

Impact 4.2-5 4.2-4

Operation of new or expanded dairies could generate adverse odors. This is a significant and unavoidable impact.

New or expanded dairies under the Element would include management of cattle manure generated at the site. Cattle manure contains complex organic compounds and simple organic and inorganic compounds and will anaerobically decompose under natural conditions. During anaerobic decomposition, gases are formed, some of which include odorous compounds (Zhang, et al., 1997). Odorous compounds include ammonia, hydrogen sulfide, and ROG. To a lesser degree, odor could also be directly associated with the dairy animals.⁵⁸

Manure management operations at dairies would necessarily include collection, treatment, storage, and reuse of the manure. New dairy facilities would typically consist of freestall barns and unpaved corrals. Expanded dairy facilities would typically consist of unpaved corrals as freestall barns generally house dairy cows. Manure generated at freestall barns would generally be collected in drive lanes and flushed with process water into on-site storage ponds. Some dairy facilities may first separate out (via gravity) the heavier, dense particles from the manure waste stream using mechanical solid separators, prior to storage in the ponds. The collected solids would typically be removed periodically, stockpiled on-site, and applied to on-site agricultural fields or transported off-site to other agricultural fields. The manure waste in the storage ponds would typically be mixed with irrigation water and applied to on-site agricultural fields.

Manure generated at the unpaved corrals of a new or expanded dairy could be managed using a flushed system or could be physically mechanically scraped off from the corral on a scheduled basis; a combination of these two techniques could also be employed. Similar to the freestall system, flushed manure would typically be deposited in storage ponds; manure may undergo gravity separation. Scraped manure would typically be removed on a scheduled basis, stockpiled on-site, and loaded onto trucks for transport or for application to on-site agricultural fields.

Manure placed in the storage ponds would naturally undergo anaerobic decomposition. In addition, stockpiled manure and possibly retained manure separated solids could naturally undergo anaerobic decomposition, depending on several factors, including moisture content and solids particle size. As a result, odorous compounds could be released into the environment, especially when the surface layer of the manure is agitated. Stockpiled manure could release odorous compounds when the material is agitated prior

⁵⁸ Cattle and their housing areas (i.e., freestall barns and corrals) may create foul odor if poorly maintained (e.g., wet environment, dirty animal exterior coating).

to, and during, application on to agricultural fields. Manure liquid waste would not be expected to generate significant odors during land application since the waste is typically mixed with irrigation water prior to application.

Manure odor is strongest at its sources and dissipates with increasing distance. The offensiveness and degree of manure odor is ultimately dependent on the sensitivity of the receptors exposed to the odor. Temperature, wind, dust conditions, topography, and the presence of physical obstructions affect the degree of odor impacts on nearby receptors. The average summer temperature in Kings County is in the upper 90° F; therefore, odorous compounds would tend to travel greater distances within the county compared to cooler conditions. During windy conditions, odor compounds are diluted with fresh air and, as a result, odors disperse more quickly and are not as noticeable at a distance. However, wind direction also defines the direction that odor travels.

Fugitive dust particles act as a transport mechanism for odor, enabling odorous compounds to be transported by air currents, even during windy conditions. Dust particles carrying odorous compounds could potentially deposit within human olfactory cells, exposing a person to the odorous compounds for an extended duration (Livestock Industry Facilities & Environment, undated). However, physical obstructions, such as windbreaks or topographical changes, cause more rapid dilution of odorous compounds and also capture odor-containing fugitive dust.

Treatment technologies are currently available to reduce the release of odors into the environment from manure storage/collection systems. As indicated in the Setting section of this analysis, available treatment technologies to reduce odors include the biological waste supplements, chemical additives, placement of covers over waste storage systems, composting, aerobic treatment, and anaerobic treatment of collected manure. Except for the inclusion of biological waste supplements and chemical additives, these treatment technologies would also reduce or prevent the release of ROG emissions; in addition, aerobic and anaerobic treatment systems would also reduce or prevent the release of other air pollutants generated from manure storage/collection systems, such as methane, ammonia, and hydrogen sulfide. In composting operations, reduction of methane and hydrogen sulfide would also be expected.

