Submitted online

September 1, 2015

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

Re: Dairy Cares' comments on July 2015 concept paper, "Draft Concepts and Funding Guidelines for Agencies, Public Discussion, Cap-and-Trade Auction Proceeds, Second Investment Plan"

Dear Chair Nichols:

On behalf of Dairy Cares, thank you for the opportunity to submit comments on the above-referenced concept paper (Concept Paper).

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 and economic sustainability of California dairies.

Dairy Cares recognizes the importance of reducing greenhouse gases (GHGs) in California and elsewhere to slow global warming. Investments of Cap-and Trade Auction Proceeds via the Greenhouse Gas Reduction Fund (GGRF) are an essential part of the strategy to reduce these emissions while maintaining a healthy business climate in California.

The purpose of Dairy Cares' comments on the Concept Paper is to identify the best investment strategies for reducing GHG emissions from dairy farms, and criteria for comparing these to other potential GGRF investments. Our comments are summarized as follows:

I. Dairy manure digesters[1] present one of the most attractive GGRF investment opportunities in terms of overall environmental return on investment; <u>however, funding must be increased to realize the state's reduction goals for GHGs and methane</u>:

a. GGRF investments in digesters can reduce emissions of methane for as little as $4 to $8 per ton over the life of a project, on a carbon equivalent basis,
b. Digesters specifically target and destroy methane, a short-lived climate pollutant, (SLCP) so GGRF investments in digesters produce climate benefits faster while helping to realize not only the state's AB 32 goals but also its SLCP reduction goals under Senate Bill 605 (2014, Lara),
c. Dairy digesters benefit disadvantaged communities, helping to achieve the state's goal for GGRF benefits to such communities (SB 535, 2012, De Leon); all five dairy digester projects funded in 2015 with GGRF will be located in disadvantaged communities,
d. Benefits to disadvantaged communities will increase over time as the number of dairy digesters increases, supporting more sophisticated projects such as renewable biomethane fueling stations that support replacing diesel trucks with cleaner-burning biomethane-fueled trucks, buses and other vehicles that travel through disadvantaged communities, and
e. There is a direct relationship between the amount of GGRF funding invested in digesters and the number of dairy digesters that can be built in California to capture and destroy methane; CARB should align its expectations for reductions of dairy methane to meet AB 32 Scoping Plan goals and SB 605 goals with the amount of GGRF made available for such projects.

II. Widespread conversion of manure flush systems to scrape systems may cause unacceptable adverse environmental and economic impacts:

a. Scrape systems have the potential to increase odors and other air emissions, and impact animal health and worker safety;
b. Conversion to scrape dramatically affects the dairy farm's system for managing manure as a crop fertilizer, limiting the ability to apply during the growing season and possibly increasing the need for synthetic (chemical) fertilizers; and
c. Additional research could help identify how to use scrape systems to achieve methane reductions while avoiding unnecessary impacts to air and water quality, animal health and worker safety, while also better quantifying the cost-per-ton of GHG reductions from such strategies.

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[1] Throughout this letter, the term "dairy digesters" is refers to anaerobic digesters where the primary or only feedstock is manure generated by dairy cows and other dairy animals. In these systems, manure is stored in a tank (including above-ground tanks made of concrete or steel or covered manure lagoons) and the manure decomposes in an oxygen-starved environment, releasing methane, carbon dioxide and trace gases. After cleaning and conditioning, methane can be used as a fuel to power engines for transportation or generating electricity, or otherwise combusted, similar to natural gas.

III. Short-term research could demonstrate other effective methane avoidance measures:

a. More efficient mechanical separation of manure particles in flush systems could lead to reduced methane emissions and other benefits, such as nutrient management improvement; and
b. Mechanical separation systems are already commercially available and a proven technology for other purposes; GGRF-funded research could quantify and demonstrate their GHG reduction potential and cost-per-ton GHG reduction efficiency in a fairly short time-frame.

Detailed comments

I. Dairy digesters represent an excellent investment of the GGRF, reducing one ton of emissions for every $4 to $8 invested; recent funding levels have helped to create new projects but more funding is needed to accelerate construction of digesters.

