
APPENDIX F

Air Quality and Greenhouse Gas Emissions
Technical Appendix

APPENDIX F-1

CalEEMod Operational Emissions Calculations

“Remarks” for the Azevedo Dairy #2 Expansion Project CalEEMod (v.2022.1.1.26) Model Run

“Remarks” are typically used in California Emissions Estimator Model (CalEEMod) to explain non-default inputs. For the current modeling, this document replaces the “remarks” section of the referenced CalEEMod model to provide more space to both identify non-default inputs and to explain how CalEEMod is used to calculate emissions for the current project. When defaults were retained and no further explanation was necessary, no “remarks” are recorded below. The proposed project increment of increase of operational emissions were estimated as set forth below. Based on project details, only mobile source emissions are included.

Azevedo Dairy #2 Expansion Model Run

Land Use

- 68,000 square foot concrete manure storage area.

Construction Phase

- The only construction activities associated with the dairy expansion project would include the construction of a new 68,000 square foot concrete manure storage area and the installation of a new mechanical separator. No new buildings are proposed for this project. Construction activities are anticipated to not exceed two weeks. Therefore, emissions and health risk associated with construction activities are considered de-minimis and are not analyzed any further.

Vehicle Trips

- Animal Confinement Facilities operate 7 days a week. The proposed expanded operations would generate an increase of approximately 17.2 average daily trips (ADTs) (or 0.25 trips per 1,000 square feet). Fleet mix modified to reflect project increase, 46.5 percent auto/light truck and 53.5 percent heavy duty trucks.

Operational Off-Road Equipment

- Calculated separately. See Appendix G.

Area Sources, Energy, Water and Wastewater, Solid Waste

- These rates are not applicable to the proposed dairy, and were not included. Electricity use provided by project applicant and calculated for GHG separately.

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Azevedo Dairy #2 Custom Report

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1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	Azevedo Dairy #2
Operational Year	2025
Lead Agency	Merced County
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.80
Precipitation (days)	28.8
Location	State Hwy 59, El Nido, CA, USA
County	Merced
City	Unincorporated
Air District	San Joaquin Valley APCD
Air Basin	San Joaquin Valley
TAZ	2310
EDFZ	5
Electric Utility	Pacific Gas & Electric Company
Gas Utility	Pacific Gas & Electric
App Version	2022.1.1.26

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
Other Non-Asphalt Surfaces	68.0	1000sqft	1.56	0.00	—	—	—	—

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.04	0.03	0.74	0.55	0.01	0.01	0.26	0.28	0.01	0.07	0.08	—	701	701	0.01	0.10	1.92	732
Total	0.04	0.03	0.74	0.55	0.01	0.01	0.26	0.28	0.01	0.07	0.08	—	701	701	0.01	0.10	1.92	732
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.04	0.03	0.79	0.44	0.01	0.01	0.26	0.28	0.01	0.07	0.08	—	690	690	0.01	0.10	0.05	719
Total	0.04	0.03	0.79	0.44	0.01	0.01	0.26	0.28	0.01	0.07	0.08	—	690	690	0.01	0.10	0.05	719
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.01	0.01	0.14	0.08	< 0.005	< 0.005	0.05	0.05	< 0.005	0.01	0.01	—	115	115	< 0.005	0.02	0.14	120
Total	0.01	0.01	0.14	0.08	< 0.005	< 0.005	0.05	0.05	< 0.005	0.01	0.01	—	115	115	< 0.005	0.02	0.14	120

APPENDIX F-2

Emissions Calculations

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Herd Breakout

	Existing	Proposed
Milking Cow	1,135	3,000
Dry Cow	0	500
Heifer (15-24 mo)	450	500
Heifer (7-14 mo)	575	0
Calves (4-6 mo)	575	0
Calf (under 3 mo)	0	0
Totals	2,735	4,000
Increase		1,265

VOC Emissions from Harvested Acres in Merced County

	tons/day	lbs/year	lbs/acre/yr
Merced Farm	0.81	591,300	1.189
Harvested Acres			
	497,467		
		lbs/year	tons/year
Acres Existing	202	240	0.120
Acres Proposed	198	235	0.118
			-0.002

Farm Equipment emissions were calculated using an emissions factor of 1.19 lbs/acre/year of VOC based on an estimated 0.81 tons/day VOC emitted from farming equipment in the County, with 497,467 acres harvested. This emission factor is based on 2017 inventory data, the latest available, and would represent a conservative estimate of emissions.

This emission factor was applied to the existing 202 acres harvested (fields are harvested multiple times a year) and to the proposed 198 acres harvested (fields would be harvested multiple times a year).

California Air Resources Board. CEPAM2019V1.03 Emission Projection Data. 2017 Estimated Annual Average Emissions. Merced County. Accessed on July 12, 2024 at <<https://ww2.arb.ca.gov/applications/emissions-county>>

United States, Department of Agriculture (USDA). 2017. 2017 Census of Agriculture – County Data: Total Cropland - Harvested Cropland, Acres. Merced County. Accessed on July 12, 2024 at <https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Census_by_State/California/>

VOC Emissions from Mobile Sources

Emissions	Emissions (lbs/day)	Emissions (tons/yr)
Onsite Mobile Source (Tractors and milk tankers)	0.43	0.078
Traffic		0.14
Tons/Year Total Mobile Source		0.218

Emissions from traffic were estimated using CalEEMod Version 2022.1.1.26, Appendix F-1. See Appendix G for Onsite Mobile Sources such as feed loaders.

Total VOC Emissions

Emission Source	Existing VOC/ROG Emissions (tons/yr)	Proposed VOC/ROG Emissions (tons/yr)	Increment of Increase with Proposed Expansion
Traffic and Onsite Mobile Source			0.218
Farm Equipment	0.120	0.118	-0.002
Feed and Manure Management	25.89	41.68	15.79
	26.01	41.80	16.01

VOC emissions from traffic and onsite off-road equipment such as feed loaders were estimated using CalEEMod Version 2022.1.1.26. Onsite truck travel and idling VOC emissions are estimated in Appendix G of the EIR. VOC emissions from feed and manure management (including cow housing, liquid manure, and solid manure) were estimated using the SJVAPCD dairy emissions calculator. See Appendix F for calculator emissions and CalEEMod results.

Herd Breakout

	Existing	Proposed
Milking Cow	1,135	3,000
Dry Cow	0	500
Heifer (15-24 mo)	450	500
Heifer (7-14 mo)	575	0
Heifer (4-6 mo)	575	0
Calf (under 3 mo)	0	0
Totals	2,735	4,000

PM Emissions from Cow Housing

	Existing PM ₁₀ Emissions	Proposed PM ₁₀ Emissions	PM ₁₀ Increment of Increase	PM _{2.5} Increment of Increase
Totals (lbs/yr)	11,547	12,195	648	74
Tons/Year	5.77	6.10	0.32	0.04

See SJVAPCD Calculator for PM₁₀ Calculation Worksheets and Controls. To generate PM_{2.5} emissions, the PM₁₀ emission results were multiplied by the PM_{2.5} fraction from the livestock fugitive dust profile in the California Emission Inventory Data and Reporting System (CEIDARS) developed by the California Air Resources Board.

Wind Erosion Cropped Fields

	PM Emission Factor (tons/acre/yr)	PM ₁₀ /PM _{2.5} Emission Factor (tons/acre/yr)	Emission Factor (lbs/acre/yr)	Existing Acreage	Existing Emissions (tons/year)	Proposed Acreage	Proposed Emissions (tons/year)
PM₁₀	0.013659	0.0061466	12.3	82	0.50	80	0.49
PM_{2.5}*		0.0010594	2.12	82	0.087	80	0.085
	Note: PM _{2.5} Emissions Factor estimated from a comparison of Annual Average Emissions of both PM ₁₀ and PM _{2.5} as found in CARB Almanac Emission Projection Data (Published in 2013). 2012 Estimated Annual Average Emissions. 2012 Emissions Data for Merced County, Dust from Agricultural Lands (Non-Pasture). http://www.arb.ca.gov/ei/emissiondata.htm						
	PM Emission Factor found in Methodology for California Air Resources Board, Section 7.12, Windblown Dust - Agricultural Lands, Revised July 1997. http://www.arb.ca.gov/ei/areasrc/index7.htm						

PM Emissions from Mobile Sources

Emissions	PM10 Emissions (lbs/day)	PM2.5 Emissions (lbs/day)	PM10 Emissions (tons/yr)	PM2.5 Emissions (tons/yr)
Onsite Mobile Source (Tractors and milk tankers)	0.01	0.01	0.001825	0.001825
Traffic			0.05	0.0100000
Tons/Year			0.052	0.012

Emissions from traffic were estimated using CalEEMod Version 2020.4.0, Appendix F-1. See Appendix G for Onsite Mobile Sources such as feed loaders.

Land Preparation and Harvesting

	Crop Type	PM10 Emission Factor (lbs/acre/year)	PM2.5 Emission Factor (lbs/acre/year)	Existing Acreage	Existing PM10 Emissions (tons/year)	Existing PM2.5 Emissions (tons/year)	Proposed Acreage	Proposed PM10 Emissions (tons/year)	Proposed PM2.5 Emissions (tons/year)
Land Preparation	Oats	3.70	0.55	82	0.15	0.02	80	0.15	0.02
	Corn, silage	6.90	0.10	63	0.22	0.00	61	0.21	0.00
	Sudangrass	4.00	0.06	19	0.04	0.00	57	0.11	0.00
	Alfalfa, hay	4.00	0.60	0	0.00	0.00	0	0.00	0.00
	Wheat	3.70	0.06	0	0.00	0.00	0	0.00	0.00
	Walnut	3.13	0.47	0	0.00	0.00	0	0.00	0.00
	Earlage*	6.90	1.03	0	0.00	0.00	0	0.00	0.00
	Almond	3.13	0.47	0	0.00	0.00	0	0.00	0.00
	Sorghum	3.70	0.06	0	0.00	0.00	0	0.00	0.00
	Pistachios	3.13	0.47	0	0.00	0.00	0	0.00	0.00
Total Land Preparation					0.41	0.03		0.47	0.03
Harvesting	Oats	5.80	0.87	82	0.24	0.04	80	0.23	0.03
	Corn, silage	0.17	0.00	63	0.01	0.00	61	0.01	0.00
	Sudangrass	0.00	0.00	57	0.00	0.00	57	0.00	0.00