However, the use of aerobic and anaerobic technologies at dairy facilities is currently not common in California and there are few examples of use in the San Joaquin Valley. An aerobic treatment system was operated at two dairy facilities in the San Joaquin Valley, one in Kings County and another in Kern County. The system operated in Kings County was a six-month pilot study and the system operated in Kern County was only recently implemented in May 1999 (see discussion in Setting section). There are no anaerobic

digesters in use at any dairy in Kings County.⁵⁹ In addition, implementation of composting may require large land areas to appropriately handle the manure. However, significant reduction of odors from manure treated by closed-system anaerobic digesters is expected.

The Kings County's Right to Farm Ordinance indicates that no lawful agricultural activity, operation, or facility "*conducted or maintained for commercial agricultural purposes in a manner consistent with proper and accepted customs and standards as established and followed by similar agricultural operations in the same locality, shall be or become a nuisance, private or public, due to any changed condition in or about the locality, including, but not limited to, the encroachment of non-agricultural uses such as rural residences.*" Common inconveniences and discomforts associated with agricultural operations include manure odors.

The policies under Goal 1 address siting requirements for dairies. **Policy DE 1.2g** requires that dairies (including manure and dairy process water storage areas) be located more than one-half mile from any existing public or private school site although, manure used as fertilizer and dairy process water used to irrigate cropland may be transported to and used within the one-half mile buffer zone but must be scheduled during weekends or summer vacation when the schools are closed. **Policy DE 1.2h** requires a minimum distance of one-quarter mile between dairy facilities and other dairies and confined animal feeding operations. The Element also requires a minimum buffer zone of one-half mile between a dairy and an existing residential zone (**Policy DE 1.2i**).

The Element also provides siting restrictions for new or expanded dairies near individual residences within the agricultural zoned areas. **Policy DE 3.1b** requires that proximity of rural residences be considered in the siting of individual dairy structures; and **Policy DE 3.1c** requires that barns, corrals, and waste disposal systems be located a sufficient distance from residences not associated with the dairy so that a conflict of land uses does not occur.

Policy DE 3.1a adequately requires that air quality, including odor control from construction and operation, be considered during the preparation of the countywide policy required under **Goal DE 3**. **Policies DE 5.1b** and **5.1c** require the preparation of an Odor Management Plan (OMP) and a Manure Treatment Management Plan (MTMP), respectively, as part of a technical report to be submitted with each new or expanded dairy application. These plans would be reviewed and approved by Kings County. **Policy DE 5.1b** requires the OMP to address standard operating practices for livestock handling, manure collection, treatment, storage, and land application. The policy also requires that practices be identified and implemented to reduce or control odors released from dairy

⁵⁹ A flushed swine manure covered pond digester system has been in operation since 1982 at Royal Farms in Tulare. No major problems have been encountered during operation and the system has generated \$44,000 per year in offset power bills (U.S. EPA, 1997).

operations. **Policy DE 5.1c** specifies that the MTMP provide for manure treatment to reduce air emissions, the source of odors. As discussed in the Settings section, treatment technologies are available to reduce odors generated from manure storage/collection systems. **Policy DE 5.1c** requires the estimation of anticipated ROG, ammonia, and methane emissions generated by manure and process water management. The policy requires that the MTMP would provide treatment of all manure to reduce ROG, nitrous oxides, ammonia, methane, hydrogen sulfide, and odor emissions. The MTMP would describe general housekeeping practices, feed management, solid manure moisture management, the purpose and procedures for the use of additives or adsorbents, and land application methodologies that effectively minimize air pollutant emissions. The policy further requires that the MTMP include an advanced treatment technology to reduce ROG emissions for all new dairies and dairy expansions that include construction of new dairy facilities. Effective advanced treatment technologies provided in the policy include: 1) controlled anaerobic digestion; 2) aerobic treatment; and 3) combined controlled aerobic/anaerobic treatment.

