



**San Joaquin Valley
Air Pollution Control District**

Van Der Kooi Dairy

Supplemental Environmental Impact Report
State Clearinghouse Number 2006011107

California Environmental Quality Act

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**SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DISTRICT
GOVERNING BOARD 2008**

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Introduction

The San Joaquin Valley Air Pollution Control District (District), serving as Lead Agency, has completed a Supplemental Environmental Impact Report (EIR) for the Van Der Kooi dairy project. The Draft EIR was circulated from November 14, 2006, through December 29, 2006. Pursuant to California Environmental Quality Act (CEQA) §15088, the District evaluated all comments that were received for the Draft EIR and prepared written responses which can be found in Section 4 of the Final EIR, State Clearinghouse Number 2006011107. The District finalized the EIR in November 2007.

Recent concerns over global warming have identified green house gas (GHG) emissions and their contribution to global climate change (GCC) as environmental effects to be considered under CEQA. The District has determined that the existing Final EIR adequately address all other project related environmental impacts. This Supplemental EIR has been prepared to revise the EIR to include a discussion of the project's construction and operational greenhouse gas emissions and possible impact on air quality and global climate change.

Project Summary

Charles Van Der Kooi has applied to the District for a permit for the establishment of a 3,200 Holstein milk cow dairy on a 1,242-acre site in Fresno County. 110 acres will make up the dairy facilities site (corrals, barns, lagoon, etc.), while the remaining 1,132 acres will remain in current agricultural production of alfalfa and corn silage/wheat. The herd will be supported by 480 dry cows, 2,060 heifers, and 380 calves. The proposed project is located at 13695 West Elkhorn Avenue, between Howard and Madera Avenue, in Fresno County.

Health Risk Assessment:

A Health Risk Assessment was performed to analyze probable nuisance or human health impact from hydrogen sulfide (H₂S). Currently there is no approved H₂S emission factor for dairy operations. However, a recent study conducted by Dr. Schmidt entitled *On-site Dairy Emissions Using Flux Chambers*, suggests an H₂S emission factor in the range of 0.02 lbs/hd-yr to 0.3 lbs/hd-yr (0.16 lbs/hd-yr average). Using the worst case emission factor of 0.3 lb/hd-yr for each animal regardless of size, it was determined that this resulted in an increase of the prioritization score by only 0.1 concluding that there is no measurable acute, chronic or cancer risk. The prioritization score is an estimate of the probability of contracting cancer or having a chronic non-carcinogenic or acute effect using a screening analysis based on the emission rate of toxic air contaminants and the toxicity of the pollutants emitted. A score greater than 1.0 would be considered significant. This analysis concludes that impacts from H₂S would be less than significant. See Appendix D for the result.

Environmental Impact from Greenhouse Gas

Recent concerns over global warming have created a greater interest in greenhouse gases (GHG) and their contribution to global climate change (GCC). However, at this time there are no generally accepted thresholds of significance for determining the impact of GHG emissions from an individual project on GCC. Thus, permitting agencies are in the position of developing policy and guidance to ascertain and mitigate to the extent feasible the effects of GHG, for CEQA purposes, without the normal degree of accepted guidance and case law.

Greenhouse Gases: Gases that trap heat in the atmosphere are called greenhouse gases; they act in the atmosphere in a manner analogous to the way a greenhouse retains heat. Common GHG include water vapor, carbon dioxide, methane, nitrous oxides, chlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, ozone, and aerosols. Without the

natural heat trapping effect of GHG, the earth's surface would be about 34 degrees Centigrade cooler (Climate Action Team, 2006). Natural processes and human activities are primarily responsible for the emission of GHG. Green house gases include:

Water Vapor: Although not considered a pollutant, water vapor is the most important, abundant, and variable GHG. In the atmosphere, it maintains a climate necessary for life. The main source of water vapor is evaporation from the ocean (approximately 85 percent). Other sources include sublimation (change from solid to gas) from ice and snow, evaporation from other water bodies, and transpiration from plant leaves.

