



November 23, 2015

To California Governor Jerry Brown, Mary Nichols, Chair of California Air Resources Board (CARB), Secretary of California Natural Resources Agency John Laird, State Senator Kevin De Leon, Asm. Toni Atkins, State Senator Ricardo Lara, Asm. Tony Thurmond, Asm. Dar Williams, State Senator Fran Pavley, Ryan McCarthy (Science & Technology Policy Advisor, CARB), Craig Segall (Senior Staff Counsel, CARB):

We write to you concerning the matter of methane emissions in California. We view methane emissions as a key part of the climate emergency that confronts us all on this planet. Methane emissions are projected to account for approximately a third of all CO₂-equivalent global anthropogenic emissions over the next 20 years. (See Figure 8.32, Intergovernmental Panel on Climate Change AR 5th Report, 2013, Chapter 8, p.719.) One ton of uncaptured, unburnt methane emission that escapes into the atmosphere has the same heat-trapping effect as 86 tons of carbon dioxide trapping heat in the atmosphere over a period of 20 years. In 2013, roughly 1.158 million tonnes (metric tons) of methane were emitted into the atmosphere from the following sources, expressed in million tonnes of CO₂ equivalent: livestock-related enteric fermentation - 11.78 [item 3A1], livestock-related manure management - 12.14 [item 3A2], natural gas pipeline leakage - 3.81 [item 1B2b], and rice cultivation - 1.22 [item 3A7]. (Source: CARB, California Greenhouse Gas Inventory for 2000-2013 — by Sector and Activity http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_ipcc_all_2000-13_20150831.pdf) The total of the methane emissions from these sources is 28.95 million tonnes of CO₂ equivalent (CO₂e). The value of 1.158 million tonnes of CH₄ is derived by dividing 28.95 million metric tonnes of CO₂e by 25, which is the 2007 IPCC 100-yr methane GWP that CARB uses. <http://www.arb.ca.gov/cc/inventory/background/gwp.htm>).

Under section 39730, the Air Board is required to devise a strategy by January 2016 to reduce short term climate pollutants Likewise, EXECUTIVE ORDER B-30-15 requires state regulatory authorities to issue regulations which will substantially reduce greenhouse gas emissions over the next several decades. Methane is listed as a “greenhouse gas” within California Health and Safety Code Section 38505(g), of the California Global Warming Solutions Act of 2006 and it is also a short-term climate pollutant. Unfortunately, methane emissions have been largely ignored in California. The dairy and livestock industries operate with no regulations constraining uncaptured, unburnt methane emissions. No mandatory annual methane emission reduction targets for the dairy and livestock industries are currently being contemplated by any major institutional actor, including the California Air Resources Board. And Southern California Gas Co. is currently warning that it might need several months to plug a massive natural gas leak that has been sickening residents in the San Fernando Valley for weeks and releasing mind-boggling volumes of methane gas into the atmosphere. (<http://www.latimes.com/local/california/la-me-1121-gas-leak-20151121-story.html>) (See Appendix B for more comment and information on this methane emission disaster.)

The current market-based system effectively sets a very low price on greenhouse gas emissions. This price is far too low to adequately compensate for GHG emission damage to the environment. To help remedy this situation, we advocate institution of a robust methane emissions fee to promote both a reduction in the exploitation of oil/methane gas reserves and a rapid conversion to de-carbonized energy production and jobs. This methane emissions fee would also likely trigger meaningful, internally-funded research by the livestock/dairy industry concerning substantial methane emissions reduction strategies and technologies. (See appendix A.) We propose that California adopt a mandatory methane emissions fee or fine, based in part upon the findings of a recent, peer-reviewed paper published by Dr. Drew Shindell. <http://link.springer.com/article/10.1007/s10584-015-1343-0> (Dr. Shindell was a Coordinating Lead Author, Anthropogenic and Natural Radiative Forcing, Chapter 8, Intergovernmental Panel on Climate Change, Fifth Assessment Report, 2013.)

Our proposal is presented below:

"All those legally responsible for the generation of more than 40 pounds of uncaptured, unburnt methane emissions per year shall be required to pay an annual fee on each ton of uncaptured, unburnt methane emission for which they are responsible. The fee shall be 100 percent of the baseline value of \$4700 of damages per ton of methane (CH₄) that is presented in The social cost of atmospheric release, Drew T. Shindell, Climatic Change (2015) 130:313–326, DOI 10.1007/s10584-015-1343-0, page 319, Table 2, Median total; declining rate."

We believe that a 100 percent methane fee or fine based upon Dr. Shindell's \$4700 methane finding is reasonable and accords with the best available science concerning methane and carbon dioxide. A fee value of \$4700/CH₄ ton is approximately 43 times greater than the \$110 damage value presented in Dr. Shindell's published paper for one ton of carbon dioxide. This ratio of 43 to 1 is in reasonable proximity to the IPCC 100-yr interval methane Global Warming Potential (34 w/ cc fb) and far below the 20-year interval methane Global Warming Potential (GWP) of 86 (w/ cc fb). (Source: Intergovernmental Panel on Climate Change, Climate Change 2013: The Physical Science Basis, 714, Table 8.7, <https://www.ipcc.ch/report/ar5/wg1/> (accessed 13 July 2015)). Dr. Shindell's methane "damage" value also factors in other adverse impacts associated with methane (primarily, methane as a pathway to the formation of surface ozone-related air pollution).

