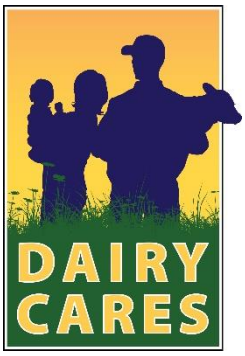

Submitted electronically

May 26, 2016

Mary D. Nichols, Chair
California Air Resources Board
1001 I Street
Sacramento, California 95814

Re: Short-Lived Climate Pollutants

Dear Chair Nichols:

Dairy Cares appreciates the opportunity to submit these comments on the California Air Resources Board's (ARB's) Proposed Short-Lived Climate Pollutant Reduction Strategy (SLCP Plan).

Dairy Cares (www.dairycares.com) is a coalition of California's dairy producer and processor organizations, including the state's largest producer trade associations (*Western United Dairymen, California Dairy Campaign, Milk Producers Council, California Farm Bureau Federation and California Cattlemen's Association*) and the largest milk processing companies and cooperatives (including *California Dairies, Inc., Dairy Farmers of America-Western Area Council, Hilmar Cheese Company, and Land O' Lakes, Inc.*), and others. Formed in 2001, Dairy Cares is dedicated to promoting the long-term environmental sustainability of California dairies.

Dairy Cares continues to recognize the importance of reducing greenhouse gases (GHGs) in California and elsewhere, and that reductions of short-lived climate pollutants (SLCPs) provide an opportunity to "jump start" efforts to slow global warming. In our previous extensive comment letters, we've discussed the significant progress California dairy farms have made to date on these issues and identified several policies – such as significant financial incentives for dairy manure biogas digesters – that will effectively and efficiently reduce emissions of SLCPs from the dairy sector. We have also suggested promising areas for research to continue and expand our abilities to reduce SLCPs from dairy farms while preserving the economic and social benefits of a healthy dairy community.

We incorporate our previous comments by reference and continue to support our previous suggestions on an achievable incentive-based plan to further reduce dairy methane emissions. However, we must also continue to express our serious concerns with what we see as unrealistic targets that are not achievable in the timeframes outlined in the SLCP Plan. There are a number

of factors that make the SLCP Plan unrealistic under the best of circumstances, let alone the difficult environment surrounding the development of dairy methane reduction projects.

Summary – The SLCP Plan is Unrealistic

Following is a summary of the key reasons the SLCP Plan is unrealistic:

- **Plan relies on an unrealistic number of digesters to achieve unreasonable targets.** There are currently only 14 operating dairy manure biogas digesters in California, and these projects took a number of years to implement. The SLCP Plan identifies the need for digesters serving 500 or more of the largest dairies in California by 2030 to achieve the targeted reductions. While a significant number can surely be developed with appropriate incentive funding, the concept of developing projects for 500 dairies is simply unrealistic under any circumstances.
- **Plan depends on failed "regional dairy digester" concept.** The SLCP Plan assumes the development of up to "55 regional digesters" that would receive fresh manure trucked in daily from multiple dairies that are more than ten miles away in some situations. This proposed approach adds significant complexity to project development, project economics and project operations. Additionally, there is no proven model for transporting thousands of tons of heavy wet manure to a centralized facility in California. Moreover, the one regional digester project built in California to serve multiple dairies in the Chino area failed economically and is no longer in operation. Project developers who have considered this model have rejected it for multiple reasons and, as a result, it is unclear who would own and operate these regional projects and how they would get financed.
- **Plan relies on revenue expectations from unproven methane-to-transportation fuel model.** The SLCP Plan also is built on the foundation and expectation of significant revenue potential from dairy methane to transportation fuel projects. Again, not a single such project currently exists in California and only one commercial scale project exists in the entire United States. While we agree that dairy methane to transportation fuel projects have added revenue potential, it is unclear and unproven how to finance such projects given their reliance on volatile and uncertain government credit programs for the overwhelming majority of their revenue streams. (This issue is discussed at length in a later section)
- **Plans relies on converting dairies to "scrape manure" systems, despite likely economic and environmental impacts.** The SLCP Plan also assumes the conversion to scrape manure management systems on the overwhelming majority of dairies in California. These scrape systems substantially limit the utilization of manure nutrients on a dairy and will require manure to be hauled and utilized off-site. It is entirely unclear at this time where and how millions of tons of manure will be effectively and efficiently utilized in the state. As a result, conversion to scrape management risks potentially significant impacts to water quality. Conversion to scrape also raises

significant cross-media air quality impacts that must be fully understood before such wholesale changes in manure management approaches are embraced.

- **Plan is unrealistic about time needed to address barriers to methane reduction projects.** The SLCP Plan correctly acknowledges that significant obstacles to methane reduction projects continue to exist, including permitting, utility interconnection, energy contract availability, etc. While we certainly appreciate ARB's commitment to work through and address these obstacles and barriers to project development, it remains unclear how and when they can be addressed. Barriers have existed for the past decade and have greatly limited project development in California. It is unreasonable to assume that without addressing these obstacles that project development will no longer be hindered, and it is also unrealistic to assume these barriers – which involve a range of persistently difficult policy, financial, and technical issues – will be fully and comprehensively addressed quickly. However, the SLCP Plan sets goals for methane reduction that appear to assume that there are no barriers at all, and even if barriers did not exist, these goals can be described, at best, as wildly optimistic.

- **Plan relies on pipeline injection projects without recognizing limitations.** The SLCP Plan also assumes that on-site dairy biogas-to-electricity projects will be limited and that costlier and more complex dairy biomethane projects will be developed. There is not a single dairy pipeline project currently injecting biomethane into the natural gas system in California today. The one previous dairy biomethane project in the San Joaquin Valley operated for only a brief period of time before the dairy and project went financially insolvent. Not all dairies are in close proximity to existing natural gas transmission pipelines, and even those that are close to pipelines face significant cost and obstacles to injection. For example, even though access to a pipeline might be feasible, it does not mean that the pipeline has the available "capacity" to handle pipeline injection from a large dairy biomethane project. This is a site-by-site project development issue that was not considered by ARB in developing the SLCP Plan. Equally important, pipeline biomethane quality standards currently being utilized in California greatly limit this option even where it is operationally feasible.

- **Plan cannot be achieved without significant funding that has not been committed to date.** The SLCP Plan acknowledges the need for an initial infusion of $500 million of incentive funding over the next five years for dairy methane reduction projects. However, that funding is not yet committed and currently appears increasingly unlikely due to elimination of the majority of funding for SLCP reduction incentives in the recently adopted Senate budget proposal. Without an infusion of initial incentive funding toward ARB's aggressive methane reductions target, progress simply cannot and will not be made. The only projects currently moving forward have significant grant funding from either the CDFA or CEC (EPIC) grant programs. Put simply, projects without significant grant funding or other incentives do not get financed and built in California.

- **Regulatory approach is counter-productive and will limit project development in California and lead to leakage.** Finally, the SLCP Plan would initiate a "regulatory rulemaking" sometime in 2017. Moving from an incentive based approach to a regulatory approach will further harm dairy methane reduction project economics by limiting the ability to generate revenue streams from state and federal GHG LCFS and RIN credit programs. Dairy methane reduction project economics are already challenging and represent the primary limiting factor to greater project development at this time. Regulatory schemes which further reduce project revenues will only further limit willingness to invest in projects and as a result, project development in California.
- **Plan does not rely on sound science.** The plan sets extremely aggressive and unrealistic goals for methane reduction based on strategies that have not been proven to be technically feasible, science-based, and for which cross-media impacts to water quality, air quality and other environmental factors have not been considered thoroughly. A science-based approach is needed that allows for a smart and strategic pathway to methane reductions, based on realistic, technically feasible measures that do not result in unreasonable environmental and economic impacts.
- **Approach will create significant environmental impacts.** The SLCP Plan will likely create significant environmental impacts, including impacts to air quality and water quality. These additional air quality impacts have significant potential to interfere with attainment of air quality standards in the San Joaquin Valley in clear violation of AB 32 requirements that all activities must "complement" and not interfere with "efforts to achieve" and maintain federal and state air quality standards.
- **Plan will likely increase global GHG emissions.** The SLCP Plan will likely increase global greenhouse gas emission impacts as a result of emissions leakage. Whether through attrition or relocation, the number of milk-producing cows in California will decrease only to have milk production in other states and regions increase to supply increasing world-wide demand for dairy products. Milk production in these other regions can have higher GHG emissions per gallon of milk produced, leading to an overall increase in global emissions.

ADDITONAL DETAILED COMMENTS

I. Regulatory Approach is Fundamentally Flawed; it Worsens Economics and Risks Significant Leakage of Dairies to Other States.

The SLCP Plan is fundamentally flawed in that it assumes that a regulatory approach is both necessary and effective to reduce methane emissions from California dairies. The opposite is true. Regulation worsens the economics of methane-reduction projects and risks leakage of

dairies and their GHG emissions to other states (or nations), while an incentive-based approach assures that:

- Methane-reduction projects are economically sound,
- Additional revenue streams (such as sale of carbon offsets) are preserved, and
- Leakage will not occur as a result of GHG reduction efforts.

Incentive programs have a long, successful track record in California. Incentive funding has been used very successfully to reduce emissions in troubled California air basins, particularly in cases where technology to reduce emissions was emerging and not yet considered to be widely available, practical or cost-effective. For example, consider the following excerpt from the San Joaquin Valley Air Pollution Control District's 2015 Annual Demonstration Report (on State Implementation Plan creditability):

> "The San Joaquin Valley Unified Air Pollution Control District (District) currently operates one of the largest and most well-respected incentive programs in California. Since 1992, the District's incentive programs have provided over $688 million in incentive funds. This has been matched by cost-sharing on the part of participating businesses, public agencies, and residents, who together have invested over $526 million, for a total public/private investment of well over $1.2 billion in low and zero emissions equipment and operations. These combined efforts have accelerated the adoption of cleaner technologies (beyond that achieved by stringent regulations alone) achieved over 117,000 tons of lifetime emission reductions, improved air quality and public health, and progressed the San Joaquin Valley (Valley) towards attainment of increasingly stringent federal air quality standards. In addition to District-administered incentive programs, the California Air Resources Board (ARB) and the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) also implement highly effective incentive programs, further reducing emissions in the Valley."[1]

Methane reduction projects are suited for research or incentive programs, not regulation. All strategies identified to date for reducing emissions of methane from dairy farms – whether they be installation of manure biogas digesters, conversion of manure flush-to-lagoon systems to scrape-and-dry storage systems, or even potential other methods such as installation of improved manure solids separation systems – are capital intensive, and without financial incentives, are not currently cost effective.

ARB appears to be operating on the flawed assumption that the simple act of implementing a regulation will automatically realize methane reductions on dairies in California, regardless of the fundamental economics, or perhaps somehow improving the economics. But this isn't true.

A successful regulatory approach depends on cost-effective methane reduction measures being available to the regulated community. There are currently no such measures available. Absent

[1] http://www.valleyair.org/MOP/docs/AnnualDemonstrationReport_081315.pdf

such measures, the risk of leakage is extremely high as cattle operations can (and have) relocated to other states with relative ease (this is discussed in more detail in section VI below).

The SCLP Plan recognizes that when a regulation requiring methane reductions from dairies becomes effective, future methane reduction projects on dairies, both in California and elsewhere, will no longer be eligible to create and sell carbon offset credits. This will eliminate an important source of revenue that currently is an important factor in determining whether such projects can "break even." Until and unless methane-reduction projects can be shown to be broadly cost-effective without income from sale of carbon credits, regulation is clearly counterproductive to the success of such projects on California dairies.

Dairy Cares is currently completing an economic study which details present leakage of dairies to other states while also showing the importance of carbon credits in determining the economic viability of projects; we will provide this study to ARB upon its completion this summer.

Scrape system conversions would benefit from additional research and potentially incentives; premature to consider regulatory approach. Likewise, we are concerned with ARB's positioning of conversion of dairies from manure flushing systems to scrape systems as a potentially economically viable alternative to biogas digesters. This approach is also fundamentally flawed for several reasons:

- Scrape systems likely will result in several negative environmental impacts to air and water quality unless mitigation measures are included – the cost of which is currently unknown and may render these projects financially unviable (discussed in more detail below in Section V
- It is also unclear what it would cost to ensure such conversions complied with current regulations from regional air districts, regional water quality control boards, county land use authorities, the State Water Resources Control Board and CalRecycle (in the event the conversion contains a composting component as identified by ARB).
- Scrape systems use energy to operate and may necessitate additional energy use and GHG emissions to haul manure, rather than using manure onsite as a fertilizer and potential source of renewable energy via biogas digesters.

II. ARB Uses the Wrong Metric to Assess Dairy Farm Performance

Dairy Cares continues to be concerned with ARB's inappropriate approach to evaluating performance of the dairy sector and setting goals for future reductions.