The policy indicates that the requirement for implementation of advanced treatment technologies would be waived for proposed existing dairy expansion projects that do not include proposed construction of new dairy facilities and for which the expanded dairy herd would not exceed the calculated capacity and would not result in ROG emissions that would exceed the SJVUAPCD threshold limits set for stationary sources.

Policy DE 5.1c also requires that the selected treatment system should meet or exceed a 50 percent VS removal efficiency. As discussed in the Settings section, the VS removal efficiency level of a treatment system may be considered an appropriate indicator for determining the remaining potential for treated manure to emit air pollutants to the atmosphere since standard testing methods for quantifying the reduction of air pollutant gases from treated manure (anaerobically or aerobically) are currently not readily available.

As indicated in Impact 4.2-3, **Policies DE ~~6.1b~~ 6.2a** and **~~6.1e~~ 6.2b** provide for monitoring of dairy operations to demonstrate the Element's effectiveness in protecting the environment and the effectiveness of the mitigation measures required for each operating dairy facility in Kings County. Although these policies specifically address odor control, the effectiveness of the OMP or MTMP in the reduction of odor cannot be determined. Therefore, **Policy DE ~~6.1e~~ 6.2d** was included in the Element to ensure that standards were established for OMP monitoring. At a minimum, the following requirements would apply to implementation of OMPs at dairy facilities.

- Periodically The dairy operator shall conduct quality assurance/quality control on the implementation of the MTMP and the standard operating procedures described in the OMP.

- Quality assurance/quality control shall be conducted by the dairy operator in a manner that will determine whether the implementation of the MTMP and specified standard operating procedures indicated in the OMP are effectively reducing or controlling odors generated from livestock handling, manure collection, treatment, storage, and land application.
- Quality assurance/quality control shall be conducted ~~at least on a weekly basis during conditions~~ by the dairy operator when ~~the potential for odor release/migration is high (e.g., high temperature) and on a monthly basis during the remainder of the year occurs, and corrective action shall be taken.~~
- The results of all quality assurance/quality control shall be documented by the dairy operator in logs maintained at the dairy facilities.

In addition, ~~Policy DE 6.1f 6.2e~~ requires that, when standard methods for testing air emissions become available, dairy owner/operators would be required to test for ROG, hydrogen sulfide, ammonia, and methane emissions (possible odor-related gases).

The policies under ~~Objective DE 7.2 6.4~~ would establish a mechanism to evaluate and respond to public complaints regarding nuisances or permit violations due to dairy operations. A common nuisance at dairies is odor. ~~Policy DE 7.1d 6.1b~~ specifically indicates that the County would review the implementation of the OMP or MTMP.

Mitigation Measure ~~4.2-5 4.2-4~~

No additional feasible mitigation measures are available.

Implementation of ~~Policies DE 1.2g, 1.2h, 1.2i, 3.1a, 3.1b, 3.1c, 5.1b, 5.1c, 5.1h 5.1g, 6.1b 6.1a, 6.1e 6.2d, 6.1f 6.2e, 7.1d 6.1b, and 7.2a 6.4a~~ through ~~7.2c 6.4c~~ would significantly reduce odors generated from dairy facilities operated in conformance with the Element. However, even with the implementation of the OMP and MTMP and the establishment of a nuisance complaint system, receptors may continue to be exposed to adverse odor, specifically since the degree of manure odor is ultimately dependent on the sensitivity of the receptors exposed to the odor. Therefore, this impact would be considered significant and unavoidable.

Impact ~~4.2-6 4.2-5~~

Operation of new or expanded dairies would generate ozone precursor (ROG and NOx) emissions from cattle manure and combustion engine exhaust. This is a significant and unavoidable impact.