	Crop Type	PM10 Emission Factor (lbs/acre/year)	PM2.5 Emission Factor (lbs/acre/year)	Existing Acreage	Existing PM10 Emissions (tons/year)	Existing PM2.5 Emissions (tons/year)	Proposed Acreage	Proposed PM10 Emissions (tons/year)	Proposed PM2.5 Emissions (tons/year)
	Alfalfa, hay	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	Wheat	5.80	0.09	0	0.00	0.00	0	0.00	0.00
	Walnut	31.20	0.47	0	0.00	0.00	0	0.00	0.00
	Earlage*	0.17	0.00	0	0.00	0.00	0	0.00	0.00
	Almond	31.20	0.47	0	0.00	0.00	0	0.00	0.00
	Sorghum	5.80	0.09	0	0.00	0.00	0	0.00	0.00
	Pistachios	3.12	0.05	0	0.00	0.00	0	0.00	0.00
	Total Harvesting				0.24	0.04		0.24	0.03
	Total Farming Operations				0.65	0.06		0.71	0.06
	Notes: CARB PM10 emission factors based on 2012 crop acreage. PM2.5 Emissions Factor estimated from CARB speciation profiles included in resource below.								
	California Air Resources Board, Section 7.4, Agricultural Land Preparation Operations, Revised and updated, April 2016. Section 7.5, Agricultural Harvest Operations, Updated April 2016, Revised March 2017. http://www.arb.ca.gov/ei/areasrc/index7.htm								
	Based on double-cropping, fields would undergo land preparation twice in a year, and therefore the acreage was considered for each occurrence. Harvesting operations would occur multiple times for project fields. Cropping patterns obtained from existing and proposed NMPs.								
	*The ARB sources did not have an emission factor for Earlage. Since Earlage consists of corn grain, cobs, husks, and sometimes stalk, the emission factors for corn were used for this analysis.								

Dry Manure Application PM Emissions

	Emission Factor (lbs/acre/yr)	Existing Acreage	Existing Emissions (tons/year)	Proposed Acreage	Proposed Emissions (tons/year)
PM10	5.07	0	0.00	0	0.00
PM2.5	3.042	0	0.00	0	0.00
To generate PM _{2.5} emissions, the PM ₁₀ emission results were multiplied by the PM _{2.5} fraction from the livestock waste profile in the California Emission Inventory Data and Reporting System (CEIDARS) developed by the California Air Resources Board.					

Aggregate PM10 and PM2.5

Emission Source	Existing PM ₁₀ Emissions (tons/year)	Proposed PM ₁₀ Emissions (tons/year)	Project Increase PM10 Emissions	Existing PM _{2.5} Emissions (tons/year)	Proposed PM _{2.5} Emissions (tons/year)	Project Increase PM2.5 Emissions
Wind Erosion	0.504	0.492	-0.012	0.087	0.085	-0.002
Farming Operations	0.650	0.710	0.059	0.062	0.062	-0.000
Mobile Source	-	-	0.052			0.012
Animal Movement	5.774	6.098	0.324	0.658	0.695	0.037
Dry Manure Application	0.000	0.000	0.000	0.000	0.000	0.000
Total	6.928	7.299	0.423	0.807	0.842	0.046

Dry Manure Applied - Existing	
Field Name	Acres
Field 1	0
Field 2	0
Total Acres	0

Dry Manure Applied - Proposed	
Field Name	Acres
Field 1	0
Field 2	0
Total Acres	0

Farming Equipment: NO_x Emissions from Harvested Acres in Merced County

	tons/day	lbs/year	lbs/acre/yr	tons/year	Increment of Increase
Merced Farm	4.59	3,350,700	6.736		
Total Harvested Acres	497,467				
Harvested Acres Existing	202	1,360.58		0.680	
Harvested Acres Proposed	198	1,333.63		0.667	-0.013

Farm Equipment emissions were calculated using an emissions factor of 6.74 lbs/acre/year of NO_x based on an estimated 4.59 tons/day NO_x emitted from farming equipment in Merced County, with 497,467 acres harvested. This emission factor is based on 2017 inventory data, the latest available, and would represent a conservative estimate of emissions.

This emission factor was applied to the existing 202 acres harvested (fields are harvested multiple times a year) and to the proposed 198 acres harvested (fields would be harvested multiple times a year).

California Air Resources Board. CEPAM2019V1.03 Emission Projection Data. 2017 Estimated Annual Average Emissions. Merced County. Accessed on July 12, 2024 at <<https://ww2.arb.ca.gov/applications/emissions-county>>

United States, Department of Agriculture (USDA). 2017. 2017 Census of Agriculture – County Data: Total Cropland - Harvested Cropland, Acres. Merced County. Accessed on July 12, 2024 at < https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Census_by_State/California/ >

Table 1. County Summary Highlights: 2017 (continued)

[For meaning of abbreviations and symbols, see introductory text.]

Item	Merced	Modoc	Mono	Monterey	Napa	Nevada	Orange
Farms number	2,337	423	65	1,104	1,866	673	193
Land in farms acres	946,385	571,191	73,031	1,340,142	255,778	52,061	32,401
Average size of farm acres	405	1,350	1,124	1,214	137	77	168
Median size of farm acres	40	239	36	80	11	10	4
Estimated market value of land and buildings:							
Average per farm dollars	5,299,308	2,640,981	2,158,060	8,944,364	6,052,361	574,346	3,205,502
Average per acre dollars	13,086	1,956	1,921	7,368	44,154	7,425	19,094
Estimated market value of all machinery and equipment\$1,000							
Average per farm dollars	782,567	82,713	9,143	889,335	175,969	23,051	31,350
	334,860	195,540	140,666	805,557	94,303	34,251	162,436
Farms by size:							
1 to 9 acres	384	41	12	276	843	295	130
10 to 49 acres	867	65	24	227	555	253	31
50 to 179 acres	465	81	6	148	256	74	14
180 to 499 acres	284	66	6	138	103	34	11
500 to 999 acres	165	52	2	92	57	11	4
1,000 acres or more	172	118	15	223	52	6	3
Total croplandfarms							
	1,851	319	36	789	1,788	377	147
.....acres							
	546,460	159,907	7,913	366,709	67,701	4,816	9,564
Harvested croplandfarms							
	1,777	283	30	704	1,753	318	142
.....acres							
	497,467	115,640	7,591	299,378	60,978	3,313	5,803
Irrigated landfarms							
	1,975	310	47	638	1,749	465	138
.....acres							
	493,726	142,138	41,736	294,590	60,945	4,952	4,214

CEPAM2019v1.03 Emission Projection Data by EIC

2017 Annual Average Emissions (Tons/Day)

MERCED COUNTY
MISCELLANEOUS PROCESSES
650-FUGITIVE WINDBLOWN DUST

Download these results (as a comma delimited file).

[Start a new query.](#)

<i>EMISSIONS INVENTORY CATEGORY</i>	<i>TOG</i>	<i>ROG</i>	<i>CO</i>	<i>NOX</i>	<i>SOX</i>	<i>PM</i>	<i>PM10</i>	<i>PM2.5</i>	<i>NH3</i>
650-650-5400-0000 Methodology 650-DUST FROM AGRICULTURAL LANDS (NON-PASTURE) 5400-DUST 0000-SUB-CATEGORY UNSPECIFIED	-	-	-	-	-	12.25	5.57	0.96	-
650-651-5400-0000 Methodology 651-DUST FROM PASTURE LANDS 5400-DUST 0000-SUB-CATEGORY UNSPECIFIED	-	-	-	-	-	2.73	1.24	0.21	-
650-652-5400-0000 Methodology 652-DUST FROM UNPAVED ROADS AND ASSOCIATED AREAS 5400-DUST 0000-SUB-CATEGORY UNSPECIFIED	-	-	-	-	-	0.78	0.46	0.06	-
TOTAL	-	-	-	-	-	15.75	7.26	1.24	-
FARM EQUIPMENT	0.94	0.81	4.91	4.59	0.00	0.29	0.29	0.26	0.00

CEPAM2019v1.03 Emission Projection Data by EIC

2017 Annual Average Emissions (Tons/Day)

MERCED COUNTY
MISCELLANEOUS PROCESSES
620-FARMING OPERATIONS

Download these results (as a comma delimited file).
Start a new query.

<i>EMISSIONS INVENTORY CATEGORY</i>	<i>TOG</i>	<i>ROG</i>	<i>CO</i>	<i>NOX</i>	<i>SOX</i>	<i>PM</i>	<i>PM10</i>	<i>PM2.5</i>	<i>NH3</i>
620-614-5400-0000 f Methodology 614-TILLING DUST 5400-DUST 0000-SUB-CATEGORY UNSPECIFIED	-	-	-	-	-	9.31	4.23	0.63	-
620-615-5400-0000 f Methodology 615-HARVEST OPERATIONS - DUST 5400-DUST 0000-SUB-CATEGORY UNSPECIFIED	-	-	-	-	-	11.17	5.08	0.76	-

NOx Emissions from Mobile Sources

Emissions	Emissions (lbs/ day)	Emissions (tons/ yr)
Onsite Mobile Source (Tractors and milk tankers)	0.85	0.155
Traffic		0.14
Tons/Year		0.30

Emissions from traffic were estimated using CalEEMod Version 2022.1.1.26, Appendix F-1. See Appendix G for Onsite Mobile Sources such as feed loaders.

NOx Emissions from Agricultural Activities

	Acres	N2O	N2O	Total NOx Emissions (tons/yr)
		Annual Average (Metric Tons CO ₂ e/Acre/Year)	Annual Average (tons NOx/acre/year)	
Existing Cropping				
Corn/Oats	63	0.32	0.0012	0.075
Oats/Silage	19	0.24	0.0009	0.017
Total				0.091
Proposed Cropping				
Corn/Oats	61	0.32	0.0012	0.072
Oats/Silage	19	0.24	0.0009	0.017
Total				0.089
Increment of Increase				-0.002

The Michigan State University's US Cropland Greenhouse Gas Calculator accounts for different cropping systems using USDA county-specific data considering crop type, tillage, fertilizer, and environmental variables to calculate greenhouse gas emissions. Michigan State University's US Cropland Greenhouse Gas Calculator. Accessed on July 12, 2024 at <<http://carboncalculator.kbs.msu.edu/>>

Total NOx Emissions

	Increment of Increase
	tons/yr
Traffic and Onsite Mobile Source	0.30
Farming Equipment	-0.013
Soil Emissions	-0.002
Total	0.279

Pre-Project Facility Information

- Does this facility house Holstein or Jersey cows?
Most facilities house Holstein cows unless explicitly stated on the PTO or application.
- Does the facility have an anaerobic treatment lagoon?
- Does the facility land apply liquid manure?
Answering "yes" assumes worst case.
- Does the facility land apply solid manure?
Answering "yes" assumes worst case.
- Is any scraped manure sent to a lagoon/storage pond?
Answering "yes" assumes worst case.