As noted in our previous comment letters on the SLCP Plan, incorporated here by reference, California dairies already are among the world's most efficient performers for carbon footprint on a GHG-per-unit-of-milk-produced basis. This is the metric used to evaluate performance of the livestock and agriculture sector by the academic community and the United Nations Food

and Agriculture Organization (FAO). In a 2013 report,[2] the FAO noted that "possible interventions to reduce emissions are … based on technologies and practices that improve production efficiency at animal and herd levels. They include the use of better quality feed and feed balancing to lower enteric and manure emissions. Improved breeding and animal health help to shrink the herd overhead (i.e. unproductive part of the herd) and related emissions."

It is well understood by the FAO and in the academic community that North American dairy producers, particularly in the U.S. and California, lead the world with the smallest carbon footprint per unit of milk produced (FAO). In the U.S., the carbon footprint of dairy production has been reduced by more than 60 percent since 1944, helping to realize this world leadership. [3]

Even when total farm emissions of methane from both manure management and enteric emissions are considered, California dairies maintain their position at the forefront of GHG efficient dairy production.

Unfortunately, ARB unfairly uses California dairy's production efficiency against the sector by referring to emissions "per animal" in the SLCP Plan rather than per unit of milk produced. This is akin to criticizing mass transportation vehicles for having marginally more total mass emissions of GHG compared to private passenger vehicles, even though the mass transit vehicles greatly outperform the private vehicles when passenger miles are considered.

ARB's approach and unreasonable demands to further reduce the industry's GHG emissions by 75 percent by 2030 (manure management) ignores and fails to credit the progress already made by the industry. Additional progress is possible, surely, but because California dairies have already taken up most of the efficiency practices recommended by FAO, there is an increasing degree of difficulty as further reductions are considered. This should be taken into account.

Further, given that there are more than 1.3 billion cattle on earth, or about 722 cattle for every dairy cow in California, it is important to consider that reductions from California agriculture will do nothing to impact global levels of livestock emissions of methane unless efforts are also made elsewhere than California. Importantly, no other state in the U.S. and no other country on earth requires or regulates emissions reductions of methane from livestock or agriculture.

Rather than using a "per cow" emissions metric or measuring performance against total emissions of the state's herd, Dairy Cares believes the appropriate metric would be to measure GHG emissions per milk produced, and encourage and incentivize continued improvements and further leadership by California dairies.

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[2] http://www.fao.org/3/i3437e.pdf, "TACKLING CLIMATE CHANGE THROUGH LIVESTOCK - A global assessment of emissions and mitigation opportunities," FAO, 2013.

[3] http://agron-www.agron.iastate.edu/Courses/agron515/Capperetal.pdf. Journal of Animal Science, March 13, 2009, "The environmental impact of dairy production: 1944 compared with 2007," Capper et al.

III. Plan is Based on Flawed Economic Assumptions Regarding Transportation Fuel Projects

Transportation fuel projects, while creating a potential opportunity for increased revenue for dairy methane digester projects, also come with greatly increased risk and uncertainty. Transportation fuel projects would receive revenue for energy sales at the price of wholesale natural gas as well as LCFS credits and cellulosic RIN credits from the Federal Renewable Fuel Standard Program. A typical transportation fuel project would receive about 80 percent of its revenue from the creation and sale of LCFS and RIN credits and just 20 percent of its revenue from the sale of natural gas. Therefore, as the SLCP Plan acknowledges, transportation fuel projects and their revenue streams are "highly dependent on the value of LCFS and RIN credits." As a result, 80 percent of the prospective revenue stream for these projects faces increased uncertainty, volatility and risk.

The price of credits is both volatile and uncertain. Price volatility is exacerbated by the lack of long-term contracts and certainty. There are currently no long-term contracts for credits, which creates significant and potentially unsurmountable project financing issues. Credits are also subject to market cycles and can fluctuate wildly. While credit prices are currently high, that has not always been the case and volatility adds significantly to project financing difficulty.

Long-term certainty of credits is also a significant and uncontrollable risk. Both federal RINs and state LCFS credits are subject to political decision-making. The federal RFS program and the RIN credits are subject to sunset in 2022, while the state LCFS program has no defined date. As a result, there is no guarantee that revenues available from credits will continue past 2022 (just 6 short years) and could end sooner if policy makers or regulators end the programs earlier. This latter concern is exacerbated by the fact that many powerful political groups and leading economists have called for an end to the LCFS in California. Moreover, RINs are outside the control of either state policymakers or regulators further adding to their long-term uncertainty. Finally, uncertainty around dairy methane regulatory actions could also greatly limit revenue associated with credit revenue streams.

IV. Plan must be Smart and Strategic and Allow Sufficient Time to Avoid Cross-Media Impacts

Dairy Cares strongly believes that given the extremely small potential of the SLCP Plan to effect global methane levels (see Section II above), it is extremely important (and required by law especially AB 32) that any measures taken to reduce methane from California dairies not adversely impact the environment in our state and particularly among rural, disadvantaged communities.

Unfortunately, the rushed approach, lack of sound science and lack of careful environmental analysis in the plan all but assures that the SLCP Plan poses the risk of cross-media impacts to air quality, water quality, and potentially to other natural resources.

Water quality potential risks. With its reliance on converting many (perhaps hundreds) of dairies from manure flushing systems to manure scrape systems, the SLCP Plan creates a huge potential change to the way manure nitrogen is stored and handled both on and off dairies. By converting most of the manure on dairies from wet storage (liquid) to dry storage (solid), the SLCP Plan will make it difficult or impossible for many dairies to use most of their manure to fertilize their own crops (dry manure can only be applied prior to planting the crop, while liquid manure can be added gradually as needed by the crop during the growing season). This would necessitate the storage and transport of millions of tons of manure off of dairies to other locations. It is far from clear that there is a willing agricultural use market for this manure (use of raw manure is discouraged and in some cases illegal for crops intended for human consumption). Composting manure could alleviate part of this concern, but adds significant economic costs and regulatory burdens, not to mention environmental impacts.

All this is not to say that in some cases, conversions from flush systems to manure-scraping systems may be appropriate, economic and any environmental impacts can be reasonably mitigated. However, the scale that ARB is depending on this strategy as a GHG-reduction option is not justified by any known set of facts, and attempting to push such conversions too far, too fast or where inappropriate would likely cause more problems than would be solved.

For additional technical detail on the potential water quality issues posed by wide-scale conversions of dairies to scrape systems, see the May 25, 2016 letter from Luhdorff and Scalmanini Consulting Engineers (attached as part of this comment submittal package).

Air quality potential risks. Similar to the concerns expressed above, it is clear that wide-scale implementation of biogas digesters or conversions from flush systems to scrape systems could have significant impacts to regional air quality if not implemented wisely, carefully, and on a timeline consistent with development and availability of technology and methods not currently available,

All 14 dairy biogas digesters in California today depend on converting biogas to electricity with a generator powered by an internal combustion engine. While these are designed to minimize emissions related to combustion, they do produce emissions of oxides of nitrogen (NOx), which contributes to formation of ozone and particulate matter. Large-scale adoption of these types of digesters in the San Joaquin Valley, where 85 percent of California dairies are located, would contribute significant amounts of NOx in an air basin that already is in extreme non-attainment for federal standards for ozone (and non-attainment for particulate matter standards).

Similarly, it is likely that conversion of flush systems to scrape systems will increase air emissions from dairies, possibly including ammonia, volatile organic compounds, particulate matter and odors. These potential impacts should be studied prior to developing incentives or regulations that encourage such conversions.

For additional technical detail on the potential air quality issues posed by the SLCP plan, see the May 26, 2016 letter from Ramboll Environ (attached as part of this comment submittal package).

V. Environmental Assessment is Inadequate to Comply with California Environmental Quality Act (CEQA)

ARB's Environmental Assessment (EA) of the SLCP Plan is inadequate. It fails to evaluate in any meaningful way the potential environmental impacts of its recommended strategies. The ARB analysis essentially boils down to "these measures could increase or decrease air emissions" and places the responsibility of mitigating those emissions on others.

Even worse, the EA concludes, wholly without evidence and likely incorrectly, that the SLCP Plan would result in no impacts to water quality and might in fact improve water quality. As discussed in Section IV, this isn't supported by facts.

The EA is inadequate in its assessment of leakage potential resulting from the proposed regulation, failing to describe in any meaningful way the likelihood that it would cause dairy production and GHG emissions to move out of state (and out of reach of ARB) and thereby likely result in an increase in GHG emissions from dairies overall. The EA also fails to examine whether regulation, by ending the ability to market offsets from GHG reductions, would hamper progress to build biogas digesters not only in California but in other states.

Similarly, the EA fails to evaluate whether an incentive program provides an environmentally superior alternative to regulation.

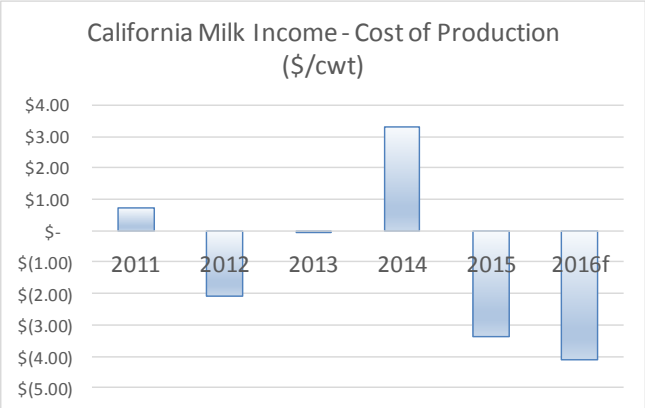
For additional detail information and concerns about the inadequacy of the EA, see the May 26, 2016 letter from Greenberg Glusker (attached as part of this comment submittal package).

VI. Leakage Potential is Real

As discussed above in Section III, the SLCP Plan depends on flawed economic assumptions. What is clear is that *any* of the strategies identified in the plan will require funding to be successful and that none of these are cost-free or likely to be economical without sufficient funding and/or guaranteed revenue streams. Given that regulation or unrealistic goals without sufficient funding will mean significant new costs for the industry, we evaluate the ability of the industry to bear any new costs.

The financial situation in the dairy industry is catastrophic. In recent years, milk price volatility has become a part of dairy operators' reality. The large variation in margins is testament to that. As costs of production have increased, milk prices have mostly failed to follow

along, resulting in more frequent negative margins than positive ones (see chart below). The margins outlined below do not include all the costs of compliance with environmental regulations, which are becoming an increasingly larger part of the cost of producing milk in California. Each year, dairies are forced out of business. The net loss of dairy operations over the past five years totaled 278 farms (a decline of 16%). These data do not include the number of farmers forced out of business and whose dairies were acquired by another dairy operation that managed to stay in business. The financial situation is particularly dire in 2016. With the milk price averaging close to $1.57/cwt below 2015 for the first half of 2016, more dairies will be forced out of business.



Sources: Data from 2011-2015 - California Department of Food and Agriculture
2016 estimate – Western United Dairymen calculations

To find a clear sign that the financial situation in California has deteriorated, one needs to look no further than USDA's *Milk Production* report. Indeed, so far in 2016 (first four months), milk production in California has averaged 2.8% below last year. What's even more concerning is that the same three months last year also averaged 2.8% below the previous year. Put another way, we are in a period of year-over-year-over-year declines. It has now been 17 consecutive months of milk production declines. This trend is not a normal, national trend. In the U.S., in contrast, milk production has been up an average 1.1% in 2016 compared to last year. During the same period last year, milk production was up an average of 1.8%. Consolidation (with dairies getting larger) is not the only factor to blame for the decline in California: in fact, the average size of a dairy farm in California dropped by 2 cows in 2015, to 1,215 cows. While milk per cow was down slightly year-over-year, a more concerning reality was apparent in the statistical data: a total of 41,670 cows left the California dairy herd in 2015.

Dairies can't pass on costs. California dairies are complex and advanced operations. Nearly all California dairies are family run, and the farmers strive for production efficiencies through the use of advanced technologies in breeding, nutrition, reproduction, animal housing, and animal welfare. While producers can try to improve efficiencies on the production side, they are mostly left to the vagaries of the regulated pricing system when it comes to the revenue side of the

equation. Indeed, the minimum price producers receive throughout the state is dictated by a complex pricing system. Therefore, unlike other types of businesses, producers do not have the ability to pass on any added costs to consumers.

