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California Air Resources Board
Research Division
Via web submission

RE: Comments in response to Draft Analysis of Progress toward Achieving the 2030 Dairy and Livestock Sector Methane Emission Target on June 14, 2021

3Degrees Group, Inc. ("3Degrees") appreciates this opportunity to provide comments to the CARB Research Division in response to the *Draft Analysis of Progress toward Achieving the 2030 Dairy and Livestock Sector Methane Emission Target* published on June 14, 2021. 3Degrees is an offset project developer based in San Francisco and has been working with dozens of domestic livestock offset projects to issue credits into ARB's Cap-and-Trade program. 3Degrees strongly supports the state's goal of methane emission reductions in the state from the dairy and livestock sector, particularly through the use of State funding and market-based incentive programs. As an offset project developer have witnessed how adding carbon offset revenue to a budget sheet can have real impacts on a dairy's ability to finance voluntary emission reduction projects. And over the past decade as the carbon markets have matured, this has only become a more serious driver in a dairy's financial decisions to mitigate methane emissions.

Recommendation #1: Revise Finding 1-6 about AMMP being difficult to quantify.

3Degrees would like to respond to one of the points made in the Draft Analysis under the *Finding 1-6* about Alternative Manure Management Projects being unlikely to be implemented without incentives. The finding states that such projects are not eligible to generate environmental credits "because it is difficult to quantify methane emission reductions relative to facility baseline emissions." 3Degrees disagrees with this assertion and have found Alternative Manure Management Program (AMMP) projects no more difficult to quantify than other livestock methane emission reduction projects such as digester projects.

The finding states that site-specific project variations influence methane emissions making it difficult to quantify. Yet in practice, having worked on dairy manure greenhouse gas accounting for more than a decade, we find that site-specific variations are not difficult to overcome. For example, the existing Offset Protocol for Livestock Projects uses the following equation[1] for baseline emissions from anaerobic storage of manure:

$$BE_{CH4,AS} = \sum_{L,i} (VS_{\deg,AS,L,i} \times B_{0,L}) \times 0.68 \times 0.001 \times GWP_{CH4}$$

Where:

$$VS_{avail,AS,L,i} = (VS_L \times P_{L,i} \times MS_{AS,L} \times RD_{rm,i} \times 0.8) + (VS_{avail,AS,L,i-1} - VS_{\deg,AS,L,i-1})$$

[1] Compliance Offset Protocol for Livestock Projects, November 14, 2014, Equation 5.3

The key terms in these equations are either found in tables (VS_L, the volatile solids from each animal; and $B_{o,L}$ the maximum methane producing capacity) or represent actual operating characteristics of the livestock operation ($P_{L,i}$, the animal populations; and $MS_{AS,L}$, the fraction of volatile solids sent to the anaerobic manure storage system from each livestock category L, also thought of as the collection rate to any given storage/treatment system). These terms are generally easy to quantify and have been well understood by project developers, verification bodies, and CARB Cap-and-Trade staff. These equations are applicable to the baseline methane emissions of any livestock operation – regardless of the type of methane mitigation they implement – whether digester or an AMMP project.

The project emissions are also easily quantifiable. The same Offset Protocol uses the following equation[2] to quantify methane emissions from non-anerobic storage/treatment systems:

$$PE_{CH4,nBCS} = \left(\sum_{L} (EF_{CH4,L,nBCSs} \times P_L) \right) \times 0.001$$

Where:

$$EF_{CH4,L,nBCSs} = \left(VS_L \times B_{o,L} \times \mathrm{RD}_{\mathrm{rp}} \times 0.68\right) \times \left(\sum_{S} (MCF_S \times MS_{L,S}) \right)$$

In these equations, VS and Bo again come from tables for manure generation characteristics, PL again comes from operating records about the animal populations, and MSL,S again is a well understood parameter reflecting the manure collection rates. The key variable in this equation is the methane conversion fraction, MCFS. This comes from a table within the Offset Protocol[3] and an expert is shown below for context. This table contains essentially the methane production rates from non-anaerobic storage and treatment systems commonly found on livestock operations, whether or not they have a digester project, and whether or not they have an AMMP project. In fact, all AMMP project activities can be quantified using these tables. For example, a dairy farm can quantify it's baseline methane emissions using the baseline equations from Equation 5.3, and the AMMP practices using the project emission equations from Equation 5.9 and the table below.