Ozone: Unlike other GHG, ozone is relatively short-lived and, therefore, is not global in nature. It is difficult to make an accurate determination of the contribution of ozone precursors (nitrogen oxides and volatile organic compounds) to global climate change (California Air Resources Board (CARB) 2004b).

Aerosols: Aerosols are suspensions of particulate matter in a gas emitted into the air through burning biomass (plant material) and fossil fuels. Aerosols can warm the atmosphere by absorbing and emitting heat and can cool the atmosphere by reflecting light. Cloud formation can also be affected by aerosols. Sulfate aerosols are emitted when fuel-containing sulfur is burned. Black carbon (or soot) is emitted during biomass burning or incomplete combustion of fossil fuels. Particulate matter regulation has been lowering aerosol concentrations in the United States; however, global concentrations are likely increasing.

Carbon dioxide: Carbon dioxide (CO₂) is an odorless, colorless gas, which has both natural and anthropogenic sources. Natural sources include the following: respiration of bacteria, plants, animals, and fungus, evaporation from oceans, volcanic outgassing, and decomposition of dead organic matter. Anthropogenic sources of carbon dioxide are from burning coal, oil, natural gas, and wood. Concentrations of CO₂ were 379 parts per million (ppm) in 2005, which is an increase of 1.4 ppm per year since 1960 (Intergovernmental Panel on Climate Change 2007).

Methane: Methane (CH₄) is a flammable gas and is the main component of natural gas. When one molecule of CH₄ is burned in the presence of oxygen, one molecule of carbon dioxide and two molecules of water are released. There are no ill health effects from CH₄. A natural source of CH₄ is from the anaerobic decay of organic matter. Geological deposits, known as natural gas fields, also contain CH₄, which is extracted for fuel. Other sources are from cattle, fermentation of manure, and landfills.

Nitrous oxide: Nitrous oxide (N₂O), also known as laughing gas, is a colorless greenhouse gas. Higher concentrations of N₂O can cause euphoria, dizziness, and slight hallucinations. N₂O is produced by microbial processes in soil and water, including those reactions that occur in fertilizer containing nitrogen. In addition to agricultural sources, some industrial processes (nitric acid production, nylon production, fossil fuel-fired power plants, and vehicle emissions) also contribute to its atmospheric load. It is used in racecars, rocket engines, and as an aerosol spray propellant.

Chlorofluorocarbons: Chlorofluorocarbons (CFCs) are gases formed synthetically by replacing all hydrogen atoms in CH₄ or ethane with chlorine and/or fluorine atoms. CFCs are nonflammable, nontoxic, insoluble, and chemically uncreative in the troposphere (the level of air at the earth's surface). CFCs were first synthesized in 1928 for use as cleaning solvents, refrigerants, and aerosol propellants. They destroy stratospheric ozone; therefore, their production was stopped as required by the Montreal Protocol in 1987.

Hydrofluorocarbons: Hydrofluorocarbons (HFCs) are synthetic man-made chemicals that are used as a substitute for CFCs for automobile air conditioners and refrigerants.

Perfluorocarbons: Perfluorocarbons (PFCs) have stable molecular structures and do not break down through the chemical processes in the lower atmosphere. High-energy ultraviolet rays, roughly 60 kilometers above the earth's surface are able to destroy the compounds. PFCs have long lifetimes, ranging between 10,000 and 50,000 years. Two common PFCs are tetrafluoromethane and hexafluoroethane. Concentrations of tetrafluoromethane in the atmosphere are over 70 parts per trillion (ppt) (Environmental Protection Agency (EPA) 2006d). The two main sources of PFCs are primary aluminum production and semiconductor manufacture.

Sulfur hexafluoride: Sulfur hexafluoride (SF₆) is an inorganic, colorless, odorless, nontoxic, nonflammable gas. Concentrations in the 1990s were roughly 4 ppt (EPA 2006d). SF₆ is used for insulation in electric power transmission and distribution equipment, in semiconductor manufacturing, the magnesium industry, and as a tracer gas for leak detection.