Pre-Project Herd Size							
Herd	Flushed Freestalls	Scraped Freestalls	Flushed Corrals	Scraped Corrals	Total # of Animals		
Milk Cows			1,135		1,135		
Dry Cows			0		0		
Support Stock (Heifers, Calves, and Bulls)			1,600		1,600		
Large Heifers			0		0		
Medium Heifers			0		0		
Small Heifers			0		0		
Bulls			0		0		
	Calf Hutches				Calf Corrals		Total # of Calves
	Aboveground Flushed	Aboveground Scraped	On-Ground Flushed	On-Ground Scraped	Flushed	Scraped	
Calves							0

Total Herd Summary	
Total Milk Cows	1,135
Total Mature Cows	1,135
Support Stock (Heifers, Calves, and Bulls)	1,600
Total Calves	0
Total Dairy Head	2,735

Pre-Project Silage Information			
Feed Type	Max # Open Piles	Max Height (ft)	Max Width (ft)
Corn	1	20	85
Alfalfa			
Wheat	1	20	85

Post-Project Facility Information

- Does this facility house Holstein or Jersey cows?
Most facilities house Holstein cows unless explicitly stated on the PTO or application.
- Does the facility have an anaerobic treatment lagoon?
- Does the facility land apply liquid manure?
Answering "yes" assumes worst case.
- Does the facility land apply solid manure?
Answering "yes" assumes worst case.
- Is any scraped manure sent to a lagoon/storage pond?
Answering "yes" assumes worst case.
- Does this project result in an increase or relocation of uncovered surface area for any lagoon/storage pond?

Post-Project Herd Size							
Herd	Flushed Freestalls	Scraped Freestalls	Flushed Corrals	Scraped Corrals	Total # of Animals		
Milk Cows			3,000		3,000		
Dry Cows			500		500		
Support Stock (Heifers, Calves, and Bulls)			500		500		
Large Heifers					0		
Medium Heifers					0		
Small Heifers					0		
Bulls					0		
	Calf Hutches				Calf Corrals		Total # of Calves
	Aboveground Flushed	Aboveground Scraped	On-Ground Flushed	On-Ground Scraped	Flushed	Scraped	
Calves							0

Total Herd Summary	
Total Milk Cows	3,000
Total Mature Cows	3,500
Support Stock (Heifers, Calves, and Bulls)	500
Total Calves	0
Total Dairy Head	4,000

Post-Project Silage Information			
Feed Type	Max # Open Piles	Max Height (ft)	Max Width (ft)
Corn	1	20	85
Alfalfa			
Wheat	1	20	85

VOC Mitigation Measures and Control Efficiencies

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

Cow Housing				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	VOC Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
Enteric Emissions Mitigations				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Feed according to NRC guidelines	10%	10%
Total Control Efficiency			10%	10%
Corrals/Pens Mitigations				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Feed according to NRC guidelines	10%	10%
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Inspect water pipes and troughs and repair leaks at least once every seven days. <i>Note: If selected for dairies > 999 milk cows, CE is already included in EF.</i>	0%	0%
<input type="checkbox"/>	<input type="checkbox"/>	Dairies: Clean manure from corrals at least four times per year with at least 60 days between cleaning, or clean corrals at least once between April and July and at least once between September and December. <i>Note: If selected for dairies > 999 milk cows, CE is already included in EF. Note: No additional control given for increased cleaning frequency (e.g. BACT requirement). Heifer/Calf Ranches:</i> Scrape corrals twice a year with at least 90 days between cleanings, excluding in-corral mounds. <i>Note: No additional control given for increased cleaning frequency (e.g. BACT requirement).</i>	0%	0%
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Scrape, vacuum, or flush concrete lanes in corrals at least once every day for mature cows and every seven days for support stock, or clean concrete lanes such that the depth of manure does not exceed 12 inches at any point or time. <i>Note: No additional control given for increased cleaning frequency (e.g. BACT requirement).</i>	10%	10%
<input type="checkbox"/>	<input type="checkbox"/>	Implement one of the following: 1) slope the surface of the corrals at least 3% where the available space for each animal is 400 sq ft or less and slope the surface of the corrals at least 1.5% where the available space for each animal is more than 400 sq ft; 2) maintain corrals to ensure proper drainage preventing water from standing more than 48 hrs; 3) harrow, rake, or scrape pens sufficiently to maintain a dry surface. <i>Note: If selected for dairies > 999 milk cows, CE already included in EF.</i>	0%	0%
<input type="checkbox"/>	<input type="checkbox"/>	Install shade structures such that they are constructed with a light permeable roofing material. <i>Note: If selected for dairies > 999 milk cows, the control efficiency will be 5% since the EF used includes a partial control for this measure.</i>	5%	5%
<input type="checkbox"/>	<input type="checkbox"/>	Install all shade structures uphill of any slope in the corral. <i>Note: If selected for dairies > 999 milk cows, the control efficiency will be 5% since the EF used includes a partial control for this measure.</i>	5%	5%
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Clean manure from under corral shades at least once every 14 days, when weather permits access into corral. <i>Note: If selected for dairies > 999 milk cows, the control efficiency will be 5% since the EF used includes a partial control for this measure.</i>	5%	5%
<input type="checkbox"/>	<input type="checkbox"/>	Install shade structure so that the structure has a North/South orientation. <i>Note: If selected for dairies > 999 milk cows, the control efficiency will be 5% since the EF used includes a partial control for this measure.</i>	5%	5%
<input type="checkbox"/>	<input type="checkbox"/>	Manage corrals such that the manure depth in the corral does not exceed 12 inches at any time or point, except for in-corral mounding. Manure depth may exceed 12 inches when corrals become inaccessible due to rain events. The manure facility must resume management of the manure depth of 12 inches or lower immediately upon the corral becoming accessible. <i>Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF.</i>	0%	0%
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Knockdown fence line manure build-up prior to it exceeding a height of 12 inches at any time or point. Manure depth may exceed 12 inches when corrals become inaccessible due to rain events. The facility must resume management of the manure depth of 12 inches or lower immediately upon the corral becoming accessible.	10%	10%
<input type="checkbox"/>	<input type="checkbox"/>	Use lime or a similar absorbent material in the corral according to the manufacturer's recommendation to minimize moisture in the corrals.	0%	0%
<input type="checkbox"/>	<input type="checkbox"/>	Apply thymol to the corral soil in accordance with the manufacturer's recommendation.	0%	0%
Total Control Efficiency			30.75%	30.75%
Bedding Mitigations				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Feed according to NRC guidelines	10%	10%
<input type="checkbox"/>	<input type="checkbox"/>	Use non-manure-based bedding and non-separated solids based bedding for at least 90% of the bedding material, by weight, for freestalls (e.g. rubber mats, almond shells, sand, or waterbeds).	0%	0%
<input type="checkbox"/>	<input type="checkbox"/>	For a large dairy (1,000 milk cows or larger) or a heifer/calf ranch - Remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every 7 days.	0%	0%
<input type="checkbox"/>	<input type="checkbox"/>	(D) For a medium dairy only (500 to 999 milk cows) - Remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every 14 days.	0%	0%
Total Control Efficiency			10.00%	10.00%
Lanes Mitigations				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Feed according to NRC guidelines	10%	10%

<input type="checkbox"/>	<input type="checkbox"/>	Pave feedlines, where present, for a width of at least 6 feet along the corral side of the feedline fence for milk and dry cows and at least 6 feet along the corral side of the feedline for heifers. Note: No control efficiency at this time.	0%	0%
<input type="checkbox"/>	<input type="checkbox"/>	Dikes: Flush, scrape, or vacuum freestall flush lanes immediately prior to or after, or during each milking, or flush or scrape freestall flush lanes at least 3 times per day. Heifer/Calf Ranches: Vacuum, scrape, or flush freestalls at least once every seven days.	10%	10%
<input type="checkbox"/>	<input type="checkbox"/>	(D) Have no animals in exercise pens or corrals at any time.	0%	0%
Total Control Efficiency			19.00%	19.00%

Liquid Manure Handling				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	VOC Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
Lagoons/Storage Ponds Mitigations				
<input type="checkbox"/>	<input type="checkbox"/>	Feed according to NRC guidelines	10%	10%
<input type="checkbox"/>	<input type="checkbox"/>	Use phototropic lagoon	0%	0%
<input type="checkbox"/>	<input type="checkbox"/>	Use an anaerobic treatment lagoon designed according to NRCS Guideline No. 359, or aerobic treatment lagoon, or mechanically aerated lagoon, or covered lagoon digester vented to a control device with minimum 95% control	0%	0%
<input type="checkbox"/>	<input type="checkbox"/>	Remove solids from the waste system with a solid separator system, prior to the waste entering the lagoon. Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF.	0%	0%
<input type="checkbox"/>	<input type="checkbox"/>	Maintain lagoon pH between 6.5 and 7.5	0%	0%
Total Control Efficiency			10.00%	10.00%
Liquid Manure Land Application Mitigations				
<input type="checkbox"/>	<input type="checkbox"/>	Feed according to NRC guidelines	10%	10%
<input type="checkbox"/>	<input type="checkbox"/>	Only apply liquid manure that has been treated with an anaerobic or aerobic treatment lagoon, aerobic lagoon, or digester system	0%	0%
<input type="checkbox"/>	<input type="checkbox"/>	Allow liquid manure to stand in the fields for no more than 24 hours after irrigation. Note: If selected for dairies > 999 milk cows, control efficiency is already included in EF.	0%	0%
<input type="checkbox"/>	<input type="checkbox"/>	Apply liquid/slurry manure via injection with drag hose or similar apparatus	0%	0%
Total Control Efficiency			10.00%	10.00%

