SLCP RS/Revised Draft EA Comments – WUMU/SFK/VCCH

January 17, 2017

From: Todd Shuman, Ara Marderosian, and Jan Dietrick

To: Ryan McCarthy and Craig Segal, California Air Resources Board (CARB):

We submit these comments concerning the CA ARB SLCP Reduction Strategy and Revised Draft Environmental Assessment, November, 28, 2016

Introduction

A few years ago, California initiated a CEQA review process to address short-lived climate pollutant emissions in California. This process was drastically altered by the establishment of SB 1383 as new law in September 2016. It is now unclear what can be meaningfully accomplished through the California Air Resources Control Board (CA ARB) SLCP Reduction Strategy CEQA review currently occurring. Nonetheless, we submit the following comments concerning the revised Draft EA of the revised SLCP Reduction Strategy, as well as the Strategy itself. (A second submission with all the file attachments referenced in this document will be submitted by email directly to CA ARB

The Limitations Imposed By SB 1383

To start, we must address the new environment created by SB 1383. SB 1383 now prevents the institution of any mandatory emission reduction targets for livestock/dairy-related methane emissions for

the year 2020. The mandatory delay concerning institution of new livestock/dairy-related regulations until 2024 or after effectively prevents establishment of mandatory livestock/dairy-related emissions reduction targets for the year of 2025 as well. The "up-to-40 percent" specification in SB 1383 prevents the institution of year 2030 mandatory livestock/dairy-related emission reduction targets that **exceed** 40% (relative to year 2013 levels). The "mid-2020 ARB livestock/dairy sector reduction standard evaluation" provision allows the CA ARB to reduce any specified year 2030 mandatory emissions reduction target concerning the livestock/dairy sector(s) to a emission reduction target level far **below** 40 percent.

Mandatory emission reduction targets concerning enteric emissions (the largest methane emission source in California, at 30 percent of the total methane emissions statewide) are prohibited altogether, unless a punishing gauntlet of ill or un-defined conditions and criteria can somehow be successfully traversed by anyone who might endorse and promote the policy that meaningful mandatory emission reduction targets (and mandatory application of emission reduction approaches/technologies/feed sources) should also apply to the largest methane emission source in the state of California (i.e. enteric emissions from livestock, especially cattle).

As citizen-activists who have been involved in this process over the last year and a half, we still struggle to grasp this failure of the State of California to address forthrightly the cumulative climate disruption impacts that have been (and will continue to be) generated by California livestock (especially cattle). We believe that the failure of the State of California to take action that would compel significant reductions in livestock-related methane emissions in the near term will not be viewed favorably in the future, and neither will the deliberate actions taken by the State of California that will

effectively block the institution of reasonable policies and technologies that could compel significant near-term livestock-related methane emission reductions.

Still, we present below information and critique that could, and should, provide a basis for an alternative policy approach to livestock-related Greenhouse Gas (GHG) emissions, if political, economic, and social conditions change sufficiently in California in the future.

Livestock and Global Surface Temperature Change

To start, we submit an extended analysis that draws upon information disclosed in Figure 2d of "New use of global warming potentials to compare cumulative and short-lived climate pollutants", Myles R. Allen, Jan S. Fuglestvedt, Keith P. Shine, Andy Reisinger, Raymond T. Pierrehumbert and Piers M. Forster, Nature Climate Change, PUBLISHED ONLINE: 2 MAY 2016 | DOI: 10.1038 /NCLIMATE2998
http://www.nature.com/nclimate/journal/v6/n8/full/nclimate2998.html

The recently published Allen et al. (2016) analysis disclosed information that now enables us to estimate much more precisely the degree to which past global Greenhouse Gas (GHG) emissions have been, and will be, changing the environment of our planet. (See Appendix A, which includes Figure 2d with a grid superimposed. Note: we submitted the full Allen et al. [2016] paper to CA ARB on May 26, 2016 as part of our May 26, 2016 comments)

Figure 2d of Allen et al. (2016), which uses the Global Temperature Potential (GTP) metric (as opposed to the Global Warming Potential [GWP] metric), provided us a basis for estimating global surface

temperature change values associated with past CH4, CO2, and N20 emissions.[1]

Our analysis indicates that total cumulative **anthropogenic** CH4, CO2, and N2O emissions from 1950-2016 appear to have increased **gross** annual global surface temperatures approximately 1.5 degrees C (in 2015 and 2016, and likely for 2017 and 2018 as well) *above and beyond* what such surface temperatures otherwise would have been without such **anthropogenic** CH4/CO2/N2O emissions over the1950-2016 period. (The effect of negative atmospheric climate forcers [or atmospheric cooling agents, such as SO_2] is not included in the cumulative gross annual global surface temperature change values derived from Allen et al. [2016].)