Manure Decomposition

Similar to existing conditions, new or expanded dairies may emit ROG emissions from cattle manure at any location where cattle manure is present, provided the manure is undergoing natural anaerobic decomposition. These locations could include the freestall drive lanes, storage ponds, unpaved corrals, manure stockpiles, and areas where manure waste is applied. As indicated earlier, limited data for estimating ROG emissions from cattle manure are currently available. The most recent emission factor is published in CARB's Emission Inventory Procedural Manual, Methods for Assessing Area Source Emissions.

ROG emissions were estimated for future conditions (assuming the maximum capacity of cattle are housed in the County) and for a typical 500-, ~~735-~~ ~~705-~~ 2,000-, and 5,000- milk cow dairy facility, based on the emission factor developed by CARB. Under future conditions, the number of milk cows and support stock considered in calculating ROG emissions were based on Table 5 of the Element (Theoretical Dairy Herd Capacity of Kings County).⁶⁰ In estimating the emissions for the 500-, 2,000-, and 5,000-milk cow dairies, the assumed number of support stock were based on the individual support stock to milk cow ratio provided in Table 5 of the Element (Theoretical Dairy Herd Capacity of Kings County).

Potentially 5,191 tons per year of ROG could be generated from the manure produced under future conditions at maximum buildout if no controls on emissions are implemented (Table 4.2-5a). This amount reflects approximately 51 percent of the total ROG emissions and greater than 100 percent of the ROG emissions from livestock waste decomposition estimated by CARB for Kings County in 2000. In addition, 7, 10, 27, and 68 tons per year of ROG could be generated by manure decomposition from a 500-, ~~735-~~ ~~705-~~ 2,000-, and 5,000- milk cow dairy facility, respectively (Table 4.2-5c). While ROG is not in itself a regulated pollutant, it is a precursor of ozone, which is a Federal- and State-regulated pollutant. The net increase in ROG emissions generated from cattle manure decomposition at a new or expanded dairy is considered a significant impact since the emissions from each dairy facility may exceed the SJVUAPCD significance threshold of 10 tons per year.

As discussed in Impact ~~4.2-5~~ 4.2-4 and in the Settings section, treatment technologies are currently present to reduce or prevent the release of ROG emissions into the environment from manure storage/collection systems. These treatment technologies include placement of impermeable covers over waste storage systems, composting, aerobic treatment, or anaerobic treatment of collected manure. Of these treatment technologies, aerobic and anaerobic treatment systems would also reduce or prevent the release of other air

⁶⁰ The theoretical future capacity was determined by subtracting the number of cattle at existing dairies from the total theoretical capacity of Kings County to host dairies, as provided in Table 5 of the Element.

pollutants generated from manure storage/collection systems, such as methane, ammonia, and hydrogen sulfide. In composting operations, reduction of methane and hydrogen sulfide would also be expected.

The effectiveness of these technologies in reducing ROG has not been critically evaluated. Containment of biogas in anaerobic digesters and subsequent use of biogas as electricity or fuel (i.e., combustion) would be expected to reduce ROG. Direct measurement of ROG is not typically performed during monitoring of emissions from treatment systems. Although methane levels are sometimes monitored, ROG and hydrogen sulfide are not typically monitored at anaerobic digesters. Under aerobic conditions (i.e., during effective aeration and aerobic composting), significant production of ROG would not be expected. However, production of ROG (due to anaerobic conditions) could be expected in any untreated stockpiles of manure and in open process water storage ponds that are not aggressively aerated.

