also requires dairy owners/operators to maintain daily logs documenting general process operations, problems encountered in manure management, and actions taken to resolve problems, including modification of treatment processes.

The policies under **Goal DE ~~7~~ 6** provide a mechanism for the County to track and evaluate the monitoring program and address dairy operational problems encountered.

TABLE 4.2-7: **Estimated Manure Decomposition Emissions for Existing and Future Conditions under the Element (tons per year)**

Condition	ROG	Methane
EXISTING CONDITIONS		
Total head from existing dairies	1,694	14,804
FUTURE CONDITIONS		
Dairy expansion projects not subject to advanced treatment[1]	~~369~~ 334	~~3,221~~ 2,916
Total new dairies and dairy projects subject to advanced treatment[2]	~~1,564~~ 1,581	~~13,667~~ 13,820
Subtotal Future Conditions (Existing and Future)	~~3,627~~ 3,609	~~31,693~~ 31,541
TOTAL NET INCREASE IN EXISTING EMISSIONS FROM MANURE DECOMPOSITION (UNDER THE ELEMENT)	~~1,933~~ 1,915	~~16,889~~ 16,736

[1] The values in this table represent emissions generated from dairy expansion projects that do not exceed the ROG threshold limit and are not subject to the Element's advanced treatment requirement. The total allowable head from dairy expansion projects was estimated based on the maximum allowable expansion of the individual existing dairies without exceeding the ROG threshold limit.

[2] Dairy expansion projects that exceed the ROG threshold limit are subject to the Element's requirement for advanced treatment. The values represented in this table reflect a 50 percent reduction in ROG and methane emissions released to the environment from further decomposition of treated manure and dairy process water from implementation of an advanced treatment system.

The Element includes **Policy DE 5.1i** as a mechanism to ensure that the net increase in emissions from individual new or expanded dairy development projects would not exceed the SJVUAPCD threshold levels for ROG and NOx. The policy requires that, as part of the technical report to be submitted with each application to either establish a new dairy or expand an existing dairy, dairy applicants shall be required to estimate the anticipated net increase in ROG and NOx emissions generated from anticipated dairy equipment compared to existing conditions and demonstrate that the net increase will not exceed the SJVUAPCD threshold limits for ROG and NOx.

Mitigation Measure ~~4.2-6~~ 4.2-5

No additional feasible mitigation measures are available.

Implementation of **Policies DE 3.1a, 5.1c, 5.1i, ~~6.1b~~ 6.1a, ~~6.1e~~ 6.2d, ~~6.1f~~ 6.2e,** and ~~**6.2a**~~ **6.3a** would be expected to reduce ~~ROG~~ ozone precursors generated from dairy facilities within the project site and would also reduce other air pollutants generated from cattle manure and equipment and vehicle exhaust. Standard testing methods are not currently readily available to quantify the reduction of ROG under each manure treatment technology. However, the VS removal efficiency level of the advanced treatment system (required under **Policy DE 5.1c**) may be considered an appropriate indicator for determining the remaining potential for treated manure to emit air pollutants to the atmosphere. An accurate method for quantifying the potential air pollutant emissions from treated manure are anticipated to be available following completion of USDA ARS research activities under the national programs.

In addition, anaerobic decomposition of manure, and the associated release of ROG emissions, would occur nearly immediately upon generation of manure and during temporary stockpiling of manure. As immediate treatment of manure is not practical, some ROG emissions would be expected even with the implementation of the MTMP. Therefore, future dairy facilities may continue to exceed the 10 tons per year SJVUAPCD threshold limit for ROG. Therefore, this impact would be considered significant and unavoidable.

Impact ~~4.2-7~~ 4.2-6

Operation of new or expanded dairies would generate ammonia emissions from cattle manure. This is a significant and unavoidable impact.