Using Allen et al. (2016) in conjunction with a number of other authoritative sources (especially Gerber et al. [2013], our analysis also indicates that global livestock supply chain-associated GHG emissions are likely responsible for roughly one-fifth (20.5%) of the cumulative gross global surface temperature change over this period.[2]

---

[1]: We note that the SLCP Reduction Strategy itself, on page 40, appears to acknowledge the validity of using the GTP metric as a substitute for the 100-year GWP metric by referencing the Norwegian Environmental Agency, Report M135/2014, *Summary of proposed action plan for Norwegian emissions of short-lived climate forcers,* in which the Norwegian Government uses the 10-year interval GTP metric for its assessment of prospective SLCP impacts. This report states: "As we have assessed it, 'GTP10, Norway', i.e. global temperature change potential calculated ten years after the emission occurred in Norway, is the most appropriate metric for analysing measures for Norwegian emissions of short-lived climate forcers in the short term. This metric gives a snapshot of the temperature response 10 years after the emission and reflects both the short lifetime of short-lived climate forcers and the fact that the emissions occur in Norway."

[2]: We note that this value excludes foregone carbon sequestration due to the conversion of forests into pastures and livestock feed crop production. If foregone carbon sequestration is included into the "equation", the livestock supply chain share of total increases to roughly a quarter (25.5%) of the global surface temperature rise that has occurred since 1950. See attached spreadsheet set, "Anthropogenic GHG Emissions and Global Surface Temperature Change Values, 1950-2016".

The single largest emission source in these cumulative global livestock-supply-train-associated GHG emissions is enteric methane emissions, mostly from cattle. In 2011, roughly 98 Megatonnes of methane emission were attributed to the emission source of enteric methane emissions by the Food and Agriculture Organization (FAOSTAT, 2016). (This value is just under 30 percent of the global anthropogenic methane emission total for year 2011.)

In our May 26, 2016 comments to CA ARB, we submitted the estimated future global temperature change (GTC) values (in degrees Celsius) associated with year 2011 total global anthropogenic livestock and cattle-related methane emissions (expressed as a pulse). We again provide these values below, which are derived from Figure 2d of Allen et al. (2016) and FAOSTAT:

Year	2015	2021/2022	2031/2032	2050
Livestock enteric:	0.0044	0.0061	0.0044+	0.0015
Cattle enteric:	0.0033	0.0045	0.0033+	0.0011

In short, total year 2011 anthropogenic livestock-related and cattle-related methane emissions likely increased the 2015 average global temperature by 0.0044 and 0.0033 degrees C (respectively) *beyond what the 2015 global average temperature would otherwise have been.* Such year 2011 anthropogenic livestock-related and cattle-related methane emissions can be expected to increase the 2021/2022 average global temperature by 0.0061 and 0.0045 degrees C (respectively) *beyond what the 2021/2022 global average temperature would otherwise likely be.* [See **Appendix A**]

California Livestock and the Cumulative Effects of Enteric Methane Emissions from California Livestock

Total annual methane emissions from California livestock (enteric and manure sources combined) are estimated by CA ARB at just under one megatonne (Mt) per year. Based on the information provided in Allen et al. (2016) above, a one Mt methane emission in 2011 can be expected to generate the following annual global temperature effects 20 and 40 years in the future: 0.00004545+ degrees Celsius global temperature rise for the year 2031-2032 and 0.00001535 degrees Celsius global temperature rise for the year 2051-2052. Alternative (and substantially higher) global temperature change values concerning a one Mt methane emission pulse (again originating with a 2010-2011 methane emission pulse and spanning over a 20 year-40-year time frame) has been provided in **What Science Tells us: why methane is important,Global Methane Forum**, Washington DC 29th March, 2016, Drew Shindell, Professor of Climate Sciences, Duke University, CCAC Science Advisory Panel Chair, and Johan C.I. Kuylenstierna, Policy Director, Stockholm Environment Institute, CCAC Science Advisory Panel member. On Slide/Page 45, Shindell and Kuylenstierna write: "How much benefit do we get from reductions? Each Mt methane emission prevented avoids: ~300-400 premature deaths due to ozone; ~186,000 tons of crop yield loss due to ozone; ~0.002C [sic] warming over 2-4 decades; 3000-6000 $US societal benefits."