Worldwide Greenhouse Gas Inventory: In 2004, total worldwide GHG emissions were estimated to be 20,135 teragram CO₂ equivalents (Tg CO₂ Eq.) (22,194,810,000 tons), excluding emissions/removals from land use, land use change, and forestry (United Nations Framework Convention on Climate Change 2006). (Note that sinks, or GHG removal processes, play an important role in the GHG inventory as forest and other land uses absorb carbon.) In 2004, U.S. GHG emissions were 7,074.4 Tg CO₂ Eq. (7,798,111,120 tons) (EPA 2006a). In 2005, total U.S. GHG emissions were 7,260.4 Tg CO₂ Eq. (8,003,138,920 tons), a 16.3 percent increase from 1990 emissions, while U.S. gross domestic product increased by 55 percent over the same period (EPA 2007a). Emissions rose from 2004 to 2005, an increase of 0.8 percent. Factors causing the increase are the following: (1) strong economic growth in 2005, leading to increased demand for electricity and (2) an increase in the demand for electricity due to warmer summer conditions (EPA 2007a). However, a decrease in demand for fuels due to warmer winter conditions and higher fuel prices moderated the increase in emissions (EPA 2007a). California is a substantial contributor of GHG as it is the second largest contributor in the U.S. and the sixteenth largest in the world (California Energy Commission (CEC) 2006). In 2004, California produced 492 Tg CO₂ Eq. (542,331,600 tons) (CEC 2006), which is approximately seven percent of U.S. emissions. The major source of GHG in California is transportation, contributing 41 percent of the State's total GHG emissions (CEC 2006). Electricity generation is the second largest source, contributing 22 percent of the State's GHG emissions.

Global Climate Changes: Global climate change (GCC), which most scientists believe is caused by GHG emissions, is a widely discussed economic, political, and scientific issue in the United States. GCC is a change in the average weather of the earth that may be measured by changes in temperature, precipitation, storms, and wind. The baseline by which these changes are measured originates in historical records identifying temperature changes that have occurred in the past, such as during previous ice ages. Many recent concerns over GCC utilize this data to extrapolate a level of statistical significance specifically focusing on temperature records from the past 150 years (the Industrial Age) that differ from previous climate changes in rate and magnitude.

Key Legislation and Policies: The Global Warming Solutions Act of 2006, also known as Assembly Bill 32 (AB 32), was signed into law on September 27, 2006. AB 32 requires the California Resources Board (CARB) to do the following:

- By July 1, 2007, adopt a list of early action measures that can be implemented by regulation before January 2010.
- By January 1, 2008, adopt mandatory reporting requirements for significant sources.
- By January 1, 2008, establish a statewide GHG emission cap for 2020 based upon 1990 emissions levels.

- By January 1, 2009, adopt a scoping plan indicating how emission reductions will be achieved for significant GHG sources via regulations, market mechanisms, or other measures.
- By January 1, 2011, adopt regulations to achieve the maximum technologically feasible and cost effective reductions in GHG.

Thresholds of Significance: There are no widely accepted published thresholds of significance for determining the impact of GHG emissions. However, for the purposes of analyzing the GHG impacts of discretionary projects, the District is proposing to develop a GHG significance threshold in terms of annual CO₂ equivalent (CO₂e) emissions. For the purpose of analyzing this project's impact on air quality, the District has applied a GHG significant threshold of 42,000 tons per year of CO₂e. See Appendix C for a discussion of the proposed threshold.

Project Specific Greenhouse Gas Emissions

Impact #1 Construction Exhaust Emissions of Greenhouse Gases

GHG emissions from site preparation and facilities construction activity have been estimated based on construction equipment, construction employment, and construction duration. The results are shown in Table 1 below.

