO2e calculations

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)

The BE calculation (in lbs/year) is performed pollutant-by-pollutant for each unit within the project to calculate the QNEC, and if applicable, to determine the amount of offsets required.

Pursuant to District Rule 2201, BE = PE1 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 District Rule 2201.

As shown in Section VII.C.5 above, the facility is not a Major Source for any pollutant.

Therefore BE=PE1.

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): CO_2, N_2O, CH_4, HFCs, PFCs, and SF_6

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.

PSD Major Source Determination: Potential to Emit (tons/year)							
	NO2	VOC	SO2	CO	PM	PM10	CO2e*
Total PE from New and Modified Units	0	64.8	0	0	4.9	4.9	30,501
PSD Major Source threshold	250	250	250	250	250	250	100,000
New PSD Major Source?	N	N	N	N	N	N	N

*See Appendix G for Dairy GHG/CO2e calculations

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 D.

VIII. Compliance

Rule 1070 Inspections

This rule applies to any source operation, which emits or may emit air contaminants.

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. Therefore, 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 2201 New and Modified Stationary Source Review Rule

A. Best Available Control Technology (BACT)

1. BACT Applicability

BACT requirements are triggered on a pollutant-by-pollutant basis and on an emissions unit-by-emissions unit basis for the following*:

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 a Title I Modification.

*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

As discussed in Section VII.A above, each permit unit at a dairy is treated as an emissions unit for BACT purposes, except for the liquid manure handling permit unit, which is treated as two emissions units: lagoons/storage ponds and liquid manure land application. The facility has proposed to install a new cow housing unit:

<u>Cow Housing (N-6096-2-5)</u>

The proposed Saudi-Style barns will be identical. Therefore, the following emissions calculations are representative of both barns.

Saudi-Style Barn #2 and #3

PM10 = [(EF lb-PM_{10}/hd-yr x # milk cows) + (EF lb-PM_{10}/hd-yr x # large heifer)] / 365 days
= [(1.37 lb-PM_{10}/hd-yr x 590) + (1.37 lb-PM_{10}/hd-yr x 1,063)] / 365
= 6.2 lb-PM_{10}/day

VOC = [(EF lb-VOC/hd-yr x # Jersey milk cows) + (EF lb-VOC/hd-yr x # Jersey large heifer) + (EF lb-VOC/hd-yr x # Jersey medium heifer) + (EF lb-VOC/hd-yr x # Holstein milk cows) + (EF lb-VOC/hd-yr x # Holstein large heifer) + (EF lb-VOC/hd-yr x # Holstein medium heifer)] / 365 days
= [(6.97 lb-VOC/hd-yr x 342) + (3.04 lb-VOC/hd-yr x 617) + (2.06 lb-VOC/hd-yr x 137) + (9.81 lb-VOC/hd-yr x 248) + (4.28 lb-VOC/hd-yr x 244) + (2.91 lb-VOC/hd-yr x 99)] / 365
= 22.8 lb-VOC/day

NH3 = [(EF lb-NH_3/hd-yr x # Jersey milk cows) + (EF lb-NH_3/hd-yr x # Jersey large heifer) + (EF lb-NH_3/hd-yr x # Jersey medium heifer) + (EF lb-NH_3/hd-yr x # Holstein milk cows) + (EF lb-NH_3/hd-yr x # Holstein large heifer) + (EF lb-NH_3/hd-yr x # Holstein medium heifer)] / 365 days
= [(14.25 lb-NH_3/hd-yr x 342) + (3.74 lb-NH_3/hd-yr x 617) + (3.74 lb-NH_3/hd-yr x 137) + (20.07 lb-NH_3/hd-yr x 248) + (5.27 lb-NH_3/hd-yr x 244) + (5.27 lb-NH_3/hd-yr x 99)] / 365
= 39.7 lb-NH_3/day

As shown above, the applicant is proposing to install new cow housing with a PE greater than 2.0 lbs/day for VOC, PM_{10}, and NH_3; therefore, BACT is triggered for VOC, PM10, and NH_3 from the cow housing.

Above-ground Calf Hutches

Per District Rule 4570, above-ground flushed calf hutches are a mitigation measure that receives 28% control efficiency for NH_3 emissions.

PM10 = [(EF lb-PM_{10}/hd-yr x # calves)] / 365 days
= [(0.069 lb-PM_{10}/hd-yr x 500)] / 365
= 0.1 lb-PM_{10}/day

VOC = [(EF lb-VOC/hd-yr x # Jersey calves) + (EF lb-VOC/hd-yr x # Holstein calves)]] / 365 days
= [(0.54 lb-VOC/hd-yr x 290) + (0.77 lb-VOC/hd-yr x 210)] / 365
= 0.9 lb-VOC/day

NH3 = [(EF lb-NH_3/hd-yr x # Jersey calves) + (EF lb-NH_3/hd-yr x # Holstein calves)] / 365 days
= [(1.225 lb-NH_3/hd-yr x 290) + (1.725 lb-NH_3/hd-yr x 210)] / 365
= 1.96 lb-NH_3/day

As shown above, the applicant is proposing to install new calf hutches with a PE less than 2.0 lbs/day for PM10, VOC, and NH_3; therefore, BACT is not triggered from the calf hutches.

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

As discussed in Section I above, there are no emissions units being relocated from one stationary source to another; therefore BACT is not triggered relocation of an emissions unit.

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

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))

HAPE for the dairy permit units will be calculated based on the pre-project annual emissions and the pre-project emission factors and control efficiencies for each type of cow, which were taken from the tables in Section VII.C.1 above, and the post-project emission factors and control efficiencies that were used in the tables in Section VII.C.2 above to calculate the post project emissions (PE2) from the unit.

N-6096-1-4 (Milking Parlor)

VOC	PE_2 (lb/day)	-	PE_1 (lb/day)	x	(EF_2)	/	(EF_1)	=	AIPE (lb/day)
Jersey Milk Cow	2.0	-	1.4	x	0.30	/	0.30	=	0.6
Holstein Milk Cow	2.7	-	1.4	x	0.42	/	0.42	=	1.3
Lagoon/Storage Pond AIPE									**1.9**

NH_3	PE_2 (lb/day)	-	PE_1 (lb/day)	x	(EF_2)	/	(EF_1)	=	AIPE (lb/day)
Jersey Milk Cow	0.6	-	0.4	x	0.09	/	0.09	=	0.2
Holstein Milk Cow	0.9	-	0.5	x	0.14	/	0.14	=	0.4
Lagoon/Storage Pond AIPE									**0.6**

N-6096-3-6 (Liquid Manure Handling)

Lagoon/Storage Pond

VOC	PE_2 (lb/day)	-	PE_1 (lb/day)	x	(EF_2)	/	(EF_1)	=	AIPE (lb/day)
Jersey Milk Cow	5.4	-	3.9	x	0.83	/	0.83	=	1.5
Jersey Dry Cow	0.4	-	0.6	x	0.45	/	0.45	=	-0.2
Jersey Lg. Heifer	0.6	-	0.0	x	0.35	/	0.35	=	0.6
Jersey Med.Heifer	0.4	-	0.2	x	0.24	/	0.24	=	0.2
Jersey Sm. Heifer	0.1	-	0.1	x	0.13	/	0.13	=	0.0
Jersey Calves	0.0	-	0.0	x	0.06	/	0.06	=	0.0
Jersey Bulls	0.0	-	0.0	x	0.21	/	0.21	=	0.0
Holstein Milk Cow	5.5	-	3.9	x	1.17	/	1.17	=	1.6
Holstein Dry Cow	0.4	-	0.6	x	0.64	/	0.64	=	-0.2
Holstein Lg. Heifer	0.7	-	0.0	x	0.49	/	0.49	=	0.7
Holstein Med.Heifer	0.4	-	0.2	x	0.33	/	0.33	=	0.2
Holstein Sm. Heifer	0.1	-	0.1	x	0.19	/	0.19	=	0
Holstein Calves	0.1	-	0.0	x	0.09	/	0.09	=	0.1
Holstein Bulls	0.0	-	0.0	x	0.30	/	0.30	=	0.0
Lagoon/Storage Pond AIPE									**4.5**

NH_3	PE_2 (lb/day)	-	PE_1 (lb/day)	x	(EF_2)	/	(EF_1)	=	AIPE (lb/day)
Jersey Milk Cow	38.0	-	27.1	x	5.82	/	5.82	=	10.9
Jersey Dry Cow	2.7	-	3.7	x	2.98	/	2.98	=	-1.0
Jersey Lg. Heifer	2.9	-	0.0	x	1.56	/	1.56	=	2.9
Jersey Med.Heifer	1.7	-	0.9	x	1.07	/	1.07	=	0.8
Jersey Sm. Heifer	0.5	-	0.5	x	0.85	/	0.85	=	0.0
Jersey Calves	0.2	-	0.0	x	0.25	/	0.25	=	0.2
Jersey Bulls	0.2	-	0.2	x	2.13	/	2.13	=	0.0
Holstein Milk Cow	38.7	-	27.6	x	8.20	/	8.20	=	11.1
Holstein Dry Cow	2.7	-	3.8	x	4.20	/	4.20	=	-1.1
Holstein Lg. Heifer	2.9	-	0.0	x	2.20	/	2.20	=	2.9
Holstein Med.Heifer	1.8	-	1.0	x	1.50	/	1.50	=	0.8
Holstein Sm. Heifer	0.5	-	0.5	x	1.20	/	1.20	=	0.0
Holstein Calves	0.2	-	0.0	x	0.35	/	0.35	=	0.2
Holstein Bulls	0.2	-	0.2	x	3.00	/	3.00	=	0.0
Lagoon/Storage Pond AIPE									**27.7**

The Pre- and Post-Project pH levels and H2S concentrations will stay the same. Therefore, EF2/EF1 = 1.

AIPE = PE2 – (PE1 x (EF2 / EF1))

$= 17.3$ lb-H_2S/day – (11.9 lb-H_2S/day x (1))

$= 17.3$ lb-H_2S/day – 11.9 lb-H_2S/day

$= 5.4$ lb-H_2S/day

As demonstrated above, the AIPE is greater than 2.0 lb/day for VOC, NH_3, and H_2S from the lagoon system; therefore BACT is triggered for VOC, NH_3, and H_2S from the lagoon system.

Land Application

VOC	PE_2 (lb/day)	-	PE_1 (lb/day)	x	(EF_2)	/	(EF_1)	=	AIPE (lb/day)
Jersey Milk Cow	5.8	-	4.1	x	0.89	/	0.89	=	1.7
Jersey Dry Cow	0.4	-	0.6	x	0.49	/	0.49	=	-0.2
Jersey Lg. Heifer	0.7	-	0.0	x	0.37	/	0.37	=	0.7
Jersey Med.Heifer	0.4	-	0.2	x	0.25	/	0.25	=	0.2
Jersey Sm. Heifer	0.1	-	0.1	x	0.14	/	0.14	=	0.0
Jersey Calves	0.1	-	0.0	x	0.07	/	0.07	=	0.1
Jersey Bulls	0.0	-	0.0	x	0.22	/	0.22	=	0.0
Holstein Milk Cow	6.0	-	4.2	x	1.26	/	1.26	=	1.8
Holstein Dry Cow	0.4	-	0.6	x	0.69	/	0.69	=	-0.2
Holstein Lg. Heifer	0.7	-	0.0	x	0.53	/	0.53	=	0.7
Holstein Med.Heifer	0.4	-	0.2	x	0.36	/	0.36	=	0.2
Holstein Sm. Heifer	0.1	-	0.1	x	0.20	/	0.20	=	0.0
Holstein Calves	0.1	-	0.0	x	0.10	/	0.10	=	0.1
Holstein Bulls	0.0	-	0.0	x	0.32	/	0.32	=	0.0
Land Application AIPE									**5.1**

NH_3	PE_2 (lb/day)	-	PE_1 (lb/day)	x	(EF_2)	/	(EF_1)	=	AIPE (lb/day)
Jersey Milk Cow	41.2	-	29.4	x	6.32	/	6.32	=	11.8
Jersey Dry Cow	2.9	-	4.0	x	3.20	/	3.20	=	-1.1
Jersey Lg. Heifer	3.0	-	0.0	x	1.63	/	1.63	=	3.0
Jersey Med.Heifer	2.0	-	1.1	x	1.21	/	1.21	=	0.9
Jersey Sm. Heifer	0.5	-	0.5	x	0.92	/	0.92	=	0.0
Jersey Calves	0.2	-	0.0	x	0.26	/	0.26	=	0.2
Jersey Bulls	0.2	-	0.2	x	2.29	/	2.29	=	0.0
Holstein Milk Cow	42.0	-	30.0	x	8.90	/	8.90	=	12
Holstein Dry Cow	2.9	-	4.1	x	4.50	/	4.50	=	-1.2
Holstein Lg. Heifer	3.1	-	0.0	x	2.30	/	2.30	=	3.1
Holstein Med.Heifer	2.0	-	1.1	x	1.70	/	1.70	=	0.9
Holstein Sm. Heifer	0.5	-	0.5	x	1.30	/	1.30	=	0.0
Holstein Calves	0.2	-	0.0	x	0.37	/	0.37	=	0.2
Holstein Bulls	0.2	-	0.2	x	3.23	/	3.23	=	0
								Land Application AIPE	**29.8**

As demonstrated above, the AIPE is greater than 2.0 lb/day for VOC and NH_3 from the land application; therefore BACT is triggered for VOC and NH_3 from land application.