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

Silage and TMR				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	VOC Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
Corn/Alfalfa/Wheat Silage Mitigations				
<input type="checkbox"/>	<input type="checkbox"/>	1. Utilize a sealed feed storage system (e.g. Ag-Bag) for bagged silage, or		
<input type="checkbox"/>	<input type="checkbox"/>	2. Cover the surface of silage piles, except for the area where feed is being removed from the pile, with a plastic tarp that is at least 5 mils thick (0.005 inches), multiple plastic tarps with a cumulative thickness of at least 5 mils (0.005 inches), or an oxygen barrier film covered with a UV resistant material within 72 hours of last delivery of material to the pile, and implement one of the following:		
<input type="checkbox"/>	<input type="checkbox"/>	a) build silage piles such that the average bulk density is at least 44 lb/cu-ft for corn silage and 40 lb/cu-ft for other silage types, as measured in accordance with Section 7.10 of Rule 4570.		
<input type="checkbox"/>	<input type="checkbox"/>	b) when creating a silage pile, adjust filling parameters to assure a calculated average bulk density of at least 44 lb/cu-ft for corn silage and at least 40 lb/cu-ft for other silage types, using a spreadsheet approved by the District.		
<input type="checkbox"/>	<input type="checkbox"/>	c) harvest silage crop at > or = 65% moisture for corn, and > = 60% moisture for alfalfa/grass and other silage crops; manage silage material delivery such that no more than 6 inches of materials are uncompacted on top of the pile; and incorporate the applicable Theoretical Length of Crop (TLC) and roller opening for the crop being harvested.		
<input type="checkbox"/>	<input type="checkbox"/>	For dairies - implement two of the following:		
<input type="checkbox"/>	<input type="checkbox"/>	For heifer/calf ranches - implement one of the following:		
<input type="checkbox"/>	<input type="checkbox"/>	Manage Exposed Silage: a) manage silage piles such that only one silage pile has an uncovered face and the uncovered face has a total exposed surface area of less than 2,150 sq. ft., or b) manage multiple uncovered silage piles such that the total exposed surface area of all silage piles is less than 4,300 sq ft.	39.0%	39.0%
Total Control Efficiency			39.00%	39.00%

		Maintain Silage Working Face: a) use a shaver/razer to remove silage from the silage pile, or b) maintain a smooth vertical surface on the working face of the silage pile		
		Silage Additive: a) Inoculate silage with homolactic acid bacteria in accordance with manufacturer recommendations to achieve a concentration of at least 100,000 colony forming units per gram of wet forage or apply propionic acid, benzoic acid, sorbic acid, sodium benzoate, or potassium sorbate at a rate specified by the manufacturer to reduce yeast counts when forming silage pile, or b) apply other additives at specified rates that have been demonstrated to reduce alcohol concentrations in silage and/or VOC emissions from silage and have been approved by the District and EPA.		
Total Control Efficiency			39.00%	39.00%

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

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

Ammonia Mitigation Measures and Control Efficiencies

Milking Parlor				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	NH3 Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
Milking Parlor Floor Mitigations				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Feed according to NRC guidelines	28%	28%
Total Control Efficiency			28%	28%

Cow Housing				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	NH3 Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
Corrals/Pens Mitigations				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Feed according to NRC guidelines	28%	28%
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Clean manure from corrals at least four times per year with at least 60 days between cleaning, or clean corrals at least once between April and July and at least once between September and December. OR Use lime or a similar absorbent material in the corral according to the manufacturer's recommendation to minimize moisture in the corrals. OR Apply thymol to the corral soil in accordance with the manufacturer's recommendation.	0%	50%
Total Control Efficiency			28%	64%
Bedding Mitigations				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Feed according to NRC guidelines	28%	28%
<input type="checkbox"/>	<input type="checkbox"/>	Use non-manure-based bedding and non-separated solids based bedding for at least 90% of the bedding material, by weight, for freestalls (e.g. rubber mats, almond shells, sand, or waterbeds). OR For a large dairy only (1,000 milk cows or larger) - Remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every 7 days. OR For a medium dairy only (500 to 999 milk cows) - Remove manure that is not dry from individual cow freestall beds or rake, harrow, scrape, or grade freestall bedding at least once every 14 days.	0.0%	0.0%
Total Control Efficiency			28.00%	28.00%
Lanes Mitigations				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Feed according to NRC guidelines	28%	28%
Total Control Efficiency			28%	28%

Liquid Manure Handling				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	NH3 Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
Lagoons/Storage Ponds Mitigations				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Feed according to NRC guidelines	28%	28%
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Use phototropic lagoon OR Remove solids from the waste system with a solid separator system, prior to the waste entering the lagoon.	0%	80%
Total Control Efficiency			28.0%	85.6%
Liquid Manure Land Application Mitigations				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Feed according to NRC guidelines	28%	28%
<input type="checkbox"/>	<input type="checkbox"/>	Only apply liquid manure that has been treated with an anaerobic treatment lagoon	0%	0%
Total Control Efficiency			28.00%	28.00%

Solid Manure Handling				
Measure Proposed?		Mitigation Measure(s) per Emissions Point	NH3 Control Efficiency (%)	
Pre-Project	Post-Project		Pre-Project	Post-Project
Solid Manure Land Application Mitigations				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Feed according to NRC guidelines	28%	28%
<input type="checkbox"/>	<input type="checkbox"/>	Incorporate all solid manure within 72 hours of land application. AND Only apply solid manure that has been treated with an anaerobic treatment lagoon, aerobic lagoon or digester system. AND Apply no solid manure with a moisture content of more than 50%	0%	0%
Total Control Efficiency			28.00%	28.00%

Dairy Emission Factors

		lb/hd-yr Dairy Emissions Factors for Holstein Cows																												
		Milk Cows				Dry Cows				Large Heifers (15 to 24 months)				Medium Heifers (7 to 14 months)				Small Heifers (3 to 6 months)				Calves (0 - 3 months)				Bulls				
		Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled		Uncontrolled		Controlled		
		<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	<1000 milk cows	≥1000 milk cows	EF1	EF2	
Milking Parlor	VOC	Enteric Emissions in Milking Parlors	0.43	0.41	0.37	0.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Milking Parlor Floor	0.04	0.03	0.03	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Total	0.47	0.44	0.40	0.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		NH3	0.19	0.19	0.14	0.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cow Housing	VOC	Enteric Emissions in Cow Housing	3.89	3.69	3.32	3.32	2.33	2.23	2.01	2.01	1.81	1.71	1.54	1.54	1.23	1.17	1.05	1.05	0.69	0.65	0.58	0.58	0.32	0.31	0.28	0.28	1.10	1.04	0.94	0.94
		Corrals/Pens	10.00	6.60	4.57	4.57	5.40	3.59	2.49	2.49	4.20	2.76	1.91	1.91	2.85	1.88	1.30	1.30	1.60	1.04	0.72	0.72	0.75	0.50	0.35	0.35	2.55	1.67	1.16	1.16
		Bedding	1.05	1.00	0.90	0.90	0.57	0.54	0.49	0.49	0.44	0.42	0.38	0.38	0.30	0.28	0.26	0.26	0.17	0.16	0.14	0.14	0.08	0.08	0.07	0.07	0.27	0.25	0.23	0.23
		Lanes	0.84	0.80	0.65	0.65	0.45	0.44	0.35	0.35	0.35	0.33	0.27	0.27	0.24	0.23	0.18	0.18	0.13	0.13	0.10	0.10	0.06	0.06	0.05	0.05	0.21	0.20	0.16	0.16
		Total	15.78	12.09	9.44	9.44	8.75	6.80	5.34	5.34	6.81	5.22	4.10	4.10	4.62	3.56	2.79	2.79	2.59	1.98	1.55	1.55	1.22	0.95	0.74	0.74	4.13	3.16	2.48	2.48
	NH3	Enteric Emissions in Cow Housing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Corrals/Pens	41.90	41.90	30.17	15.08	21.20	21.20	15.26	7.63	11.00	11.00	7.92	3.96	7.90	7.90	5.69	2.84	6.00	4.32	2.16	1.80	1.80	1.30	0.65	15.30	15.30	11.02	5.51	
		Bedding	6.30	6.30	4.54	4.54	3.20	3.20	2.30	2.30	1.70	1.70	1.22	1.22	1.20	1.20	0.86	0.86	0.90	0.90	0.65	0.65	0.30	0.30	0.22	0.22	2.30	2.30	1.66	1.66
		Lanes	5.10	5.10	3.67	3.67	2.60	2.60	1.87	1.87	1.30	1.30	0.94	0.94	1.00	1.00	0.72	0.72	0.70	0.70	0.50	0.50	0.20	0.20	0.14	0.14	1.90	1.90	1.37	1.37
		Total	53.30	53.30	38.38	23.29	27.00	27.00	19.44	11.81	14.00	14.00	10.08	6.12	10.10	10.10	7.27	4.43	7.60	7.60	5.47	3.31	2.30	2.30	1.66	1.01	19.50	19.50	14.04	8.53
Liquid Manure Handling	VOC	Lagoons/Storage Ponds	1.52	1.30	1.17	1.17	0.82	0.71	0.64	0.64	0.64	0.54	0.49	0.49	0.43	0.37	0.33	0.33	0.24	0.21	0.19	0.19	0.11	0.10	0.09	0.09	0.40	0.33	0.30	0.30
		Liquid Manure Land Application	1.64	1.40	1.26	1.26	0.89	0.76	0.69	0.69	0.69	0.58	0.53	0.53	0.47	0.40	0.36	0.36	0.26	0.22	0.20	0.20	0.12	0.11	0.10	0.10	0.42	0.35	0.32	0.32
		Total	3.16	2.70	2.43	2.43	1.71	1.47	1.33	1.33	1.33	1.13	1.02	1.02	0.90	0.77	0.69	0.69	0.51	0.43	0.38	0.38	0.24	0.21	0.18	0.18	0.82	0.68	0.61	0.61
	NH3	Lagoons/Storage Ponds	8.20	8.20	5.90	1.18	4.20	4.20	3.02	0.60	2.20	2.20	1.58	0.32	1.50	1.50	1.08	0.22	1.20	1.20	0.86	0.17	0.35	0.35	0.25	0.05	3.00	3.00	2.16	0.43
		Liquid Manure Land Application	8.90	8.90	6.41	6.41	4.50	4.50	3.24	3.24	2.30	2.30	1.66	1.66	1.70	1.70	1.22	1.22	1.30	1.30	0.94	0.94	0.37	0.37	0.27	0.27	3.23	3.23	2.33	2.33
		Total	17.10	17.10	12.31	7.59	8.70	8.70	6.26	3.84	4.50	4.50	3.24	1.97	3.20	3.20	2.30	1.44	2.50	1.80	1.11	0.72	0.72	0.52	0.32	0.27	0.27	6.23	6.23	4.49
Solid Manure Handling	VOC	Solid Manure Storage	0.16	0.15	0.14	0.14	0.09	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.05	0.04	0.04	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.04	0.04	0.04	0.04
		Separated Solids Piles	0.06	0.06	0.05	0.05	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02
		Solid Manure Land Application	0.39	0.33	0.30	0.30	0.21	0.18	0.16	0.16	0.16	0.14	0.12	0.12	0.11	0.09	0.08	0.08	0.06	0.05	0.05	0.05	0.03	0.03	0.02	0.02	0.10	0.08	0.07	0.07
	Total	0.61	0.54	0.49	0.49	0.33	0.29	0.26	0.26	0.26	0.23	0.20	0.20	0.17	0.15	0.14	0.14	0.10	0.09	0.08	0.08	0.05	0.04	0.04	0.04	0.04	0.16	0.14	0.13	0.13
	NH3	Solid Manure Storage	0.95	0.95	0.95	0.95	0.48	0.48	0.48	0.48	0.25	0.25	0.25	0.25	0.18	0.18	0.18	0.18	0.13	0.13	0.13	0.13	0.04	0.04	0.04	0.04	0.35	0.35	0.35	0.35
		Separated Solids Piles	0.38	0.38	0.38	0.38	0.19	0.19	0.19	0.19	0.10	0.10	0.10	0.10	0.07	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.14	0.14	0.14	0.14
Solid Manure Land Application		2.09	2.09	1.50	1.50	1.06	1.06	0.76	0.76	0.55	0.55	0.40	0.40	0.39	0.39	0.28	0.28	0.30	0.30	0.22	0.22	0.09	0.09	0.06	0.06	0.76	0.76	0.55	0.55	
Total	3.42	3.42	2.83	2.83	1.73	1.73	1.43	1.43	0.90	0.90	0.75	0.75	0.64	0.64	0.53	0.53	0.48	0.48	0.40	0.40	0.15	0.15	0.12	0.12	1.25	1.25	1.04	1.04		