The pricing system, which ultimately determines the prices producers receive, uses formulas to calculate prices monthly. Those formulas follow market trends in national dairy commodities, but nowhere do they include a component for the cost of producing milk at the dairy. When the cost of production at the dairy increases in California, it leaves the dairy producer with two choices: 1) absorb the increased costs, when margins are positive, or 2) go out of business. With recent years' lack of profitability, most producers are forced to choose the latter. To further compound the problem, dairy producers in California receive one of the lowest milk prices in the country. Increasing their cost of producing milk, when the other dairies in the rest of the country are not, would put them at a further competitive disadvantage. *(Source of table below – California Department of Food and Agriculture)*

Mailbox milk price

Dollars Per Hundredweight	2010	2011	2012	2013	2014	2015
California	$ 14.37	$ 18.13	$ 16.29	$ 18.26	$ 21.83	$ 15.08
New England States	$ 17.50	$ 21.35	$ 19.63	$ 21.51	$ 25.42	$ 18.56
New York	$ 16.33	$ 20.00	$ 18.57	$ 20.50	$ 24.54	$ 17.21
Eastern Pennsylvania	$ 17.05	$ 20.86	$ 18.95	$ 20.60	$ 24.51	$ 17.16
Appalachian States	$ 18.10	$ 21.65	$ 19.47	$ 21.23	$ 25.45	$ 17.94
Southeast States	$ 18.51	$ 22.09	$ 20.04	$ 21.61	$ 25.89	$ 18.20
Southern Missouri	$ 16.46	$ 20.15	$ 18.05	$ 20.31	$ 24.80	$ 17.88
Florida	$ 19.53	$ 23.27	$ 21.26	$ 23.02	$ 27.13	$ 19.20
Western Pennsylvania	$ 17.03	$ 20.93	$ 18.88	$ 20.45	$ 24.45	$ 17.32
Ohio	$ 17.17	$ 20.85	$ 18.68	$ 20.53	$ 24.20	$ 17.32
Indiana	$ 16.83	$ 20.44	$ 18.06	$ 19.97	$ 23.55	$ 16.46
Michigan	$ 16.31	$ 20.11	$ 17.91	$ 19.76	$ 23.47	$ 16.05
Wisconsin	$ 15.98	$ 20.06	$ 19.31	$ 20.10	$ 24.10	$ 17.67
Minnesota	$ 15.75	$ 19.99	$ 19.35	$ 19.95	$ 24.10	$ 17.44
Iowa	$ 16.41	$ 20.26	$ 18.97	$ 20.35	$ 24.48	$ 17.09
Illinois	$ 16.56	$ 20.63	$ 19.13	$ 20.36	$ 24.47	$ 17.33
Corn Belt States	$ 16.01	$ 19.83	$ 18.11	$ 19.28	$ 22.97	$ 16.06
Western Texas	$ 15.70	$ 19.33	$ 17.65	$ 19.00	$ 22.71	$ 16.06
New Mexico	$ 14.81	$ 18.28	$ 16.78	$ 17.96	$ 21.51	$ 15.03
Northwest States	$ 15.71	$ 19.83	$ 18.05	$ 19.75	$ 23.74	$ 16.43
All Federal Order Areas	$ 16.33	$ 20.19	$ 18.68	$ 20.08	$ 24.01	$ 17.01

*Mailbox milk prices: Net prices received by dairy producers across the U.S. by state or marketing region.

difficult, but it's even harder for larger ones. Financing challenges will vary depending on each

dairy's financial situation. But one thing is universal: the dairy needs to be profitable as the core business to be able to supply the manure to the digester for a period long enough to recoup the capital investment plus have a reasonable return for taking the business risk. Looking at the current financial situation in the dairy industry and the aforementioned negative margins experienced, it is questionable whether many of these farms will still be in business in 10 years. It would not make sense for a financial institution to lend money for a digester project if the dairy will likely be out of business in the near future.

Another important consideration lenders make is the total debt outstanding to be serviced by the cows. More specifically, industry standards hover around total debt per cow to be less than $2,100. In some cases, the debt load can go higher, but there needs to be significant cash flow to justify it. Looking at the latest *Dairy Farms Operating Trends* report published by the accounting firm Frazer LLP, debt per cow in California already reached an uncomfortable level. As of December 31, 2015, dairies in Southern California, the San Joaquin Valley and Kern County (the areas reported in the document), debt per cow already amounted to $2,943, $3,259 and $3,404 respectively for each of these regions.

Another financial ratio banks look at before considering projects is the debt-to-equity ratio. Based on conversations with California dairy lenders, lending guidelines tend to indicate that debt to equity ratios should be 0.65:1 or lower. Anything over 1:1 is considered high risk. As exemplified in the *Dairy Farms Operating Trends* documents, dairies in California are already extremely leveraged. Ratios shown would be considered high risk, with values of 1.42:1, 1.46:1 and 0.97:1 for Southern California, San Joaquin Valley and Kern County, respectively.

Finally, lenders rely heavily on the cash flow projections of the project. While a short term projection may yield positive cash flows based on the current value of the credits, a slightly longer term projection may not. While the value of the credits is known today, any assumption on their value beyond the near term is likely unreliable and the cash flow would certainly be volatile. In the current milk pricing environment, banks want to see strong income streams: some "iron clad sources of income" to cover the risk.

Using values in the report, $5.4 million is a lot to absorb for a 2,000 cow herd. Over a ten-year period, with monthly payments, and interest at 5.5%, this would be $58,609/month. When a herd of that size in Southern California, San Joaquin Valley and Kern county lost an average of $4,340, $26,400 and $29,900 per month respectively in 2015 (and the financial situation has worsened since then), it does not add up.

To conclude, even if a dairy had enough real estate as collateral, the lack of confidence in the viability of dairy farms combined with the long term cash flow uncertainty would make digester projects' financing impossible for a large proportion of dairies in the state.

VII. Conclusion

Despite the many concerns expressed here, Dairy Cares believes that is possible to further improve the GHG efficiency of California's dairy farms, even though they are already among the world's most efficient. Moving forward, Dairy Cares strongly supports advancement of an effective and efficient incentive-based approach and the development of reasonable and achievable methane reduction targets. The adoption of achievable targets is critical to avoid failure by the state and industry and also avoid global GHG emissions increases through emissions leakage. The success of this approach hinges on continued efforts by ARB, other state agencies, the dairy industry and other stakeholders to address significant ongoing economic and other barriers and obstacles to wide adoption of dairy methane reduction projects. Dairy Cares strongly encourages the immediate establishment of a working group of stakeholders to begin the process of identifying achievable targets and solutions to economic, project finance and other barriers to broader project adoption. At a minimum the following barriers must be addressed to facilitate the wide scale dairy methane reduction project development needed to further achieve dairy methane reduction targets. Unless the barriers are addressed, significant dairy methane reduction cannot and will not be achieved.

We strongly recommend that ARB direct its staff to work with us to address the following issues:

a. Research needs. Significantly more research is needed to understand and evaluate the options for reducing GHG from dairies. We recommend that ARB in cooperation with the dairy industry, California Department of Food and Agriculture, and regional water quality and air quality authorities, form a task force to develop, fund and implement a research strategy. Goals of the strategy would be to evaluate the potential for various management practices and technologies to reduce dairy GHG emissions (especially methane/SLCPs) while understanding the cost and return on investment in terms of GHG reduced. The research should be comprehensive enough to understand, fully, potential impacts to water quality, air quality or other cross-media impacts, and to identify strategies to mitigate those impacts, as well as compile the costs for such mitigation. Only when the costs are fully understood can we determine what is achievable, when it can be achieved, how much funding is needed and what other actions are necessary to be successful. Importantly, this type of science-based approach will be extremely helpful in determining the best method for achieving future reductions, and whether incentives or regulations or a combination of both would be effective.

b. Incentive Funding. Extensive GGRF and other incentive funding will be required. We believe the $500 million figure proposed by the California Department of Food and Agriculture (CDFA), that is, $100 million per year for five years, represents an appropriate and significant initial investment on incentivizing broader adoption of digester technology in the dairy community. Without incentive funding, these projects are not economical and will not be built. However, with incentive funding, dairy digesters represent a highly efficient GHG reduction technology, returning up to one ton of CO2e

reduction for each $8 of investment.[4] As a result, dairy digesters are a sound investment strategy not only to reduce GHG but to reduce methane, an important SLCP.

An initial $500 million commitment would send a strong message to the dairy industry and the digester community that the state is serious about broadening dairy methane reduction project adoption as a means to control manure methane. It would also allow the industry to begin to create economies of scale and establish the network of contractors, vendors and service providers to efficiently and effectively broaden adoption.

c. Incentive Programs. Existing incentive programs should be reviewed and redesigned to more effectively provide grants and other incentives to qualified projects. To achieve any significant level of adoption, incentives will need to be well-designed and readily available to projects to facilitate project financing. The dairy industry looks forward to working with CARB, CDFA, and the dairy digester development community to structure appropriate grants and other incentive programs.

d. Energy Contracts. Energy contracts, power purchase agreements and other off-take agreements must be readily available to project proponents. While the BioMAT FiT program is now available for electrical energy generation projects, similar long-term energy contracts must be made available for biomethane injection and transportation fuel projects. Creation of a properly structured biomethane FiT program for dairy digester projects could provide greater incentives for biomethane (RNG) injection projects and encourage their development. Similar programs will need to be designed and implemented for RNG transportation fuel as well, to ensure long-term off take agreements from financeable partners are available.

e. Interconnection barriers. Barriers to electricity and pipeline injection projects continue to limit project development due to high cost and extensive gas conditioning requirements. Reduction of cost and appropriate relaxation of gas injection standards will facilitate project development and enable and encourage pipeline biomethane opportunities.

f. Utility culture change. CARB and California Public Utilities Commission officials must also ensure Investor-Owned Utilities (IOUs) are prepared to work with, and not against, project developers to provide timely, efficient and cost-effective opportunities to facilitate development.

g. SB 1122 Biomat FiT reform. While the SB 1122 program has begun offering electrical energy procurement contracts, additional program improvements are necessary to maximize its effectiveness to achieve broad dairy digester project development.

[4] We believe this number is actually as low as $2 per ton if 20-year GHG potential and 20-year useful life of the project are taken into consideration as appropriate.

Improvements to this program will be required to ensure an effective mechanism that enables project financing and rapid project development.

h. Efficient credit production. The ongoing availability of GHG and LCFS credits represent important revenue streams to enhance the economics of dairy digester projects. Establishing a guaranteed 20-year crediting period would also enhance project and long-term economic stability. Enhancing and streamlining credit accounting and verifications could also greatly enhance project viability

i. Continued electrical energy project opportunities. Due to potential concerns with emissions related to electrical energy projects utilizing low NOx engines, effective alternatives must be developed. Not all projects will have access to natural gas pipelines for RNG or transportation fuel project development. As a result, research and development must be done to continue to provide cost-effective and workable electrical energy generation opportunities. Electrical energy production will remain the only viable option for some dairy projects.

We appreciate the opportunity to provide these comments and look forward to working with ARB to establish an achievable and workable plan to further decrease dairy methane emissions in California.

Sincerely,

/s/ Michael Boccadoro

/s/ J.P. Cativiela

for Dairy Cares

C: Charles “Chuck” Ahlem, Chairman, Dairy Cares
Paul Sousa, Environmental Services Director, Western United Dairyman
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May 26, 2016

Via Electronic Submittal and U.S. Mail
http://www.arb.ca.gov/lispub/comm/bclist.php

Air Resources Board
Attn: Clerk of the Board
1001 I Street
Sacramento, CA 95814

Re: **Comments on the Draft Environmental Analysis for the Proposed Short-Lived Climate Pollutant Reduction Strategy Dated April 11, 2016**

Dear Chairwoman Nichols and Members of the California Air Resources Board:

We submit these comments to the Draft Environmental Analysis for the Proposed Short-Lived Climate Pollutant Reduction Strategy dated April 11, 2016 (the "Draft EA") on behalf of Dairy Cares. Dairy Cares is a coalition of 14 organizations and companies doing business in California's dairy industry and is dedicated to fostering a sustainable California dairy industry. The Dairy Cares coalition includes four membership organizations representing dairy farmers on trade-related issues (Western United Dairymen, Milk Producers Council, California Dairy Campaign, and California Farm Bureau Federation), three farmer-owned cooperatives that process and market milk (California Dairies Inc., Dairy Farmers of America-Western Area Council, and Land O' Lakes), three privately-held companies that produce, process and/or market dairy products (Hilmar Cheese Company, Joseph Gallo Farms, and Bar 20 Dairy Farms), two associations whose members have significant business interests within the California dairy industry (California Cattlemen's Association and Dairy Institute of California), Ruan Transport Corp. (a hauler of milk), and Conestoga-Rovers Associates (an environmental services provider for dairy farms).

These organizations and their members produce, process or market more than 95% of California's milk and represent the interests of more than 1,400 independently operated dairy farms statewide.