<u>Solid Manure Handling System (N-6096-4-3):</u>

<u>Solid Manure Storage</u>

VOC	PE_2 (lb/day)	-	PE_1 (lb/day)	x	(EF_2)	/	(EF_1)	=	AIPE (lb/day)
Jersey Milk Cow	0.6	-	0.4	x	0.09	/	0.09	=	0.2
Jersey Dry Cow	0.0	-	0.1	x	0.05	/	0.05	=	-0.1
Jersey Lg. Heifer	0.1	-	0.0	x	0.04	/	0.04	=	0.1
Jersey Med.Heifer	0.0	-	0.0	x	0.02	/	0.02	=	0.0
Jersey Sm. Heifer	0.0	-	0.0	x	0.01	/	0.01	=	0.0
Jersey Calves	0.0	-	0.0	x	0.01	/	0.01	=	0.0
Jersey Bulls	0.0	-	0.0	x	0.02	/	0.02	=	0.0
Holstein Milk Cow	0.6	-	0.8	x	0.12	/	0.12	=	-0.2
Holstein Dry Cow	0.0	-	0.1	x	0.07	/	0.07	=	-0.1
Holstein Lg. Heifer	0.1	-	0.0	x	0.05	/	0.05	=	0.1
Holstein Med.Heifer	0.0	-	0.0	x	0.03	/	0.03	=	0.0
Holstein Sm. Heifer	0.0	-	0.0	x	0.02	/	0.02	=	0.0
Holstein Calves	0.0	-	0.0	x	0.01	/	0.01	=	0.0
Holstein Bulls	0.0	-	0.0	x	0.03	/	0.03	=	0.0
								Land Application AIPE	**0.0**

NH_3	PE_2 (lb/day)	-	PE_1 (lb/day)	x	(EF_2)	/	(EF_1)	=	AIPE (lb/day)
Jersey Milk Cow	4.4	-	3.1	x	0.67	/	0.67	=	1.3
Jersey Dry Cow	0.3	-	0.4	x	0.34	/	0.34	=	-0.1
Jersey Lg. Heifer	0.3	-	0.0	x	0.18	/	0.18	=	0.3
Jersey Med.Heifer	0.2	-	0.1	x	0.13	/	0.13	=	0.1
Jersey Sm. Heifer	0.1	-	0.1	x	0.09	/	0.09	=	0.0
Jersey Calves	0.0	-	0.0	x	0.03	/	0.03	=	0.0
Jersey Bulls	0.0	-	0.0	x	0.25	/	0.25	=	0.0
Holstein Milk Cow	4.5	-	3.2	x	0.95	/	0.95	=	-0.1
Holstein Dry Cow	0.3	-	0.4	x	0.48	/	0.48	=	0.3
Holstein Lg. Heifer	0.3	-	0.0	x	0.25	/	0.25	=	0.1
Holstein Med.Heifer	0.2	-	0.1	x	0.18	/	0.18	=	0.0
Holstein Sm. Heifer	0.1	-	0.1	x	0.13	/	0.13	=	0.0
Holstein Calves	0.0	-	0.0	x	0.04	/	0.04	=	0.0
Holstein Bulls	0.0	-	0.0	x	0.35	/	0.35	=	0.0
								Land Application AIPE	**3.2**

As demonstrated above, the AIPE is not greater than 2.0 lb/day for VOC, but is greater than 2.0 lb/day for NH_3; therefore BACT is only triggered for NH_3 from solid manure storage.

Separate Solids Piles

VOC	PE_2 (lb/day)	-	PE_1 (lb/day)	x	(EF_2)	/	(EF_1)	=	AIPE (lb/day)
Jersey Milk Cow	0.3	-	0.2	x	0.04	/	0.04	=	0.1
Jersey Dry Cow	0.0	-	0.0	x	0.02	/	0.02	=	0.0
Jersey Lg. Heifer	0.0	-	0.1	x	0.02	/	0.02	=	-0.1
Jersey Med.Heifer	0.0	-	0.0	x	0.01	/	0.01	=	0.0
Jersey Sm. Heifer	0.0	-	0.0	x	0.01	/	0.01	=	0.0
Jersey Calves	0.0	-	0.0	x	0.00	/	0.00	=	0.0
Jersey Bulls	0.0	-	0.0	x	0.01	/	0.01	=	0.0
Holstein Milk Cow	0.5	-	0.2	x	0.05	/	0.05	=	0.3
Holstein Dry Cow	0.0	-	0.0	x	0.03	/	0.03	=	0.0
Holstein Lg. Heifer	0.1	-	0.0	x	0.02	/	0.02	=	0.1
Holstein Med.Heifer	0.0	-	0.0	x	0.02	/	0.02	=	0.0
Holstein Sm. Heifer	0.0	-	0.0	x	0.01	/	0.01	=	0.0
Holstein Calves	0.0	-	0.0	x	0.00	/	0.00	=	0.0
Holstein Bulls	0.0	-	0.0	x	0.02	/	0.02	=	0.0
								Land Application AIPE	**0.4**

NH_3	PE_2 (lb/day)	-	PE_1 (lb/day)	x	(EF_2)	/	(EF_1)	=	AIPE (lb/day)
Jersey Milk Cow	1.8	-	1.3	x	0.27	/	0.27	=	0.5
Jersey Dry Cow	0.1	-	0.2	x	0.13	/	0.13	=	-0.1
Jersey Lg. Heifer	0.1	-	0.0	x	0.07	/	0.07	=	0.1
Jersey Med.Heifer	0.1	-	0.0	x	0.05	/	0.05	=	0.1
Jersey Sm. Heifer	0.0	-	0.0	x	0.04	/	0.04	=	0.0
Jersey Calves	0.0	-	0.0	x	0.01	/	0.01	=	0.0
Jersey Bulls	0.0	-	0.0	x	0.10	/	0.10	=	0.0
Holstein Milk Cow	1.8	-	1.3	x	0.38	/	0.38	=	0.5
Holstein Dry Cow	0.1	-	0.2	x	0.19	/	0.19	=	-0.1
Holstein Lg. Heifer	0.1	-	0.0	x	0.10	/	0.10	=	0.1
Holstein Med.Heifer	0.1	-	0.0	x	0.07	/	0.07	=	0.1
Holstein Sm. Heifer	0.0	-	0.0	x	0.05	/	0.05	=	0.0
Holstein Calves	0.0	-	0.0	x	0.02	/	0.02	=	0.0
Holstein Bulls	0.0	-	0.0	x	0.14	/	0.14	=	0.0
								Land Application AIPE	**1.2**

As demonstrated above, the AIPE is not greater than 2.0 lb/day for VOC or NH_3; therefore BACT is not triggered separate solids piles.

Land Application

VOC	PE_2 (lb/day)	-	PE_1 (lb/day)	x	(EF_2)	/	(EF_1)	=	AIPE (lb/day)
Jersey Milk Cow	1.4	-	1.0	x	0.21	/	0.21	=	0.4
Jersey Dry Cow	0.1	-	0.1	x	0.11	/	0.11	=	0.0
Jersey Lg. Heifer	0.2	-	0.0	x	0.09	/	0.09	=	0.2
Jersey Med.Heifer	0.1	-	0.1	x	0.06	/	0.06	=	0.0
Jersey Sm. Heifer	0.0	-	0.0	x	0.03	/	0.03	=	0.0
Jersey Calves	0.0	-	0.0	x	0.02	/	0.02	=	0.0
Jersey Bulls	0.0	-	0.0	x	0.05	/	0.05	=	0.0
Holstein Milk Cow	1.4	-	1.0	x	0.30	/	0.30	=	0.4
Holstein Dry Cow	0.4	-	0.5	x	0.16	/	0.16	=	-0.1
Holstein Lg. Heifer	0.2	-	0.0	x	0.12	/	0.12	=	0.2
Holstein Med.Heifer	0.1	-	0.1	x	0.08	/	0.08	=	0.0
Holstein Sm. Heifer	0.0	-	0.0	x	0.05	/	0.05	=	0.0
Holstein Calves	0.0	-	0.0	x	0.02	/	0.02	=	0.0
Holstein Bulls	0.0	-	0.0	x	0.07	/	0.07	=	0.0
								Land Application AIPE	**1.1**

NH_3	PE_2 (lb/day)	-	PE_1 (lb/day)	x	(EF_2)	/	(EF_1)	=	AIPE (lb/day)
Jersey Milk Cow	9.7	-	6.9	x	1.48	/	1.48	=	2.8
Jersey Dry Cow	0.7	-	0.9	x	0.75	/	0.75	=	-0.2
Jersey Lg. Heifer	0.7	-	0.0	x	0.39	/	0.39	=	0.7
Jersey Med.Heifer	0.5	-	0.2	x	0.28	/	0.28	=	0.3
Jersey Sm. Heifer	0.1	-	0.1	x	0.21	/	0.21	=	0.0
Jersey Calves	0.0	-	0.0	x	0.06	/	0.06	=	0.0
Jersey Bulls	0.1	-	0.1	x	0.54	/	0.54	=	0.0
Holstein Milk Cow	9.9	-	7.0	x	2.09	/	2.09	=	2.9
Holstein Dry Cow	0.7	-	1.0	x	1.06	/	1.06	=	-0.3
Holstein Lg. Heifer	0.7	-	0.0	x	0.55	/	0.55	=	0.7
Holstein Med.Heifer	0.5	-	0.2	x	0.39	/	0.39	=	0.3
Holstein Sm. Heifer	0.1	-	0.1	x	0.30	/	0.30	=	0.0
Holstein Calves	0.1	-	0.0	x	0.09	/	0.09	=	0.1
Holstein Bulls	0.1	-	0.1	x	0.76	/	0.76	=	0.0
Land Application AIPE									**7.3**

As demonstrated above, the AIPE from separate solids piles is not greater than 2.0 lb/day for VOC, but greater than 2.0 lb/day for NH_3; therefore BACT is triggered only for NH_3 from land application.

Feed Storage and Handling Permit Unit (N-6096-5-3):

Feed Storage and Handling					
VOC Emissions - Silage					
	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
Corn Silage	5.8	5.8	21,155	21,155	0.0
Alfalfa Silage	0.0	0.0	10,649	10,649	0.0
Wheat Silage	5.5	5.5	26,745	26,745	0.0
Total					0.0
VOC Emissions - TMR					
	PE2 (lb/day)	PE1 (lb/day)	EF2	EF1	AIPE (lb/day)
TMR	171.2	103.3	7,709	7,709	67.8
Total					**67.8**

As demonstrated above, the AIPE from TMR is greater than 2.0 lb/day for VOC, but not greater than 2.0 lb/day for silage; therefore BACT is triggered for VOC only from TMR.

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; 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 E), BACT has been satisfied with the following:

Cow Housing (N-6096-2-5)

PM_{10}:
1) Biweekly scraping and/or manure removal of the exercise pens using a pull type manure harvesting equipment in morning hours when moisture in air except during periods of rainy weather.
2) Concrete freestall and drylot feed lanes and walkways.

VOC:
1) Concrete feed lanes and walkways for all cows
2) Flushing the manure lanes and walkways for the milk and dry cows four times per day and flushing manure lanes and walkways for the remaining animals once per day (or for dairies that cannot use a flush system, scraping manure lanes and walkways for mature cows (milk and dry cows) with an automatic scraper four times per day and cleaning manure lanes and walkways for support stock (heifers) at least once per day)
3) Feeding all animals in accordance with National Research Council (NRC) or other District-approved guidelines.
4) Biweekly scraping and/or manure removal of the exercise pens using a pull type manure harvesting equipment in morning hours when moisture in air except during periods of rainy weather.
5) Properly sloping corrals (minimum of 3% slope where 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.
6) At least one of the feedings of the heifers at this dairy shall be near (within one hour of) dusk.
7) VOC mitigation measures required by District Rule 4570.

NH_3:
1) Concrete feed lanes and walkways in freestall barns for all cows
2) Flushing the manure lanes and walkways for the milk and dry cows four times per day and flushing manure lanes and walkways for the remaining animals once per day (or for dairies that cannot use a flush system, scraping manure lanes and walkways for mature cows (milk and dry cows) with an automatic scraper four times per day and cleaning manure lanes and walkways for support stock (heifers) at least once per day)
3) Feeding all animals in accordance with National Research Council (NRC) or other District-approved guidelines.
4) Biweekly scraping and/or manure removal of the exercise pens using a pull type manure harvesting equipment in morning hours when moisture in air except during periods of rainy weather.
5) Properly sloping corrals (minimum of 3% slope where 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.

Liquid Manure Handling System (N-6096-3-2)

Lagoon & Storage Pond

VOC: 1) Anaerobic treatment lagoon designed according to Natural Resources Conservation Service (NRCS) guideline (or phototropic lagoon determined to be equivalent), and solids removal/separation system (mechanical separator(s) or settling basin(s)/weeping well(s) with accumulated solids removed at least once every 3 months, except when prevented by wet conditions).

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

H_2S: 1) All animals fed in accordance with National Research Council (NRC) or other District-approved guidelines utilizing routine nutritional analysis for rations.