As the California Air Resources Board (CARB) has noted, "Methane emissions from manure management can be significantly reduced by capturing and destroying or utilizing methane from lagoons … and/or converting manure into renewable energy in anaerobic digesters."[2] Dairy Cares concurs, as digesters not only limit releases of methane into the atmosphere, but capture methane for use as a valuable renewable energy resource that can replace fossil fuel.

Dairy Cares believes that in the near term, anaerobic digesters – whether designed to capture emissions from lagoons or from manure stored in tanks – represent the best opportunity to reduce methane emissions from California dairies. This is clearly a technologically feasible option, as there are currently 12 dairy digesters in operation in California and many more worldwide (although nearly everywhere dairy digesters currently appear, they are supported by incentive funding either in the form of construction grants or subsidized rates for electricity production). Biogas collected from digesters can be used to generate electricity, can be cleaned and conditioned to be injected into natural gas transmission pipelines, or can be cleaned, conditioned and compressed to be used as a transportation fuel (identical to Compressed Natural Gas or CNG). Though technically feasible, digesters are not currently for the vast majority of family-owned dairies in the state. Of the 12 dairy digesters currently in operation, all were built with significant incentive funding. At least five more dairy digesters are planned for construction in California in the next one to two years, also relying on significant incentive funding.

However, increased continued public investment is needed before digesters can become economically feasible. Investment in digesters must be accelerated to allow construction of enough dairy digesters to meet methane reductions consistent with the state's overall goal of 40 percent GHG reductions from 1990 levels by 2030.

[2] "Short-Lived Climate Pollutant Reduction Strategy, Concept Paper," May 2015, http://www.arb.ca.gov/cc/shortlived/concept_paper.pdf Accessed September 1, 2015

Dairy Cares estimates that construction of an additional 100 to 200 dairy digesters in the state could capture and utilize between 2 and 2.5 million metric tons (carbon dioxide equivalent or CO2e) of methane annually. With an estimated 30-year project life, these projects could collectively reduce a total of 60 to 75 million metric tons CO2e of SLCP. This scale of investment would also generate significant amounts of renewable energy:

- Up to 50 million kilowatt hours per year of electricity, or
- 500,000 MMBtu or Renewable Natural Gas annually, or
- 3.5 million diesel gallon equivalents of transportation fuel.

Competitive with other GGRF-funded projects

Dairy digesters have been shown to be highly competitive with other projects eligible for funding (or currently funded) by the GGRF. An analysis of available CARB data estimating GHG reductions for different project types[3] suggests dairy digesters can reduce methane at a cost per ton[4] of approximately $7. By comparison, other types of projects funded by GGRF ranged widely in cost from as little as $2 per metric ton to as much as $2,250. Nearly all other projects analyzed – including home weatherization, rail and mass transit, zero emission vehicle incentives, building retrofits, water efficiency projects and others – provided smaller emissions reductions per ton of GGRF invested. For example, photovoltaic solar projects ranged from $202 to $288 per ton of emissions reduced – meaning the return on GGRF investment in dairy digesters was 30 to 40 times higher. Only a few types of projects had comparable performance to dairy digesters, including forest and wetlands conservation projects and loans for organics and recycling equipment.

Recent third-party analysis by experts from the University of California and California State University system appears to validate the CARB estimates cited above. These experts confirmed that five dairy digester projects funded by the California Department of Agriculture in July 2015 are expected to collectively reduce dairy methane emissions by 1,377,111 metric tons (carbon equivalent basis) over the first 10 years of their project lives, at a cost of close to $30 million total, including $11,266,955 in GGRF investments.[5] This means if only the emissions reductions during the first 10 years of the projects are considered, the cost of reductions is $8.18 per ton. However, dairy digesters are expected to have even longer project lives, as evidenced by the California Public Utilities Commission's Bioenergy Feed-In Tariff Program, which allows for electricity purchase agreements up to 20 years in length. Thus, the reductions of such projects could be double what is estimated by the UC and Cal State experts if a longer project life is taken into consideration, thereby dropping the cost of reductions in terms of GGRF investment to as little as $4 per ton.