As discussed in detail below, although the California Air Resources Board ("ARB") prepared the Draft EA under its certified regulatory program and with a "program" level review, the Draft EA still must comply with the fundamental requirements of the California Environmental Quality Act ("CEQA"). The Draft EA, however, fails to do so in its environmental review of the proposed Short-Lived Climate Pollutant Reduction Strategy (the "SLCP Strategy" or "Strategy"). Specifically, the Draft EA (a) lacks a coherent, finite and stable project description; (b) fails to adequately address and evaluate the potential significant impacts

of the SLCP Strategy; (c) fails to provide any substantive discussion of the possible mitigation measures to avoid or reduce significant impacts; (d) fails to consider a reasonable range of alternatives to lessen or avoid significant impacts; (e) concludes certain impacts are unmitigable and unavoidable without first conducting a good faith, reasoned evaluation; and (f) generally fails to provide the fundamental information and analysis necessary to constitute an adequate environmental review under CEQA. Simply stated, the Draft EA, even as a first-tier programmatic document, falls short of multiple CEQA requirements. To correct these deficiencies, the Draft EA must be significantly redrafted and recirculated prior to ARB consideration of the final EA and the SLCP Strategy.

I. THE DRAFT EA DOES NOT COMPLY WITH AND IS IN VIOLATION OF CEQA

A. The Draft EA Fails to Fulfill the Fundamental Requirements of CEQA

We understand that ARB prepared the Draft EA in lieu of an environmental impact report because ARB's adoption of the SLCP Strategy falls under CEQA's certified regulatory program and its exemption from having to prepare and certify an EIR. (Draft p. EA 1-3) However, despite this exemption, the Draft EA must comply fully with the fundamental requirements of CEQA. The Draft EA fails to do so.

CEQA states that certified regulatory programs remain "subject to other provisions in CEQA such as the policy of avoiding significant adverse effects on the environment where feasible." CAL. CODE REGS. TIT. 14 § 15250; *see also POET, LLC v. California Air Res. Bd.*, 218 Cal.App.4th 681, 710-711 (2013). Serving as the "functional equivalent" of an EIR, the Draft EA must "provide the public and governmental decision makers with detailed information on the project's likely effect on the environment, describe ways of minimizing any significant impacts, point out mitigation measures, and identify any alternatives that are less environmentally destructive." *Ebbetts Pass Forest Watch v. Dep't of Forestry and Fire Prot.*, 43 Cal.4th 936, 943 (2008)(citations omitted). CEQA also requires that the Draft EA include "a description of the proposed activity with alternatives to the activity, and mitigation measures to minimize any significant adverse effect on the environment of the activity." CAL. PUB. RES. CODE § 21080.5(d)(3)(A); *see also* CAL. CODE REGS. TIT. 14 § 15252 (document used as substitute for an EIR shall include "[a]lternatives to the activity and mitigation measures to avoid or reduce any significant or potentially significant effects that the project might have on the environment" or statement that the project would not have any significant or potentially significant effects).

ARB's certified regulatory program requirements also demand that the Draft EA be prepared consistent with the goals and policies of CEQA. CAL. CODE REGS. TIT. 17 § 60005(b). The Draft EA must address and analyze "long or short term adverse and beneficial environmental impacts, feasible mitigation measures and feasible alternatives to the proposed action which would substantially reduce any significant adverse impact identified." *Id.* ARB

also cannot approve any action for which significant environmental impacts have been identified "if there are feasible mitigation measures or feasible alternatives available which would substantially reduce such adverse impact." CAL. CODE REGS. TIT. 17 § 60006. This is consistent with CEQA's edict that rules and regulations for a certified regulatory program must "[r]equire that an activity will not be approved or adopted as proposed if there are feasible alternatives or feasible mitigation measures available that would substantially lessen a significant adverse effect that the activity may have on the environment." CAL. PUB. RES. CODE § 21080.5(d)(2)(A).

As discussed in detail below, the Draft EA fails to adequately and meaningfully consider and evaluate significant environmental impacts from ARB's proposed adoption of the SLCP Strategy, including impacts to air quality and water quality as well as global greenhouse gas emissions impacts attributable to leakage. While the Draft EA professes to be "conservative" (Draft EA 1-1) by finding that significant or potentially significant impacts may arise in a number of areas, including air quality, it fails to provide fundamental information regarding the nature and extent of those impacts – information which is crucial to adequately inform the public and the Board of the environmental consequences of adopting the SLCP Strategy, as CEQA mandates. It is not enough for the EA to merely say that there may be impacts and those impacts may be significant. The EA must provide as much specific information about the nature and extent of those impacts as is reasonably available. The Draft EA also *utterly* fails to provide any framework or specific performance criteria for mitigating the significant impacts from the proposed adoption of the SLCP Strategy.

B. The Draft EA Fails to Comply with the Requirements for a Programmatic Environmental Analysis

In an effort to justify its lack of detailed analysis, the Draft EA improperly relies on the programmatic nature of the document. (*See e.g.*, Draft EA pp. 1-4 through 1-5) While a programmatic environmental analysis need not provide the level of detailed evaluation of environmental impacts required for a project level EIR, it must evaluate environmental impacts and potential feasible mitigation to the extent possible at this stage. *See Rio Vista Farm Bureaus Ctr. v. County of Solano*, 5 Cal.App.4th 351 (1992) (program EIR for hazardous waste management plan still discussed in general terms the environmental impacts and mitigation measures included in the plan). At a minimum, an EIR, including a program EIR, "must include detail sufficient to enable those who did not participate in its preparation to understand and to consider meaningfully the issues raised by the proposed project." *Id.* at 375, *citing Laurel Heights Improvement Ass'n v. Regents of Univ. of Cal.*, 47 Cal.3d 376, 405 (1988). The Draft EA fails to do so.

The Draft EA merely states that certain environmental impacts may or may not arise, without any serious evaluation or substantive discussion of those impacts. The Draft EA then asserts, without support or explanation, that any such significant impacts would be mitigated by

other agencies. The failure to identify and consider the feasibility and effectiveness of potential mitigation measures constitutes an impermissible deferral of mitigation under CEQA. *POET,* 218 Cal.App.4th at 735 (CEQA's requirement that an agency not defer the formulation of mitigation measures also applies to certified regulatory programs).

Moreover, the Draft EA is *so devoid of* substance that it fails to satisfy any of the purposes served by preparing a programmatic-level EIR. *See* CAL. CODE REGS. TIT. 14 § 15168. It cannot be relied upon to avoid future EIRs and does not simplify later environmental review because it fails to discuss in any substantive manner the significant environmental impacts from the adoption of the SLCP Strategy or the mitigation to address those impacts. It also does not adequately consider broad programmatic issues. As such, the Draft EA lacks the necessary elements to qualify as even a first-tier environmental review document and, therefore, cannot be used as a base document for subsequent environmental review.

Throughout the document, the Draft EA continually shirks any effort to describe the impacts from the SLCP Strategy by stating it is difficult to anticipate the compliance response. However, if the SLCP Strategy is implemented there will be a compliance response. Either dairy operators will comply with the SLCP Strategy and thus create air quality, water quality and other impacts or the dairy operators will shut down or relocate their businesses outside of California. In either case, there is a finite range of compliance responses, and the impacts from those responses can and should be estimated and assessed for purposes of informing ARB of the consequences of any decision to adopt the SLCP Strategy.

II. THE DRAFT EA LACKS AN ADEQUATE PROJECT DESCRIPTION

An accurate project description is an essential component to assessing whether a proposed project may have a significant effect on the environment. CAL. CODE REGS. TIT. 14 § 15124. "An accurate project description is necessary for an intelligent evaluation of the potential environmental effects of a proposed activity." *San Joaquin Raptor/Wildlife Rescue Ctr. v. County of Stanislaus*, 27 Cal.App.4th 713, 730 (1994)(citations omitted). The project description in the Draft EA is not finite and stable in violation of CEQA. *See County of Inyo* v. City of Los Angeles, 71 Cal.App.3d 185, 197 (1977).

The project description fails to describe how ARB intends to implement the SLCP Strategy. For example, will ARB use the SLCP Strategy as a framework for the development of new regulations? If yes, under what authority will ARB adopt the regulations? If ARB does not intend to adopt new regulations, how will ARB mandate the implementation of the SLCP Strategy? The Draft EA should be revised to describe the full scope of the project and how it will be implemented.

III. THE DRAFT EA FAILS TO PROPERLY DESCRIBE THE ENVIRONMENTAL SETTING AND THE REGULATORY SETTING AND USES AN IMPROPER BASELINE

Consideration of the existing physical environmental conditions is essential to assess the significant impacts that may result from ARB's adoption of the SLCP Strategy. The environmental and regulatory setting for Air Quality and Water Quality as presented in the Draft EA fails to describe the physical environmental conditions and how ARB's adoption of the SLCP Strategy may impact these conditions. CODE REGS. TIT. 14 § 15125(a). As set forth in CEQA Guidelines Section 15125(a):

> "An EIR must include a description of the physical environmental conditions in the vicinity of the project, as they exist at the time …the environmental assessment is commenced, from both a local and regional perspective. This environmental setting will normally constitute the baseline physical conditions by which a Lead Agency determines whether an impact is significant."

The Draft EA does not satisfy this requirement. Without an adequate baseline description, "analysis of impacts, mitigation measures and project alternatives becomes impossible." *County of Amador v. El Dorado County Water Agency*, 76 Cal.App.4th 931, 953 (1999); *see also* CAL. CODE REGS. TIT. 14 §§ 15125(a) & 15126.2(a). An EIR's assessment of a project's environmental impacts should examine changes to existing physical conditions expected to result from the project. CAL. CODE REGS. TIT. 14 §§ 15125(a) & 15126.2(a). The Draft EA fails to properly identify and describe the baseline for air quality and water quality and fails to consider the existing physical conditions. (Draft EA, Appendix A)

The environmental and regulatory setting for Air Quality is only described in very broad terms. The Draft EA fails entirely to discuss the environmental setting with respect to ambient air quality. The Draft EA must address current air quality conditions in the air basins in which dairies operate, particularly the San Joaquin Valley air basin where the vast majority of dairies operate. The San Joaquin Valley is often described as having the worst air quality in the nation. It is designated an extreme ozone nonattainment area for the U.S. EPA 8-hour ozone standard and is nonattainment for PM 10. (*See* Discussion in Technical Assessment of the Short-Lived Climate Pollutant Strategy submitted by Ramboll Environ, p. 3 (the "Ramboll Report"), which is attached as an appendix and incorporated by this reference.)

The Draft EA also fails entirely to discuss the regulatory setting at the local or regional level. Since the Draft EA relies on the local agencies to implement adequate mitigation through their permitting authority, a careful examination of the local and regional regulatory setting is critical. This is particularly true in the San Joaquin Valley Air Pollution Control District (the

"SJVAPCD"). The regulatory setting should describe the attainment status for ambient air quality and the attainment plans as adopted under the State Implementation Plan.

It is important for ARB, and the public, to understand the direct conflict between the SLCP Strategy and the SJVAPCD plans to meet U.S. EPA ambient air quality standards. *See e.g.*, the SJVAPCD 2007 Ozone Plan dated April 30, 2007.[1] Under Assembly Bill ("AB") 32, strategies cannot be implemented that interfere with the efforts to reach attainment. CAL. HEALTH & SAFETY CODE § 38562(b)(4). We cannot risk making the air quality in the San Joaquin Valley air basin worse in exchange for marginal benefits from methane reduction. Rules and permitting requirements applicable to dairies for the SJVAPCD, and other relevant districts, should also be discussed.

The Draft EA's environmental and regulatory setting for Water Quality is also general and lacks any specific meaningful information. Importantly, many areas of the San Joaquin Valley are underlain by groundwater that suffers from significant nitrate contamination. (*See e.g.*, the Central Valley RWQCB's materials for the "Central Valley Salinity Alternatives for Long-Term Sustainability.")[2] The Draft EA should discuss such contamination and its impacts on local communities. The SLCP Strategy, if implemented, may also contribute to an increase in such contamination.

The regulatory setting should also describe the relevant rules, requirements and orders that dairy operators must comply with in managing their nutrient load, such as the Central Valley Regional Water Quality Control Board's (the "Central Valley RWQCB") General Order for Waste Discharge Requirements applicable to dairies[3] and to manure digesters.[4] ARB and the public must have the opportunity to understand how the SLCP Strategy, if implemented, may interfere with the carefully crafted plans of the Central Valley RWQCB and dairy operators to protect groundwater supplies. Without fully understanding the setting, ARB cannot understand

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[1] The SJVAPCD 2007 Ozone Plan is available at http://www.valleyair.org/air_quality_plans/docs/AQ_Ozone_2007_Adopted/2007_8HourOzone_CompletePlan.pdf which is incorporated herein by reference. Other ozone plans adopted by the District can be found at http://www.valleyair.org/Air_Quality_Plans/Ozone_Plans.htm and are incorporated by reference. The Draft EA should also consider the SJVAPCD's PM plans which can be found here: http://www.valleyair.org/Air_Quality_Plans/PM_Plans.htm and are incorporated by reference.