2) Solids separation system (mechanical separators or settling basins)

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 Handling and Land Application (N-6096-4-3)

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

NH3: 2) Rapid incorporation of solid manure into the soil after land application

Feed Storage and Handling - TMR (N-6096-5-3)

VOC: Implement District Rule 4570 management practices for feed.

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.

b. PE > 100 lb/day

The PE2 for this new unit is compared to the daily PE Public Notice thresholds in the following table:

<u>N-6096-1-4, '-3-3, '-4-3, and '-5-3</u>
Applications which include a new emissions unit with a PE greater than 100 pounds during any one day for any pollutant will trigger public noticing requirements. There are no new emissions units associated with this project. Therefore public noticing is not required for this project for PE > 100 lb/day.

<u>N-6096-2-5</u>
The new emissions units (Saudi-Style Barn #2 and #3) are identical. Therefore, the following table is representative for each new barn.

PE > 100 lb/day Public Notice Thresholds			
Pollutant	PE2 (lb/day)	Public Notice Threshold	Public Notice Triggered?
NO_X	0	100 lb/day	No
SO_X	0	100 lb/day	No
PM_{10}	6.2	100 lb/day	No
CO	0.0	100 lb/day	No
VOC	22.8	100 lb/day	No

Therefore, public noticing for PE > 100 lb/day purposes is required.

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	475	475	20,000 lb/year	No
SO_X	1	1	54,750 lb/year	No
PM_{10}	6,433	10,649	29,200 lb/year	No
CO	54	54	200,000 lb/year	No
VOC	83,278	125,439	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	475	475	0	20,000 lb/year	No
SO_x	1	1	0	20,000 lb/year	No
PM_{10}	10,649	6,433	4,216	20,000 lb/year	No
CO	54	54	0	20,000 lb/year	No
VOC	125,439	83,278	42,161	20,000 lb/year	Yes
NH_3	162,819	110,227	52,592	20,000 lb/year	Yes

As shown above, the SSIPEs for all pollutants are less than 20,000 lb/year except for VOC and NH_3; therefore public noticing for VOC and NH_3 is required.

2. Public Notice Action

As discussed above, public notice will be required for exceeding the SSIPE threshold for VOC and NH_3.

D. Daily Emission Limits (DELs)

Daily Emissions Limitations (DELs) and other enforceable conditions are required by Section 3.17 to restrict a unit's maximum daily emissions, to a level at or below the emissions associated with the maximum design capacity. Per Sections 3.17.1 and 3.17.2, 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.

N-6096-2-5 (Cow Housing):

- The number of cattle housed at this dairy at any one time shall not exceed any of the following: 2,381 Jersey milk cows; 328 Jersey dry cows; 1,761 Jersey support stock; 1,724 Holstein milk cows; 237 Holstein dry cows; 1,275 Holstein support stock; and 60 bulls. [District Rule 2201]
- The number of calves may exceed the value stated in the equipment description as long as the total support stock (heifers, bulls, and calves) does not exceed the combined values stated in the equipment description, and there is no increase in the number of hutches or corrals. [District Rule 2010]
- The feed lanes and walkways at this dairy shall be constructed of concrete. [District Rule 2201]

- 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

1. Source Testing

No source testing is currently required for dairy operations.

2. Monitoring

No monitoring is required for this project.

3. Recordkeeping

N-6096-2-5 (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 exercise pens are scraped. [District Rule 2201]
- 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 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]

N-6096-3-3 (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 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]

N-6096-4-3 (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]

N-6096-5-3 (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 F 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[2] 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.

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[2] 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.

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.

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[3]	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[4]	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

[3] 0.01 + 0.07 = 0.08 lbs/hd-yr
[4] 0.012 + 0.15 = 0.162 lbs/hd-yr

these factors at this time in order to calculate the worst-case emissions. The emission calculations are shown below:.

HAP Emissions Dairy						
Type of Cow	**Number of cows**		**Emission Factor lbs/hd-yr***		**lbs/yr**	**tons/yr**
Milking Cow	4,105	x	1.828	=	7,504	3.8
Dry Cow	565	x	1.123	=	634	0.3
Heifer (15-24 mo)	1,160	x	0.786	=	912	0.5
Heifer (7-14 mo)	1,026	x	0.686	=	704	0.4
Heifer (4-6 mo)	350	x	0.621	=	217	0.1
Calf (under 3 mo)	500	x	0.584	=	292	0.1
Bulls	60	x	1.123	=	67	0.0
Total				=	**10,331**	**5.2**

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

Total HAPS = (10,331 lbs/yr)/ 2000 = 5.2 tons/year

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 3.03 tons per year (4.1 tons 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

Section 5.0 stipulates that no person shall discharge into the atmosphere emissions of any air contaminant aggregating more than 3 minutes in any 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 considered to be exempt.

Pursuant to District Rule 8081, Section 4.1, on-field agricultural sources are exempt from the requirements of Regulation VIII.

An on-field agricultural source is 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;

The units involved in this project are used solely for the raising of dairy animals. Therefore, these units are exempt from the provisions of this rule.

Rule 4102 Nuisance

Section 4.0 prohibits discharge of air contaminants which could cause injury, detriment, nuisance or annoyance to the public.

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

California Health and Safety Code 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 F), the total facility prioritization score including this project was less than one. Therefore, no further analysis was required and the project was approved without TBACT.

Categories	Dairy Milk Parlor (Unit 1-4)	Dairy Cow House (Unit 2-5)	Dairy Lagoon (Unit 3-3)	Solid Manure Storage (Unit 4-3)	Feed and Storage (Unit 5-3)	Project Totals	Facility Totals
Prioritization Score	N/A[1]	N/A[1]	N/A[1]	N/A[2]	N/A[3]	N/A	>1.0
Acute Hazard Index	0.00	0.10	0.31[4]	N/A[2]	N/A[3]	0.41	0.41
Chronic Hazard Index	0.00	0.02	0.00	N/A[2]	N/A[3]	0.02	0.02
Maximum Individual Cancer Risk (10^{-6})	0.04	0.62	0.83	N/A[2]	N/A[3]	1.49	1.51
T-BACT Required?	NO	NO	NO	NO	NO		
Special Permit Conditions?	NO	NO	NO	NO	NO		

1 Prioritization for this unit was not conducted since the facility has a previous cancer risk score.
2 Solid Manure NH_3 emissions were combined with lagoon emissions unit 3-3.
3 At this time there is no Toxic emission information from feed and storage emissions.
4 H_2S analysis was required for the project's proposed lagoon and storage pond and was added to unit (3-3).

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).

In addition to the above analysis, a CEQA Health Risk Assessment was also performed. To comply with CEQA, all sources including mobile sources that are attributed to the project were also included in the analysis. In accordance with District CEQA guidance these additional sources include the emissions from milk trucks traveling to and from the milk barn from Whitesbridge Road, feed trucks traveling to and from the feed storage are from Whitesbridge Road, and trucks hauling manure for land application from the solids handling area to the fields; emissions during idling of milk trucks at the milk barn, feed trucks at the feed storage area, and manure hauling trucks at the solids handling area; and emissions from the tractor used to scrape manure from the corrals.

The following conclusions were drawn from these analyses:

1. There will be no significant contributions to a violation of the State Ambient Air Standards for PM10 because the maximum predicted 24-hour PM10 concentration is less than the District's draft interim significance threshold.
2. Cancer, chronic non-carcinogenic, and acute risks from emissions of toxic air contaminants at the proposed dairy expansion will not be significant. The maximum impacts are below the District's significance levels for CEQA (i.e., a cancer risk less than 10 in a million and chronic non-carcinogenic and acute HIs less than 1).

Therefore, the emission increases for this project was determined to be less than significant. The HRA Summary and the CEQA HRA summary are attached in Appendix G of this report.

Special Permit Conditions

The following conditions will be added to permit unit '-3-3 to ensure that human health risks will not exceed District allowable levels:

- The pH value cannot be any lower than 7.5. [District Rules 2201 and 4102]
- The quarterly H2S concentration cannot exceed 5 mg/L. [District Rules 2201 and 4102]

Rule 4550 Conservation Management Practices (CMP)

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 December 17, 2009. The current CMP is for 3,955 total mature cows (milk and dry); therefore, 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).

The applicant submitted an Authority to Construct (ATC) application to incorporate the requirements of District Rule 4570 into the permits for the existing dairy (Project # N-1111055). Because it has been determined that the mitigation measures required by Rule 4570 for the expansion are required as BACT, implementation of these measures will be required upon commencement of construction under the ATCs authorizing the expansion. According to the facility, the Rule 4570 mitigation measures have already been implemented for the expansion.

Therefore, the facility is in compliance with this Rule.

California Health and Safety Code 42301.6 (School Notice)

The applicant states that this site is not located within 1,000 feet of a school. Therefore, pursuant to California Health and Safety Code 42301.6, 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.

The County of Merced (County) is the public agency having principal responsibility for approving the Project. As such, the County served as the Lead Agency for the project. On December 5, 2012, the County certified the Environmental Impact Report (EIR), finding that emissions from mobile sources would have a significant, unavoidable impact on air quality. The County approved the project and adopted a Statement of Overriding Consideration (SOC). 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). 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 considered the Final EIR certified by the County.

The District's engineering evaluation of the project (this document) demonstrates that the District would impose permit conditions requiring the applicant to meet BACT. Thus, the District concludes that through a combination of project design elements and permit conditions, project specific stationary source emissions will be reduced to less than significant levels.

The County concluded that emissions from mobile sources would have a significant impact on air quality. The District finds that impacts from mobile source emissions are within the jurisdiction of the California Air Resources Board. The District has no statutory authority over mobile source emissions and cannot impose additional mitigation measures to reduce emissions from those sources.

As a Responsible Agency the District is required to issue findings for significant air quality impacts detailed in the Lead Agency's EIR and adopt an SOC. The District has required all feasible mitigation measures to lessen stationary source emissions impacts to air quality from this project. As a single purpose agency, the District lacks the Lead Agency's broader scope of authority over the project and does not believe that it should overrule the decisions made by the Lead Agency. Accordingly, after considering the Lead Agency's EIR, the SOC, and the substantial evidence the Lead Agency relied on in adopting the SOC, the District finds that it had no basis on which to disagree with the SOC and evidence relied on therein. The District therefore adopts the Lead Agency's SOC by reference as its own.

IX. Recommendation

Compliance with all applicable rules and regulations is expected. Pending a successful Public Noticing period, issue Authorities to Construct N-6096-1-4, '-2-5, '-3-3, '-4-3, and '-5-3 subject to the permit conditions on the attached draft Authorities to Construct in Appendix B.

X. Billing Information

Annual Permit Fees			
Permit Number	Fee Schedule	Fee Description	Annual Fee
N-6096-1-4	3020-06	Milking Parlors	$105.00
N-6096-2-5	3020-06	Cow Housing	$105.00
N-6096-3-3	3020-06	Liquid Manure Handling System	$105.00
N-6096-4-3	3020-06	Solid Manure Handling System	$105.00
N-6096-5-3	3020-06	Feed Storage and Handling	$105.00

Appendixes

A: Current Dairy Permits (N-6096-1-3, '-2-3, '-3-2, '-4-2, and '-5-2)
B: Draft ATCs (N-6096-1-4, '-2-5, '-3-3, '-4-3, and '-5-3)
C: Anaerobic Treatment Lagoon Design Check
D: Quarterly Net Emissions Change
E: BACT Analysis
F: Summary of Health Risk Assessment (HRA) and Ambient Air Quality Analysis (AAQA)
G: Dairy GHG Calculations
H: Memo – Antonio Azevedo Verbal Land Use Agreement

APPENDIX A
Current Dairy Permits (N-6096-1-3, '-2-3, '-3-2, '-4-2, and '-5-2)

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: N-6096-1-3 **EXPIRATION DATE:** 12/31/2014

EQUIPMENT DESCRIPTION:
2,926 COW MILKING OPERATION WITH ONE 50 STALL ROTARY 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 February 19, 2013. [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: N-6096-2-3 **EXPIRATION DATE:** 12/31/2014

EQUIPMENT DESCRIPTION:
COW HOUSING - 2,926 MILK COWS NOT TO EXCEED A COMBINED TOTAL OF 3,718 MATURE COWS (MILK AND DRY COWS); 970 TOTAL SUPPORT STOCK (HEIFERS AND BULLS); AND 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 February 19, 2013. [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 inspect water pipes and troughs and repair leaks at least once every seven (7) days. [District Rule 4570]
8. 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]
9. 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]
10. 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]
11. 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]

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

12. 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]
13. 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]
14. 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]
15. 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]
16. 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]
17. Permittee shall measure and document the depth of manure in the corrals at least once every ninety (90) days. [District Rule 4570]
18. 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]
19. 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]
20. 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: N-6096-3-2 **EXPIRATION DATE:** 12/31/2014

EQUIPMENT DESCRIPTION:
LIQUID MANURE HANDLING SYSTEM CONSISTING OF ONE SETTLING BASIN; AND ONE LAGOON; MANURE LAND APPLIED THROUGH FLOOD 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 February 19, 2013. [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 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]
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: N-6096-4-2 **EXPIRATION DATE:** 12/31/2014

EQUIPMENT DESCRIPTION:
SOLID MANURE HANDLING CONSISTING OF MANURE STOCK PILES; WINDROW STATIC PILE COMPOSTING; SOLID MANURE APPLICATION TO LAND AND 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 February 19, 2013. [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 solid manure from housing, permittee shall either 1) remove dry manure from the facility, or 2) 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 twenty-four (24) hours per event. [District Rule 4570]
7. Permittee shall keep records of dates when manure is removed from the facility or permittee shall maintain records to demonstrate that dry manure piles outside the pens are covered with a weatherproof covering from October through May. [District Rule 4570]
8. If weatherproof coverings are used, permittee shall maintain records, such as manufacturer warranties or other documentation, demonstrating that the weatherproof covering over dry manure 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
These terms and conditions are part of the Facility-wide Permit to Operate.