Silage and TMR (Total Mixed Ration) Emissions (µg/m ² -min)					
Feed Storage and Handling	VOC	Silage Type	Uncontrolled	EF1	EF2
		Com Silage	34,081	21,155	21,155
Alfalfa Silage	17,458	10,649	10,649		
Wheat Silage	43,844	26,745	26,745		
TMR	13,058	10,575	10,575		

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

PM ₁₀ Emission Factors (lb/hd-yr)		
Type of Cow	Dairy EF	Source
Cows in Freestalls	1.37	Based on a Summer 2003 study by Texas A&M ASAE at a West Texas Dairy
Milk/Dry in Loafing Bams	2.73	SJVAPCD
Heifers/Bulls in Loafing Bams	5.28	SJVAPCD
Calves in Loafing Bams	0.69	SJVAPCD
Milk/Dry in Corrals	5.46	Based on a Summer 2003 study by Texas A&M ASAE at a West Texas Dairy
Support Stock (Heifers/Bulls) in Open Corrals	10.55	Based on a USDA/UC Davis report quantifying dairy and feedlot emissions in Tulare & Kern Counties (April '01)
Large Heifers in Open Corrals	8.01	SJVAPCD
Calf (under 3 mo.) open corrals	1.37	SJVAPCD
Calf on-ground hutches	0.343	SJVAPCD
Calf above-ground flushed	0.069	SJVAPCD
Calf above-ground scraped	0.206	SJVAPCD

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

Pre-Project Potential to Emit (PE1)

Pre-Project Herd Size						
Herd	Flushed Freestalls	Scraped Freestalls	Flushed Corrals	Scraped Corrals	Total # of Animals	
Milk Cows	0	0	1,135	0	1,135	
Dry Cows	0	0	0	0	0	
Support Stock (Heifers, Calves and Bulls)	0	0	1,600	0	1,600	
Large Heifers	0	0	0	0	0	
Medium Heifers	0	0	0	0	0	
Small Heifers	0	0	0	0	0	
Bulls	0	0	0	0	0	
	Calf Hutches			Calf Corrals		Total # of Calves
	Aboveground Flushed	Aboveground Scraped	On-Ground Flushed	On-Ground Scraped	Flushed	
Calves	0	0	0	0	0	0

Silage Information				
Feed Type	Maximum # Open Piles	Maximum Height (ft)	Maximum Width (ft)	Open Face Area (ft ²)
Corn	1	20	85	1,317
Alfalfa	0	0	0	0
Wheat	1	20	85	1,317

Milking Parlor				
Cow	VOC		NH3	
	lb/day	lb/yr	lb/day	lb/yr
Milk Cows	1.2	454	0.4	155

Cow Housing						
Cow	VOC		NH3		PM10	
	lb/day	lb/yr	lb/day	lb/yr	lb/day	lb/yr
Total	47.3	17,274	163.5	59,685	31.6	11,547

Liquid Manure Handling						
Cow	VOC		NH3		H2S*	
	lb/day	lb/yr	lb/day	lb/yr	lb/day	lb/yr
Milk Cows	7.6	2,758	38.3	13,972	1	354
Dry Cows	0.0	0	0.0	0	0.1	30
Support Stock (Heifers, Calves and Bulls)	4.5	1,632	14.2	5,184	0	16
Large Heifers	0.0	0	0.0	0	0	0
Medium Heifers	0.0	0	0.0	0	0	0
Small Heifers	0.0	0	0.0	0	0	0
Calves	0.0	0	0.0	0	0	0
Bulls	0.0	0	0.0	0	0	0
Total	12.1	4,390	52.5	19,156	1.1	400

Solid Manure Handling				
Cow	VOC		NH3	
	lb/day	lb/yr	lb/day	lb/yr
Milk Cows	1.5	556	8.8	3,212
Dry Cows	0.0	0	0.0	0
Support Stock (Heifers, Calves and Bulls)	0.9	320	3.3	1,200
Large Heifers	0.0	0	0.0	0
Medium Heifers	0.0	0	0.0	0
Small Heifers	0.0	0	0.0	0
Calves	0.0	0	0.0	0
Bulls	0.0	0	0.0	0
Total	2.4	876	12.1	4,412

Feed Handling and Storage		
	Daily PE (lb-VOC/day)	Annual PE (lb-VOC/yr)
Corn Emissions	8.2	2,993
Alfalfa Emissions	0.0	0
Wheat Emissions	10.4	3,784
TMR	60.3	22,007
Total	78.9	28,784

Total Daily Pre-Project Potential to Emit (lb/day)							
Permit	NOx	SOx	PM10	CO	VOC	NH3	H2S
Milking Parlor	0.0	0.0	0.0	0.0	1.2	0.4	0.0
Cow Housing	0.0	0.0	31.6	0.0	47.3	163.5	0.0
Liquid Manure	0.0	0.0	0.0	0.0	12.1	52.5	1.1
Solid Manure	0.0	0.0	0.0	0.0	2.4	12.1	0.0
Feed Handling	0.0	0.0	0.0	0.0	78.9	0.0	0.0
Total	0.0	0.0	31.6	0.0	141.9	228.5	1.1

Total Annual Pre-Project Potential to Emit (lb/yr)							
Permit	NOx	SOx	PM10	CO	VOC	NH3	H2S
Milking Parlor	0	0	0	0	454	155	0
Cow Housing	0	0	11,547	0	17,274	59,685	0
Liquid Manure	0	0	0	0	4,390	19,156	400
Solid Manure	0	0	0	0	876	4,412	0
Feed Handling	0	0	0	0	28,784	0	0
Total	0	0	11,547	0	51,779	83,408	400

Calculations for milking parlor:

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

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

Calculations for cow housing:

See detailed calculations under Cow Housing Calculations worksheet.

Calculations for liquid manure and solid manure handling:

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

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

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

Calculations for silage emissions:

Annual PE = (EF1) x (area ft²) x (0.0929 m²/ft²) x (8,760 hr/yr) x (60 min/hr) x 2.20E-9 lb/μg

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

Calculation for TMR emissions:

Annual PE = (# cows) x (EF1) x (0.658 m²) x (525,600 min/yr) x (2.20E-9 lb/μg)

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

Notes

Calves are not included in TMR calculation.

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

Major Source Emissions (lb/yr)					
Permit	NOx	SOx	PM10	CO	VOC
Milking Parlor	0	0	0	0	0
Cow Housing	0	0	0	0	0
Liquid Manure	0	0	0	0	2,112
Solid Manure	0	0	0	0	0
Feed Handling	0	0	0	0	0
Total	0	0	0	0	2,112

APPENDIX F-3

Greenhouse Gas Emissions Model Methodology
and Calculations

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GREENHOUSE GAS EMISSIONS QUANTIFICATION: METHODOLOGY AND CALCULATIONS

As set forth in CEQA Guidelines Section 15064.4(c), the lead agency has discretion to select the model or methodology it considers most appropriate to enable decision makers to intelligently take into account the project's incremental contribution to climate change. Where direct quantification of emissions is not possible, they may be described qualitatively.

For the purposes of this Environmental Impact Report, the proposed dairy expansion project estimated calculations include greenhouse gas (GHG) emissions that occur at the project dairy farm, but it does not account for the full production system of the dairy beyond the farm boundaries, nor does it include any soil carbon sequestration in the field. More complicated models are useful for understanding farm processes and their interacting effects on overall greenhouse gas emissions, and they can assist in the development and evaluation of mitigation strategies for reducing emissions and improving overall sustainability of dairy farms¹. However, in order to provide a more direct estimate for decision support, this assessment uses a simpler method based on emission factors and basic calculator models available to estimate GHG emissions from the animals, manure management, lagoons, energy use at the dairy, vehicle use and trucking, and from cropping activities. These simpler emission methodologies generally result in larger overall GHG emissions since they do not include emission sinks that are used in life cycle assessment methodologies.

The proposed dairy project includes increased solid manure exported offsite to be applied to cropland in the area. This analysis assumes animal wastes used as fertilizer would replace all or a portion of existing synthetic fertilizers used on existing cropland, and no feature of general best practices in the San Joaquin Valley would require the application of greater amounts of fertilizer than those currently used. Therefore, it is assumed that N₂O emissions from offsite agricultural fields would not change dramatically, and the GHG emissions from exported manure applied to offsite fields are not included in this analysis.

Listed below are the GHG emission sources and calculation methodologies used for this analysis.

GHG Emissions from the Dairy: Enteric Emissions, Lagoons, Manure Spreading and Storage

The San Joaquin Valley Air Pollution Control District Dairy Calculator (Rev. January 6, 2020, updated with CARB emission factors from the Year 2021 GHG Inventory) was used to estimate GHG emissions from the existing and proposed herd, including emissions from the lagoon, manure spreading, solid manure storage, and enteric emissions. The calculator uses GHG emission factors by animal type to determine CH₄ and N₂O emissions from these sources, and converting the emissions into carbon dioxide (CO₂) equivalents (see calculations included in this appendix).