[2] The Central Valley RWQCB's materials for the "Central Valley Salinity Alternatives for Long-Term Sustainability" are available at http://www.waterboards.ca.gov/centralvalley/water_issues/salinity/ and are incorporated by this reference.

[3] The Central Valley RWQCB's General Order for Waste Discharge Requirements applicable to dairies is available at http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2010-0118_rev.pdf which is incorporated by reference.

[4] The Central Valley RWQCB's General Order for Waste Discharge Requirements applicable to manure digesters is available at http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2010-0130_wdr_go.pdf which is incorporated by reference.

how its actions will impact groundwater quality and supplies and may interfere with the Central Valley RWQCB's efforts.

IV. THE DRAFT EA LACKS AN ADEQUATE CONSIDERATION AND ANALYSIS OF SIGNIFICANT ENVIRONMENTAL IMPACTS TO AIR QUALITY AND WATER QUALITY AND GREENHOUSE GAS EMISSIONS ATTRIBUTABLE TO LEAKAGE

"The fundamental purpose of an EIR is 'to provide public agencies and the public in general with detailed information about the effect which a proposed project is likely to have on the environment.'" *Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova,* 40 Cal.4th 412, 428 (citations omitted). As discussed below, the Draft EA fails to satisfy this purpose in the impact analyses and discussion of leakage, air quality and water quality.

A. Greenhouse Gas Emissions and Leakage

The Draft EA fails to fully acknowledge the potential for leakage and to evaluate the extent of the environmental impacts attributable to leakage. The SLCP Strategy, if implemented to regulate and control dairy emissions, would require a dramatic transformation of dairy operations statewide, including the replacement of lagoon flush systems with dry manure practices, the widespread development and use of anaerobic digesters and, in some instances, the conversion to pastures. The adoption of such costly measures will have a significant economic impact on dairy operators, as discussed in Appendix D of the Draft EA, and is unlikely to be economically feasible.[5] Dairy Cares is in the process of conducting an economic study of leakage of dairies from California to other states, which analyzes the potential additional economic impacts of increased costs for GHG reduction measures on dairies; the study is expected to be completed this summer and will be provided to ARB on completion.

Dairy operators as a whole in California are already operating on thin margins, and rising operating costs are continuing to eat into those profits. Adding the expense of costly control measures to existing, economically tenuous, operations will likely have a significant economic impact such that profits may all but disappear. The Draft EA needs to consider these impacts under CEQA. Physical changes causing social or economic effects may constitute significant effects on the environment. *See* CAL. CODE REGS. TIT. 14 § 15131; *Christward Ministry v. Superior Court*, 184 Cal.App.3d 180, 197 (1986). The Draft EA concludes, without support, that there will not be any foreseeable job losses or population displacement as a result. (Draft EA, p. 4-115)

[5] Personal communications with Neil Black, California Bioenergy, April and May 2016; personal communications with Annie AcMoody, Western United Dairymen, May 2016.

Without the prospect of a reasonable return, dairies will be far less likely to invest in expansion or modernization of their operations even before any control measures must be implemented. Rather than expend the significant sums to implement control measures, dairies may wind down or relocate out-of-state. We will likely not see many new dairies enter the market. Whether through attrition or relocation, the number of milk-producing cows in California will decrease only to have milk production in other states or countries take its place. Ironically, this may result in an *increase* in global methane emissions. Whatever incentives there may be in California to voluntarily reduce methane emissions, there may be comparatively little or no incentive to do so outside of California. The Draft EA must consider these potential impacts. "If the forecasted economic or social effects of a proposed project directly or indirectly will lead to adverse physical changes in the environment, then CEQA requires disclosure and analysis of these resulting physical impacts." *Bakersfield Citizens for Local Control v. City of Bakersfield*, 124 Cal.App.4th 1184, 1205 (2004). The Draft EA must also consider that the potential implementation of the SLCP Strategy to reduce methane emissions may defeat its very purpose and run afoul of AB 32's requirement to avoid leakage. CAL. HEALTH & SAFETY CODE § 38562(b)(8).

Ending the availability of offsets once regulations are put in place is likely to drastically limit those willing to invest in voluntary projects even while offsets remain available. The additionality "legal requirement" test of the Livestock Protocol is whether at the time of operational "commencement" there is a legal requirement to reduce methane emissions. (Draft EA, p. 2-10) (See also Chapters 3.4-3.6 of Compliance Offset Protocol Livestock Projects, 2014). If a voluntary project is started and not completed before regulations become effective, the expected voluntary offsets will not be available. If the SLCP Strategy is adopted, those who would otherwise consider investing in voluntary offset projects – a process which can take years to plan, finance, design and permit – are less likely to do so because of (1) the uncertainty as to whether their anaerobic digester system would be operational by the time regulations became effective and (2) the diminished value of LCFS credits that will occur once such regulations become effective. While awaiting the implementation of regulations, there is a risk no new voluntary projects are likely to be constructed, thus losing a valuable opportunity to reduce methane emissions during that time which the Draft EA must evaluate. The SLCP Strategy suggests that offsets will also no longer be available outside of California. (Draft EA, p. 2-10) Thus, it is possible that the opportunity for reductions in methane emissions outside of California will be reduced as well.

B. Air Quality

1. The Draft EA Fails to Adequately Consider the Potential for Significant Impacts to Air Quality as a Result of Converting Dairy Manure Management Systems

The Draft EA recognizes the potential for significant impacts to air quality as a result of converting existing flush manure management systems to dry manure management or the use of digesters. (Draft EA, p. 4-28) However, the Draft EA provides little information other than to state that VOC, NOx, PM 10 and ammonia emissions may increase or they may decrease. (*Id.*) The Draft EA does not have any idea what the impacts would be if ARB adopts the SLCP Strategy:

> "In sum, the operation of digesters and dry manure management practices at dairies *could decrease or increase criteria air pollutant emissions* depending on the quantity and type of digester technologies installed and the end use of captured biogas."

(Draft EA, p. 4-30)(emphasis added).

There is simply no analysis of the likelihood and potential severity of such air quality impacts. This uncertainty means that neither ARB nor the public have any meaningful information upon which to assess the potential impacts of ARB's adoption of the SLCP Strategy. ARB can and should do better. The Draft EA needs to identify the variables that may cause an increase in air pollutants, quantifying the potential adverse emissions and describing the potential mitigation measures that could be used to avoid or lessen the degradation in air quality. The suggestion above that an increase is merely dependent on the "type of digester technology" or the "end use of captured gas" is far too simplistic and, in any event, is not supported by any meaningful discussion, giving ARB and the public a false sense that air quality impacts can be avoided by available, feasible digester technology and by dictating the end use of captured biogas. There is far more to it than that. Indeed, some of the potential strategies may not even require digesters. Moreover, simply stating that local permitting agencies will implement appropriate mitigation is insufficient for, among other reasons, there is absolutely no assurance that any such mitigation can be feasibly implemented.

2. The Draft EA Fails to Adequately Evaluate Whether a Scrape Manure System Will Cause Different and Greater VOC Emissions than a Flush/Lagoon System

The Draft EA acknowledges that converting dairies from a system where cattle manure is flushed with water to storage ("flush" dairies) to systems where manure is scraped and collected for storage in tanks or drying areas ("scrape" dairies) will cause emissions of volatile organic

compounds ("VOCs"). (Draft EA, p. 4-28) It also states that dairies using flush systems create VOCs. It does not, however, evaluate whether a scrape system will create greater VOC emissions or different kinds of VOCs than a flush system. Flush systems are intended to cause the anaerobic biodegradation of the manure, which generally results in greater methane emissions. Scrape systems may rely on aerobic degradation, which may result in greater VOC emissions. If ARB is trading more VOC emissions for less methane emissions, that is a significant environmental impact which must be addressed at the outset of the SLCP Strategy planning process. Moreover, if those additional VOC emissions interfere with the attainment of air quality standards in the San Joaquin Valley, then the SLCP Strategy violates AB 32 and cannot be implemented under AB 32. AB 32 states that all activities to meet the state's goals must "complement" and "not interfere with, efforts to achieve and maintain federal and state ambient air quality standards." CAL. HEALTH & SAFETY CODE § 38562(b)(4).

The studies utilized by the SJVAPCD to estimate emissions for flush dairies already hint at the possibility of increased VOC emissions from dry manure management. *See e.g.*, San Joaquin Valley Air Pollution Control District, Air Pollution Control Officer's Revision of the Dairy VOC Emission Factors dated February 2012.[6] The SJVAPCD used those studies to develop emission factors for flush dairies. Those emission factors reflect significant VOC emissions from manure in the freestall barns during the relatively short time before the manure is flushed. *See Id.* at p. 4. Moreover, even higher VOC emissions originate from the corrals and pens. *Id.* This suggests that the longer the manure remains out of the flush system (i.e. out of water), the more VOCs it may emit. Plainly not only should more studies be conducted, but this information is vital in order to properly evaluate the SLCP Strategy under CEQA. The additional studies should examine the scraping action, the scraped lanes themselves and the changes in volume, moisture content and storage method, and other changes to the manure, to understand and estimate the potential increase in VOC emissions from a dry system. ARB must also examine the potential emission of ammonia and PM10 in a scrape system versus a flush system.

3. The Draft EA Makes Unsubstantiated Assumptions Regarding the Ability of Dairy Operations to Manage Dry Manure Onsite

The Draft EA presumes that typical dairy operations can manage scraped manure onsite. (Draft EA, p. 4-29) This may not be the case. In a flush system, liquid manure can be applied to the dairy operator's feed crops, such as corn, as needed pursuant to a nutrient management plan during the growing season. However, the use of dry manure on crops has significant challenges which the Draft EA fails to recognize (see discussion below in Section IV(c)). Moreover, to the

[6] The San Joaquin Valley Air Pollution Control District, Air Pollution Control Officer's Revision of the Dairy VOC Emission Factors dated February 2012 is available at https://www.valleyair.org/busind/pto/emission_factors/2012-Final-Dairy-EE-Report/FinalDairyEFReport(2-23-12).pdf and incorporated by reference.

extent the manure cannot be used by the dairy operator, the Draft EA must assess the impacts from using, treating or disposing of the manure off-site.

Many agricultural operators are prohibited by law from applying raw manure to crops destined for human consumption. Even if manure is first composted, a process that triggers significant regulatory requirements and costs, it is unknown whether sufficient demand exists from non-dairy agricultural operators to utilize such compost. While the Draft EA suggests that an onsite or centralized digester could take manure, such a digester would also add emissions (as discussed below). The use of a manure scraping system raises further questions that the Draft EA fails to answer. Will new massive composting facilities be needed for manure? What is the potential for PM10, VOC and ammonia emissions from those facilities? What is the impact to air quality from the thousands of truck trips that will be required to move the dry manure? Likewise, to the extent that eliminating flush systems deprives the dairy operator of sufficient nutrients for the operator's crops, the operator will need to have synthetic fertilizer delivered, which will further increase truck trips.

4. The Draft EA Fails to Discuss How the Increase in Emissions from the Equipment Associated with a Digester System Will Impact Air Quality

The Draft EA recognizes that equipment associated with a digester system will cause NOx, SOx and VOC emissions. (Draft EA, p. 4-29) However, there is no discussion of how those emissions will impact air quality, especially in the San Joaquin Valley air basin. The Draft EA blithely states that local permitting agencies will ensure that "an air basin does not go out of attainment for ambient air quality standards." (*Id.*) This statement alone reflects how out of touch the Draft EA is with the real world potential impacts of the SLCP Strategy. By far, most of the state's dairy cows are located in the San Joaquin Valley air basin which is already out of attainment and is, in fact, in extreme non-attainment for ozone. Significant reductions in NOx emissions are critical to the SVJAPCD's ozone attainment plans (*See, e.g.* 2007 8 Hour Ozone Attainment Plan, Chapter 3). The addition of NOx, in particular, from potentially hundreds of digesters will in all likelihood interfere with the SJVAPCD's attainment plans. The Draft EA's failure to explain how the SJVAPCD will permit NOx-emitting digesters and avoid any significant new NOx emissions while maintaining consistency with a potential digester requirement, does not meet the requirements of CEQA nor ARB's certified regulatory program. *See e.g.*, CAL. CODE REGS. TIT. 14 § 15250; *see also POET,* 218 Cal.App.4th at 710-711; *Ebbetts Pass Forest Watch*, 43 Cal.4th at 943; CAL. CODE REGS. TIT. 17 §§ 60005(b), 60006. If digester technology is reasonably available that will not interfere with SJVAPCD's ozone attainment plans, then the Draft EA should identify it and its related costs.