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[3] Appendix B, http://www.arb.ca.gov/cc/capandtrade/auctionproceeds/2015ggrf-annual-report-to-legislature.pdf
[4] Dollars of GGRF funding, not including private investment, divided by carbon dioxide equivalent reductions of methane.
[5] http://www.cdfa.ca.gov/EnvironmentalStewardship/Dairy_Digesters.html

Short-lived climate pollutant (SLCP) benefits

As stated above, dairy digesters provide substantial GHG reduction benefits. However, unlike many other projects considered for funding via the GGRF, dairy digesters directly reduce emissions of methane, an SLCP. This gives dairy digesters the added benefit of not only helping the state meet its AB 32 and Scoping Plan goals, but also for meeting the aggressive methane reduction targets identified by CARB in the implementation process for Senate Bill 605 – a 40 percent reduction of methane below forecasted levels by 2030.[6] Dairy Cares believes the state should give additional priority to projects seeking GGRF funding when those projects also specifically reduce SLCPs.

Benefits to disadvantaged communities

Many of the state's dairies are co-located in disadvantaged communities as defined by the California Environmental Protection Agency (Cal EPA). Under Senate Bill 535 (2012, De Leon), the state is required to invest a portion of cap-and-trade auction proceeds in disadvantaged communities, or providing benefits to those communities.

Digesters offer multiple economic and environmental benefits to those communities in which they are located. For example, digesters reduce odors and emissions of certain air pollutants, such as ammonia, hydrogen sulfide, and volatile organic compounds. Both the construction and continued operation and maintenance of digesters generate local jobs.

As more dairy digesters are constructed, there is an opportunity for even more benefits to accrue to disadvantaged communities. A concentration of digesters provides the opportunity to develop more advanced projects, such as cleaning and conditioning methane (biomethane) for use as a renewable vehicle fuel – similar to compressed natural gas – which could be used as a cleaner, renewable alternative to fossil-derived diesel fuel. Replacing diesel-fueled trucks with cleaner-burning biomethane-fueled trucks along busy transportation corridors such as Highway 99 and Interstate 5 could further reduce impacts to disadvantaged communities that lie along those corridors.

Increased digester funding needed to support faster progress in dairy sector

In the May 2015 Short-Lived Climate Pollutant Strategy Concept Paper, ARB noted that it wants to "significantly cut methane from dairies," and "will identify necessary investments and other strategies to control manure methane emissions from the largest sources as quickly as possible – and no later than 2025."

Dairy Cares respectfully suggests that the goals set through the SB 605 process, and the investment priorities in the GGRF Second Investment Plan, are inextricably linked. There is a direct relationship between the amount of investment that is available for dairy digesters (and potentially, other methane reduction and avoidance projects) and the amount of methane

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[6] Ibid., page 13, "Short-Lived Climate Pollutant Reduction Strategy, Concept Paper," May 2015, http://www.arb.ca.gov/cc/shortlived/concept_paper.pdf Accessed September 1, 2015

reductions that can be practically achieved without severe economic harm to dairies and the economies of disadvantaged communities.

Dairy Cares believes the construction of a significant number of dairy digesters, and the resulting methane reductions, is achievable. Policies such as Senate Bill 1122 (Rubio, 2012) have improved the outlook for electricity sales from digesters, but further incentives are still needed. Foremost, significantly more investment from the GGRF: The fiscal year 2014-15 allocation of $11.1 million was enough to build five digester projects – excellent progress, but at this funding level it would take several decades to provide emissions reductions within the dairy manure management sector that would be aligned and comparable with other state GHG reduction targets.

To move dairy digesters forward in California, Dairy Cares recommends:

- The state should allocate between $30 million and $50 million in GGRF investment over a two-year period for continued construction of a dairy digester design, development and demonstration hub in Kern County. With access to several large dairy facilities closely co-located, natural gas pipelines and close access to Highway 99 and Interstate 5, this area serves as a strong candidate to develop a network of digesters and explore advanced energy uses such as truck and farm equipment fueling, pipeline injection of renewable natural gas and research and development of digester effluent for advanced fertilizer products.
- An investment of approximately $50 to $100 million annually for a five-year period (roughly 2017-2021) to build 100 to 200 additional digesters throughout the state (again, with the caveat that the state's expectations for methane reductions from dairy manure management should be aligned with funding levels). This effort should include close collaboration with local air pollution control districts to ensure that any emissions resulting from biogas combustion are minimized. Efforts should be made to encourage long-term, stable incentives for energy sales (including fuel, electricity and natural gas) and to remove risk associated with sales of renewable natural gas as a vehicle fuel. Providing this level of funding will greatly advance the technology, management logistics, efficiencies and economics of digester projects.
- CARB should examine and implement reforms in the grant funding process. Current grant programs involve a high amount of uncertainty and delay for developers. A program that streamlines funding and increases certainty for deserving projects that meet recognized parameters – modeled after the federal 1603 program ("Payments for Specified Energy Properties in Lieu of Tax Credits") would be helpful in realizing this goal.