New or expanded dairies allowed under the Element could potentially generate ammonia emissions from manure generated at the facilities. Ammonia emissions would contribute to odor problems and would be expected to increase $PM_{2.5}$ generation. Potential ammonia emissions from cattle manure at the animal housing units and decomposing stored manure for future (assuming the maximum capacity of cattle are housed in the County) and typical dairy facilities (500-, ~~735-~~ 705-, 2,000-, and 5,000-cow dairies) were estimated. It should be noted, however, that additional ammonia would also be released into the environment during application of process water and stockpiled manure onto agricultural fields. However, ammonia emissions would also be expected with the use of nitrogen-rich manufactured fertilizer that would be necessary if manure were not used as fertilizer.

Similar to existing conditions, a range in emissions was calculated for future and a typical 500-, ~~735-~~ 705-, 2,000-, and 5,000-cow dairy using emission factors published in the 1994 Development and Selection of Ammonia Emission Factors, developed by Battye, et al. (1994) for the U.S. EPA (Scenario One) and from James, et al. (Scenario Two). Potentially between 7,338 and 29,821 tons per year of ammonia could be generated from future conditions (Table 4.2-5a); similarly a range between 10 and 39 tons per year, 14 and 57 tons per year, 38 and 156 tons per year, and between 96 and 390 tons per year of could be

generated at a typical 500-, ~~735-~~ 705-, 2,000-, and 5,000-milk cow dairy, respectively (Table 4.2-5c).

The lower ranges reflect the emission factors developed in 1994 and are based on the animal quantity, animal type (applicable only for the 1994 emission factor), and emission factors for decomposition of newly generated manure at the animal housing unit and decomposition of stored manure. The higher ranges reflect the emission factor developed by the University of California at Davis (74 pounds per head per year) and are based on the animal quantity at a dairy facility. This emission factor reflects the emission factor from a combination of the different cattle typically housed at a dairy facility and is not specific to the cattle type (e.g., cow, heifer, calf).

The number of cattle under future conditions was obtained from Table 5 of the Element (Theoretical Dairy Capacity of Kings County); for the typical dairy conditions, the number of support stock (dry cows, heifers, and calves) was determined using the ratio of milk cow to individual support stock and existing milk cow data provided in Table 5 of the Element (Theoretical Dairy Capacity of Kings County). Actual ammonia emissions that could be generated are highly variable and are dependent on site-specific factors as discussed above.

Ammonia is included under the State Air Toxics "Hot Spots" Information and Assessment Act (AB2588) as substances for which emissions must be estimated for facilities that exceed certain thresholds. These thresholds include facilities that emit ten tons or more of PM_{10} per year. Prior to December 1998, agricultural and livestock operations were exempted from AB2588. However, Section 44380.1 of the California Health and Safety Code has been revised and agricultural and livestock operations are now only exempt from paying fees associated with AB2588, but not from complying with the remainder of the act. Enforcement of AB2588 requirements is the responsibility of local air quality control districts. The SJVUAPCD is currently not devoting staff time to enforce AB2588 requirements on agricultural or livestock operations (Villalvazo, 1999).

In the late 1990s, an evaluation of the methods for determining ammonia emissions in the San Joaquin Valley was conducted (Coe, et al., 1998). The purposes of the study were to review existing literature to determine the most recent understanding that has evolved to date regarding ammonia emission inventories; compile an improved ammonia inventory for the San Joaquin Valley, conduct a pilot-scale field study to test the techniques to quantify ammonia emissions; and develop and demonstrate uncertainty measures. For livestock emissions, the evaluation considered the emission factors developed by Asman in 1992, as published and evaluated in the 1994 Development and Selection of Ammonia Emission Factors, developed by Battye, et al. for the U.S. EPA. The pilot study evaluated livestock, soil, and wastewater plant ammonia emissions since these sources contributed a relatively large fraction of the total inventory and because the contribution from

wastewater plants were determined to be less than previously estimated. The ammonia emission inventory concluded that livestock sources contributed 50 percent of the ammonia generated in the valley, natural soil emissions contributed 40 percent, fertilizer application contributed 6 percent, and the remaining 4 percent were from publicly owned treatment waste systems, landfills, mobile sources, miscellaneous solvents, stationary combustion, industrial sources, ammonia refrigeration, and geothermal emissions. The study indicated that the livestock population was dominated by cattle.