5. The Draft EA Fails to Provide any Support For its Assertion that the Use of Digesters Will Result in the Generation of Renewable Natural Gas Which Will Offset the Emissions from Digester-Related Equipment

The Draft EA postulates that the use of digesters will result in the generation of renewable natural gas, the use of which would replace fossil fuels and result in fewer NOx and other emissions. (Draft EA, pp. 4-28 through 4-29) The Draft EA also suggests that these reductions may offset the increase in NOx emissions from digesters. (Draft EA, p. 4-29) This is a quantum conclusory leap. The Draft EA should support this assertion, if possible, by including a careful evaluation of the feasibility of generating renewable natural gas that can be used in farm equipment and vehicles and quantifying the relative changes in NOx emissions.

6. The Draft EA Fails to Address the Potential for Increase in Methane Emissions from a Pasture-Based System

The Draft EA assumes that the conversion of existing flush dairies to pasture-based operations would result in reduced methane emissions. However, this disregards the fact that pasture systems may limit the ability to manage feed in a manner that would reduce enteric emissions. (Ramboll Report, p. 3) Depending on the farm and the forage available, a pasture-based system could result in greater methane emissions (per unit of milk produced) than a flush-based system. The Draft EA must address the potential that converting confined animal operations to pasture-based systems could actually increase methane emissions produced per gallon of milk. The Draft EA should also address the potential for a policy encouraging such conversions to adversely impact water and available land resources by reducing the amount of milk produced per acre and per unit of irrigation water used.

7. The Draft EA Fails to Adequately Assess Short-Term Impacts from Construction

The Draft EA fails to provide a meaningful assessment of the air quality impacts of emissions from construction of digesters and conversion of flush systems to dry systems. While it may not be possible to precisely estimate the compliance response, reasonable ranges can be estimated and the impacts calculated. The EA must also anticipate and estimate the impacts from construction occurring at hundreds of dairies, some in close proximity to each other, over short concentrated time periods that will be dictated by regulatory compliance deadlines. The short-term impacts may result in significant aggregate and cumulative ambient air quality impacts, toxic air contaminant impacts and localized impacts, particularly in the San Joaquin Valley.

C. Water Quality

The Draft EA also fails to adequately evaluate the impacts to groundwater quality caused by dry manure management. As discussed in detail in the Comments on Proposed Short-Lived Climate Pollutant Reduction Strategy submitted by Luhdorff & Scalmanini Consulting Engineers, which is attached as an appendix incorporated by this reference, the SLCP Strategy and Draft EA erroneously assume that the conversion from flush dairies to solid-scrape dairies will benefit groundwater quality. However, the flush dairy system's liquid manure is a critical component of nutrient application at contemporary dairy farms, allowing liquid manure to be applied during the growing season when needed by the crops. Flush dairies field-apply the majority or at least a large proportion of manure nutrients in liquid form.

If dairies are required to employ dry manure management at least two adverse impacts will result: (1) dairy operators will be required to purchase synthetic fertilizer as a substitute for the manure that can no longer be used onsite and (2) dairy operators will have to secure a reliable mechanism for the export of vastly increased amounts of solid manure. Both of these issues will result in increased logistical, financial and energy implications. The Draft EA fails to analyze the related significant impacts that may result from requiring a dry manure management system.

V. THE DRAFT EA LACKS ADEQUATE CONSIDERATION AND ANALYSIS OF FEASIBLE MEASURES TO ADDRESS THE SIGNIFICANT ENVIRONMENTAL IMPACTS FROM ADOPTION OF THE SLCP STRATEGY

An EIR must propose and describe mitigation measures to minimize significant environmental impacts identified in the EIR. CAL. PUB. RES. CODE §§ 21002.1(a), 21100(b)(3); CAL. CODE REGS. TIT. 14 § 15126.4. As discussed above, the Draft EA fails to provide any meaningful discussion of mitigation measures to address the significant impacts from the adoption of the SLCP Strategy including, without limitation, mitigation to address impacts to air quality and water quality.

Moreover, the Draft EA does not even provide any affirmative assurances that ARB will mitigate the significant impacts from its adoption of the SLCP Strategy. For example, with respect to long-term operational air quality impacts from the methane reduction measures, the Draft EA merely states that "it is expected that at the specific measure development stage, ARB will design and implement measures identified in this Proposed Strategy in ways that protect and enhance air quality, while avoiding other negative environmental effects to the greatest degree feasible." (Draft EA, p. 4-32) This statement fails to demonstrate that, in fact, the SLCP Strategy can be feasibly implemented in ways that will mitigate the significant impacts identified, or which should be identified, in the Draft EA. Additionally, the Draft EA states that ARB has no authority to require "project-level mitigation" and, therefore, the programmatic level of analysis associated with this EA cannot and does not attempt to address project-specific details of mitigation. (*Id.*) At a minimum, however, ARB can and should set forth a framework

and performance criteria for addressing these project-level impacts. Without such an analysis, ARB has no means of evaluating the extent to which its decisions will result in project-level, regional and statewide impacts.

While on a programmatic level an agency can defer setting forth specific mitigation measures, it still should make a "firm commitment" to mitigate such future impacts and "commit itself to eventually devising measures that will satisfy specific performance criteria articulated at the time of project approval." *Rio Vista Farm Bureaus Ctr. v. County of Solano*, 5 Cal.App.4th 351, 377 (1992); *see also Center for Biological Diversity v. Dep't of Fish and Wildlife*, 234 Cal.App.4th 214, 241-42 (2015) (program EIR that deferred mitigation measures, should still articulate a specific performance criteria and make further project approvals contingent on finding a way to meet them). The Draft EA fails to satisfy this requirement. Moreover, even if ARB commits to a performance criterion – such as no impacts to ambient air quality – without assessing whether and how such performance criteria can be feasibly met, ARB cannot assess whether the SLCP Strategy, as opposed to other alternatives, is a reasonable strategy to pursue.

VI. THE DRAFT EA FAILS TO CONSIDER A REASONABLE RANGE OF ALTERNATIVES

An EIR must describe a reasonable range of feasible alternatives that can avoid or lessen the project's significant environmental effects. CAL. PUB. RES. CODE §§ 21002.1(a), 21100(b)(4). The California Supreme Court has described the discussion of mitigation measures and alternatives as the "core of an EIR." *Citizens of Goleta Valley v. Bd. of Supervisors*, 52 Cal.3d 553, 564 (1990).

Due to the deficiencies in the environmental analysis of the Draft EA, the Draft EA deprives ARB of critical information needed in order to identify the environmentally superior alternative. ARB will lack the essential relevant and accurate assessment to properly weigh the significant impacts from implementation of the SLCP Strategy against the environmental benefits of reducing methane emissions. If it did, it would be compelled to look at alternatives other than those presented. With respect to dairies, for example, the Draft EA fails to present an alternative strategy focused entirely on voluntary reductions and incentives. Instead, incentivized voluntary reductions are merely proposed as a temporary measure while ARB attempts to implement a regulatory program that will fundamentally and adversely change the way dairies operate and will ultimately deprive dairies of the availability of incentives in the future. The likely ultimate result will be to shift production outside of California (i.e. leakage), accompanied by the commensurate increases in greenhouse gas emissions.

VII. THE DRAFT EA DOES NOT PROVIDE A GOOD FAITH, REASONED ANALYSIS AS TO WHETHER UNMITIGATED IMPACTS COULD BE MITIGATED OR AVOIDED THROUGH MITIGATION AND/OR THE ADOPTION OF AN ALTERNATIVE

As discussed above, the Draft EA fails to adequately consider mitigation measures to address the significant environmental impacts that will result if ARB adopts the SLCP Strategy and fails to consider a reasonable range of alternatives. Instead, the Draft EA repeatedly states in a boilerplate fashion that any identified impacts "would be potentially significant and unavoidable." *See e.g.*, Draft EA, p. 4-27 and Attachment B (summary of "potentially significant and unavoidable" impacts.). These conclusory statements lack the underlying good faith and reasoned analysis required by CEQA and improperly deprives the Board and the public of the opportunity to assess the legitimacy of those conclusions.

Thank you for your careful consideration.

Sincerely yours,

David E. Cranston

DEC/ts

cc: Dairy Cares
Michael Boccadoro
J.P. Cativiela

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

GROUNDWATER RESOURCES
HYDROLOGY · DEVELOPMENT · MANAGEMENT

May 25, 2016 *Electronic Submittal*

Chair Mary D. Nichols
California Air Resources Board

SUBJECT: COMMENTS ON PROPOSED SHORT-LIVED CLIMATE POLLUTANT REDUCTION STRATEGY (SLCP STRATEGY)

Dear Chair Nichols:

Section V.B.1 (p. 65) of the *Proposed Short-Lived Climate Pollutant Reduction Strategy* proposes the conversion of flush dairies to solid-scrape dairies as a means to reduce methane emissions. The rationale set forth to support such conversion implies that it would improve groundwater quality protection. It also highlights the conversion as a means to facilitate increased nutrient export off the farm as a benefit to nutrient management on dairies. We submit that both of these notions are speculative and that practical consequences to on-farm nutrient management were not considered.

Matching Manure Applications with Plant Nitrogen Demand

Nearly every dairy in the Central Valley grows corn in the summer for forage; for this reason, corn was chosen to illustrate the concept of plant nitrogen uptake and how this relates to the proposed conversion. Corn (like other plants) takes up nitrogen (N) through its root system to support its growth. The rate of N uptake varies greatly throughout the growing season (**Figure 1**). Specifically, N uptake is very small in the beginning when the plant is small and changes nonlinearly throughout the growing season (i.e., approximately four months). As shown, large proportions of N are taken up during relatively short time periods.

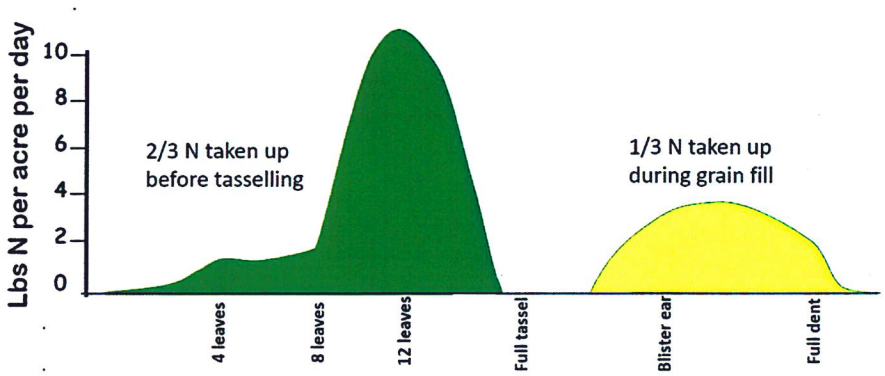

Figure 1: Corn N uptake throughout the growing season in relation to major growth stages (created with data from Karlen, D.L., R.L. Flannery, and E.J. Sadler. 1988. *Aerial Accumulation and Partitioning of Nutrients by Corn.* Agron. J. 80:232–242).

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Applying N to the plant when it needs it is one of the "4Rs of nutrient stewardship" in agriculture (i.e., right source, right rate, right time, right place) which is supported globally and born of the International Plant Nutrition Institute (IPNI). The 4Rs provide the conceptual basis for best management practices (BMPs) to achieve cropping system goals: minimizing field nutrient loss and maximizing crop uptake to attain optimum yield and quality. This can be done with manure in liquid form, as generated on flush dairies. Specifically, dairymen inject liquid manure into the irrigation water to apply small, targeted amounts of N to match crop demand throughout the season. This practice is sometimes referred to as "spoon feeding," and it is similar to the widespread practice of injecting liquid synthetic fertilizers (e.g., anhydrous ammonia) into the irrigation water stream on farms that do not have access to organic fertilizer sources. This N delivery strategy cannot be done with solid manure (dry or slurry) or composts because these materials are broadcasted with spreader trucks and the window of opportunity for broadcasting is between crop rotations (i.e., typically pre-plant). Solid manure applications are valuable to the overall soil and plant health. However, they need to be carried out in moderation (i.e., at the right rate) due to the small plant N demand following the weeks after application. Over-application has the potential to induce leaching losses associated with irrigation events when the crop root system is in its early stages, while not supplying sufficient N when crop N demand sharply increases at the 8-leaves stage.

In conclusion, the proposed conversion removes dairy operators' ability to locally recycle manure nutrients by fertilizing their forage crops at the right rate throughout the crop growing season. It assumes that this will improve groundwater quality protection with neither consideration of alternative modes of N delivery and their effect on groundwater quality nor consideration of practical consequences to on-farm nutrient management

Consequences to On-Farm Nitrogen Management

Flush dairies field-apply the majority or at least a large proportion of manure nutrients in the liquid form. Removal of this mode of N delivery creates at least two problems that have logistical, financial, and energy implications:

1. Dairy operators will have to buy synthetic fertilizer to make up for the manure (which is a no-cost byproduct of dairy operations) that can no longer be used on site. The manufacturing of synthetic N fertilizer is an energy intensive process that largely relies on the combustion of fossil fuels and, thus, contributes to greenhouse gas (GHG) emissions. Additional GHG emissions would be associated with the hauling of synthetic fertilizer (and presumably an increased mass of solid manure products) greater distances.