¹ Rotz, A. 2018. Modeling greenhouse gas emissions from dairy farms. *J. Dairy Sci.* 101:6675–6690. July 01, 2018. Accessed on May 4, 2023 at: <<https://doi.org/10.3168/jds.2017-13272>>

GHG Emissions from Energy Use

Since annual energy use was not available from the project applicant, this analysis uses the average energy use for San Joaquin Valley dairies of 504 kWh per cow-year. This per cow factor was used to calculate estimated energy use for the existing and proposed expanded herd. Because there are energy efficiencies that occur with a larger herd size, this is considered a conservative estimate methodology.

GHG Emissions from Mobile Sources

GHG emissions from vehicle trips (employee trips, milk tanker trucks, commodities transport, solid manure transport, etc.) and off-road equipment sources (feed loading, bedding delivery, manure scraping, manure loading, and feed delivery) were estimated using CalEEMod Version 2020.4.0. Due to the limited amount, estimated GHG emissions from solid waste were included with mobile source emissions.

GHG Emissions from Agricultural Activities

The two major greenhouse gases from field crop agriculture are carbon dioxide (CO₂) and nitrous oxide (N₂O). Carbon dioxide is emitted through fossil fuel use on and off the farm, from activities such as vehicle use and fertilizer production. It can also be emitted or sequestered (stored) in the soil. Whether or not soil carbon sequestration occurs depends on the type of land and the farming practices, for example, soil tillage and plant residue management. Nitrous oxide is a very powerful greenhouse gas and is emitted primarily through soil management activities such as nitrogen fertilizer application. The Michigan State University's US Cropland Greenhouse Gas Calculator accounts for different cropping systems using USDA county-specific data considering crop type, tillage, fertilizer, and environmental variables to calculate greenhouse gas emissions. The dairy existing and proposed crop types and acreage were used to estimate the change in GHG emissions from project site cropland with implementation of the expansion.

Michigan State University's US Cropland Greenhouse Gas Calculator. Accessed on March 30, 2023 at <<http://carboncalculator.kbs.msu.edu/>>

Energy Use at the Azevedo Dairy #2

Energy Use	kWh/mo	kWh/d	kWh/yr	cows	kWh/yr/cow
Average			1,378,440	2,735	504.00
Estimated Proposed			2,016,000	4,000	
kWh/yr/cow				504.00	
Increase			637,560		

Greenhouse Gas Emission Rates for Electricity Use

eGrid State	Average Output Emission Rate (lb CO ₂ e/MWh)	Average Output Emission Rate (lb CO ₂ e/kWh)
California	457.485	0.457485

Source: eGRID2022. Released 1/30/2024. Accessed at: <<https://www.epa.gov/energy/emissions-generation-resource-integrated-database-eGRID>>

GHG Emissions from Energy Consumption

	Herd Count	Average Electricity Use (kWh/yr)	GHG Emission Rate (lbs CO ₂ e/kWh)	GHG Emissions (lbs CO ₂ e/yr)	GHG Emissions (metric tons CO ₂ e/yr)
Electricity Use	2,735	1,378,440	0.457485	630,616	286
Expansion Projection	4,000	2,016,000	0.457485	922,290	418
Increment of Increase	1,265	637,560	-	291,674	132

GHG Emissions from the Dairy - Enteric emissions, lagoons, manure spreading and storage

	Existing Total Emissions (metric tons/yr)	Proposed Total Emissions (metric tons/yr)	Increment of Increase
Tons/Year	15,071	32,993	17,922

GHG emissions from the herd were estimated using emissions factors from the CARB. See GHG Calculation Worksheet

GHG Emissions from Agricultural Activities

	Acres	Soil	N2O	Fuel	Fertilizer	Total GHG Emissions (metric tons CO ₂ e/yr)
		Annual Average (Metric Tons CO ₂ e/Acre/Year)				
Existing Cropping						
Corn/Oats	63	-0.02	0.32	0.05	0.02	23.31
Oats/Silage	19	0.10	0.24	0.05	0.02	7.79
Total						31.1
Proposed Cropping						
Corn/Oats	61	-0.02	0.32	0.05	0.02	22.57
Oats/Silage	19	0.10	0.24	0.05	0.02	7.79
Total						30.36
Change						-0.74

The Michigan State University’s US Cropland Greenhouse Gas Calculator accounts for different cropping systems using USDA county-specific data considering crop type, tillage, fertilizer, and environmental variables to calculate greenhouse gas emissions. Michigan State University’s US Cropland Greenhouse Gas Calculator. Accessed on July 12, 2024 at <<http://carboncalculator.kbs.msu.edu/>>

Total Greenhouse Gas Emissions

	Increased Herd (metric tons CO ₂ e/yr)	Increased Mobile Source* (metric tons CO ₂ e/yr)	Increased Electricity (metric tons CO ₂ e/yr)	Increased Farming Emissions (metric tons CO ₂ e/yr)	GHG Emissions (metric tons CO ₂ /yr)
Dairy Expansion	17,922	120	132	-0.74	18,174

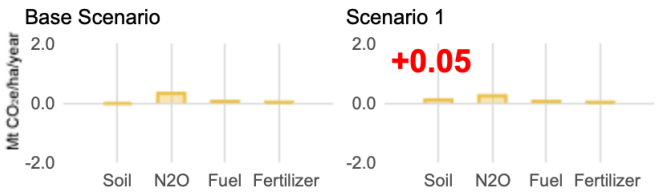
*GHG emissions from mobile sources were estimated using CalEEMod Version 2022.1.1.26.

GHG emissions from the herd were estimated using emissions factors from the CARB. See GHG Calculation Worksheet

Conversion Factors	
1 megawatt-hour (MWh)	1,000 kilowatt-hour (kWh)
1 short ton	2,000 pounds (lb)
1.10231 short ton	1 metric ton
2.2046 lb	1 kilogram (kg)



Instructions



Base Scenario for Merced County, CA

Greenhouse Gas Costs
CO₂ equivalents (Mt/ac/year)

Year	Crop	Yield	Tillage	Fertilizer	Soil	N2O	Fuel	Fertilizer	Total
1	oats	58.0 bu/ac	conventional	66.1 lb N/ac	0.14	0.14	0.05	0.01	0.34
2	corn	148.3 bu/ac	conventional	142.0 lb N/ac	-0.19	0.50	0.05	0.03	0.40 Remove
Annual Average:					-0.02	0.32	0.05	0.02	0.37

Scenario 1 for Merced County, CA [Delete](#)

Greenhouse Gas Costs
CO₂ equivalents (Mt/ac/year)

Year	Crop	Yield	Tillage	Fertilizer	Soil	N2O	Fuel	Fertilizer	Total
1	oats	58.0 bu/ac	conventional	66.1 lb N/ac	0.14	0.14	0.05	0.01	0.34
2	silage	14.7 t/ac	conventional	142.0 lb N/ac	0.07	0.35	0.05	0.03	0.50 Remove
Annual Average:					0.10	0.24	0.05	0.02	0.42

Uncontrolled GHG Emissions Factors (lbs/hd-yr)						
Animal Type	CH4 (Anaerobic Digester Lagoon)	CH4 (Lagoon)	CH4 (Manure Spreading)	CH4 (Solid Manure Storage)	CH4 (Enteric)	CO2 Equivalent Multiplier for CH4
Milk Cows	180.93	322.94	4.99	39.95	318.14	25
Dry Cows	180.93	322.94	4.99	39.95	318.14	25
Support Stock*	54.87	97.94	1.55	--	144.56	25
Large Heifers	54.87	97.94	1.55	--	144.56	25
Medium Heifers	54.87	97.94	1.55	--	95.76	25
Small Heifers	54.87	97.94	1.55	--	95.76	25
Calves	--	--	--	--	25.59	25
Bulls*	54.87	97.94	1.55	--	144.56	25

*Emission factors for Support Stock and Bulls assumed to be the same as Large Heifers. Where there are no emission factor provided beyond dairy cows by the GHG Inventory, none are used. For anaerobic digester lagoons, emission factors for support stock are scaled from the dairy cow emission factor.

1 short ton = 0.9072 metric ton

Global warming potential of CH4 = 25
Global warming potential of N2O = 298

CO2e from CH4 = [CH4 lagoon + CH4 manure spreading + CH4 solid manure storage + CH4 enteric] x 25 x 0.9072 metric tons/short tons + 2000 lb/ton

CO2e from N2O = [N2O lagoon + N2O manure spreading + N2O solid manure storage + N2O enteric] x 298 x 0.9072 metric tons/short tons + 2000 lb/ton

Note: CO2 equivalent emissions are calculated using Global Warming Potential values from the Fourth Assessment Report of the IPCC consistent with that used in the California's Greenhouse Gas Inventory (2023 Edition).

Emission factors obtained from Documentation of California's 2000-2021 GHG Inventory, Year 2021. <https://ww2.arb.ca.gov/applications/california-ghg-inventory-documentation>.

Uncontrolled GHG Emissions Factors (lbs/hd-yr)						
Animal Type	N2O (Anaerobic Digester Lagoon)	N2O (Lagoon)	N2O (Manure Spreading)	N2O (Solid Manure Storage)	N2O (Enteric)	CO2 Equivalent Multiplier for N2O
Milk Cows	2.3914	4.20	0.55	4.22	0	298
Dry Cows	2.3914	4.20	0.55	4.22	0	298
Support Stock*	1.01	1.78	0.24	--	0	298
Large Heifers	1.01	1.78	0.24	--	0	298
Medium Heifers	1.01	1.78	0.24	--	0	298
Small Heifers	1.01	1.78	0.24	--	0	298
Calves	--	--	--	--	0	298
Bulls*	1.01	1.78	0.24	--	0	298

Pre-Project CO2e Emissions

Pre-Project Lagoon CO2e Emissions from CH4 (metric tons/yr)				
Animal Type	Number of Cows	CH4 (Lagoon) (lb/hd-yr)	CO2e Multiplier	CO2e Lagoons (metric tons/yr)
Milk Cows	1,135	322.94	25	4,157
Dry Cows	0	322.94	25	-
Support Stock	1,600	97.94	25	1,777
Large Heifers	0	97.94	25	-
Medium Heifers	0	97.94	25	-
Small Heifers	0	97.94	25	-
Calves	0	--	--	-
Bulls	0	97.94	25	-

Pre-Project Non-Lagoon CO2e Emissions from CH4 (metric tons/yr)						
Animal Type	Number of Cows	CH4 (Manure Spreading) (lb/hd-yr)	CH4 (Solid Manure Storage) (lb/hd-yr)	CH4 (Enteric) (lb/hd-yr)	CO2e Multiplier	CO2e Non-Lagoons (metric tons/yr)
Milk Cows	1,135	4.99	39.95	318.14	25	4,673
Dry Cows	0	4.99	39.95	318.14	25	-
Support Stock	1,600	1.55	--	144.56	25	2,651
Large Heifers	0	1.55	--	144.56	25	-
Medium Heifers	0	1.55	--	95.76	25	-
Small Heifers	0	1.55	--	95.76	25	-
Calves	0	--	--	25.59	25	-
Bulls	0	1.55	--	144.56	25	-