It is unknown whether future regulation of ammonia emissions from livestock operations would occur. While ammonia is an air pollutant of concern and is being studied, this EIR considers conservatively that emissions from the project are a significant and unavoidable impact.

As indicated in the Setting section, treatment technologies are currently ~~anaerobic~~ available to reduce or prevent the release of ammonia emissions into the environment from manure storage/collection systems, such as permeable and impermeable covers, aerobic treatment systems, and anaerobic digester systems. Of the treatment technologies available, 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, ROG, and hydrogen sulfide. Ammonia generation would not be expected in aerobic treatment systems that are designed to denitrify nitrogen compounds. In anaerobic digestion systems, ammonia that may be generated from manure treatment would be captured and combusted. However, effluent discharged from these systems would have the potential to release ammonia. Therefore, effluent produced by controlled anaerobic digestion would need to be stored in aerobic ponds (to allow conversion of ammonia to atmospheric nitrogen or nitrates) or applied immediately to crops to minimize the release of ammonia to the atmosphere.

Policies DE 3.1a, 5.1c, ~~6.1b~~ 6.1a, ~~6.1e~~ 6.2d, and **~~6.2a~~ 6.3a,** and policies under **Goal DE ~~7~~ 6** are also relevant to ammonia emissions from cattle manure. Although **Policy DE 3.1a** specifically addresses ammonia emissions in the development of the countywide policy, **Policy DE 5.1c** requires the preparation of an MTMP that would be implemented to reduce air pollutant emissions from the manure, including ammonia. **Policy DE 4.1b.B** requires that the timing and method of application of manure and process water to land minimize unnecessary contact with air to minimize the release of ammonia into the atmosphere. **Policy DE ~~6.1e~~ 6.2d** requires that the County set standards for implementation of the OMP and MTMP and minimally requires that quality assurance/quality control be implemented and documented. 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). Because of the current lack of available standard methods to monitor the

effectiveness of the treatment technologies in reducing air pollutants (ROG, ammonia, hydrogen sulfide, and methane) and lack of regulatory standards, dairy operators can only provide VS removal efficiency level data of the selected treatment technology to the County to certify that the MTMP is being implemented as part of the monitoring program. **Policy DE ~~7.1d~~ 6.1b** requires that the Dairy Monitoring Office include a compliance specialist capable of technically reviewing monitoring programs required by the Element, including the OMP and MTMP. However, as indicated previously, there is a current lack of available standards to determine the effectiveness of manure treatment technologies in reducing ROG, hydrogen sulfide, ammonia, and methane. An accurate method for quantifying the potential air pollutant emissions from treated manure is anticipated to be available following completion of USDA ARS research activities under the national programs. This is a significant impact.

Mitigation Measure ~~4.2-7~~ 4.2-6

No additional feasible mitigation measures are available.

Implementation of **Policies DE 3.1a, 5.1c, 5.1e, ~~6.1b~~ 6.1a, ~~6.1e~~ 6.2d, ~~6.2a~~ 6.3a,** and **~~7.1d~~ 6.1b** would be expected to reduce ammonia generated from dairy facilities and would also reduce other air pollutants generated from cattle manure. However, testing methods are not currently readily available to quantify the reduction of ammonia from the advanced treatment technology although 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. In addition, temporarily stockpiled manure would release ammonia emissions. It is considered impractical to immediately treat all manure generated at dairies operated in conformance with the Element. A significance criteria for ammonia has yet to be established by SJVUAPCD and the significance of the impact of the expected ammonia releases cannot be defined at this time. Therefore, the impact would remain significant and unavoidable.

Impact ~~4.2-8~~ 4.2-7

Operation of new or expanded dairies would generate hydrogen sulfide emissions. This is a significant and unavoidable impact.

Hydrogen sulfide is an odorous compound that is also produced during anaerobic decomposition of manure (Shultz and Collar, 1993).[61] Hydrogen sulfide can cause dizziness, respiratory tract irritation, nausea, and headaches. Hydrogen sulfide emissions generated from decomposition of cattle manure are conservatively considered a significant

[61] An emission factor for hydrogen sulfide production from manure decomposition is not available.

impact since emissions may adversely affect receptors and on-site workers (e.g., odor release and health hazard).