**Table 1
Greenhouse Gas Emissions from Construction Exhaust**

Equipment	CO₂ (tons/year)
Scrapers (2)	213.10
Grader	43.51
Dozer	81.99
Loader	32.57
Water Truck (2)	72.95
Total	444.12
SJVAPCD Proposed Threshold	42,000

Conclusion: GHG emissions from the project's site preparation and facilities construction activities were estimated using URBEMIS version 9.2.4, (Appendix A). As presented in Table 1 below, GHG emissions resulting from site development and facilities construction totaled 444.12 tons of CO₂, which is below the District's proposed significance threshold of 42,000 tons of CO₂ equivalents.

Mitigation Measures: None are required.

Impact #2 Operational Emissions of Greenhouse Gases

The lack of validated scientific information on dairy emissions results in uncertainty in characterizing the project's GHG emissions and their impact on GCC. However, the District has quantified the operational GHG emissions from the Charles Van Der Kooi Dairy project using the available scientific methodology and information. Using CARB's emissions factors, the operational emissions of CH₄ and N₂O from the project are presented below in Table 2.

Table 2
Operational Greenhouse Gas Emissions from Van Der Kooi Dairy

Pollutant	Pre-Project emissions tons/year	Post-Project emissions tons/year^a	Reductions from mitigation measures applied tons/year	Increase in GHG emissions tons/year^b
Methane (CH ₄)	533.11	1,208.66	143.07	532.48
CO ₂ Equivalents	11,195.31	25,381.86	3,004.47	11,182.08
Nitrous Oxide (N ₂ O)	0.52	4.89	0.0	4.37
CO ₂ Equivalents	161.2	1,515.9	0.0	1,354.7
CO ₂ Equivalents (Total)	11,356.51	26,897.76	3,004.07	12,536.78

a Includes the following reductions: feeding cottonseed, daily manure removal, and land incorporation of solid manure.

b CH₄ Increase is calculated as: 1,208.66 – 533.11 - 143.07 = 532.48.

The District has statutory authority over the project via its Permits Required Rule (Rule 2010) and New Source Review Rule (Rule 2201). Pursuant to these rules, the District can impose mitigation measures limiting the project’s emissions of criteria pollutants. The District has imposed mitigation measures on the Van Der Kooi Dairy project to reduce Volatile Organic Compounds (VOC) emissions. Certain mitigation measures imposed on the Van Der Kooi Dairy project will also contribute to the reduction of GHG emissions. These measures are the following:

Mitigation Measure #2-1 Reduction of Greenhouse Gas Emissions (quantifiable):

- 1. Feeding dietary oils (eg. Cottonseed) to animals.

Explanation: Nutritional and dietary management is routinely practiced to improve milk production and herd health. Many of these practices have the potential to reduce air emissions. A literature review showed that there are quite a few number of dietary products and techniques which have the potential to reduce GHG emissions. However, further research is needed to better quantify these reductions from many of the feed strategies.

The District was able to find studies¹ that demonstrated that a significant amount of methane reductions can be achieved by feeding dietary oils (eg. Cottonseed), ranging from 12% to 36%. Charles Van Der Kooi Dairy has proposed to feed their dairy cows cottonseed, which will result in a significant reduction in GHG emissions from their facility. Although, a reduction of up to 36% can be achieved by feeding 6% cottonseed based on Beauchemin et al. 2007,

¹ Beauchemin KA, Kreuzer M, O’Mara FO, McAllister TA (2007) Nutritional management for enteric methane abatement: a review. Special Edition: Proceedings of the 3rd Greenhouse Gases and Animal Agriculture Conference. *Australian Journal of Experimental Agriculture* (in press).

Grainger C, Clarke T, Beauchemin KA, McGinn SM, Eckard RJ (2007a) Supplementation with whole cottonseed reduces methane emissions and increases milk production of dairy cows offered a forage diet supplemented with grain. Special Edition: Proceedings of the 3rd Greenhouse Gases and Animal Agriculture Conference. *Australian Journal of Experimental Agriculture* (in press).

the District will only apply a 12% reduction from the Grainger et al. 2007 study, in order to be conservative.