MCF VALUES BY TEMPERATURE FOR MANURE MANAGEMENT SYSTEMS

System	MCFs by average reporting period temperature (°C)																			Source and comments
	Cool					Temperate												Warm			
	≤ 10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	≥ 28	
Pasture/Range/Paddock	0.01					0.02											0.02			Judgment of IPCC Expert Group in combination with Hashimoto and Steed (1994).
Daily spread	0.001					0.02											0.01			Hashimoto and Steed (1993).
Solid storage	0.02					0.04											0.05			Judgment of IPCC Expert Group in combination with Amon et al. (2001), which shows emissions of approximately 2% in winter and 4% in summer. Warm climate is based on judgment of IPCC Expert Group and Amon et al. (1998).
Dry lot	0.01					0.02											0.02			Judgment of IPCC Expert Group in combination with Hashimoto and Steed (1994).

[2] Compliance Offset Protocol for Livestock Projects, November 14, 2014, Equation 5.9

[3] Compliance Offset Protocol for Livestock Projects, November 14, 2014, Table A.5

3Degrees believes the existing Offset Protocol for Livestock Projects provides a rigorous quantification framework, which has already been reviewed and approved by ARB, for estimating emissions changes from the implementation of AMMP. To adapt this protocol, 3Degrees believes the primary challenge will be not be in the quantification methods themselves, but in writing a performance standard to establish which alternative manure practices are considered additional to common practice. Baseline methane emissions from such AMMP projects can be quantified using the very same approach as for digester projects, namely modeling methane emissions from an uncovered anaerobic lagoon, while project emissions can be quantified utilizing the same modeled approach with default methane emission factors for non-anaerobic storage/treatment systems.

This is not only a viable quantification in theory, **3Degrees has already completed validation of our first AMMP project under a voluntary carbon standard**, and we have a robust pipeline of similar projects behind it.

The scale of the potential methane avoidance from alternative manure management projects potential impact toward achieving the state's 2030 goals, combined with the need for expanded carbon market incentives justifies the development of a compliance protocol with a performance standard. Given the increase in value and dependability, compliance eligibility will scale this sector quickly while enabling the viability of methane avoidance projects at many of the smaller dairies in the State. 3Degrees therefore wants to voice strong support for the development of an alternative manure management project protocol. 3Degrees also strongly supports the expansion of methane reductions by exploring development of a compliance offset protocols for enteric fermentation. Combined with continued and expanded grant incentives, this approach appears to be the better method to achieve the 2030 target over direct regulation of the livestock sector.

Recommendation #2: Revise the Low Carbon Fuel Standard's "adjustment factor" for electric dairy digester projects to stop penalizing harder to develop and finance digester opportunities at projects that are not a good fit for generating renewable natural gas.

For the dairy sector to reach these ambitious methane reduction goals, we believe it will be essential to incentivize dairy digester projects that are far from pipelines and have small or medium herd sizes. These projects struggle to justify the very large capital costs needed in order to clean, transport and inject biogas into the pipeline as renewable natural gas but have greater financial viability if instead designed to make electricity.

As the largest supplier of renewable energy to electric vehicles in California, we believe the current guidance from the Air Resources Board (as outlined in the LCFS Guidance 19-06 Determining Carbon Intensity of Dairy and Swine Manure Biogas to Electricity Pathways) unnecessarily penalizes dairy digesters that make electricity instead of renewable natural gas through the "adjustment factor" that discounts the avoided emissions of any projects with engines with an electrical efficiency of less than 50%. In our anecdotal experience, well designed projects generally have an electrical efficiency of 35% to 40%, which means their total avoided emissions are discounted by 20% to 30% by this artificial adjustment factor. For electric projects with marginal economics, this discount can be catastrophic.

We completely understand that the Air Resources Board wants to incentivize fuel cells and other cutting-edge technologies to reduce combustion emissions, which is essential for air districts in

non-attainment areas -- but California must seize all opportunities for methane reduction, including those dairies that are in attainment areas, in order to reach these ambitious methane reductions. We believe the additional penalty that comes from this “adjustment factor” instead simply serves as a disincentive to develop electric projects anywhere. This has no effect on non-attainment air districts, as internal combustion engine projects can’t be built there with or without the adjustment factor. We therefore recommend the Air Resource Board revisit the use of this adjustment factor in light of the increasing electrification of transportation throughout the state and the desire to capture methane reductions from all dairies -- including those that are not attractive renewable natural gas projects.

Thank you for your consideration and we look forward to continued discussion on the State’s progress in achieving manure methane reductions.

Sincerely,

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