Hydrogen sulfide is included under the State Air Toxics "Hot Spots" Information and Assessment Act (AB2588) as substances for which emissions must be estimated for facilities that exceed certain thresholds. These thresholds include facilities that emit ten tons or more of PM_{10} per year. As indicated in Impact ~~4.2-7~~ 4.2-6, enforcement of AB2588 requirements is the responsibility of local air quality control districts.[62]

California has an ambient air quality standard for hydrogen sulfide, although monitoring data are limited statewide and the San Joaquin Valley is yet to be assigned an attainment or nonattainment designation. Significance criteria for hydrogen sulfide for the San Joaquin Valley have not been developed by SJVUAPCD.

As indicated in the Setting section, treatment technologies are currently present to reduce or prevent the release of hydrogen sulfide emissions into the environment from manure storage/collection systems such as chemical additives, permeable and impermeable covers, composting, aerobic treatment, and anaerobic digestion. Of the available treatment technologies, 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, ROG, and ammonia. Composting would also reduce the release of methane and ROG emissions.

Policies DE 3.1a, 5.1c, ~~6.1b~~ 6.1a, ~~6.1e~~ 6.2d, and **~~6.2a~~ 6.3a,** and policies under **Goal DE ~~7~~ 6** are also relevant to hydrogen sulfide emissions from cattle manure. In summary, **Policy DE 3.1a** addresses ammonia emissions in the development of the countywide policy. **Policy DE 5.1c** requires the preparation of an MTMP that would be implemented to reduce air pollutant emissions from the manure, including ammonia. **Policies DE ~~6.1b~~ 6.1a, ~~6.1e~~ 6.2d,** and **~~6.2a~~ 6.3a** do not specifically address monitoring of the MTMP. In addition, **Policy DE ~~6.1f~~ 6.2e** requires that, when standard methods for testing air emissions become available, dairy owners/operators would be required to test for ROG, hydrogen sulfide, ammonia, and methane emissions (possible odor-related gases). Because of the current lack of available standard methods to monitor the effectiveness of the treatment technologies in reducing air pollutants (ROG, ammonia, hydrogen sulfide, and methane), dairy operators can only provide VS removal efficiency level data of the selected treatment technology to the County to certify that the MTMP is being implemented as part of the monitoring program. **Policy DE ~~7.1d~~ 6.1b** requires that the Dairy Monitoring Office includes a compliance specialist capable of technically reviewing monitoring programs required by

[62] However, the SJVUAPCD is currently not devoting staff time to enforcing AB2588 requirements for agricultural or livestock operations (Villalvazo, 1999).

the Element, including the OMP and MTMP. However, as indicated previously, there is a current lack of available standards to determine the effectiveness of manure treatment technologies in reducing ROG, hydrogen sulfide, ammonia, and methane. An accurate method for quantifying the potential air pollutant emissions from treated manure are anticipated to be available following completion of USDA ARS research activities under the national programs. This is a significant impact.

Mitigation Measure ~~4.2-8~~ 4.2-7

No additional feasible mitigation measures are available.

Implementation of **Policies DE 3.1a, 5.1c, ~~6.1b~~ 6.1a, ~~6.1e~~ 6.2d, ~~6.1f~~ 6.2e, ~~6.2a~~ 6.3a,** and **~~7.1d~~ 6.1b** would be expected to reduce hydrogen sulfide generated from dairy facilities and would also reduce other air pollutants generated from cattle manure. However, the effectiveness of the various treatment systems in reducing hydrogen sulfide at dairies currently cannot be demonstrated since standard testing methods for emission of this pollutant from manure at dairies are not readily available although the VS removal efficiency level of an advanced treatment system (required under **Policy DE 5.1c**) may be considered an appropriate indicator for determining the remaining potential for treated manure to emit air pollutants to the atmosphere. In addition, hydrogen sulfide would be emitted by temporarily stockpiled manure. Because emission of hydrogen sulfide would be expected after mitigation and no significance criteria have been developed for this compound, the residual impact is conservatively considered significant and unavoidable in this EIR.