2. Removal of manure from the concrete feed lanes at least once a day.

Explanation: Charles Van Der Kooi Dairy is required to remove the manure from the concrete feedlanes at least 4 times a day for the mature cows and two times a day for the remaining support stock. The primary purpose of frequent removal of manure from the concrete feedlanes was to reduce VOC emissions from the decomposition of fresh manure on those lanes. However, based on a news alert issued by *Science for Environment Policy*, frequent removal of manure from the concrete feedlanes was also found to reduce GHG emissions by up to 7.1%. Since Charles Van Der Kooi Dairy is flushing at a frequency twice that for the support stock and four times that for the mature cows, GHG emission reductions would be expected to be much greater than the 7.1%. However, in order to be conservative, a control efficiency of 7.1% will be applied at this time.

3. Solid manure applied to fields shall be incorporated into the soil immediately (within two hours) after application.

Explanation: 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*” by the Dairy Permitting Advisory Group (DPAG) provided a VOC control efficiency of incorporating manure into the soil in the range of 29-58%. CH₄ emissions will also be assumed to be reduced similarly to VOC due to the organic content of both pollutants, however due to the lack of data, the lower control efficiency of 29% will be used.

Effectiveness of Measures: 1. Feeding animals dietary oils (eg. Cottonseed) will result in a reduction of approximately 78.13 tons of CH₄/year from the project. 2. Removal of manure from the concrete feed lanes at least once a day will result in a reduction in emissions of approximately 33.77 tons of CH₄/year from the project. 3. Incorporating solid manure into the soil immediately after land application will result in a potential reduction in emissions of approximately 31.17 tons of CH₄/year from the project.

Design Elements #2-2 Reduction of Greenhouse Gas Emissions:

1. Downwind windbreak designed in accordance to the NRCS guideline #380

Explanation: Plants are nature’s CO₂ sinks, meaning, through photosynthesis, plants remove or sequester carbon from the atmosphere. Charles Van Der Kooi dairy has proposed to install windbreaks at their facility (a 3-row windbreak, consisting of hundreds of trees and shrubs). Although the primary purpose of the windbreaks is to reduce the PM₁₀ from the facility, it will also serve as a medium for removal of CO₂ from the facility or the surrounding environment. Generally a large number of trees are required in order to be considered effective in reducing CO₂ emissions. Although this windbreak is expected to result in some GHG reduction, the extent of the reductions cannot be quantified at this time.

2. All open corrals adequately 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.)
3. Maintain corrals to ensure drainage and prevent water from standing more than 48 hours after a storm.

4. Knockdown fence line animal waste build-up prior to it exceeding a height of 12 inches at any time or point.

Effectiveness of Measures: The purpose of the above mitigation measures is to reduce anaerobic decomposition, which takes place inside of the corrals. The byproducts of anaerobic decomposition are primarily CH₄ and CO₂ emissions with secondary pollutants consisting of VOC, NH₃, and sulfur compounds. Although a significant amount of GHG emissions can potentially be reduced through these measures, the amount cannot be quantified at this time due to lack of data.

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

Explanation: Nutritional management of dairy feed is routinely practiced to improve milk production and herd health. The requirement to feed in accordance with The NRC guidelines has the potential for reducing VOC and NH₃ emissions by reducing the quantity of undigested nutrients in the manure. Many of these emissions originate from the decomposition of undigested protein in animal waste.² 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 NH₃ and VOCs. Nutritional management has also been shown to impact CH₄ production. Data is available demonstrating that a change in diet by feeding various types of feed can in fact reduce CH₄ emissions. However, the effects these feeds have on VOC and NH₃ emissions is not available. Since these impacts are not known, these various feedstuffs will not be required as part of this evaluation. Although feeding to the NRC guidelines has the potential to result in significant GHG emission reductions, these reductions will not be quantified at this time.