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: N-6096-5-2 **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 February 19, 2013. [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

14. Permittee shall feed steam-flaked, dry rolled, cracked or ground corn or other steam-flaked, dry rolled, cracked or ground cereal grains. [District Rule 4570]
15. Permittee shall maintain records to demonstrate animals are fed steam-flaked, dry rolled, cracked or ground corn or other steam-flaked, dry rolled, cracked or ground cereal grains. 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]
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

Draft ATCs (N-6096-1-4, '-2-5, '-3-3, '-4-3, and '-5-3)

San Joaquin Valley
Air Pollution Control District

AUTHORITY TO CONSTRUCT

PERMIT NO: N-6096-1-4 **ISSUANCE DATE:** DRAFT

LEGAL OWNER OR OPERATOR: ANTONIO AZEVEDO DAIRY
MAILING ADDRESS: 2025 W EL NIDO
EL NIDO, CA 95317

LOCATION: 2025 W EL NIDO
EL NIDO, CA 95317

EQUIPMENT DESCRIPTION:
MODIFICATION OF 2,926 COW MILKING OPERATION WITH ONE 50 STALL ROTARY MILK PARLOR: ADDITION OF 1,179 MILK COWS

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 (209) 557-6400 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

Arnaud Marjollet, Director of Permit Services

N-6096-1-4 : Apr 28 2014 2:14PM – YOSHIMUJ : Joint Inspection NOT Required

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: N-6096-2-5 **ISSUANCE DATE:** DRAFT

LEGAL OWNER OR OPERATOR: ANTONIO AZEVEDO DAIRY
MAILING ADDRESS: 2025 W EL NIDO
EL NIDO, CA 95317

LOCATION: 2025 W EL NIDO
EL NIDO, CA 95317

EQUIPMENT DESCRIPTION:
MODIFICATION OF COW HOUSING - 2,926 MILK COWS NOT TO EXCEED A COMBINED TOTAL OF 3,718 MATURE COWS (MILK AND DRY COWS); 970 TOTAL SUPPORT STOCK (HEIFERS AND BULLS); AND FREESTALLS WITH FLUSH SYSTEM: ADD 1,179 MILK COWS; REMOVE 227 DRY COWS; ADD 2,126 SUPPORT STOCK; INSTALL TWO SAUDI-STYLE FREESTALL BARNS AND 500 CALF HUTCHES

CONDITIONS

1. The number of cattle housed at this dairy at any one time shall not exceed any of the following: 2,381 Jersey milk cows; 328 Jersey dry cows; 1,761 Jersey support stock; 1,724 Holstein milk cows; 237 Holstein dry cows; 1,275 Holstein support stock; and 60 bulls. [District Rule 2201]
2. {4671} The number of calves may exceed the value stated in the equipment description as long as the total support stock (heifers, bulls, and calves) does not exceed the combined value stated in the equipment description, and there is no increase in the number of hutches or corrals. [District Rule 2010]
3. {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]
4. {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]

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (209) 557-6400 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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Arnaud Marjollet, Director of Permit Services
N-6096-2-5 : Jul 22 2014 3:28PM – YOSHIMUJ : Joint Inspection NOT Required

5. {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]
6. The manure lanes and walkways at this dairy shall be constructed of concrete. [District Rule 2201]
7. Calves shall be housed in individual calf hutches. [District Rule 2201]
8. 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]
9. At least one of the feedings of the heifers at this dairy shall be near (within one hour of) dusk. [District Rule 2201]
10. The manure lanes and walkways for mature cows at this dairy shall be flushed at least four times per day. The manure lanes and walkways for support stock at this dairy shall be flushed at least once per day. [District Rules 2201 and 4570]
11. 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]
12. 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]
13. Permittee shall keep records or maintain an operating plan that requires the manure lanes and walkways for mature cows to be flushed at least four times per day and the manure lanes and walkways for support stock to be flushed at least once per day. [District Rules 2201 and 4570]
14. 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 Rule2201]
15. Permittee shall maintain records of dates exercise pens are scraped. [District Rule 2201]
16. 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]
17. {4486} 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]
18. {4499} Permittee shall inspect water pipes and troughs and repair leaks at least once every seven (7) days. [District Rule 4570]
19. {4500} 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]
20. {4501} 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]
21. {4502} 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]
22. {4554} 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]

CONDITIONS CONTINUE ON NEXT PAGE

23. {4555} 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]

24. {4556} 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]

25. {4517} 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]

26. {4518} 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]

27. {4519} Permittee shall measure and document the depth of manure in the corrals at least once every ninety (90) days. [District Rule 4570]

28. {4449} 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]

29. {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]

30. {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: N-6096-3-3 **ISSUANCE DATE:** DRAFT

LEGAL OWNER OR OPERATOR: ANTONIO AZEVEDO DAIRY
MAILING ADDRESS: 2025 W EL NIDO
EL NIDO, CA 95317

LOCATION: 2025 W EL NIDO
EL NIDO, CA 95317

EQUIPMENT DESCRIPTION:
MODIFICATION OF LIQUID MANURE HANDLING SYSTEM CONSISTING OF ONE SETTLING BASIN; AND ONE LAGOON; MANURE LAND APPLIED THROUGH FLOOD IRRIGATION): INCREASE LIQUID MANURE DUE TO THE INCREASE IN HERD SIZE; INSTALL AN ANAEROBIC TREATMENT LAGOON SYSTEM AND A STORAGE POND

CONDITIONS

1. The pH value cannot be any lower than 7.5. [District Rules 2201 and 4102]
2. The quarterly H2S concentration cannot exceed 5 mg/L. [District Rules 2201 and 4102]
3. {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]
4. {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]
5. Permittee shall use an anaerobic treatment lagoon designed according to NRCS Guideline No. 359. [District Rules 2201 and 4570]
6. Permittee shall remove solids with a solid separator system prior to the manure entering the lagoons. [District Rules 2201 and 4570]
7. Permittee shall only land apply liquid manure that has been treated with an anaerobic treatment lagoon. [District Rules 2201 and 4570]

CONDITIONS CONTINUE ON NEXT PAGE

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Seyed Sadredin, Executive Director / APCO

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Arnaud Marjollet, Director of Permit Services

N-6096-3-3 : Jul 23 2014 1:19PM – YOSHIMUJ : Joint Inspection NOT Required

8. 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]
9. 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]
10. {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]
11. {4538} Permittee shall remove solids with a solid separator system, prior to the manure entering the lagoon. [District Rule 4570]
12. 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]
13. Permittee shall maintain records that only liquid manure treated with an anaerobic treatment lagoon is applied to fields. [District Rule 2201]
14. 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]
15. 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]
16. {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]
17. {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: N-6096-4-3 **ISSUANCE DATE:** DRAFT

LEGAL OWNER OR OPERATOR: ANTONIO AZEVEDO DAIRY
MAILING ADDRESS: 2025 W EL NIDO
EL NIDO, CA 95317

LOCATION: 2025 W EL NIDO
EL NIDO, CA 95317

EQUIPMENT DESCRIPTION:
MODIFICATION OF SOLID MANURE HANDLING CONSISTING OF MANURE STOCK PILES; WINDROW STATIC PILE COMPOSTING; SOLID MANURE APPLICATION TO LAND AND HAULED OFFSITE: INCREASE THE SOLID MANURE DUE TO THE INCREASE IN HERD SIZE

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. {4526} Within seventy two (72) hours of removal of solid manure from housing, permittee shall either 1) remove dry manure from the facility, or 2) 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 twenty-four (24) hours per event. [District Rule 4570]

CONDITIONS CONTINUE ON NEXT PAGE

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Seyed Sadredin, Executive Director / APCO

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Arnaud Marjollet, Director of Permit Services
N-6096-4-3 : Jul 23 2014 1:19PM – YOSHIMUJ : Joint Inspection NOT Required

5. {4527} Permittee shall keep records of dates when manure is removed from the facility or permittee shall maintain records to demonstrate that dry manure piles outside the pens are covered with a weatherproof covering from October through May. [District Rule 4570]

6. {4528} If weatherproof coverings are used, permittee shall maintain records, such as manufacturer warranties or other documentation, demonstrating that the weatherproof covering over dry manure 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]

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

8. 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]

9. 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]

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 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]

12. 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]

13. 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]

14. {4542} Permittee shall maintain records to demonstrate that all solid manure has been incorporated within seventy-two (72) hours of land application. [District Rule 4570]

15. {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]

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: N-6096-5-3 **ISSUANCE DATE:** DRAFT

LEGAL OWNER OR OPERATOR: ANTONIO AZEVEDO DAIRY
MAILING ADDRESS: 2025 W EL NIDO
EL NIDO, CA 95317

LOCATION: 2025 W EL NIDO
EL NIDO, CA 95317

EQUIPMENT DESCRIPTION:
MODIFICATION OF FEED STORAGE AND HANDLING CONSISTING OF COMMODITY BARNS AND SILAGE PILES: INCREASE FEED THROUGHPUT DUE TO THE INCREASE IN HERD SIZE

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]
5. 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]

CONDITIONS CONTINUE ON NEXT PAGE

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Seyed Sadredin, Executive Director / APCO

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Arnaud Marjollet, Director of Permit Services

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6. Permittee shall begin feeding total mixed rations within two hours of grinding and mixing rations. [District Rules 2201 and 4570]
7. Permittee shall store grain in a weatherproof storage structure or under a weatherproof covering from October through May. [District Rules 2201 and 4570]
8. Permittee shall maintain records of demonstrating grain is/was stored in a weatherproof storage structure or under a weatherproof covering from October through May. [District Rule 4570]
9. 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]
10. {4462} Permittee shall feed steam-flaked, dry rolled, cracked or ground corn or other steam-flaked, dry rolled, cracked or ground cereal grains. [District Rule 4570]
11. {4463} Permittee shall maintain records to demonstrate animals are fed steam-flaked, dry rolled, cracked or ground corn or other steam-flaked, dry rolled, cracked or ground cereal grains. 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]
12. {4468} For bagged silage/feedstuff, permittee shall utilize a sealed feed storage system (e.g., ag bag). [District Rule 4570]
13. {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]
14. {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]
15. {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]
16. {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]
17. {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]
18. {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]
19. {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]

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CONDITIONS CONTINUE ON NEXT PAGE

20. {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]

21. {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]

22. {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]

23. {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]

24. {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]

25. {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]

26. {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]

27. {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]

28. 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]

29. 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]

30. 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]

31. 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]

CONDITIONS CONTINUE ON NEXT PAGE

32. 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]

33. {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]

34. {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]

APPENDIX C
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	575	ft
Width	165	ft
Depth	13	ft
Slope	1	ft

Primary Lagoon Volume	**1,111,244 ft3**

Primary Treatment Lagoon Dimensions

Length	330	ft
Width	700	ft
Depth	25	ft
Slope	1	ft

Primary Lagoon Volume	**5,152,083 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: Holstein 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	4,105	x	17	x	71%	x	50%	=	**24,774**
Dry Cow	565	x	9.2	x	71%	x	50%	=	**1,845**
Heifer (15 to 24 months)	3,096	x	7.1	x	48%	x	50%	=	**5,276**
Heifer (7 to 14 months)	0	x	4.9	x	48%	x	50%	=	**0**
Heifer (3 to 6 months)	0	x	2.7	x	48%	x	50%	=	**0**
Calf (under 3 months)	0	x	1.0	x	100%	x	50%	=	**0**
Bulls	0	x	9.2	x	48%	x	50%	=	**0**
Total for Dairy									**31,895**

[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	24,774	÷	0.011	=	**2,252,152**
Dry Cow	1,845	÷	0.011	=	**167,754**
Heifer (15 to 24 months)	5,276	÷	0.011	=	**479,599**
Heifer (7 to 14 months)	0	÷	0.011	=	**0**
Heifer (3 to 6 months)	0	÷	0.011	=	**0**
Calf (under 3 months)	0	÷	0.011	=	**0**
Bulls	0	÷	0.011	=	**0**
Total for Dairy					**2,899,504**

[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 =	**6,263,327**		**2,899,504 =**	**3,363,823 (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	4,105	x	2.40	ft^3	=	9,852	ft^3/day
Dry Cows	565	x	1.30	ft^3	=	735	ft^3/day
Heifers (15-24 mo)	3,096	x	0.78	ft^3	=	2,415	ft^3/day
Heifers (7-14 mo)	0	x	0.78	ft^3	=	-	ft^3/day
Heifers (3-6 mo)	0	x	0.30	ft^3	=	-	ft^3/day
Calves	0	x	0.15	ft^3	=	-	ft^3/day
Bulls	0	x	1.30	ft^3	=	-	ft^3/day
Total	7,766					**13,001**	**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:

Gallon	#	x	ft3	+	ft3
Milk Cow*Day	**Milk Cows**		**gallon**		**day**

Total HFR:

50 ~~gal~~	4105 ~~milk cows~~	x	**ft3**	+	13,001	**ft3**
~~milk cow *~~ day			7.48 ~~gal~~			day
				=	**40,441.2**	**ft3/day**

Formula:

MTV (ft3) /	(day) =
	HFR (~~ft3~~)

HRT:

2,899,504 ~~ft3~~	day	=		=	**71.696761**	**days**
	40,441.2 ~~ft3~~				

APPENDIX D

Quarterly Net Emissions Change

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 - BE, where:

QNEC = Quarterly Net Emissions Change for each emissions unit, lb/qtr.
PE2 = Post Project Potential to Emit for each emissions unit, lb/qtr.
BE = Baseline Emissions (per Rule 2201) for each emissions unit, lb/qtr.