II. Widespread conversion of manure flush systems to scrape systems may cause unacceptable adverse environmental and economic impacts

Dairy Cares strongly disagrees with the Concept Paper's conclusory statement on page 20 that "Traditional methods of managing livestock manure should be transitioned to scrape manure management systems …" Similarly, Figure 7 on page 21 lists "Conversion from flush-managed dairies to scrape manure management systems" as a "draft investment concept." We believe these conclusions are premature at best and not based on sufficient evidence and analysis.

This view was also reflected in the May 2015 SLCP concept paper, which stated that "switching from lagoon systems to solid manure management 'scrape' systems (to avoid generating methane in the first place)."[7]

It is clear doing so would in fact reduce the amount of manure stored in retention ponds (lagoons, which are temporary storage areas for manure and water until it is recycled to flush barn floors or applied to crops mixed with irrigation water). Less manure in retention ponds means reduced methane emissions, but converting flush systems to scrape on many dairies, or on a wide-scale basis, would create severe, unintended consequences. Flush systems were implemented on many dairies decades ago for a variety of beneficial reasons, including reducing energy and fuel use for barn cleaning and to improve overall sanitation, which in turn reduces emissions of volatile organic compounds, ammonia and hydrogen sulfide. Cleaner barns mean improved health and well-being for animals; cleaner barn floors resulting from flushing rather than scraping manure means floors are less slippery and less of a danger to animals. Flush systems also make it possible to clean barns without physically removing animals, which reduces the chances of worker and animal injury.

Water quality and nutrient management related to scrape systems

Another critical issue related to converting from a flush to scrape system is that such a change will also change the character of the resulting flow of manure nutrients in a way that can impact water quality. Instead of being flushed to a system where solids are separated from liquids – creating some solid manure for storage and some liquid manure – all of the manure will end up in a slurry and eventually dried for storage or land application. While this may reduce methane emissions compared to a hybrid system that stores a liquid fraction of manure in the lagoon and solids (larger fibrous particles from manure) separately, there are also likely to be unintended consequences.

In a flush system, much of the manure nutrients, including nitrogen compounds, remain in the liquid system. As with all manure, the ultimate destination is for these nutrients to be land applied to fertilize feed crops. The advantage of storing these nutrients in liquid form is that they may be applied in small amounts matching the crop's nutrient requirements during the growing season. This is not done with solid manure, which is only applied prior to planting of crops. That is, all the manure generated by the dairy would need to be applied to cropland during very short windows of time, possibly resulting in over-application, rather than applying it in more even, reasonable amounts over the course of the growing season and when needed by growing plants.

Without the ability to apply these nutrients as a liquid, many dairy farmers would be left with solid manure they are unable to use effectively and agronomically. This, in turn, would likely require them to export their manure to other farms and to use additional synthetic fertilizer to

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[7] Concept Paper, p. 21.

make up the difference. This could result in negative economic effects, by causing the operating costs for dairies to rise. It could also mean increased environmental impacts resulting from increased need for chemical fertilizer, and increased fuel use to transport manure to other locations.

Scrape systems can work, but utility is limited

This is not to say that a scrape system could not be made to work in certain circumstances; some dairies in fact successfully operate such systems, but have made significant adjustments to address the challenges described here.

These adjustments may not be desirable at other dairies, or achievable without significant investment in new infrastructure. In fact – even without considering economic factors – if all environmental, worker safety and animal health factors are taken properly into consideration, conversions from flush systems to scrape may still not be considered to provide an overall benefit on many, if not most, dairies.

We can envision circumstances where a conversion of flush to scrape would result in an overall benefit, including methane reductions. For example, a hypothetical dairy with a manure retention pond that is too small for the amount of manure generated on that dairy, coupled with a lack of necessary manure conveyance infrastructure (e.g. not enough pumps, pipelines, meters, etc.) to deliver the liquid manure to nearby fields, might want to consider major changes. Such a dairy could potentially implement a plan to convert to scrape, set aside land areas to dry and compost manure, and plan on using some of the dry manure or compost on the farm while exporting the remainder for nutrient management and nutrient balance purposes. However, that dairy would still have to maintain a storage area for water used to clean the milk barn, and might still choose to flush lanes periodically after scraping to improve health and safety and reduce air emissions.