Pre-Project Lagoon CO2e Emissions from N2O (metric tons/yr)				
Animal Type	Number of Cows	N2O (Lagoon) (lb/hd-yr)	CO2e Multiplier	CO2e Lagoons (metric tons/yr)
Milk Cows	1,135	4.20	298	644
Dry Cows	0	4.20	298	-
Support Stock	1,600	1.78	298	385
Large Heifers	0	1.78	298	-
Medium Heifers	0	1.78	298	-
Small Heifers	0	1.78	298	-
Calves	0	--	298	-
Bulls	0	1.78	298	-

Pre-Project Non-Lagoon CO2e Emissions from N2O (metric tons/yr)						
Animal Type	Number of Cows	N2O (Manure Spreading) (lb/hd-yr)	N2O (Solid Manure Storage) (lb/hd-yr)	N2O (Enteric) (lb/hd-yr)	CO2e Multiplier	CO2e Non-Lagoons (metric tons/yr)
Milk Cows	1,135	0.55	4.22	0	298	732
Dry Cows	0	0.55	4.22	0	298	-
Support Stock	1,600	0.24	--	0	298	51
Large Heifers	0	0.24	--	0	298	-
Medium Heifers	0	0.24	--	0	298	-
Small Heifers	0	0.24	--	0	298	-
Calves	0	--	--	0	298	-
Bulls	0	0.24	--	0	298	-

Total Pre-Project CO2e Emissions (metric tons/yr)			
Animal Type	CO2e from CH4	CO2e from N2O	Total
Milk Cows	8,830	1,376	10,206
Dry Cows	0	-	-
Support Stock	4,428	437	4,865
Large Heifers	0	-	-
Medium Heifers	0	-	-
Small Heifers	0	-	-
Calves	0	-	-
Bulls	0	-	-
Total			15,071

Post-Project CO2e Emissions

Post-Project Lagoon CO2e Emissions from CH4 (metric tons/yr)				
Animal Type	Number of Cows	CH4 (Lagoon) (lb/hd-yr)	CO2e Multiplier	CO2e Lagoons (metric tons/yr)
Milk Cows	3,000	322.94	25	10,986
Dry Cows	500	322.94	25	1,831
Support Stock	500	97.94	25	555
Large Heifers	0	97.94	25	-
Medium Heifers	0	97.94	25	-
Small Heifers	0	97.94	25	-
Calves	0	--	--	-
Bulls	0	97.94	25	-

Post-Project Non-Lagoon CO2e Emissions from CH4 (metric tons/yr)						
Animal Type	Number of Cows	CH4 (Manure Spreading) (lb/hd-yr)	CH4 (Solid Manure Storage) (lb/hd-yr)	CH4 (Enteric) (lb/hd-yr)	CO2e Multiplier	CO2e Non-Lagoons (metric tons/yr)
Milk Cows	3,000	4.99	39.95	318.14	25	12,352
Dry Cows	500	4.99	39.95	318.14	25	2,059
Support Stock	500	1.55	--	144.56	25	828
Large Heifers	0	1.55	--	144.56	25	-
Medium Heifers	0	1.55	--	95.76	25	-
Small Heifers	0	1.55	--	95.76	25	-
Calves	0	--	--	25.59	25	-
Bulls	0	1.55	--	144.56	25	-

Post-Project Lagoon CO2e Emissions from N2O (metric tons/yr)				
Animal Type	Number of Cows	N2O (Lagoon) (lb/hd-yr)	CO2e Multiplier	CO2e Lagoons (metric tons/yr)
Milk Cows	3,000	4.20	298	1,703
Dry Cows	500	4.20	298	284
Support Stock	500	1.78	298	120
Large Heifers	0	1.78	298	-
Medium Heifers	0	1.78	298	-
Small Heifers	0	1.78	298	-
Calves	0	--	298	-
Bulls	0	1.78	298	-

Post-Project Non-Lagoon CO2e Emissions from N2O (metric tons/yr)						
Animal Type	Number of Cows	N2O (Manure Spreading) (lb/hd-yr)	N2O (Solid Manure Storage) (lb/hd-yr)	N2O (Enteric) (lb/hd-yr)	CO2e Multiplier	CO2e Non-Lagoons (metric tons/yr)
Milk Cows	3,000	0.55	4.22	0	298	1,935
Dry Cows	500	0.55	4.22	0	298	323
Support Stock	500	0.24	--	0	298	16
Large Heifers	0	0.24	--	0	298	-
Medium Heifers	0	0.24	--	0	298	-
Small Heifers	0	0.24	--	0	298	-
Calves	0	--	--	0	298	-
Bulls	0	0.24	--	0	298	-

Total Post-Project CO2e Emissions (metric tons/yr)			
Animal Type	CO2e from CH4	CO2e from N2O	Total
Milk Cows	23,338	3,638	26,977
Dry Cows	3,890	606	4,496
Support Stock	1,384	136	1,520
Large Heifers	0	-	-
Medium Heifers	0	-	-
Small Heifers	0	-	-
Calves	0	-	-
Bulls	0	-	-
Total			32,993

Change in CO2e Emissions

Change in CO2e Emissions (metric tons/yr)			
Animal Type	Pre-Project CO2e	Post-Project CO2e	Change
Milk Cows	10,206	26,977	16,770
Dry Cows	0	4,496	4,496
Support Stock	4,865	1,520	(3,345)
Large Heifers	0	-	-
Medium Heifers	0	-	-
Small Heifers	0	-	-
Calves	0	-	-
Bulls	0	-	-
Total			17,922

APPENDIX F-4

Proposed Greenhouse Gas Emissions Threshold

GREENHOUSE GAS EMISSIONS THRESHOLD FOR THE PROPOSED DAIRY EXPANSION PROJECT

Introduction

The California Environmental Quality Act (CEQA) requires agencies to identify a project's potentially significant effects on the environment, and to mitigate significant effects whenever feasible. This includes the potential environmental effects of greenhouse gas (GHG) emissions. CEQA encourages public agencies to adopt "thresholds of significance" to use in determining the significance of environmental effects. A threshold of significance is an identifiable quantitative, qualitative, or performance level of a particular environmental effect. Exceedance of a threshold of significance would normally result in a determination that the project would have a significant environmental impact. Conversely, non-exceedance of a significance threshold would normally result in a determination that project would not have a significant environmental impact. In regards to thresholds of significance for GHG emissions, CEQA Guidelines Section 15064.7(c) states that a lead agency "may consider thresholds of significance previously adopted or recommended by other public agencies or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence." The California Air Resources Board (ARB) has established preliminary approaches to establishing significance thresholds, and the San Joaquin Valley Air Pollution Control District (SJVAPCD) has issued guidance for evaluating project-level GHG effects.

In determining the significance of a project's impacts, the lead agency may consider a project's consistency with the State's long-term climate goals or strategies, or with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction of greenhouse gas emissions, provided that substantial evidence supports the agency's analysis of how those goals or strategies address the project's incremental contribution to climate change and its conclusion that the project's incremental contribution is consistent with those plans, goals, or strategies (CEQA Guidelines Section 15064.4 (b)(3).) The legislative or regulatory programs establish standards that are independent of the impact analysis described in the CEQA Guidelines (see provisions beginning with Section 15126). The 2022 Scoping Plan Update is the State program for GHG emission reductions. While the 2022 Scoping Plan identifies various actions and concepts that would lead to an increase in climate-smart agricultural management actions, at this stage it does not include regulatory requirements that would reduce greenhouse gas emissions; the authority to reduce GHG emissions via measures relating to agricultural lands largely lies with state, regional, and local agencies, along with the Legislature and its budgeting choices (ARB 2022). At this time, there is no regional or Merced County greenhouse gas reduction plan or climate action plan. Therefore, there is no local, regional, or statewide plan regulating global warming by which the proposed project can be measured.

Threshold Options

In December of 2018, the Governor's Office of Planning and Research (OPR) released *CEQA and Climate Change* (OPR 2018), a discussion draft update to a 2008 advisory, suggesting relevant ways to address climate change in CEQA analyses. The document considers various approaches to performing a climate change analysis, including some of the methods that a lead agency may use in selecting appropriate significance thresholds. A lead agency may choose to review a project's

environmental impacts using more than one threshold of significance. Several threshold options included in the advisory include:

- a significance threshold based on efficiency;
- compliance with State goals
- consistency with relevant regulations, plans, policies, and regulatory programs
- numeric/quantitative threshold

Additional thresholds considered by OPR in a recent webinar on GHG emissions analysis include a net-zero threshold and a zero threshold. A lead agency may choose to review a project's environmental impacts using more than one threshold of significance. Regardless of which threshold or combination of thresholds the lead agency uses, the agency must support its analysis and significance determination with substantial evidence. (CEQA Guidelines Section 15064.7.)

Thresholds Previously Adopted or Recommended

United States Environmental Protection Agency (EPA)

EPA's Final Mandatory GHG Reporting Rule became effective December 29, 2009. The rule requires reporting of GHG emissions from large sources and suppliers in the United States, and is intended to collect accurate and timely emissions data to inform future policy decisions. Under the rule, suppliers of fossil fuels or industrial greenhouse gases, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons per year (mt/yr) or more of GHG emissions are required to submit annual reports to EPA. EPA estimates that the reporting rule will cover about 85 percent of GHG emissions in the United States.

For manure management systems, such as on a dairy, the animal population threshold level below which facilities are not required to report emissions is 3,200-cow dairy herd, which represents a conservative estimate of the 25,000 mt/yr CO₂ equivalent (CO₂e) threshold level. Facilities that meet or exceed these populations will need to conduct an analysis to determine if they emit more than 25,000 mt/yr CO₂e. While congress restricted EPA from expending any funds in fiscal years 2010 through 2023 for the purpose of implementing the manure management section of the rule, this did not change the requirements of the rule, and facilities that meet the threshold size are advised to keep the appropriate records.

California Air Resources Board

The California Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (California Mandatory Reporting Rule) (17 CCR, Section 95100-95157), approved in 2007, is similar to the U.S. EPA Mandatory Reporting Rule in that it requires certain large emitters and suppliers to report their GHG data on an annual basis; however, the California emissions threshold is lower at only 10,000 metric tons of CO₂e per year. The California Mandatory Reporting Rule excludes GHG emissions related to livestock manure management systems and agricultural irrigation pumps.

