May 26, 2016

Ryan McCarthy
Science & Technology Policy Advisor
California Air Resources Board
1001 "I" St. Sacramento, CA, 95814
California Air Resources Board

Re: Environmental Defense Fund Comments on the Proposed Short-Lived Climate Pollutant Reduction Strategy

Dear Mr. McCarthy,

Thank you for accepting these comments submitted by Environmental Defense Fund ("EDF") on the California Air Resources Board ("CARB") proposal to emissions of short-lived climate pollutants ("SLCPs"). We appreciate your incorporation of our previous comments of October 30, 2015. Furthermore, overall we support this approach to addressing the impacts of climate change by developing near-term solutions for reducing this class of potent climate pollutants while continuing to address all GHG emissions in the long term. To realize the goals of the Global Warming Solutions Act of 2006 ("AB 32"), we must address both short-lived climate pollutants, as well as long term pollutants like carbon dioxide.

In this comment letter EDF is focusing its comments on the reductions of manure and enteric fermentation methane emissions.

Improve Dairy Manure Methane Emission Inventories

EDF urges caution in using current inventory estimates to establish targets and set state policy. This is because current manure methane inventories are based on a few measurements outside of California. For example, the methane conversion factor that is used to estimate emissions from anaerobic lagoons is based on Mangino et al. (2001)[1]'s prediction, which is based on only two long-term studies in North Carolina; one covered hog and one covered dairy lagoon (Safley and Westerman, 1992). At the time when these measurements were completed, measurement techniques were few and relatively expensive compared to today. Thus, as a part of the efforts to collect data from California dairy farms, we strongly recommend that California's inventories are reviewed and validated by long-term measurements (at least one year) of multiple Californian dairies with different manure management systems before regulating manure

[1] Mangino, J., Bartram, D. & Brazy, A. 2001. Development of a methane conversion factor to estimate emissions from animal waste lagoons. Presented at U.S. EPA's 17th Annual Emission Inventory Conference, Atlanta GA, April 16-18, 2002.

reduction. These same measurements can be used to develop methodologies to verify the adoption of reductions strategies on farms.

Manure Methane Emission Reduction Strategies

We agree with California Air Resource Board (CARB) that there are opportunities to reduce manure methane emissions and that the proposed strategies can reduce manure methane emissions. However, we question the calculations to achieve a 75% manure methane reduction from 2013 levels by 2030. Most of the proposed strategies involve switching to anaerobic digesters because it not only reduces methane emissions but also produce biogas that could be sold for Low Carbon Fuel Standard (LCFS) credits. However, according to CARB 2013 inventories, manure methane emissions could only be reduced by 71% even if all manure systems were switched to anaerobic digesters (Table 1). Another proposed strategy is to switch confined systems to pasture systems. If that was done with all dairy farms, it would hypothetically reduce manure methane emissions by 97% (Table 1). However, the tradeoffs also need to be accounted for, such as increase in enteric methane per kg of milk through decreased milk production, increased methane per unit of intake, and increased nitrous oxide emissions from urine deposition on pasture. Bargo et al. (2002)[2] found a 30% reduction in milk yield and 19% reduction of dry matter intake (**DMI**) when cows were on pasture and supplemented with concentrate compared to cows that were housed in a barn and fed a total mixed ration (**TMR**). This would require a 43% increase of the cattle population in California to maintain the same milk production, which would lead to a 15% increase of DMI and enteric emissions if similar methane emissions are assumed for cows on pasture and cows fed TMR [20 g methane/kg DMI]. However, it is more likely that enteric emissions on pasture will increase by 20% per kg of DMI (24 g methane/kg DMI). This would lead to 39% increase of enteric methane emissions. Thus, total methane reductions would be 71% instead of 95%. However, this hypothesis needs to be verified by more research to estimate the tradeoffs between both systems. This underlines, as mentioned previously, the importance of good baseline estimates as well as estimates for the various reduction strategies. Furthermore, research needs to verify that the proposed reduction strategies are able to meet the high targets set by CARB.