Absent compelling evidence to the contrary, Dairy Cares believes it would cause environmental and economic harm if an otherwise well-designed and well-managed dairy with a manure management flush system were forced to convert to scrape. At minimum, the significant potential for negative consequences to water quality, nutrient management, animal health and worker safety should be carefully considered and fully addressed before such a conversion is recommended or incentivized. In addition, we would suggest that this topic be subjected to serious cross-disciplinary academic research scrutiny prior to it being recommended for widespread adoption.

At minimum, flush-to-scrape conversions should be evaluated to determine their potential to reduce emissions and cost, so that it can be determined if this would be an effective way to use GGRF resources.

III. Short-term research could demonstrate other effective methane avoidance measures

Dairy Cares was pleased to see that the Concept Paper acknowledges that solids separation (used in flush systems to divert larger fibrous solids from the flushed manure stream via mechanical separation) "may have a role" in emissions reductions.

When dairies use a flush system to remove manure from barns, the flush water is usually captured prior to entering a retention pond (lagoon) in an attempt to separate large, fibrous plant cellulose materials and sands (solids) from liquids. This results in two manure-related streams:

- Solids that can be dried and stockpiled for use as bedding, compost or a pre-plant soil amendment (low in nitrogen but high in carbon), and
- Liquid that can be stored and reused to flush barns or to be added to irrigation water in a process known as "fertigation," where nutrients and water are added to growing crops simultaneously.

Separation is generally accomplished with the use of gravity catch basins (sometimes called separation basins) with small weirs or similar outflows near the top, which allow liquid to flow freely to the retention pond while solids "settle" in the basin.

While this type of system is functional and effective, its percentage of solids removal can be rather low, as low as 20 percent of the solids in the liquid stream. In these cases, many of the solids flow through to the lagoon, where they tend to settle to the bottom of the lagoon and form a sludge layer. Eventually the lagoon fills up and must be excavated.

To avoid excessive lagoon maintenance and to improve the quality of the lagoon liquid for fertigation, many dairies have experimented with increased efficiency in separating solids from the liquid post-flush. One common technique is mechanical screen separators, which in some cases have increased volatile solids removal to as high as 65 percent.[8] Another technique called "weeping walls" has also shown similar levels of efficiency.[9]

Though these technologies have been used to date with an eye on other goals (improved nutrient management and pond maintenance), the increased diversion of volatile solids from the lagoon by these systems likely reduces methane emissions, perhaps significantly. However, these systems also can be extraordinarily expensive (some anecdotal estimates have put the cost of systems on large dairies in the hundreds of thousands of dollars or higher, not including ongoing labor and maintenance and value of land permanently dedicated to the system).

Research needed but can likely be accomplished in short term

At this time, there is not enough available data to evaluate any of the methane avoidance techniques identified here (either conversions of flush systems to scrape systems or improved

[8] Chastain, J., 2008, "Field evaluation of a two-stage liquid-solid separation system at a California Dairy, Department of Agricultural and Biological Engineering, Clemson University.
[9] Meyer, D., Harner, J.P., Tooman, E.E., and Collar, C. 2004, "Evaluation of weeping wall efficiency of solid liquid separation," American Society of Agricultural Engineers 349-354.

solids separation) for cost effectiveness, and cost effectiveness is necessary in determining whether any or all of these practices should be incentivized.

Dairy Cares is prepared to work with CARB in the near term on a rapid schedule to identify research projects that could support a more thorough evaluation of these practices for decision-making purposes. Because these practices are fairly well established as being technically feasible and workable on dairies for other purposes, we believe research to evaluate these for methane reduction effectiveness could be accomplished on a much more rapid schedule than would be possible for newer or emerging technologies.

Conclusion

Once again, we thank you for the opportunity to make these comments. Dairy Cares recognizes the importance of proactive efforts by our member organizations to promote and achieve reductions of dairy-generated methane, and we are committed to working with you to achieve that goal in a way that also protects the important benefits that dairies bring to the Golden State.

Sincerely,

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