2. Faced with vastly increased (millions of tons annually) of dry manure that no longer can be used agronomically on their own farms, dairy operators will be forced to export solid manure. While local markets and opportunities exist in some areas, these often consist of individual relationships between dairy operators and their neighbors because hauling costs for a low-value product such as manure are a factor that severely limits economically feasible hauling distances. Dry manure that cannot be economically

transported to users who are able to store it safely and use it agronomically may pose a potential threat to water quality. As a result, it is unclear if the large-scale conversion of flush dairies to scrape dairies being proposed by the Air Resources Board (ARB) is practically feasible and in the best interests of water and air quality protection. The capacity of the market to accept manure exports is unknown, and even if additional capacity exists, it is likely movements of manure at the scale envisioned by ARB would have to be planned and coordinated on a regional or even broader scale.

In summary, we hope that the ARB will fully consider the potential impacts of its proposed strategy. A plan that relies heavily on scraping and drying manure for export, without recognizing the very real, practical considerations such as market demand, economic and environmental costs related to transportation of manure, and increased chemical fertilizer use on dairies could easily result in policies that create unacceptable environmental and economic risks for dairy farms and water and air quality.

Sincerely,

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RAMBOLL ENVIRON

ENVIRONMENT & HEALTH

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TECHNICAL ASSESSMENT OF THE SHORT-LIVED CLIMATE POLLUTANT STRATEGY

Dear Mr. Cativiela:

Ramboll Environ has reviewed the Short-Lived Climate Pollutant Strategy (SLCP Strategy). The results of our technical review are presented below.

Date May 26, 2016

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SHORT-LIVED CLIMATE POLLUTANT STRATEGY

The California Air Resources Board (ARB) released the Short-Lived Climate Pollutant Strategy (SLCP Strategy) in April 2016. This document identifies the SLCPs of concern, namely black carbon, methane, and hydrofluorocarbons (HFCs), and proposes a strategy to reduce these emissions in order to achieve statewide climate goals. Our review focuses on the actions proposed to reduce dairy methane emissions.

The SLCP Strategy focuses on the dairy sector as a vehicle to reducing methane emissions, with a goal of reducing methane emissions from manure management by 75 percent by 2030 and from enteric fermentation by 25 percent by 2030. The proposed actions for manure management include:

- Scrape conversion and onsite manure digestion producing pipeline-injected renewable natural gas vehicle fuel.
- Scrape conversion and transport of manure offsite for centralized digestion producing pipeline injected renewable natural gas as a vehicle fuel.
- Scrape conversion, collection and open solar drying of manure onsite.
- Scrape conversion and onsite manure digestion for onsite production of renewable electricity.
- Conversion of dairy operations to pasture-based management.

For reducing methane emissions from enteric fermentation, the SLCP Strategy notes recent research on feed supplements that may reduce emissions without affecting milk production, and states that ARB will continue to evaluate research on this area.

Greenhouse Gases Impacts

Metrics

We first want to clarify the units used in the SLCP Strategy as well as other carbon footprint assessments. Total emissions of greenhouse gases (GHGs) are a frequent metric used for comparison, however total emissions often are not the best metric for comparison. In the dairy sector, at least two alternative metrics are available: emissions per head and emissions per unit of milk produced. We believe that the second metric is a more useful metric as it accounts for the demand for a product: milk. Decreasing GHG emissions per cow is not helpful if the milk production also decreases, necessitating the need for additional cows in order to meet the public's demand. However, increasing milk production while maintaining, or even reducing, GHG emissions results in a lower GHG intensity. Thus, we encourage the use of the second metric – GHG emissions per unit of milk produced – when discussing potential reduction measures and comparing management options.

California's GHG Intensity

The SLCP Strategy notes that California's methane emissions from manure management are higher than the U.S. average, and that methane emissions from enteric fermentation are relatively low per gallon of milk. It further states that "if dairy farms in California were to manage manure in a way to further reduce methane emissions, a gallon of California milk might be the least GHG intensive in the world."[1] We note that U.S. dairies have historically improved in this area, reducing the GHG intensity, or methane emissions per unit milk production, over time. California dairies have been shown to have lower GHG intensities compared to the U.S. average.[2] The number of milking cows in California has shown little variation in the past 10 years, increasing by only 1% while milk production has increased by almost 13%.[3,4] We want to recognize the progress that California dairies have made and suggest that continued improvements be encouraged rather than inadvertently offset due to legislative requirements.

Emissions from Farm

The SLCP suggests that converting dairies to pasture-based systems will reduce methane. Based on the current research available, we believe a more nuanced approach is needed.

Research, as well as basic chemistry, has demonstrated that manure managed aerobically (e.g., solid storage, pasture-based systems) emits less methane than manure managed anaerobically.[5] However, data

[1] ARB. 2016. Proposed Short-Lived Climate Pollutant Reduction Strategy. April 2016. Page 65. Available at: http://www.arb.ca.gov/cc/shortlived/meetings/04112016/proposedstrategy.pdf. Accessed May 2016.

[2] See Attachment A.

[3] California's annual average milking cow inventory = 1,780,000 head in 2014 and 1,755,000 head in 2005. California's milk production = 42,337 million pounds in 2014 and 37,564 million pounds in 2005. (CDFA 2015 Report).

[4] California Department of Food and Agriculture (CDFA). 2016. California Agricultural Statistics Review, 2014-2015. Available at: https://www.cdfa.ca.gov/Statistics/PDFs/2015Report.pdf. Accessed May 2016.

[5] Montes, F., R. Meinen, C. Dell, A. Rotz, A.N. Hristov, J. Oh, G. Waghorn, P.J. Gerber, B. Henderson, H.P.S. Makkar, and J. Dijkstra. 2014. Mitigation of methane and nitrous oxide emissions from animal operations: II. A review of manure management mitigation options. J. Anim. Sci. 2013.91:5070-5094.

has documented that dairy cows fed a high quality total mixed ration (TMR) emit less methane per unit of milk produced than cows fed lower quality grass feed.[6]

Directly measuring a whole farm's GHG emissions is a difficult, if not impossible, task. As such, modeling is a useful tool to assess the GHG emissions of different farming systems. Multiple modeling studies have compared pasture-based systems to dairies with cows fed TMR and with liquid manure storage systems.[7],[8] The results suggest that GHG emissions of farming systems vary widely, and that one system does not consistently result in fewer emissions per unit of milk produced. In addition, as the SLCP Strategy notes, pasture-based systems may be "challenging to implement at many existing, larger dairies in the Central Valley."[9]

As such, a strategy that encourages and/or requires conversion to a pasture-based system may result in greater methane emissions depending on the farm. In addition, California's milking cows are currently fed high efficiency rations, meaning that, as noted in the SLCP Strategy, "California dairy cows produce low enteric fermentation emissions per gallon of milk".[10] Converting to other rations may reduce the milk production feed efficiency. Either of these scenarios would be counterproductive to ARB's goal of reducing statewide methane emissions.

Criteria Pollutants Impacts

Assembly Bill 32 (AB 32) states that all activities to meet the state's goals must "complement, and do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards".[11] Thus it is imperative to recognize how the regional attainment status will be impacted by actions proposed in the SLCP Strategy. The San Joaquin Valley (SJV) has the vast majority of milking cows in California. The SJV is currently in extreme nonattainment for ozone and nonattainment for PM.[12]

The SLCP Strategy notes that dry or scrape-based manure management systems reduce methane emissions compared to lagoons, but could lead to increased emissions of particulate matter (PM), nitrous oxide (NO_x), and volatile organic compounds (VOCs), among other pollutants.[13] In addition, as noted in the preceding

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[6] Knapp, J.R., G.L Laur, P.A. Vadas, W.P. Weiss, and J.M. Tricarico. 2014. *Invited Review*: Enteric methane in dairy cattle production: Quantifying the opportunities and impact of reducing emissions. Journal of Dairy Science. 97(6): 3231-3261.

[7] Belflower, J.B., J.K. Bernard, D.K.Gattie, D.W. Hancock, L.M. Risse, and C.A. Rotz. 2012. A case study of the potential environmental impacts of different dairy production systems in Georgia. Agricultural Systems. 108(2012):84-93.

[8] Zehetmeier, M., J. Baudracco, H. Hoffman, and A. Haibenhuber. 2012. Does increasing milk yield per cow reduce greenhouse gas emissions? A system approach? Animal. 2012 Jan 6(1): 154-66.

[9] ARB. 2016. Proposed Short-Lived Climate Pollutant Reduction Strategy. April 2016. Page 66. Available at: http://www.arb.ca.gov/cc/shortlived/meetings/04112016/proposedstrategy.pdf. Accessed May 2016.

[10] ARB. 2016. Proposed Short-Lived Climate Pollutant Reduction Strategy. April 2016. Page 65. Available at: http://www.arb.ca.gov/cc/shortlived/meetings/04112016/proposedstrategy.pdf. Accessed May 2016.

[11] AB 32. Section 38562(b)(4).

[12] USEPA. 2016. Green Book Nonattainment Areas. April 22, 2016. Available at: https://www3.epa.gov/airquality/greenbook/ancl.html#CALIFORNIA. Accessed May 2016.

[13] ARB. 2016. Proposed Short-Lived Climate Pollutant Reduction Strategy. Appendix C. Draft Environmental Analysis. April 2016. Page 4-28. Available at: http://www.arb.ca.gov/cc/shortlived/meetings/04112016/appendixc.pdf. Accessed May 2016.

section, moving to scrape-based manure management systems may actually increase methane emissions per unit milk produced on a whole-farm basis.

As mentioned in the SLCP Strategy, installing digesters likely requires the installation of associated equipment for on-site electricity generation, generation of transportation fuel, or pipeline injection.[14] This associated equipment results in emissions of criteria pollutants, including VOCs and NO_x. The San Joaquin Valley Air Pollution Control District (SJVAPCD) has strict requirements for permitting engines due to the need to maintain their attainment, and improve nonattainment, status.

Converting from lagoons to dry or scrape-based manure management systems can decrease methane but may increase VOCs. At this time, there is not an appropriate methodology to quantify the potential change in VOCs from the actions proposed in the SLCP Strategy. The guidance available from the SJVAPCD provides VOC emission factors for various manure management systems, including liquid and solid manure handling, liquid and solid manure land application, separated solids piles, corrals/pens, freestall barns, and milking parlors.[15] However, none of these emission factors adequately capture the scenario that is described in the SLCP Strategy, namely freshly scraped lanes in a freestall barn.

A wholesale change in the dominant type of California farms from lagoon to dry-scrape management systems would also require a significant amount of demolition and construction. Any analysis should include the construction equipment and fugitive dust emission impacts from converting systems on dairies throughout California. We also note that additional water (that will not be able to be recycled) will be necessary to control fugitive dust during these wide-scale demolition and construction activities.

Additional Considerations

Inventory Methodology

We appreciate ARB's acknowledgement that inventory improvement is necessary and encourage these efforts. The current methodology that the USEPA, and thus ARB, uses to estimate methane emissions from manure management has limitations. Specifically, methane emissions are calculated using factors for volatile solids excreted (animal-dependent), the maximum methane producing capacity of a unit mass of volatile solids (animal-dependent), and a percentage of methane that is produced and emitted (dependent on the manure management system). The methane emissions are thus estimated based on the assumption of volatile solids in a given manure management system. In reality, the volatile solids loading can change as manure is excreted; is flushed, scraped, and/or separated; and is directed to the final manure holding area. The methodology only accounts for the beginning and end of the process, ignoring the middle. While tracking VOCs through the system would admittedly be more challenging, it would result in more accurate emissions. This area of research should be investigated.

Finally, we reviewed the supporting documents cited for the growth factor. We would like to know the explicit growth factor used in developing the inventory.

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[14] ARB. 2016. Proposed Short-Lived Climate Pollutant Reduction Strategy. Appendix C. Draft Environmental Analysis. April 2016. Page 4-29. Available at: http://www.arb.ca.gov/cc/shortlived/meetings/04112016/appendixc.pdf. Accessed May 2016.

[15] San Joaquin Valley Air Pollution Control District (SJVAPCD). 2012. Air Pollution Control Officer's Revision of the Dairy VOC Emission Factors. February 2012. Available at: http://www.valleyair.org/busind/pto/emission_factors/2012-Final-Dairy-EE-Report/FinalDairyEFReport%282-23-12%29.pdf. Accessed May 2016.

Leakage

We want to reiterate that ARB has repeatedly emphasized their commitment to reducing the risk of leakage, as required by AB 32. Any policies that require producers to drastically change their farming system or implement costly reduction strategies increase the risk of the dairies shutting down and/or shifting milk production out of state. This would result in leakage.