Using the values in Sections VII.C.2 and VII.C.6 in the evaluation above, quarterly PE2 and quarterly BE can be calculated as follows:

Milking Parlor (N-6096-1-4)

BE (lb/qtr) N-6096-1-4					
	BE (lb/year)	÷	4 qtr/year	=	BE (lb/qtr)
NO_X	0	÷	4 qtr/year	=	0.0
SO_X	0	÷	4 qtr/year	=	0.0
PM_{10}	0	÷	4 qtr/year	=	0.0
CO	0	÷	4 qtr/year	=	0.0
VOC	1,025	÷	4 qtr/year	=	256.25
NH_3	325	÷	4 qtr/year	=	81.25

PE2 (lb/qtr) N-6096-1-4					
	PE2 (lb/year)	÷	4 qtr/year	=	BE (lb/qtr)
NO_X	0	÷	4 qtr/year	=	0.0
SO_X	0	÷	4 qtr/year	=	0.0
PM_{10}	0	÷	4 qtr/year	=	0.0
CO	0	÷	4 qtr/year	=	0.0
VOC	1,438	÷	4 qtr/year	=	359.5
NH_3	456	÷	4 qtr/year	=	114.0

Quarterly NEC [QNEC] N-6096-1-4					
	PE2 (lb/qtr)	-	BE (lb/qtr)	=	NEC (lb/qtr)
NO_X	0.0	-	0.0	=	0.0
SO_X	0.0	-	0.0	=	0.0
PM_{10}	0.0	-	0.0	=	0.0
CO	0.0	-	0.0	=	0.0
VOC	359.5	-	256.25	=	103.25
NH_3	114.0	-	81.25	=	32.75

Cow Housing (N-6096-2-5)

BE (lb/qtr) N-6096-2-5					
	BE (lb/year)	÷	4 qtr/year	=	BE (lb/qtr)
NO_X	0	÷	4 qtr/year	=	0.0
SO_X	0	÷	4 qtr/year	=	0.0
PM_{10}	6,423	÷	4 qtr/year	=	1,605.75
CO	0	÷	4 qtr/year	=	0.0
VOC	30,865	÷	4 qtr/year	=	7,716.25
NH_3	59,849	÷	4 qtr/year	=	14,962.25

PE2 (lb/qtr) N-6096-2-5					
	PE2 (lb/year)	÷	4 qtr/year	=	BE (lb/qtr)
NO_X	0	÷	4 qtr/year	=	0.0
SO_X	0	÷	4 qtr/year	=	0.0
PM_{10}	9,989	÷	4 qtr/year	=	2,497.25
CO	0	÷	4 qtr/year	=	0.0
VOC	47,120	÷	4 qtr/year	=	11,780.0
NH_3	86,876	÷	4 qtr/year	=	21,719.0

Quarterly NEC [QNEC] N-6096-2-5					
	PE2 (lb/qtr)	-	BE (lb/qtr)	=	NEC (lb/qtr)
NO_X	0.0	-	0.0	=	0.0
SO_X	0.0	-	0.0	=	0.0
PM_{10}	2,497.25	-	1,605.75	=	891.5
CO	0.0	-	0.0	=	0.0
VOC	11,780.0	-	7,716.25	=	4,063.75
NH_3	21,719.0	-	14,962.25	=	6,756.75

Liquid Manure Handling System (N-6096-3-3)

BE (lb/qtr) N-6096-3-3					
	BE (lb/year)	÷	4 qtr/year	=	BE (lb/qtr)
NO_X	0	÷	4 qtr/year	=	0.0
SO_X	0	÷	4 qtr/year	=	0.0
PM_{10}	0	÷	4 qtr/year	=	0.0
CO	0	÷	4 qtr/year	=	0.0
VOC	7,986	÷	4 qtr/year	=	1,996.5
NH_3	43,562	÷	4 qtr/year	=	10,890.5

PE2 (lb/qtr) N-6096-3-3					
	PE2 (lb/year)	÷	4 qtr/year	=	BE (lb/qtr)
NO_X	0	÷	4 qtr/year	=	0.0
SO_X	0	÷	4 qtr/year	=	0.0
PM_{10}	0	÷	4 qtr/year	=	0.0
CO	0	÷	4 qtr/year	=	0.0
VOC	12,164	÷	4 qtr/year	=	3,041
NH_3	63,295	÷	4 qtr/year	=	15,823.75

Quarterly NEC [QNEC] N-6096-3-3					
	PE2 (lb/qtr)	-	BE (lb/qtr)	=	NEC (lb/qtr)
NO_X	0.0	-	0.0	=	0.0
SO_X	0.0	-	0.0	=	0.0
PM_{10}	0.0	-	0.0	=	0.0
CO	0.0	-	0.0	=	0.0
VOC	3,041	-	1,996.5	=	1,044.5
NH_3	15,823.75	-	10,890.5	=	4,933.25

Solid Manure Handling System (N-6096-4-3)

BE (lb/qtr) N-6096-4-3					
	BE (lb/year)	÷	4 qtr/year	=	BE (lb/qtr)
NO_X	0	÷	4 qtr/year	=	0.0
SO_X	0	÷	4 qtr/year	=	0.0
PM_{10}	0	÷	4 qtr/year	=	0.0
CO	0	÷	4 qtr/year	=	0.0
VOC	1,538	÷	4 qtr/year	=	384.5
NH_3	6,491	÷	4 qtr/year	=	1,622.75

PE2 (lb/qtr) N-6096-4-3					
	PE2 (lb/year)	÷	4 qtr/year	=	BE (lb/qtr)
NO_X	0	÷	4 qtr/year	=	0.0
SO_X	0	÷	4 qtr/year	=	0.0
PM_{10}	0	÷	4 qtr/year	=	0.0

CO	0	÷	4 qtr/year	=	0.0
VOC	2,347	÷	4 qtr/year	=	586.75
NH_3	12,262	÷	4 qtr/year	=	3,065.5

Quarterly NEC [QNEC] N-6096-4-3					
	PE2 (lb/qtr)	-	BE (lb/qtr)	=	NEC (lb/qtr)
NO_X	0.0	-	0.0	=	0.0
SO_X	0.0	-	0.0	=	0.0
PM_{10}	0.0	-	0.0	=	0.0
CO	0.0	-	0.0	=	0.0
VOC	586.75	-	384.5	=	202.25
NH_3	3,065.5	-	1,622.75	=	1,442.75

Feed Handling and Storage (N-6096-5-3)

BE (lb/qtr) N-6096-5-3					
	BE (lb/year)	÷	4 qtr/year	=	BE (lb/qtr)
NO_X	0	÷	4 qtr/year	=	0.0
SO_X	0	÷	4 qtr/year	=	0.0
PM_{10}	0	÷	4 qtr/year	=	0.0
CO	0	÷	4 qtr/year	=	0.0
VOC	41,847	÷	4 qtr/year	=	10,461.75
NH_3	0	÷	4 qtr/year	=	0.0

PE2 (lb/qtr) N-6096-5-3					
	PE2 (lb/year)	÷	4 qtr/year	=	BE (lb/qtr)
NO_X	0	÷	4 qtr/year	=	0.0
SO_X	0	÷	4 qtr/year	=	0.0
PM_{10}	0	÷	4 qtr/year	=	0.0
CO	0	÷	4 qtr/year	=	0.0
VOC	66,613	÷	4 qtr/year	=	16,653.25
NH_3	0	÷	4 qtr/year	=	0.0

Quarterly NEC [QNEC] N-6096-5-3					
	PE2 (lb/qtr)	-	BE (lb/qtr)	=	NEC (lb/qtr)
NO_X	0.0	-	0.0	=	0.0
SO_X	0.0	-	0.0	=	0.0
PM_{10}	0.0	-	0.0	=	0.0
CO	0.0	-	0.0	=	0.0
VOC	16,653.25	-	10,461.75	=	6,191.5
NH_3	0.0	-	0.0	=	0.0

APPENDIX E
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.

[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) <u>Confining Animals in Enclosed Buildings and Venting Emissions to a Control Device (e.g. incinerator, biofilter, eg.)</u>

<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 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) 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.
- 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.[5] 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 with a Pull-Type Scraper

Many dairies use equipment pulled by tractors to periodically scrape the surfaces of exercise pens. Frequent scraping the freestall exercise pens 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 exercise pen surface, which will reduce gaseous pollutants from this area. The frequency that exercise pens are scraped at dairies can vary from as little as once a year to every few days.

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[5] "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 exercise pens 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 exercise pen 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 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 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.*"[6] 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 4,105 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 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.

[6] 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

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[7]; 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.

[7] 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[8]; 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[9]: $74- 98/cow more

Capital Cost for Freestall Barn Enclosure for 4,105 Milk Cows

Low capital cost estimate: $1,275/cow x 4,105 cows = $5,233,875
High capital cost estimate: $2,025/cow x 4,105 cows = $8,312,625

Increased Operating Costs for Enclosed Freestall Barns for 4,105 Milk Cows

Low operating cost estimate: $74/cow-yr x 4,105 cows = $303,770/yr
High operating cost estimate: $98/cow-yr x 4,105 cows = $402,290/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

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[8] 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

[9] 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" [10], 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?" [11], the minimum required

[10] "Improving Mechanical Ventilation in Dairy Barns", J.P. Chastain, http://www.milkproduction.com/Library/Articles/Improving_mechanical_ventilation.htm
[11] 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.

Minimum Summer Air Requirements for Freestall Barns Vented to a Biofilter for 4,105 Milk Cows

The minimum required summer airflow rate for housing 4,105 milk cows is calculated as below:

Low Summer Ventilation Rate: 4,105 milk cows x 500 cfm/cow = 2,052,500 cfm

High Summer Ventilation Rate: 4,105 milk cows x 1,000 cfm/cow = 4,105,000 cfm

Capital Cost of a Biofilter for 4,105 Milk Cows

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 4,105 milk cows:

Low capital cost estimate: \$3.00/cfm x 2,052,500 cfm = \$6,157,500
High capital cost estimate: \$35.00/cfm x 4,105,000 cfm = \$143,675,000

Operating Costs for a Biofilter for 4,105 Milk Cows

Low operating cost estimate: \$2.12/cfm-yr x 2,052,500 cfm = \$4,351,300/yr
High operating cost estimate: \$20.00/cfm-yr x 4,105,000 cfm = \$82,100,000/yr

Annualized Capital Costs for Biofilter for 4,105 Milk Cows

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 =
$[(\$5,233,875 + \$6,157,500) \times 0.1(1.1)^{10}]/[(1.1)^{10}-1] = \$1,853,894$/year

High Annualized Capital Cost Estimate =
$[(\$8,312,625 + \$82,100,000) \times 0.1(1.1)^{10}]/[(1.1)^{10}-1] = \$14,714,238$/year

<u>Total Annual Cost Estimates</u>

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 = ($1,853,894/yr) + ($303,770/yr) + ($4,351,300/yr)
= $6,508,964/year

High total annual cost estimate = ($8,312,625/yr) + ($402,290/yr) + ($82,100,000/yr)
= $90,814,915/year

<u>Potential Income from Increased Milk Production</u>

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[12] for September 2012: $17.50/cwt
Income from increased milk production: $255.50-383.25/cow-yr

Max Income from increased milk production for 4,105 milk cows:
4,105 milk cows x $383.25/cow-yr = $1,573,241/yr

Low total annual cost estimate – income from increased milk production =
($6,508,964/yr) - ($1,573,241/yr) = $4,935,723/year

VOC Emission Reductions for 4,105 Milk Cows

The annual VOC Emission reductions for enclosed freestall barns for 4,105 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)*	4,105	x	2.91	x	80%	x	85%	=	8,123
Stalls and Lanes	4,105	x	1.28	x	80%	x	85%	=	3,573
Milking Parlor Floor	4,105	x	0.02	x	80%	x	85%	=	56
Total (lb-VOC/yr)									**11,752**

*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]

[12] 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	Contro l (%)	=	lb-VOC/yr
Milk Cow	4,105	x	7.08	x	3.85E-03	x	365	x	80%	x	85%	=	**27,772**

Total VOC Emission Reductions from Milk Parlor, Cow Housing, and TMR = 11,752 lb-VOC/yr + 27,772 lb-VOC/yr = 39,524 lb-VOC/yr

Cost of VOC Emission Reductions

Low Estimate[13]= ($6,508,964/year)/[(39,524 lb-VOC/year)(1 ton/2000 lb)]
= **$329,368/ton of VOC reduced**

High Estimate = ($90,814,915/year)/[(39,524 lb-VOC/year)(1 ton/2000 lb)]
= **$4,595,431/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 $329,368/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) Scraping exercise pens every two weeks
5) VOC mitigation measures required by District Rule 4570

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

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) <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.