Impact ~~4.2-9~~ 4.2-8

Operation of new or expanded dairies would generate methane emissions from cattle and cattle manure. This is a significant and unavoidable impact.

Similar to existing conditions, new or expanded dairies would also generate methane emissions from cattle and manure management. Potential methane emissions were estimated for future (emissions from all cattle allowed under the Element) and typical 500-, ~~735-~~ 705-, 2,000-, and 5,000-milk cow dairies. Cattle digestion at new or expanded dairies the project site could potentially generate on the order of 71,000 tons per year of methane under future conditions if no emission controls are implemented (Table 4.2-5a). Potentially 93, ~~137~~ 131, 372, and 929 tons per year of methane could be emitted from cattle digestion at a 500-, ~~735-~~ 705-, 2,000-, and 5,000-milk cow dairy, respectively (Table 4.2-5c). The emissions were estimated based on EPA-developed emission factors for dairy cattle in the

western United States (U.S. EPA, 1998c) and the projected number of cows at the dairies.[63] However, the actual amount of methane generated by cattle depends on the feed quality, feeding level and schedule, and animal health.

Cattle that are productively efficient generate less methane. The EPA-developed voluntary Ruminant Livestock Efficiency Program provides beneficial practices to improve the production efficiency of ruminant livestock and, consequently, reduce methane emissions. Methane-reducing measures recommended in the program include ensuring proper herd health, nutritional feed quality, and selecting cattle that are known to be efficiently productive. The owner/operator may implement some of the methane-reducing measures, such as providing on-site cattle with a balanced ration of feed containing proper nutrients and vitamin/mineral additives, in an effort to reduce methane emissions at the dairies.

Cattle manure generated at the dairies would also release methane during the decomposition process. The amount of methane that could be released from decomposing manure under future conditions at maximum buildout (emissions from all cattle allowed under the Element) could be on the order of 45,360 tons per year (Table 4.2-5a); approximately 59, ~~87~~ 84, 238, and 594 tons per year of methane could be generated from cattle manure at a 500-, ~~735~~- 705-, 2,000-, and 5,000-milk cow dairy facility, respectively (Tables 4.2-5c). The estimates were based on the projected number of cows at each proposed dairy and emission factors for natural manure decomposition available from the Emission Inventory Procedural Manual, Methods for Assessing Area Source Emissions developed by the California Air Resources Board (CARB, 1989b; Radian, 1988).

Although the contribution to global increases of greenhouse gases by the methane generated from dairy cattle and manure decomposition from new or expanded dairies under the Element could not be quantified due to the complexities of global climatology, additional methane released to the environment would contribute to the problem of worldwide increase in greenhouse gases and would be considered a significant impact. Although Federal, State, and local regulations to enforce methane emissions have not been developed, voluntary programs established by the U.S. EPA, in coordination with other agencies, are a means to minimize or reduce methane emissions.

Policies DE 3.1a, 5.1c, ~~6.1b~~ 6.1a, ~~6.1e~~ 6.2d, ~~6.1f~~ 6.2e, and **~~6.2a~~ 6.3a**, and policies under **Goal DE ~~7~~ 6** are also relevant to methane emissions from cattle manure. Methane emissions for future conditions were estimated for dairies requiring the implementation of an advanced treatment system specified under **Policy DE 5.1c** (Table 4.2-5b). Similar to ROG estimations, the methane estimate assumed that a corresponding 50 percent reduction in

[63] The emission factors were based on a mechanistic model outlined in the 1993 U.S. EPA Report to Congress entitled "Anthropogenic Methane Emissions in the United States: Estimates for 1990."

methane emissions released into the atmosphere (i.e., not captured from the treatment system) would be achieved with a 50 percent reduction in volatile solids. Approximately ~~3,221~~ 2,916 tons per year of methane would be emitted from dairy expansion projects not subject to the advanced treatment requirement and ~~13,667~~ 13,820 tons per year 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 net methane in methane emissions from manure decomposition would be reduced from ~~30,556~~ 45,360 (no treatment) to ~~16,889~~ 16,736 (advanced treatment) tons per year when emission controls required by the Element are implemented.