Another proposed solution, the conversion from flush-system (anaerobic lagoon) to a scrape system (slurry/liquid), would reduce manure methane emission by 49% according to CARB's inventories. This might be the most cost efficient strategy per unit of saved emissions. Additionally, incentives need to be provided to farmers to implement proposed reduction

[2] Bargo, F., Muller, L. D., Delahoy, J. E. & Cassidy, T. W. 2002. Performance of High Producing Dairy Cows with Three Different Feeding Systems Combining Pasture and Total Mixed Rations. Journal of Dairy Science, 85, 2948-2963.

strategy, if the proposed strategy requires capital investment and increases overall production costs to prevent emission leakage.

Table 1. Manure CH_4 reduction potentials from milking dairy cattle in California based on CARB's inventory for 2013.

Manure system	**Manure CH_4 (g/head/yr)**	**Manure CH_4 2013 (t/yr)**	**CH4 Reduction potential if system was switched to (%)**		
			Anaerobic Digester	**Deep Pit/ Liquid/Slurry**	**Pasture**
Anaerobic Digester	81,536	1,730	0%	0%	**92%**
Anaerobic Lagoon	336,422	348,436	**76%**	**57%**	**98%**
Daily Spread	2,250	423	0%	0%	0%
Deep Pit	149,422	275	**45%**	0%	**95%**
Liquid/Slurry	149,422	53,709	**45%**	0%	**95%**
Pasture	6,751	81	0%	0%	0%
Solid Storage	18,002	2,916	0%	0%	**62%**
Total Manure CH_4 (t/yr)		407,570			
Possible Manure CH_4 reduction (t/yr)			288,515	199,014	396,398
Possible Manure Reduction, %			**71%**	**49%**	**97%**

Incentives for enteric methane reductions

According to CARB 2013 inventories a 25% decrease of enteric methane per milking dairy cow is equivalent to 37 kg methane/year, which is equivalent to 0.78 t of carbon dioxide equivalent (using 100-year Global warming potential and AR4). At the current carbon price ($13), this is equivalent to an extra $10 per cow per year or $0.03 per cow per day. Thus, even if a carbon offset protocol was developed, it would most likely not cover the extra cost for enteric methane reductions. Consequently, it is important to provide additional incentives to farmers, if one of the major reduction strategies is based on a commercial feed additive that has shown major reductions in methane emissions but not increases in milk production. Furthermore, it should be kept in mind that the additive still needs FDA approval before it can be implemented. In addition, the Proposed Short-Lived Climate Pollutant Reduction Strategy suggested grape marc as a potential strategy to reduce enteric methane emissions. However, the study (Moate et al. 2014)[3] that showed a 20% reduction in enteric methane included over 25% of grape marc in the dairy ration and was conducted on late lactating cows in Australia, producing on average only 14 kg of milk which is less than half the average milk production of California dairy cow. The inclusion of over 25% grape marc, which is high in fiber and low in starch, in the ration of high-production Californian dairy cattle will reduce milk production. Assuming demand stays constant, this decrease in milk production will result in the need for more dairy cows which would result in an overall increase in methane emissions in California or leakage to other states.

We appreciate the hard work that went into the development of the Proposed Short-Lived Climate Pollutant Reduction Strategy. We thank ARB for the opportunity to offer these comments. We look forward to continued collaboration with ARB and other stakeholders throughout the design and implementation of the Proposed Short-Lived Climate Pollutant Reduction Strategy. Please feel free to reach out for any follow-up questions.

Sincerely,

Claudia Arndt
Postdoctoral Fellow
Environmental Defense Fund

[3] Moate, P. J., Williams, S. R. O., Torok, V. A., Hannah, M. C., Ribaux, B. E., Tavendale, M. H., Eckard, R. J., Jacobs, J. L., Auldist, M. J. and Wales, W. J. 2014. Grape marc reduces methane emissions when fed to dairy cows. Journal of Dairy Science, 97, 5073-5087.