<u>Concrete Feed Lanes and Walkways</u>

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).

<u>Frequent Cleaning of Feed Lanes and Walkways</u>

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.

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 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.

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

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 – Freestalls Barns

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

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.

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) 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

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

BACT Analysis for Emissions from Liquid Manure Handling

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

a. Identify all control technologies

1) Aerobic Treatment Lagoon or Mechanically Aerated Lagoon

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) Covered Lagoon Digester Vented to a Control Device

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) <u>Solids Removal/Separation</u>

<u>Mechanical Separation</u>

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) 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 4,105 milk cows in naturally aerobic lagoons and mechanically aerated lagoons.

Space Requirement for a Naturally Aerobic Lagoon Treating Manure from 4,105 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 4,105 milk cows in the San Joaquin Valley can be calculated as follows:

BOD_5 loading (lb/day) = 4,105 milk cows x 2.9 lb-BOD_5/cow-day x 0.80
= 9,524 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 =
9,524 lb-BOD_5/day ÷ 55 lb-BOD_5/acre-day = 173 acres

Minimum Surface Area (acres) in areas of the San Joaquin Valley with a maximum loading rate of 45 lb-BOD_5/acre-day =
9,524 lb-BOD_5/day ÷ 45 lb-BOD_5/acre-day = 212 acres

As shown above the minimum surface area required for a naturally aerobic lagoon treating manure from 4,105 milk cows in the San Joaquin Valley would range from approximately 173 to 212 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 4,105 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 4,105 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.

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 4,105 milk cows will have a loading rate of approximately 11,905 lb-BOD_5/day (5,411 kg-BOD_5/day).

Energy Requirement a Mechanically Aerated Lagoon Treating Manure from 4,105 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 4,105 milk cows is calculated as follows:

High Efficiency Aerator
5,411 kg-BOD_5/day ÷ (0.68 kg-O2/kW-hr) x (365 day/year) = 2,904,434 kW-hr/year

Low Efficiency Aerator
5,411 kg-BOD_5/day ÷ (0.10 kg-O2/kW-hr) x (365 day/year) = 19,750,150 kW-hr/year

Cost of Electricity for a Mechanically Aerated Lagoon Treating Manure from 4,105 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)
2,904,434 kW-hr/year x $0.1115/kW-hr = $323,844/year

High Cost Estimate (Low Efficiency Aerator)
19,750,150 kW-hr/year x $0.1115/kW-hr = $2,202,142/year

VOC Emission Reductions from a Mechanically Aerated Lagoon Treating Manure from 4,105 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 4,105 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)	4,105	x	0.92	x	90%	=	**3,399**

The annual VOC Emission Reductions for a mechanically aerated lagoon treating land applied manure from 4,105 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)	4,105	x	0.99	x	90%	=	**3,658**

Total VOC Emissions Reductions
Total VOC Reduced = 3,399 lb-VOC/yr + 3,658 lb-VOC/yr
= 7,057 lb-VOC/yr

Cost of VOC Emission Reductions
Low Estimate = ($323,844/year)/[(7,057 lb-VOC/year)(1 ton/2000 lb)]
= $91,780/ton of VOC reduced

High Estimate = (\$2,202,142/year)/[(7,057 lb-VOC/year)(1 ton/2000 lb)]
= \$624,101/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 \$91,780/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 4,105 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 4,105 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 4,105 milk cows is calculated as follows:

Low capital cost estimate: \$585/cow x 4,105 cows = \$2,401,425
High capital cost estimate: \$1,032/cow x 4,105 cows = \$4,236,360

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 $= [\$2,401,425 \times 0.1(1.1)^{10}]/[(1.1)^{10}-1]$
$= \$390,821/\text{year}$

High Annual Capital Cost Estimate $= [\$4,236,360 \times 0.1(1.1)^{10}]/[(1.1)^{10}-1]$
$= \$689,448/\text{year}$

<u>Potential Production of Electricity from a Covered Lagoon Digester Treating Manure from 4,105 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 4,105 milk cows is calculated as follows:

Electrical Production: 670.3 kW-hr/(milk cow-yr) x 4,105 milk cows = 2,751,582 kW-hr/yr

Potential Cost Savings from Production of Electricity from a Covered Lagoon Digester Treating Manure from 4,105 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 4,105 milk cows is calculated as follows:

Potential Annual Cost Savings from Electrical Production:
2,751,582 kW-hr/yr x $0.1115/kW-hr = $306,801/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
= $390,821/yr - $306,801/yr = $84,020/year

High Annual Capital Cost Estimate minus Savings from Potential Generation
= $689,448/yr - $306,801/yr = $382,647/year

VOC Emission Reductions from a Covered Lagoon Anaerobic Digester Treating Manure from 4,105 Milk Cows That Will Also Be Applied to Land:

The annual VOC Emission Reductions for covered lagoon anaerobic digester treating the manure from 4,105 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)	4,105	x	0.92	x	80%	=	**3,021**

The annual VOC Emission Reductions for a covered lagoon anaerobic digester treating land applied manure from 4,105 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)	4,105	x	0.99	x	80%	=	**3,251**

<u>Total VOC Emissions Reductions</u>
Total VOC Reduced = 3,021 lb-VOC/yr + 3,251 lb-VOC/yr
= 6,272 lb-VOC/yr

<u>Cost of VOC Emission Reductions</u>
Low Estimate = ($84,020/year)/[(6,272 lb-VOC/year)(1 ton/2000 lb)]
= $26,792/ton of VOC reduced

High Estimate = ($382,647/year)/[(6,272 lb-VOC/year)(1 ton/2000 lb)]
= $122,018/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 $26,792/ton. This is a conservatively low estimate, with a high end estimate of upwards of $122,018/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) <u>Solids Removal/Separation</u>

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.

3. BACT for H_2S Emissions from the Lagoon & Storage Ponds

A cost effectiveness threshold has not been established for H_2S. Therefore, only options that meet the District's definition of Achieved-in-Practice controls will be considered for H_2S at this time.

a. Identify all control technologies

a. Step 1 - Identify all control technologies

The following options were identified as possible controls for H_2S emissions from the Lagoon/Storage Pond:

1. Lagoon PH maintained at a minimum of 7.8, with monitoring and recordkeeping, and adjustment with lime (or similar base) as needed
2. Feeding per NRC Guidelines
3. Solids Separation
4. Reduce or Eliminate the Use of Copper Sulfate as a Footbath Disinfectants

<u>Description of Control Technologies</u>

1) Lagoon pH Maintained at a Minimum of 7.8

Hydrogen Sulfide in the lagoon exists in both aqueous and vapor phases. The aqueous phase is represented by hydrogen sulfide (HS^-) and sulfide (S^{2-}) ions, whereas the vapor phase is represented by Hydrogen Sulfide gas. The determining factor of the proportion of each phase is pH. If the pH is low enough, virtually all Hydrogen Sulfide will exist in the vapor phase, and Hydrogen Sulfide gas emissions from the surface of the lagoon will be maximized. On the other hand, if the pH is high enough, virtually all the Hydrogen Sulfide will exist in the aqueous phase, and Hydrogen Sulfide gas emissions will be virtually non-existent.

While a pH high enough to eliminate emissions completely is probably not feasible in a large body of liquid such as a dairy manure lagoon, emissions may still be significantly reduced by maintaining the pH of the lagoon in the basic range. Modeling results indicate that significant reductions can be achieved cost effectively at a minimum pH of 7.8. This pH will be achieved by the addition of lime (or similar salts) to the lagoon. Monitoring and record keeping will be required to ensure that the pH is maintained above the recommended value.

2) Feeding per NRC Guidelines

H_2S is produced as a result of the decomposition of sulfur compounds in the manure under anaerobic conditions. The presence of these Sulfur compounds in the manure is primarily due to excretion of excess Sulfur from the digestive tract, as well as other inorganic sources[1].

Because both organic Nitrogen and Sulfur compounds are primarily components of amino acids, they tend to occur in set ratios and strategies to reduce the excretion of undigested protein and Nitrogen will also reduce the amount of Sulfur in the manure. A diet that is formulated to feed proper amounts of ruminantly-degradable protein will result in improved protein utilization by the animal and corresponding reduction in sulfur content of the manure, which will reduce the potential for production of H_2S.

3) Solids Separation

Solids separation will reduce loading and the amount of organic Sulfur compounds that are stored under anaerobic conditions, thereby reducing the potential for production of H_2S.

Reducing the loading of lagoons also creates conditions that are more favorable to the growth of sulfur-reducing phototrophic bacteria. Phototrophic or red water treatment lagoons have a characteristic purple, pink, or rose color. Purple sulfur bacteria utilize hydrogen sulfide and volatile organic acids as an electron source for an oxygenic photosynthesis and utilize volatile organic acids and alcohols as a carbon source for 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.

In addition to mechanical separators, settling basins can also be used to remove solids; however, they must be frequently emptied so the removed solids do not remain in an anaerobic condition.

4) Reduce or Eliminate the Use of Copper Sulfate as a Footbath Disinfectant

Some researchers recommended reducing or eliminating the use of Copper Sulfate as a means of reducing H2S emissions from lagoons. This will reduce the amount of inorganic sulfur compounds that are stored under anaerobic conditions, thereby reducing the potential for production of H2S. Copper Sulfate

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[1] http://www.epa.gov/ttnchie1/ap42/ch09/draft/draftanimalfeed.pdf

can also be detrimental to purple sulfur bacteria and other anaerobic microbes that reduce VOC and H2S[2].

Copper Sulfate is one of the main disinfectants used in dairy footbaths to prevent the occurrence and spread digital dermatitis (aka hairy foot warts) on the hooves of dairy cattle. Digital dermatitis is a health concern that can result in lameness in dairy cattle.

b. Step 2 - Eliminate technologically infeasible options

There are no technologically infeasible options to eliminate from step 1, but the following control options should not be considered further:

1) Lagoon pH Maintained at a Minimum of 7.8

This measure should not be considered because it would result in increased Ammonia emissions. Under pH conditions close to neutral or acidic (pH 7 or lower) Ammonia exists primarily as the soluble Ammonium ion, which is retained in the lagoon[3]. When the pH increases toward the basic range, the Ammonium ion is increasingly converted into the insoluble Ammonia phase and emitted into the atmosphere. Since under normal circumstances lagoon pH is close to neutral or is slightly acidic, it is reasonable to assume that the balance between H_2S and NH_3 emissions is somewhat optimal. Further, since NH_3 is generally present in significantly larger quantities than H_2S, leaving the pH in a natural range that may slightly favor H_2S emissions is more beneficial than influencing it into the basic range, which would favor NH_3 emissions.

2) Reduce or Eliminate the Use of Copper Sulfate as a Footbath Disinfectant

Copper Sulfate is one of the main disinfectants used in dairy footbaths to prevent the occurrence and spread of digital dermatitis (aka hairy foot warts) on the hooves of dairy cattle. Digital dermatitis is a health concern that can result in lameness in dairy cattle. Further research is needed to better quantify the effect that the use of copper sulfate has on H_2S emissions. Additional research is also needed regarding the effectiveness and practicality of the use of alternative disinfectants for the prevention of digital dermatitis. Therefore, this practice will not be required at this time but may be revaluated later.

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[2] http://www.cals.uidaho.edu/edComm/pdf/CIS/CIS1148.pdf; http://courses.cals.uidaho.edu/bae/bae404/Dairy%20Odor%20Mgmt.pdf; and http://www.deq.idaho.gov/media/635665-58_0101_0502_scientific_basis_final.pdf

[3] http://pubs.ext.vt.edu/442/442-110/442-110.html

c. Step 3 - Rank remaining options by control effectiveness

After eliminating the technologically infeasible options, the remaining options are ranked according to their control efficiencies:

1) Feeding per NRC Guidelines

2) Solids Separation

d. Step 4 - Cost Effectiveness Analysis

Since the remaining control measures are achieved in practice, a cost effectiveness analysis is not required.

e. Step 5 - Select BACT

The facility is proposing to feed all animals per NRC guidelines and separate solids (settling basin) from the manure stream prior to treatment in the lagoon. Therefore, the BACT requirements are satisfied.

BACT Analysis for Liquid Manure Land Application

1. BACT for VOC Emissions from Liquid/Slurry Manure Land Application

a. Identify all control technologies

1) Irrigation of crops using liquid/slurry manure from an aerobic treatment lagoon or mechanically aerated lagoon

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) Irrigation of crops using liquid/slurry manure from a holding/storage pond after being treated in a covered lagoon/digester

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

<u>Injection of Liquid and Slurry Manure</u>
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.[14]

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

[14] 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 4,105 milk cows in naturally aerobic lagoons and mechanically aerated lagoons.