~~In addition, **Policy DE 5.1f** requires the preparation of a Livestock Management Plan (LMP) as part of the technical report submitted with each application to either establish a new dairy or expand an existing dairy. The policy requires that the LMP identify practices to reduce methane emissions from ruminant livestock and must be consistent with the voluntary practices incorporated in EPA's Ruminant Livestock Efficiency Program. **Policy DE 6.1g** establishes minimum standards for LMPs, including requirements for maintaining records regarding control of disease and animal health, management of sick animals, feed quality and nutritional levels, herd nutrition, and herd selection. **Policy DE 7.1d** requires that the DMO include a compliance specialist that is capable of reviewing the LMPs and dairy facility logs regarding their implementation. This is a significant impact.~~

Mitigation Measure ~~4.2-9~~ 4.2-8

No additional feasible mitigation measures are available.

Implementation of **Policies DE 3.1a, 5.1c, ~~5.1f, 6.1b~~ 6.1a, ~~6.1e~~ 6.2d, ~~6.1f~~ 6.2e, ~~6.1g~~, ~~6.2a~~ 6.3a,** and ~~**7.1d**~~ **6.1b** would reduce methane generated from ruminant livestock and manure. However, methane would continue to be released by the dairy cattle and temporarily stockpiled manure even after the mitigation measures are implemented. Increase of methane in the atmosphere contributes to worldwide increases in greenhouse gases. To date, a numerical significance criterion for the impact of increases in greenhouse gases has not been established. Therefore, the residual impact of increased methane emissions after mitigation is considered significant and unavoidable.

~~Impact 4.2-10~~

~~Increased localized and regional air pollutant emissions would be generated during operation of new or expanded dairies from vehicular traffic. This is a less-than-significant impact.~~

~~Operation of new or expanded dairies under the Element would create a slight increase in vehicular traffic. Increased vehicular traffic would result in an increase in localized CO~~

~~levels in the project area and regional air pollutant emissions such as PM_{10} and ozone precursors, specifically ROG and NOx.~~

~~The increase in vehicular traffic associated with dairy operations would be from employee vehicles, manure haul trucks, feed trucks, milk trucks, and other miscellaneous vehicle use. The increase in vehicular traffic is considered to be minimal since heavy traffic volumes and congestion do not result from dairy operations, even for large dairies. Additional vehicular traffic from future or expanded dairies would not be expected to violate the SJVUAPCD threshold levels for CO, ROG, NOx, and PM_{10}, and is therefore, considered a less-than-significant impact.~~

~~***Mitigation 4.2-10***~~

~~*None required.*~~

Impact 4.2-9

Increased localized carbon monoxide would be generated from vehicular traffic during operation of new or expanded dairies. This is a less-than-significant impact.

The Element proposes approximately 257,312 additional milk cows and 285,654 head of support stock on land within designated DDOZs and NSOZs in Kings County. Assuming an average dairy size of approximately 1,000 milk cows, the number of new dairies that could be accommodated is about 257 new dairies, or an increase of 172 percent from the County's existing inventory of 149 dairies. Since the theoretical dairy herd is the factor limiting dairy development, development of larger dairies would result in fewer dairies being constructed.

Average daily truck traffic due to each new 1,000-cow dairy is assumed to be approximately 26 one-way vehicle trips per day. This estimate is based on information provided by recent dairy applicants on milk delivery trucks (two trips), feed delivery trucks (four trips), dry manure trucks (four trips), and workers/visitors for large dairy facilities. It is also assumed that each new dairy would include at least one new residence (16 trips). Truck trips would account for approximately 38 percent of the total estimated additional vehicular trips generated by the new dairies.

As indicated in the Transportation section, construction of approximately 257 new dairy facilities would generate approximately 6,682 daily trips to the local and regional roadway system, which would be distributed according to where each new dairies was located. The traffic added by each dairy project to any given roadway would be approximately 25 to 30 vehicle trips per day. The addition of this small amount of new dairy traffic would not exceed the capacity of the existing roadways in the agricultural areas of the County.