Dairy Equipment and Vehicular Traffic Emissions

As described under Impact 4.2-3, implementation of the Element would result in additional internal combustion engine emissions as the result of dairy equipment operation and increased vehicular traffic generated by the expected new and expanded dairy developments. The exhaust would include increased emission of ROG and NOx. An accurate estimate of these emissions is difficult to make without knowledge of the specific location, size, and operational characteristics of the new dairies. However, a general estimate of these emissions can be made by assuming that the remaining capacity for the maximum theoretical County dairy herd could be accommodated by the development of 52 5,000-milk cow dairies. Using this assumption and the same assumptions and methodologies described for exhaust emission of PM₁₀ (see Impact 4.2-3), ROG and NOx emissions for dairy equipment and vehicular traffic have been estimated. The estimated emissions for 500-, 705-, 2,000-, and 5,000-milk cow dairies are shown in Table 4.2-5c. The ROG and NOx emissions related to exhaust for 52 additional 5,000-milk cow dairies have been included in the estimate of the net increase in emissions associated with implementation of the Element as shown in Tables 4.2-5a (without controls) and 4.2-5b (with controls).

Several policies of the Element address air quality issues. **Policy DE 3.1a** requires that air quality be considered during the preparation of the countywide policy required under **Goal DE 3**. **Policy DE 5.1c** requires the preparation of a MTMP as part of a technical report to be submitted with each new or expanded dairy application. The policy requires that the technical report also present an estimate of the anticipated increase in ROG, ammonia, and methane emissions generated by manure and process water management proposed by the dairy development project.

The MTMP would provide treatment of all manure to reduce ROG, nitrous oxides, ammonia, methane, hydrogen sulfide, and odor emissions. The MTMP would describe general housekeeping practices, feed management, solid manure moisture management, the purpose and procedures for the use of additives or adsorbents, and land application methodologies which effectively minimize air pollutant emissions. The policy further requires that the MTMP include an advanced treatment technology to reduce ROG emissions for all new dairies and dairy expansions that include construction of new dairy facilities. Effective technologies include 1) controlled anaerobic treatment, 2) aerobic treatment, and 3) combined controlled aerobic/anaerobic treatment.

The MTMP would demonstrate that the proposed advanced treatment system shall meet or exceed the goal of 50 percent reduction in volatile solids in the treated manure and dairy process water. As indicated in the Settings section (Anaerobic and Aerobic Treatment Systems Efficiency), volatile solids provide the food and energy source for bacteria that essentially create and release gaseous compounds. Once the volatile solids are completely depleted from the manure, no further release of ROG emissions would result.

The requirement for implementation of advanced treatment technologies would be waived for proposed existing dairy expansion projects that do not include proposed construction of new dairy facilities and for which the expanded dairy herd would not exceed the calculated capacity and would not result in ROG emissions that would exceed the SJVUAPCD threshold limits set for a stationary source.

ROG emissions for future conditions were estimated for dairies requiring the implementation of an advanced treatment system (Tables 4.2-5b and 4.2-7). Since scientific data specifying the correlated release of ROG emissions with volatile solids are currently unavailable, the estimate assumed that a corresponding 50 percent reduction in ROG emissions would be achieved with a 50 percent reduction in volatile solids. Approximately ~~369~~ 334 tons per year of ROG would be emitted from dairy expansion projects not subject to the advanced treatment requirement and ~~1,564~~ 1,581 tons per year of ROG would be emitted from new dairies and expanded dairies subject to the advanced treatment system (Table 4.2-7). The estimate indicates that the total ROG emissions would reduce from ~~3,497~~ 3,609 (no treatment) to ~~1,933~~ 1,915 (advanced treatment) tons per year (a total reduction of ~~1,564~~ 1,581 tons per year) when emissions controls required by the Element are implemented.

Policies DE ~~6.1b~~ 6.1a, ~~6.1e~~ 6.2d, and ~~6.2a~~ 6.3a provide for monitoring of dairy operations to demonstrate the Element's effectiveness in protecting the environment and the effectiveness of the mitigation measures required for each operating dairy facility in Kings County. **Policy DE ~~6.1f~~ 6.2e** specifically addresses monitoring of the MTMP and requires testing of ROG emissions when standard testing methods become available. The policy