Space Requirement for a Naturally Aerobic Lagoon Treating Manure from 4,105 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 4,105 milk cows in the San Joaquin Valley can be calculated as follows:

BOD_5 loading (lb/day) = 4,105 milk cows x 2.9 lb-BOD_5/cow-day x 0.80
= 9,524 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 =
9,524 lb-BOD_5/day ÷ 55 lb-BOD_5/acre-day = 173 acres

Minimum Surface Area (acres) in areas of the San Joaquin Valley with a maximum loading rate of 45 lb-BOD_5/acre-day =
9,524 lb-BOD_5/day ÷ 45 lb-BOD_5/acre-day = 217 acres

As shown above the minimum surface area required for a naturally aerobic lagoon treating manure from 4,105 milk cows in the San Joaquin Valley would range from approximately 173 to 217 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 4,105 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 4,105 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.

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 4,105 milk cows will have a loading rate of approximately 9,524 lb-BOD_5/day (4,329 kg-BOD_5/day).

Energy Requirement a Mechanically Aerated Lagoon Treating Manure from 4,105 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 4,105 milk cows is calculated as follows:

High Efficiency Aerator
4,329 kg-BOD_5/day ÷ (0.68 kg-O2/kW-hr) x (365 day/year) = 2,323,654 kW-hr/year

Low Efficiency Aerator
4,329 kg-BOD_5/day ÷ (0.10 kg-O2/kW-hr) x (365 day/year) = 15,800,850 kW-hr/year

Cost of Electricity for a Mechanically Aerated Lagoon Treating Manure from 4,105 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)
2,323,654 kW-hr/year x $0.1115/kW-hr = $259,087/year

High Cost Estimate (Low Efficiency Aerator)
15,800,850 kW-hr/year x $0.1115/kW-hr = $1,761,795/year

VOC Emission Reductions from a Mechanically Aerated Lagoon Treating Manure from 4,105 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 4,105 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)	4,105	x	0.92	x	90%	=	**3,399**

The annual VOC Emission Reductions for a mechanically aerated lagoon treating land applied manure from 4,105 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)	4,105	x	0.99	x	90%	=	**3,658**

<u>Total VOC Emissions Reductions</u>
Total VOC Reduced = 3,399 lb-VOC/yr + 3,658 lb-VOC/yr
= 7,057 lb-VOC/yr

<u>Cost of VOC Emission Reductions</u>
Low Estimate = ($259,087/year)/[(7,057 lb-VOC/year)(1 ton/2000 lb)]
= $73,427/ton of VOC reduced

High Estimate = ($1,761,795/year)/[(7,057 lb-VOC/year)(1 ton/2000 lb)]
= $499,304/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 $73,427/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 4,105 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)[15] and the California Energy Commission (CEC) Public Interest Energy Research (PIER) Program Dairy Methane Digester System Program Evaluation Report (Feb 2009)[16]. 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

[15] "Anaerobic Digestion Capital Costs for Dairy Farms" (May 2010), EPA AgSTAR http://www.epa.gov/agstar/pdf/digester_cost_fs.pdf

[16] "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 4,105 milk cows is calculated as follows:

Low capital cost estimate: \$585/cow x 4,105 cows = \$2,401,425
High capital cost estimate: \$1,032/cow x 4,105 cows = \$4,236,360

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 $= [\$2,401,425 \times 0.1(1.1)^{10}]/[(1.1)^{10}-1]$
$= \$390,821/\text{year}$

High Annual Capital Cost Estimate $= [\$4,236,360 \times 0.1(1.1)^{10}]/[(1.1)^{10}-1]$
$= \$689,448/\text{year}$

<u>Potential Production of Electricity from a Covered Lagoon Digester Treating Manure from 4,105 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 4,105 milk cows is calculated as follows:

Electrical Production: 670.3 kW-hr/(milk cow-yr) x 4,105 milk cows =
2,751,582 kW-hr/yr

Potential Cost Savings from Production of Electricity from a Covered Lagoon Digester Treating Manure from 4,105 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 4,105 milk cows is calculated as follows:

Potential Annual Cost Savings from Electrical Production:
2,751,582 kW-hr/yr x $0.1115/kW-hr = $306,801/yr

Annualized Capital Cost for a Covered Lagoon Digester Treating Manure from 4,105 Milk Cows minus Potential Savings from Generation of Electricity:

Low Annual Capital Cost Estimate minus Savings from Potential Generation
= $390,821/yr - $306,801/yr = $84,020/year

High Annual Capital Cost Estimate minus Savings from Potential Generation
= $689,448/yr - $306,801/yr = $382,647/year

VOC Emission Reductions from a Covered Lagoon Anaerobic Digester Treating Manure from 4,105 Milk Cows That Will Also Be Applied to Land:

The annual VOC Emission Reductions for covered lagoon anaerobic digester treating the manure from 4,105 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)	4,105	x	0.92	x	80%	=	**3,021**

The annual VOC Emission Reductions for a covered lagoon anaerobic digester treating land applied manure from 4,105 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)	4,105	x	0.99	x	80%	=	**3,251**

Total VOC Emissions Reductions
Total VOC Reduced = 3,021 lb-VOC/yr + 3,251 lb-VOC/yr
= 6,272 lb-VOC/yr

Cost of VOC Emission Reductions
Low Estimate = ($84,020/year)/[(6,272 lb-VOC/year)(1 ton/2000 lb)]
= $26,792/ton of VOC reduced

High Estimate = ($382,647/year)/[(6,272 lb-VOC/year)(1 ton/2000 lb)]
= $122,018/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 $26,792/ton. This is a conservatively low estimate, with a high end estimate of upwards of $122,018/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) 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

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) <u>Land application of lagoon water such that there is no standing water</u>

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) <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. 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%.[17]

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.

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[17] 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).

With negative aeration, air is pulled through the pile from the outer surface. 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.[18]

An odor and emissions study done at the City of Philadelphia biosolids co-composting facility by the Department of Water[19] 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

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[18] Technology Assessment for SCAQMD proposed Rule 1133 Table 3-2

[19] 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.

discussed above negative aeration appears to be more efficient in reducing odors and emissions than positive aeration.

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.[20]

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

[20] SCAQMD Final Staff Report for Rule 1133, page 18

manure has gone through an ASP vented to biofilter, the 80% control efficiency of that system would carry over to land application.

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.

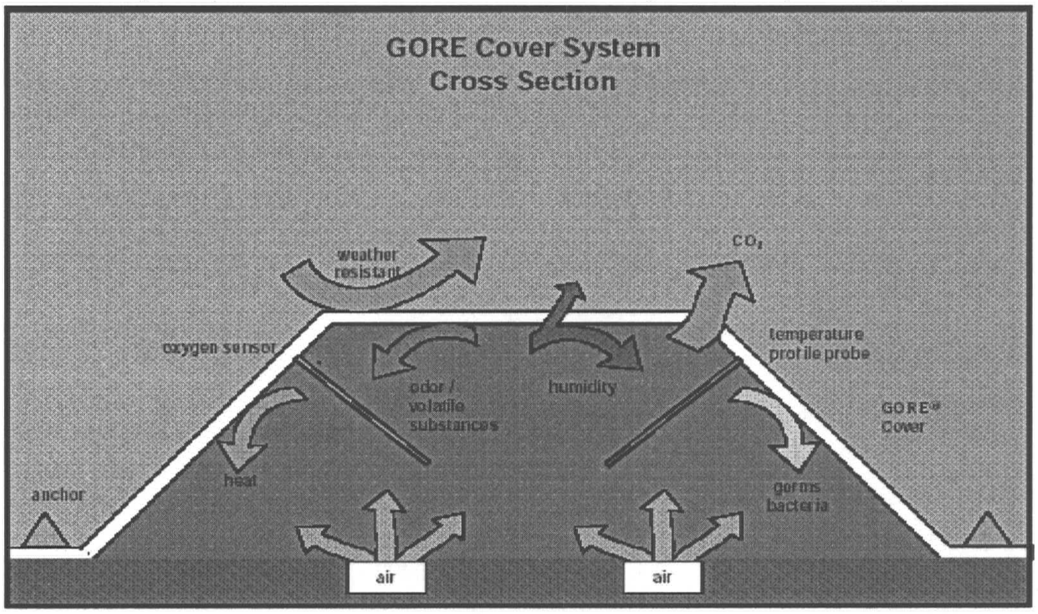
AgBag is working closely with SCAQMD and the Milk Producers Council to perform a pilot study to evaluate the efficiency of this technology. Until the study is completed, this technology will be conservatively assumed to control emissions by at least 10% more than open aerated static piles, with a minimum 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.

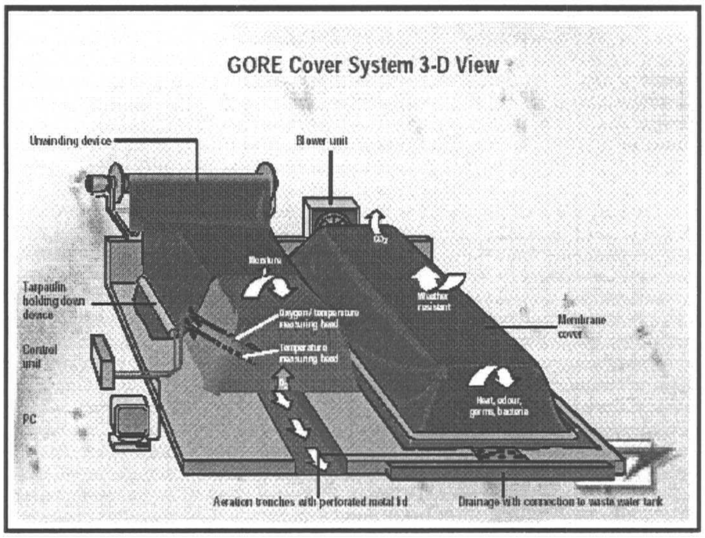
In addition to the membrane, which covers the organic material during composting, the system includes a concrete floor and wall, blowers for aeration, and a winder for efficient movement of the cover. The system also requires consistent management including preparation of materials to achieve a homogenous 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) 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

   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).[21] 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**

[21] 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

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 approximately 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:

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 4,105 milk cows and 7,766 total head. Although the total head consists of support stock, including calves, all 7,766 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 7,766 Cows:

The annual VOC Emission Reductions for ASP or in-vessel enclosure handling the solid manure from 7,766 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	7,766	x	0.23	x	50%	x	80%	=	714

*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)/[(714 lb-VOC/year)(1 ton/2000 lb)]
= $248,053/ton of VOC reduced

High Estimate = ($1,866,836/year)/[(714 lb-VOC/year)(1 ton/2000 lb)]
= $666,460/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 $248,053/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.[22]

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 reduced. However, SCAQMD stated that additional test data would be necessary to validate the efficiency of such control methods.[23]

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.

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[22] Final Staff report for proposed Rule 1133, 1133.1, and 1133.2)

[23] 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)

3) 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.

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.

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%.[24]

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 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.

[24] 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).

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 NH3 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) Enclosed Buildings for Animals and TMR with Emissions Vented to a Control Device

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.

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 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 F

Summary of Health Risk Assessment (HRA)
and
Ambient Air Quality Analysis (AAQA)

San Joaquin Valley Air Pollution Control District
Risk Management Review
(REVISED TO INCLUDE H_2S)

To:	Johnathan Yoshimura– Permit Services
From:	Suzanne Medina– Technical Services
Date:	February 24, 2014
Facility Name:	Antonio Azevedo Dairy
Location:	2025 W. El Nido, El Nido CA
Application #(s):	N-6096-1-4, 2-5, 3-3, 4-3 and 5-3
Project #:	N-1130683

A. RMR SUMMARY

Categories	Dairy Milk Parlor (Unit 1-4)	Dairy Cow House (Unit 2-5)	Dairy Lagoon (Unit 3-3)	Solid Manure Storage (Unit 4-3)	Feed and Storage (Unit 5-3)	Project Totals	Facility Totals
Prioritization Score	N/A[1]	N/A[1]	N/A[1]	N/A[2]	N/A[3]	N/A	>1.0
Acute Hazard Index	0.00	0.10	0.31[4]	N/A[2]	N/A[3]	0.41	0.41
Chronic Hazard Index	0.00	0.02	0.00	N/A[2]	N/A[3]	0.02	0.02
Maximum Individual Cancer Risk (10^{-6})	0.04	0.62	0.83	N/A[2]	N/A[3]	1.49	1.51
T-BACT Required?	**NO**	**NO**	**NO**	**NO**	**NO**		
Special Permit Conditions?	**NO**	**NO**	**NO**	**NO**	**NO**		

1 Prioritization for this unit was not conducted since the facility has a previous cancer risk score.
2 Solid Manure NH_3 emissions were combined with lagoon emissions unit 3-3.
3 At this time there is no Toxic emission information from feed and storage emissions.
4 H_2S analysis was required for the project's proposed lagoon and storage pond and was added to unit (3-3).