We note that a reasonable argument could be made that Dr. Shindell's findings are, in fact, unduly conservative, and that any methane fee should be based on the 20-year interval GWP ratio between methane and carbon dioxide. We do not assert that argument in this letter. We accept, and urge you to accept, Dr. Shindell's findings as the best available scientific information concerning the social and environmental costs of the climate pollutants that currently contribute to the "baking" of our planet.

We believe that time is in short supply concerning the actions needed to stave off the outright elimination of native biodiversity on this planet. All of us bear an ethical responsibility to make a "good faith" effort to slow down the rapid warming of our planet. Providing leadership through the institution of a substantial methane emissions fee or fine would constitute a show of "good faith" in carrying out the provisions of law outlined above, and also provide revenues necessary for some environmental remediation in addition to perhaps inducing others to follow a similar path.

Sincerely,



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Appendix A: Methane Fees and Wholesale Milk Prices.

One milking cow produces 240 lbs. of methane per year [1]. 8.3333 milking cows produce 2000 lbs. of methane per year (1 ton). One milking cow produces 2500 gallons of milk/year [2]. 8.3333 cows produce 20,832.5 gallons of milk per year.

The wholesale price of milk paid to the dairy producer is currently 16.93 dollars per hundredweight (cwt) [3]. 11.63 gallons are in a cwt [4]. \$16.93 per cwt/11.63 gallons per cwt equals \$1.45/gallon of milk. The dairy producer therefore currently receives just over 30,000 dollars (20,832.5 gallons X \$1.45 per gallon = \$30,207.12) from the wholesale milk buyer for the milk production produced by those 8.333 milking cows.

If the dairy producer has to pay an additional \$4700/ton CH₄ produced by those 8.3333 milking cows, the overall amount he must receive in the future from the milk buyer must now increase to nearly 35,000 dollars (30,207.12 + 4700 = 34,907.12) in order to cover his costs and maintain the same level of profit.

To maintain the same pre-fee “wholesale milk price per pound to total dollar amount received from the milk buyer” ratio, the wholesale price/lb. of milk received by the dairyman must rise from \$1.45/lb. to 1.68/lb. Such a price rise would constitute a 15.86 percent (approx. 16%) increase, relative to the pre-fee wholesale milk price. ($1.45/30207.12 = x/34907.12 = 1.6756$; $0.23/1.45 = 0.1586$.)

It is therefore reasonable to assume that a 16 percent rise in the wholesale price of milk may occur if the methane fee is instituted and rigorously enforced. This may lead to commensurate increases in the wholesale and retail prices of related milk and cheese commodities.

Sources:

1: Each milking cow emits CH₄: 109 kg/cow/yr., or 239.8 pounds per year. See K. A. Johnson and D. E. Johnson, "Methane Emissions from Cattle," *Journal of Animal Science* 73(8) (1995): 2483–92.

2: "The average cow in the U.S. produces about 21,000 lbs. of milk per year, that's nearly 2,500 gallons a year! On a daily basis, most cows average about 70 lbs. of milk per day, or about 8 gallons per day. 8 gallons is about 128 glasses of milk per day."
<http://www.dairymoos.com/how-much-milk-do-cows-give/>

3: DAIRY MARKET NEWS, VOLUME 82, REPORT 45, WEEK OF NOVEMBER 9 - 13, 2015, p 15 of 27, <http://www.ams.usda.gov/market-news/dairy/mnweekly-2015>

4: <http://www.experts123.com/q/how-many-gallons-are-in-a-hundredweight-of-milk.html>

Appendix B:

We also wish to further comment upon the methane disaster currently occurring in Southern California. We insist that Southern California Gas be required to pay a fine on each ton of methane emission resulting from the natural gas leak currently occurring at its Aliso Canyon natural gas storage facility. This fine per CH₄ ton released should be 100 percent of the baseline value of \$4700 of damages per ton of CH₄ that is presented in The social cost of atmospheric release, Drew T. Shindell, *Climatic Change* (2015) 130:313–326, DOI 10.1007/s10584-015-1343-0, page 319, Table 2, Median total; declining rate.

To date, CARB estimates that the leak has released the equivalent of 0.80 million metric tons of carbon dioxide, or about the same amount of GHG emissions generated by the driving of 160,000 cars for a year, or the consumption of 90 million gallons of gas.

We also wish to note that the CARB estimate for this major methane leak in terms of CO₂ equivalency is unduly conservative, as it is based on a year 2007 IPCC 100-yr interval methane GWP of 25. We believe that CARB should be evaluating this very serious methane leak using a 20-year interval methane GWP of 86 (with carbon feedbacks), which is from the IPCC 2013 AR 5th Report. If the latest methane GWP for a 20-year interval is used, then the CO₂ equivalency over a 20 year heat-trapping period increases by a factor of 3.44. The CO₂ equivalent of the CARB estimate for the released amount of methane gas over the last month then becomes 2.752 million metric tons of CO₂e that traps heat in the atmosphere for 20 years, as opposed to the 0.8 million metric tons of CO₂e that traps heat in the atmosphere for 100 years.

We lastly note that 0.8 MMTCO₂e is equivalent to 1.76 billion pounds of CO₂e (GWP 25, over the 100-yr interval). 2.752 MMTCO₂e is equivalent to 6.0671 billion pounds of CO₂e (GWP 86, over the 20-yr interval). The latter number (2.752 MMTCO₂e) is 72.28 percent of the 8.4 billion pounds that a yr. 2010 coal plant emits in terms of CO₂ emissions. The former number (0.8 MMTCO₂e) is 20.95 percent of the 8.4 billion pounds that a yr. 2010 coal plant emits in terms of CO₂ emissions.

(See <http://www2.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references.>)