Economic Analysis

The economic assessment considers the scenario of converting dairy operations to pasture-based systems. It notes that "[a]dditional forage may need to be imported to meet animal nutrition needs and limit effects on milk production efficiency but those potential costs are not included here."[16] Although we understand that this assessment is not a full economic analysis, these potential impacts are too important to exclude. As stated above, transitioning to a lower quality feed has direct impacts on milk production and must be taken into account.

Yours sincerely,

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Attachment

cc: Michael Boccadoro, West Coast Advisors
David Cranston, Greenberg Glusker

[16] ARB. 2016. Proposed Short-Lived Climate Pollutant Reduction Strategy. Appendix D. Supporting Documentation for the Economic Assessment of Measures in the Proposed Strategy. April 2016. Page 11. Available at: http://www.arb.ca.gov/cc/shortlived/meetings/04112016/appendixd.pdf. Accessed May 2016.

RAMBOLL ENVIRON

ATTACHMENT A
GREENHOUSE GAS ANALYSIS

Table 1. Summary of CA and US Analysis

Table 1a. GHG Intensity (MT CO_2e / 1000 lb milk) [1]

Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
California	0.163	0.164	0.163	0.164	0.161	0.161	0.159	0.161	0.162	0.168	0.161	0.158	0.159	0.161
US	0.181	0.181	0.177	0.178	0.172	0.169	0.168	0.171	0.170	0.172	0.167	0.166	0.165	0.165

Table 1b. GHG Emissions, Normalized (MT CO_2e / head) [2]

Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
California	4.73	4.84	4.84	4.87	4.74	4.77	4.81	5.11	5.18	5.17	5.26	5.29	5.22	5.22
US	6.64	6.86	7.00	7.13	6.98	7.19	7.26	7.73	7.74	7.70	7.77	7.84	8.01	7.93

Notes:
1. The GHG Intensity metric accounts for emissions from enteric fermentation from milking cows divided by milk production.
2. The GHG Emissions, Normalized metric accounts for emissions from enteric fermentation and manure management divided by total head of all dairy cows.

Table 2. California Dairy Analysis

Table 2a. California GHG emissions (2000-2013)

Emission Source	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Enteric Fermentation - Milking Cows [1] (MMT CO_2e)	5.3	5.5	5.7	5.8	5.9	6.0	6.2	6.6	6.7	6.6
Enteric Fermentation - All Dairy [1] (MMT CO_2e)	6.6	6.9	7.2	7.3	7.2	7.5	7.7	8.1	8.2	8.1
Manure Management [1] (MMT CO_2e)	7.6	8.2	8.4	8.8	8.4	8.8	9.0	9.8	10.3	10.3
TOTAL	14.3	15.0	15.6	16.1	15.7	16.2	16.7	17.9	18.5	18.4

Table 2b. California Dairy Production Characteristics (2000-2013)

Characteristics	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Milk Production (lbs) [2]	32,245,000,000	33,217,000,000	35,065,000,000	35,437,000,000	36,465,000,000	37,564,000,000	38,830,000,000	40,683,000,000	41,203,000,000	39,512,000,000
Dairy Cows (Head) [3,4]	1,490,000	1,560,000	1,620,000	1,670,000	1,700,000	1,740,000	1,770,000	1,790,000	1,835,000	1,840,000
Dairy Calves (Head) [3,4]	803,368	801,128	830,446	859,292	874,145	894,484	909,920	920,516	944,511	944,483
Dairy Replacements, 0-12 mos (Head) [3,4]	215,324	221,687	230,021	229,605	219,445	232,037	234,693	237,345	236,269	234,800
Dairy Replacements, 12-24 mos (Head) [3,4]	506,204	526,060	540,896	552,586	513,355	536,254	554,506	555,929	561,165	548,587
Total Dairy (Head) [3,4]	3,014,896	3,108,875	3,221,363	3,311,483	3,306,945	3,402,775	3,469,119	3,503,790	3,576,945	3,567,870

Table 2c. California Greenhouse Gas Intensity (2000-2013)

Metric	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
GHG Intensity - Enteric Only (MT CO_2e/1000 lb milk)	0.163	0.164	0.163	0.164	0.161	0.161	0.159	0.161	0.162	0.168
GHG emissions, normalized (MT CO_2e/head)	4.73	4.84	4.84	4.87	4.74	4.77	4.81	5.11	5.18	5.17

Notes:
1. Data obtained from ARB. 2015. California Greenhouse Gas Inventory - 2015 Edition. Available at: http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_by_ipcc_00-13_20150424.xlsx Accessed May 2016.
2. Data obtained from USDA. 2016. National Agricultural Statistics Service. Quick Stats. Available at: https://quickstats.nass.usda.gov/?long_desc__LIKE=milk#5DA79828-2134-39D9-B1ED-555915FD4B79 Accessed May 2016.
3. Data (2000-2012) obtained from ARB. 2014. Annex 3A. Enteric Fermentation (IPCC 3A1) to the Technical Support Document for the 2000-2012 California's Greenhouse Gas Inventory. Available at: http://www.arb.ca.gov/cc/inventory/doc/methods_00-12/annex_3a_enteric_fermentation.pdf Accessed May 2016.
4. Data (2013) obtained from ARB. 2015. Documentation of California's Greenhouse Gas Inventory. 8th Edition Last Updated 4/24/2015. Available at: http://www.arb.ca.gov/cc/inventory/doc/docs3/3a1ai_entericfermentation_livestockpopulation_dairycows_ch4_2013.htm Accessed May 2016.

Table 2. California Dairy Analysis

Table 2a. California GHG emissions (2000-2013; continued)

Emission Source	2010	2011	2012	2013
Enteric Fermentation - Milking Cows [1] ($MMT CO_2e$)	6.5	6.5	6.6	6.6
Enteric Fermentation - All Dairy [1] ($MMT CO_2e$)	8.0	8.0	8.2	8.2
Manure Management [1] ($MMT CO_2e$)	10.0	10.1	10.2	10.2
TOTAL	18.0	18.0	18.5	18.5

Table 2b. California Dairy Production Characteristics (2000-2013; continued)

Characteristics	2010	2011	2012	2013
Milk Production (lbs) [2]	40,385,000,000	41,462,000,000	41,801,000,000	41,256,000,000
Dairy Cows (Head) [3,4]	1,760,000	1,750,000	1,780,000	1,780,000
Dairy Calves (Head) [3,4]	903,970	900,041	920,353	920,353
Dairy Replacements, 0-12 mos (Head) [3,4]	223,269	226,652	245,322	245,322
Dairy Replacements, 12-24 mos (Head) [3,4]	526,699	533,985	588,161	588,161
Total Dairy (Head) [3,4]	3,413,938	3,410,678	3,533,836	3,533,836

Table 2c. California Greenhouse Gas Intensity (2000-2013; continued)

Metric	2010	2011	2012	2013
GHG Intensity - Enteric Only ($MT CO_2e$/1000 lb milk)	0.161	0.158	0.159	0.161
GHG emissions, normalized ($MT CO_2e$/head)	5.26	5.29	5.22	5.22

Notes:

1. Data obtained from ARB. 2015. California Greenhouse Gas Inventory - 2015 Edition. Available at: http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_by_ipcc_00-13_20150424.xlsx Accessed May 2016.
2. Data obtained from USDA. 2016. National Agricultural Statistics Service. Quick Stats. Available at: https://quickstats.nass.usda.gov/?long_desc__LIKE=milk#5DA79828-2134-39D9-B1ED-555915FD4B79 Accessed May 2016.
3. Data (2000-2012) obtained from ARB. 2014. Annex 3A. Enteric Fermentation (IPCC 3A1) to the Technical Support Document for the 2000-2012 California's Greenhouse Gas Inventory. Available at: http://www.arb.ca.gov/cc/inventory/doc/methods_00-12/annex_3a_enteric_fermentation.pdf Accessed May 2016.
4. Data (2013) obtained from ARB. 2015. Documentation of California's Greenhouse Gas Inventory. 8th Edition Last Updated 4/24/2015. Available at: http://www.arb.ca.gov/cc/inventory/doc/docs3/3a1ai_entericfermentation_livestockpopulation_dairycows_ch4_2013.htm Accessed May 2016.

Table 3. US Dairy Analysis

Table 3a. US GHG emissions (2000-2013)

Emission Source	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Enteric Fermentation - Milking Cows [1] (MMT CO_2e)	30.2	30.0	30.1	30.3	29.4	29.9	30.5	31.8	32.2	32.6
Enteric Fermentation - All Dairy [1] (MMT CO_2e)	76.0	75.4	75.6	76.0	73.8	75.2	76.7	80.1	81.2	82.0
Manure Management [2] (MMT CO_2e)	44.5	47.6	49.3	51.8	49.4	52.9	54.6	60.6	61.5	60.9
TOTAL (MMT CO_2e)	120.4	123.0	124.9	127.8	123.2	128.0	131.3	140.7	142.7	142.9

Table 3b. US Dairy Production Characteristics (2000-2013)

Characteristics	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Milk Production (lbs) [3]	167,393,000,000	165,332,000,000	170,063,000,000	170,348,000,000	170,832,000,000	176,931,000,000	181,782,000,000	185,654,000,000	189,978,000,000	189,202,000,000
Dairy Cows (Head) [4]	9,183,000	9,172,000	9,106,000	9,142,000	8,988,000	9,004,000	9,104,000	9,145,000	9,257,000	9,333,000
Total Dairy (Head) [4]	18,142,000	17,927,000	17,833,000	17,920,000	17,643,000	17,794,000	18,078,000	18,190,000	18,423,000	18,561,000

Table 2c. US Greenhouse Gas Intensity (2000-2013)

Metric	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
GHG Intensity - Enteric Only (MT CO_2e/1000 lb milk)	0.181	0.181	0.177	0.178	0.172	0.169	0.168	0.171	0.170	0.172
GHG emissions, normalized (MT CO_2e/head)	6.64	6.86	7.00	7.13	6.98	7.19	7.26	7.73	7.74	7.70

Notes:

1. Data represent emissions from milking cows and are obtained from USEPA. 2015. U.S. Greenhouse Gase Inventory Report: 1990-2014. Annex 3. Table A-197. Available at: https://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html Accessed May 2016.
2. Data represent emissions from all dairy cows and are obtained from USEPA. 2015. U.S. Greenhouse Gase Inventory Report: 1990-2014. Annex 3. Table A-213. Available at: https://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html Accessed May 2016.
3. Data obtained from USDA. 2016. National Agricultural Statistics Service. Quick Stats. Available at: https://quickstats.nass.usda.gov/?long_desc__LIKE=milk#5DA79828-2134-39D9-B1ED-555915FD4B79 Accessed May 2016.
4. Data obtained from USEPA. 2015. U.S. Greenhouse Gase Inventory Report: 1990-2014. Annex 3. Table A-178. Available at: https://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html Accessed May 2016.

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Table 3. US Dairy Analysis

Table 3a. US GHG emissions (2000-2013)

Emission Source	2010	2011	2012	2013
Enteric Fermentation - Milking Cows [1] (MMT CO_2e)	32.2	32.6	33.2	33.1
Enteric Fermentation - All Dairy [1] (MMT CO_2e)	81.4	82.3	83.5	83.2
Manure Management [2] (MMT CO_2e)	60.9	62.3	65.3	63.6
TOTAL (MMT CO_2e)	142.2	144.5	148.8	146.8

Table 3b. US Dairy Production Characteristics (2000-2013)

Characteristics	2010	2011	2012	2013
Milk Production (lbs) [3]	192,877,000,000	196,255,000,000	200,642,000,000	201,231,000,000
Dairy Cows (Head) [4]	9,087,000	9,156,000	9,236,000	9,221,000
Total Dairy (Head) [4]	18,298,000	18,442,000	18,587,000	18,505,000

Table 2c. US Greenhouse Gas Intensity (2000-2013)

Metric	2010	2011	2012	2013
GHG Intensity - Enteric Only (MT CO_2e/1000 lb milk)	0.167	0.166	0.165	0.165
GHG emissions, normalized (MT CO_2e/head)	7.77	7.84	8.01	7.93

Notes:

1. Data represent emissions from milking cows and are obtained from USEPA. 2015. U.S. Greenhouse Gase Inventory Report: 1990-2014. Annex 3. Table A-197. Available at: https://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html Accessed May 2016.
2. Data represent emissions from all dairy cows and are obtained from USEPA. 2015. U.S. Greenhouse Gase Inventory Report: 1990-2014. Annex 3. Table A-213. Available at: https://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html Accessed May 2016.
3. Data obtained from USDA. 2016. National Agricultural Statistics Service. Quick Stats. Available at: https://quickstats.nass.usda.gov/?long_desc__LIKE=milk#5DA79828-2134-39D9-B1ED-555915FD4B79 Accessed May 2016.
4. Data obtained from USEPA. 2015. U.S. Greenhouse Gase Inventory Report: 1990-2014. Annex 3. Table A-178. Available at: https://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html Accessed May 2016.

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