Proposed Permit Conditions

To ensure that human health risks will not exceed District allowable levels; the following permit conditions must be included for:

Unit # 3-3

1. The pH value cannot be any lower than 7.5.
2. The quarterly H2S concentration cannot exceed 5 mg/L.

B. RMR REPORT

I. Project Description

Technical Services received a request on November 18, 2013, to perform an Ambient Air Quality Analysis and a Risk Management Review for one existing Saudi-style freestall barn being permitted as new and one proposed Saudi-style freestall barn. The milk cows will increase 1,179 and support stock will increase 2,133 head. The facility boundary included long term leased land per Kevin Abernathy. The facility also proposed an addition of one lagoon and one storage pond which require H_2S modeling. The two residence sites inside the facility boundary were stated to be onsite workers only and live onsite as part of their salary, therefore were not considered receptors.

Technical Services performed a prioritization using the District's HEARTs database. Since the total facility prioritization score was greater than one, a refined health risk assessment was required. The engineer provided the VOC, PM10 and NH_3 emissions for the entire dairy. The facility stated that 58% of the herd is Jersey and 42% is Holstein and adjustments were made by the engineer to reflect the type of cow. The engineer used large heifer emission factors as worst case to give maximum flexibility for the type of support stock. The emissions from the lagoon and solid manure permits (3-3 and 4-3) were combine in the modeling run together and reported under the dairy lagoon emissions unit 3-3 as per supervisor. The Toxic emissions were calculated using the District-developed spreadsheets for dairies. The emissions were input into the HEARTs database. AERMOD was used, with the parameters outlined below and meteorological data for 2005-2009 from Merced to determine the dispersion factors (i.e., the predicted concentration or X divided by the normalized source strength or Q) for a receptor grid. These dispersion factors were input into the risk assessment module of the Hot Spots Analysis and Reporting Program (HARP) to calculate the chronic and acute hazard indices and the carcinogenic risk for the project. H2S emissions analysis was not required, because the surface area of the lagoons is not changing.

The following parameters were used for the review:

Analysis Parameters N-6096 Project 1130683			
Total Cows		3,312	
Total NH3 Increase lb/yr	54,425	**Total NH3 Increase lb/hr**	6.21
Total PM10 Increase lb/yr	4,537	**Total PM10 Increase lb/hr**	0.52

Analysis Parameters Unit 1-4 Milk Parlor			
Source Type	Area	**Location Type**	Rural
Approx. Area (m^2)	2,574	**Release Height (m)**	1

Analysis Parameters Unit 2-5 Cow Housing			
Source Type	Area	**Location Type**	Rural
Approx. Area (m^2)	52,900	**Release Height (m)**	1

Analysis Parameters Unit 3 and 4 Liquid and Solid Manure Handling			
Source Type	Area	**Location Type**	Rural
Approx. Area (m^2)	18,854	**Release Height (m)**	0

Analysis Parameters Unit 3 and 4 Proposed Lagoon and Storage Pond			
Lagoon Length (m)	100.58	**Storage Pond Length (m)**	100.35
Lagoon Width (m)	213.36	**Storage Pond Width (m)**	106.68
Depth (m)	7.62	**Depth (m)**	7.62

In addition to the above, H_2S emissions analysis was required for Unit 3-3 (lagoons). This analysis was performed using District H_2S AERMOD Hourly Emission File Generator.

<u>AAQA</u> In addition to the RMR, Technical Services performed modeling for the criteria pollutant PM_{10} using AERMOD. The emission rate used was 4,537 lb PM_{10}/year. The results from the Criteria Pollutant Modeling are as follows:

PM_{10} Pollutant Modeling Results*
Values are in µg/m^3

Category	24 Hours
Proposed Dairy	9.85
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 µg/m^3 for the 24-hour average concentration.

III. Conclusion

For each unit, the acute and chronic indices are below 1.0 and the cancer risk factor associated with each unit is less than 1.0 in a million. **In accordance with the District's Risk Management Policy, the project is approved without Toxic Best Available Control Technology (T-BACT).**

To ensure that human health risks will not exceed District allowable levels; the permit conditions listed on page 1 of this report must be included for this proposed unit.

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.

The ambient air quality impacts from PM_{10} emissions at the proposed dairy modification does not exceed the District's 24-hour interim threshold for fugitive dust sources.

IV. Attachments

A. AAQA results map
B. PMI Report
C. Indices Report
D. Correspondence
(The following attachments can be found in electronic folder)
E. RMR request from the project engineer
F. Emissions data from engineer
G. Toxic emission dairy spreadsheet
H. Prioritization score
I. Facility Summary

APPENDIX G

Dairy GHG Calculations

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 Caws	513	307.8	0	0	0	21
Dry Caws	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 Factars (lbs/hd-yr)					
Animal Type	N2O (Anaerobic Treatment Lagoon)	N2O (Manure Spreading)	N2O (Solid Manure Starage)*	N2O (Enteric)	CD2 Equivalent Multiplier for N2O
Milk Cows	1.5	0	0	0	310
Dry Caws	1.5	0	0	0	310
Suppart 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 factors for Suppot Stock and Bulls are assumed to be the same as Large Heifers.

Fugitive emissions from dairies shall be excluded in determining if a source is a major source for PSD purposes.

1 short ton = 0.9072 metric ton

Calculations:

CD2e 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/N2D Solid Manure Storage (lb/hd-yr) + CH4/N2D 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 (shart tons/yr)
Milk Cows	2,926	307.8	21	9,457
Dry Cows	792	307.8	21	2,560
Support Stock	970	110.4	21	1,124
Large Heifers	0	110.4	21	0
Medium Heifers	0	110.4	21	0
Small Heifers	0	110.4	21	0
Calves	0	--	--	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 Menure Storage (lb/hd-yr)	EF CH4 Enteric (lb/hd-yr)	Multiplier	CO2e Nan-Lagoons (short tons/yr)
Milk Cows	2,926	0.0	0.0	0.0	21	0
Dry Cows	792	0.0	0.0	0.0	21	0
Support Stock	970	0.0	--	0.0	21	0
Large Heifers	0	0.0	--	0.0	21	0
Medium Heifers	0	0.0	--	0.0	21	0
Small Heifers	0	0.0	--	0.0	21	0
Calves	0	--	--	--	--	0
Bulls	0	0.0	--	0.0	21	0

Pre-Project Lagoon CO2e Emissiona from N2O (short tons/yr)				
Animal Type	Number of Cows	EF N2D Anaerobic Treatment Lagoon (lb/hd-yr)	EF CO2e Multiplier	CO2e Lagoons (short tons/yr)
Milk Cows	2926	0.0	310	0
Dry Cows	792	0.0	310	0
Suppon Stock	970	0.0	310	0
Large Heifers	0	0.0	310	0
Medium Heifers	0	0.0	310	0
Small Heifers	0	0.0	310	0
Calves	0	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 (lbs/hd-yr)	EF N2O Solid Manure Storage (lbs/hd-yr)	EF N2D Enteric (lbs/hd-yr)	Multiplier	CD2e Non-Lagoons (short tons/yr)
Milk Cows	2,926	0	0.0	0	310	0
Dry Cows	792	0	0.0	0	310	0
Support Stock	970	0	--	0	310	0
Large Heifers	0	0	--	0	310	0
Medium Heifers	0	0	--	0	310	0
Small Heifers	0	0	--	0	310	0
Calves	0	0	--	0	--	0
Bulls	0	0	--	0	310	0

Total Pre-Project CO2e Emissions (short tons/yr)			
Animal Type	CD2e from CH4	CO2e from N2D	Total
Milk Cows	9,457	0	9,457
Dry Cows	2,560	0	2,560
Support Stock	1,124	0	1,124
Large Heifers	0	0	0
Medium Heifers	0	0	0
Small Heifers	0	0	0
Calves	0	0	0
Bulls	0	0	0
		Total	13,141

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 Lagoons (lb/hd-yr)	CO2e Multiplier	CO2e Lagoons (short tons/yr)
Milk Cows	4105	513.0	21	22,112
Dry Cows	565	513.0	21	3,043
Support Stock	3096	110.4	21	3,589
Large Heifers	0	110.4	21	0
Medium Heifers	0	110.4	21	0
Small Heifers	0	110.4	21	0
Calves	0	--	--	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 (lbs/hd-yr)	EF CH4 Solid Manure Storage (lbs/hd-yr)	EF CH4 Enteric (lbs/hd-yr)	Multiplier	CO2e Non-Lagoons (short tons/yr)
Milk Cows	4105	0.0	0.0	0.0	21	0
Dry Cows	565	0.0	0.0	0.0	21	0
Support Stock	3096	0.0	--	0.0	21	0
Large Heifers	0	0.0	--	0.0	21	0
Medium Heifers	0	0.0	--	0.0	21	0
Small Heifers	0	0.0	--	0.0	21	0
Calves	0	--	--	--	--	0
Bulls	0	0.0	--	0.0	21	0

Post-Project Lagoon CO2e Emissions from N2O (short tons/yr)				
Animal Type	Number of Cows	N2O Lagoons (lb/hd-yr)	CO2e Multiplier	CO2e Lagoons (short tons/yr)
Milk Cows	4105	1.5	310	954
Dry Cows	565	1.5	310	131
Support Stock	3096	1.4	310	672
Large Heifers	0	1.4	310	0
Medium Heifers	0	1.4	310	0
Small Heifers	0	1.4	310	0
Calves	0	--	--	0
Bulls	0	1.4	310	0

Post-Project Non-Lagoons CO2e Emissions from N2O (short tons/yr)						
Animal Type	Number of Cows	N2O Manure Spreading (lbs/hd-yr)	N2O Solid Manure Storage (lbs/hd-yr)	N2O Enteric (lbs/hd-yr)	Multiplier	CO2e Non-Lagoons (short tons/yr)
Milk Cows	4,105	0.0	0.0	0	310	0
Dry Cows	565	0.0	0.0	0	310	0
Support Stock	3,096	0.0	--	0	310	0
Large Heifers	0	0.0	--	0	310	0
Medium Heifers	0	0.0	--	0	310	0
Small Heifers	0	0.0	--	0	310	0
Calves	0	0.0	--	0	--	0
Bulls	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	22,112	954	23,066
Dry Cows	3,043	131	3,175
Support Stock	3,589	672	4,261
Large Heifers	0	0	0
Medium Heifers	0	0	0
Small Heifers	0	0	0
Calves	0	0	0
Bulls	0	0	0
		Total	**30,501**

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	9,457	23,066	13,609
Dry Cows	2,560	3,175	615
Support Stock	1,124	4,261	3,136
Large Heifers	0	0	0
Medium Heifers	0	0	0
Small Heifers	0	0	0
Calves	0	0	0
Bulls	0	0	0
		Total	**17,361**

APPENDIX H

Memo – Antonio Azevedo Verbal Land Use Agreement

SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DISTRICT MEMO

DATE: June 26, 2014

TO: File

FROM: John Yoshimura

SUBJECT: Project N-1130683

The Ambient Air Quality Analysis (AAQA) and Risk Management Review (RMR) were conducted using the combined facility boundaries based on a long-term verbal agreement land lease between Antonio Azevedo (Facility N-6096) and Corey Fagundes (Facility N-5263). Kevin Abernathy has also submitted documentation of the verbal agreement. As shown on the map, the two dairies are contiguous; the boundaries of Antonio Azevedo's dairy are outlined in red and the boundaries of Corey Fagundes' dairy are outlined in yellow.

MILK PRODUCERS COUNCIL

"Serving the Dairy Industry for More Than 60 Years"

5-28-2014

SJVAPCD
1990 E Gettysburg Ave
Fresno Ca 93726

Johnathon Yoshimura,

This letter is intended to acknowledge the Verbal agreement between the parties of Azevedo Dairy located at 2025 El Nido Rd, El Nido, Ca Facility N-6096 and Fagundes Feeds located at 1633 W El Nido Rd, El Nido, Ca. Presented by Kevin Abernathy the director of Regulatory Affair of Milk Producers Council
Since 2004 there has been an ongoing verbal agreement to do the Custom farming by Mr. Fagundes for the Dairy operation of Mr. Azevedo at the yearly going rate for the specific crop to be grown and harvested. Ranging from $ 50.00 to $ 150.00 per acre.

Along with the custom farming there has been a Verbal agreement to Purchase various crops that are grown by Mr. Fagundes and Purchased by Mr. Azevedo at the current market rate for specific crops ranging from $ 50.00 to $300.00 per ton.

At present there is no intent to Modify or Terminate the Verbal agreement between Mr. Azevedo and Mr. Fagundes. As noted above this Verbal agreement has been ongoing since 2004 and will continue for an indefinite period of time not limited to 15 years.

The above documentation is to provide the SJVAPCD the ability to include the additional acreage in the modeling run. As is true and correct to the best of my knowledge.

Kevin Abernathy

Prepared by,
Kevin Abernathy
Director of Regulatory Affairs, Milk Producers Council

13545 S. Euclid Avenue, Ontario, CA 91762 ~ phone: (909) 628-6018 ~ fax: (909) 591-7328
801 S. Mount Vernon Avenue, Bakersfield, CA 93307 ~ phone: (661) 833-2549
222 S. Thor Street, Suite 20, Turlock, CA 95380 ~ phone: (209) 250-1801
office@milkproducers.org ~ http://www.milkproducers.org


W Roosevelt Rd
2025 W El Nido Rd, El Nido, CA 95317, USA
W El Nido Rd
S Vineyard Way
W Grant Rd
© 2014 Google
3073 ft
Imagery Date: 3/20/2013
37°07'38.38" N 120°30'12.88" W elev 137 ft
Eye alt 13400 ft
Google earth