San Joaquin County Air Pollution Control District (SJVAPCD)

To assist Lead Agencies, project proponents, permit applicants, and interested parties in assessing and reducing the impacts of project specific GHG on global climate change, the SJVAPCD adopted the following guidance on December 17, 2009: *Guidance for Valley Land-use Agencies in Addressing*

GHG Emission Impacts for New Projects under CEQA and the policy: *District Policy – Addressing GHG Emission Impacts for Stationary Source Projects Under CEQA When Serving as the Lead Agency* (SJVAPCD 2009). The guidance and policy rely on the use of performance-based standards, otherwise known as Best Performance Standards (BPS) to assess significance of project specific greenhouse gas emissions on global climate change during the environmental review process, as required by CEQA. Use of BPS is a method of streamlining the CEQA process of determining significance and is not a required emission reduction measure. Projects implementing BPS would be determined to have a less than cumulatively significant impact. Otherwise, demonstration of a 29 percent reduction in GHG emissions, from business-as-usual, is required to determine that a project would have a less than cumulatively significant impact. The guidance does not limit a lead agency’s authority in establishing its own process and guidance for determining significance of project related impacts on global climate change.

Projects complying with BPS would not require specific quantification of GHG emissions and would be determined to have a less than significant cumulative impact for GHG emissions. Projects not complying with Best Performance Standards would require quantification of GHG emissions and demonstration that GHG emissions have been reduced or mitigated by 29 percent, as targeted by CARB’s AB 32 Scoping Plan. Furthermore, quantification of GHG emissions would be required for all projects for which the lead agency has determined that an Environmental Impact Report is required, regardless of whether the project incorporates BPS. (SJVAPCD 2009)

Best performance standards for GHG emissions have not yet been developed for all sources of GHG emissions. Given that understanding and regulation of GHG emission sources and mitigations is evolving, the SJVAPCD staff expects the development of BPS to be an ongoing effort. Consistent with CEQA Guidelines Section 15064(h)(3), for projects implementing best performance standards, or their equivalent, the District would conclude that the project’s incremental contribution to the cumulative impact on global climatic change is not cumulatively considerable. (SJVAPCD 2009)

The following bullet points illustrate the SJVAPCD’s process for evaluating GHG significance. Project impact can be reduced by:

- Using any combination of District approved GHG Emission Reduction Measures to meet BPS
- Complying with an approved GHG plan or mitigation program
- Reducing GHG emissions by at least 29 percent.

The SJVAPCD has developed illustrative examples for potential BPS. At this stage, these illustrative BPS should not be considered District-approved standards, but rather provide an opportunity for public input into the development of BPS and ultimate development of final BPS. The illustrative BPS now being proposed for livestock operations include that all operations shall utilize all three following control measures:

- (1) All ruminant animal feed shall include at least six percent cottonseed, or, upon SJVAPCD approval, based on sufficient demonstration that use of cottonseed is not feasible, an equivalent substitute (estimated to generate a 12 percent reduction in methane emissions from this source);

- (2) Manure from animal housing areas for mature cows shall be removed and transferred into appropriate treatment facilities at least four times a day and at least once a day for all other animals (estimated to generate a 7.1 percent reduction in methane emissions from this source); and
- (3) Collected manure shall be treated anaerobically in digesters or covered lagoons, designed and operated per NRCS standards, with captured methane used for energy recovery in a method that displaces current or required fossil fuel use, such as, but not limited to, injection into natural gas pipeline, or powering mobile equipment. Taking the effect of the CO₂ produced from the combustion of CH₄ into account, an overall reduction of 63.5 percent of fugitive CH₄ emissions can be achieved by the use of properly designed and controlled anaerobic treatment as a BPS. (SJVAPCD 2009)

Although permit requirements for many livestock farms took effect in 2004, the particular BPS proposed, with the exception of frequent manure removal from livestock housing areas, have never been implemented as mandatory permit requirements. Instead, many other control measures aimed at reducing VOC and PM₁₀ emissions have been applied with greater emphasis. Until these BPS are finalized, the following conditions would be most applicable according to the SJVAPCD:

- In order to minimize Greenhouse Gas emissions and optimize equipment efficiency, all equipment shall be operated in accordance with manufacturer specifications and approved design specifications.
- All ruminant animal feed shall include at least 6 percent cottonseed.
- Manure from animal housing areas shall be removed and transferred into appropriate treatment facilities at least four times a day for mature cows and at least once a day for all other animals. (SJVAPCD 2009)

The illustrative BPS now being proposed by the SJVAPCD for farming operations and the application of manure to cropland include that all operations shall utilize the following control measure:

- (1) Manure shall be incorporated into soil within 24 hours after application. In a report entitled “Recommendations to the San Joaquin Valley Air Pollution Control Officer Regarding Best Available Control Technology for Dairies in the San Joaquin Valley”, the Dairy Permitting Advisory Group (DPAG) concluded that VOC emissions could be reduced by 29 to 58 percent by the prompt incorporation of manure into soil after application to land. Based on this information, this BPS assumes a similar benefit as far as the reduction of CH₄ emissions is concerned. However due to the lack of data, the lower control efficiency of 29 percent of methane emissions from this source will be used.

The California Attorney General (AG) has expressed opposition to SJVAPCD strategy, claiming it leaves a number of unanswered questions, and the AG’s office issued a letter dated November 4, 2009 stating that the proposed approach would “not withstand legal scrutiny and may result in significant lost opportunities for the Air District and local governments to require mitigation of GHG emissions.” The AG noted several deficiencies, primarily that the SJVAPCD does not discuss a particular environmental objective that would be achieved by implementing the proposed thresholds, such as meeting a GHG emissions reduction trajectory consistent with that set forth in AB 32 and

Executive Order S-03-05 within the Air District’s jurisdiction. Also, the BPS are described as “illustrative” only, and it is not possible at this time to determine whether the BPS ultimately adopted will reduce GHG emissions in the San Joaquin Valley and, if so, by how much. Further, the threshold does not take into account the need for new development to be more GHG-efficient than existing development to achieve AB 32 goals, given that past and current sources of emissions, which are substantially less efficient than this average, will continue to exist and emit. The AG also points out that the SJVAPCD proposal appears to award emission reduction “points” for undertaking mitigation measures that are already required by local or state law and could offer an incentive to project proponents to artificially inflate the hypothetical project to show that the proposed project is, by comparison, GHG-efficient. Most importantly, the AG noted that according to the SJVAPCD guidance, any project employing certain, as of yet unidentified, mitigation measures would be considered to not result in a significant level of GHG emissions or a significant impact, regardless of the project’s total GHG emissions, which could be very large.

Because of the uncertain direction of legal opinion, and because BPS for dairies and agricultural operations have not been adopted and are illustrative only, this EIR does not use project compliance with BPS as a threshold of significance.

Comparison of Non-Zero Significance Thresholds

In efforts to identify a numeric threshold that could be appropriate for this analysis, a survey of several California Air Quality Management Districts’ CEQA guidance was completed. The table below summarizes significance thresholds and mandatory reporting thresholds as set forth by the EPA, the CARB, the SJVAPCD, Sacramento Metropolitan Air Quality Management District (SMAQMD), and South Coast Air Quality Management District (SCAQMD). Neither the SMAQMD nor the SCAQMD guidance contain any numeric thresholds or guidance specific to agricultural activities. Bay Area Air Quality Management District (BAAQMD) project-level significance thresholds are specific to residential, office, and retail projects, and would not apply to agricultural projects.

Comparison of Thresholds					
Category	EPA	CARB	SCAQMD	SJVAPCD	SMAQMD
	(Mandatory Reporting)				
Construction	--	--	--	--	1,100 mt/yr CO _{2e}
Industrial/ Stationary Sources Operation	25,000 mt/yr CO _{2e}	10,000 mt/yr CO _{2e}	10,000 mt/yr CO _{2e}	BPS	10,000 mt/yr CO _{2e}
Dairy/Agricultural Project	25,000 mt/yr CO _{2e}	10,000 mt/yr CO _{2e}	--	BPS	--

t/yr = metric tons per year; CO_{2e} = carbon dioxide equivalents

The EPA’s Mandatory GHG Reporting Rule threshold of 25,000 mt/yr CO_{2e} represents a reporting threshold and not a threshold of significance specifically, and it is estimated to capture approximately 85 percent of the U.S emissions of GHGs and capture all large sources of GHG emissions. This is very similar to the CARB goal of emissions capture of 90 percent to meet AB 32 goals.

Except for EPA, no other agency has established any adopted thresholds for agricultural or dairy uses at this time (May 2024). Because SJVAPCD BPS for dairies and agricultural operations have not

been adopted and are illustrative only, application of BPS as a threshold is not possible at this time. The EPA's reporting threshold of 25,000 mt/yr of CO₂e represents a conservative value that would capture many large emitters of GHGs. However, the EPA's 25,000 mt/yr CO₂e is a permit threshold that represents emissions from the entire facility and not just the increment of increase. Therefore, a dual threshold is identified that uses 10,000 mt/yr CO₂e (used by both SCAQMD and SMAQMD for industrial stationary sources) as the maximum increment of increase and also 25,000 mt/yr CO₂e as a threshold for total facility emissions.

Identified EIR Threshold

In accordance with CEQA Guideline Section 15064.4, Determining the Significance of Impacts from Greenhouse Gas Emissions, a lead agency should determine the amount of GHG emissions resulting from a project, which may be determined by either using a model or methodology to quantify GHG emissions or by relying on a qualitative analysis or performance-based standards. Additionally, a lead agency may consider: (1) whether the project would increase or reduce GHG emissions as compared to the existing environmental setting; (2) whether the project's emissions exceed a threshold of significance that the lead agency has determined applies to the project; or (3) the extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions.

Merced County has not established significance criteria for GHG emissions. Many statewide and regional GHG emission reduction strategies have few or limited agricultural measures, making compliance with these strategies as a threshold an illogical choice. For the construction phase of the project, this analysis uses the commonly adopted numeric threshold for land use projects of 1,100 metric tons CO₂e per year of GHG emissions. For operational emissions, this EIR uses a combination of significance thresholds:

- The increment of increase of the project's GHG emissions would be greater than 10,000 mt/yr of CO₂e.
- *However, if the dairy implements a voluntary Scoping Plan methane mitigation strategy for dairy and livestock operations, such as dairy digesters and alternative manure management systems, then the project's contribution to GHG emissions would be considered less than significant.*

This numeric threshold would only be applicable to dairies, and would not apply to industrial, commercial, residential, or other development types.

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