VOC Mitigation Measures that were evaluated but are not feasible for the project:

1. Freestall Enclosure and vent biogas to a control device such as an incinerator or a biofilter.

Explanation: Freestall enclosures with the biogas vented to a control device such as an incinerator or a biofilter has the potential of reducing a significant amount of CH₄ emissions. District staff has researched the use of biofilters for inclusion in the Dairy BACT Guideline. The District has been able to verify that biofilters have been used to control odors and/or emissions from wastewater treatment plants, composting operations, and enclosed barns at some poultry and swine confined animal facilities. However, to date, the District has not been able to confirm a single case of an enclosed dairy barn vented to a biofilter. As stated in the Final DPAG BACT Report, the reports of dairy barns vented to biofilters remain unverified and therefore cannot be deemed Achieved-in-Practice BACT.

The fact that biofilters have been used at poultry and swine facilities also does not render this option Achieved in Practice for dairy facilities. Dairy and swine facilities are not the same source category because the design and operation of these facilities differ significantly from that at dairies. Additionally, the airflow rate required to dissipate heat from the larger dairy animals is much higher. The higher airflow rate would necessitate a substantially larger biofilter than that employed at poultry or swine facilities in order to provide the minimum residence time needed to control emissions. Due to these reasons, the technological feasibility of capturing and controlling the air exhaust from dairy barns remains in question. However, the District has considered this technology as a

² "Emissions of Volatile Organic Compounds Originating from UK Livestock Agriculture", Hobbs, P.J. 2004 – Journal of the Science of Food and Agriculture

technologically feasible BACT option, and has performed a cost-effectiveness analysis, which concluded that this option is not cost-effective at this time.

2. Aerobic Treatment Lagoon – mechanical aeration to achieve a dissolved oxygen concentration of 2.0 mg/L.

Explanation: An aerobic treatment lagoon is a waste treatment lagoon that is designed to facilitate the decomposition of wastewater by microbes in the presence of oxygen (O₂). The process of aerobic decomposition results in the conversion of organic compounds in the wastewater into carbon dioxide (CO₂), and (H₂O), nitrates, sulphates, and inert biomass (sludge). The process of aerobic digestion is sometimes referred to as nitrification (especially when discussing NH₃ transformation). Complete aerobic digestion (100% aeration) removes nearly all malodors and also virtually eliminates VOCs, H₂S, CH₄, and NH₃ emissions from liquid waste.

Sufficient oxygen must be provided to sustain the aerobic microorganisms in completely aerated lagoons. Lagoons can be considered completely aerobic if sufficient oxygen is provided to achieve a dissolved oxygen (DO) content of 2.0 mg/L or more. Oxygen is typically provided by mechanical aerators. A major disadvantage of completely aerated lagoons is the enormous cost of the energy required to run the aerators continuously. The District performed a cost effectiveness analysis for the purposes of reducing VOC emissions. Because of the large costs, it was determined that completely aerated lagoons are not cost effective options for dairy facilities at the present time.

Conclusion: The Van Der Kooi project will result in GHG emissions. However, design features and mitigation measures have been incorporated into the project that will reduce GHG emissions. As discussed above, the reduction in GHG emissions from several measures is quantifiable, while additional reductions may result from other measures whose reductions are not quantifiable with the available science. In addition to several design elements, the proposed measures that will result in quantifiable GHG emission reductions as identified below:

- Feeding animals dietary oils (eg. Cottonseed),
- Removal of manure from the concrete feed lanes at least once a day, and
- Solid manure applied to fields incorporated within two hours into the soil.

The reductions achieved through these measures will reduce CH₄ emissions by 1,015.27 tons/year (21,320.64 tons of CO₂ equivalents).

As presented in Table 3, total operational GHG emissions are 13,169.32 tons per year of CO₂ equivalents, and are below the proposed significance threshold of 42,000 tons CO₂ equivalents per year.

**Table 3
Total Operational CO₂ Emissions from Proposed Dairy Expansion**

Source	CO ₂ e
Dairy Operational Emissions	12,536.78
Mobile Source Emissions	872.99
Total Project Emissions	13,409.77
SJVUAPCD Proposed Threshold	42,000