Following global trends, enteric emissions in California, as noted above, constitute about 30 percent of total anthropogenic methane emissions in California in a typical year.

Just under a billion pounds of methane emission per year from this California methane emission source contribute to an increasing

disruption in the global climate system that is manifest in the dramatic increase in global surface temperatures over the last 67 years.

In its April 2016 proposed SLCP Reduction Strategy, the CA ARB effectively ignored the single largest methane emission source in California: enteric emissions from California livestock. No "reasonably foreseeable compliance responses associated with the methane reduction measures" were projected concerning potential enteric emission reductions from California livestock in Appendix C, pages 4-16/17, Draft EA for Proposed SLCP Reduction Strategy (April 11, 2016). In the aftermath of the legislative and executive enactment of SB 1383, this judgment remains unchanged but now also extends to the California legislature and the Governor of California.

Unfortunately, the very real atmospheric/thermodynamic impacts of past, present, and future enteric methane emissions on the Earth's already disrupted climate system are also likely to remain unchanged.

Still, we believe that there are reasonable measures that could be (and should be) enacted to dramatically reduce methane emissions from this source (as well as other GHG emissions associated with livestock supply chains in California). We again present these measures below.

CEQA and Enteric Emissions

A billion pounds of methane emitted per year from this specific methane emission source must be considered, at the very least, a

cumulative impact – or an incremental impact, which, when added to other closely-related past, present, and reasonably foreseeable global enteric emission sources, changes the environment. Cumulative enteric methane-related impacts from livestock in California result from individually minor but collectively significant methane emissions taking place over a period of time. These impacts have been, and are, contributing to a large and growing global accumulation of enteric-related atmospheric methane that has been contributing to significantly-increased global surface and ocean temperatures over the last 55-66 years. [See **Appendix A**, **Appendix B**, and spreadsheet set, "Anthropogenic GHG Emissions and Global Surface Temperature Change Values, 1950-2016".]

It is undeniable that past, present, and reasonably foreseeable enteric-associated global temperature change is, in fact, a significant cumulative effect – an effect which has been partially generated by the many individually minor but collectively significant livestock-related methane emissions taking place in California over a period of time.

CEQA requires that CA ARB take a "hard look" at the "cumulative impacts" dimension of California-based, livestock-related enteric emissions in the SLCP Reduction Strategy and the associated Revised Draft EA and explore and evaluate alternatives that would reduce such emissions. The lack of such a "hard [cumulative impacts] look" and lack of a "thorough exploration of alternatives" that might promote substantial enteric-related methane emissions reductions in the Revised Draft EA and SLCP Reduction Strategy still constitutes a glaring and transparent violation of CEQA.

Direct Enteric Emission Methane Reduction Alternatives

We again propose that CA ARB, the legislature, and the Governor explore and consider enacting some or all of the following to reduce enteric emissions in California: measures to promote mandatory livestock herd size reduction; mandates that compel the development of enclosed barns-vented-to-biofilter treatment systems that capture emitted dairy-associated methane before it escapes into the atmosphere; and requirements that grazing cattle shall wear gas-collecting, plastic-bag-expanding backpack technology that captures emitted enteric methane so it can be burnt rather than belched into the atmosphere.

Concerning the latter strategy, we submit for the record the attached Government of Argentina INTA Reports, in Spanish and Google-translated English, as well as again submitting internet links concerning this approach. [Use Google Search to access the following links to see demonstrations of the technology: http://www.fastcoexist.com/.../these-backpacks-for-cows..., http://www.dailymail.co.uk/.../Now-THATS-wind-power-Cows... , http://grist.org/.../crazy-clip-shows-what-happens.../... See also the video, on YouTube, titled **"producción de energía de gases ruminales"**]

We propose that CA ARB explore the idea of evaluating, replicating, financing, and promoting further development of the biotech gas-collecting cow backpack methane capture concept and technological system to facilitate capture of ruminant-associated methane due to enteric fermentation.

We encourage CA ARB to procure a full translation of the full report, and evaluate the experimental results in the context of the

SLCP Reduction Strategy CEQA analysis currently underway, and also make an English translation of the report available to the public.

We believe that this approach may be one that might potentially meet the requirements of the enteric emissions provision of SB 1383 in the future, though it is possible that more work may need to be done to address the question of economic viability, along with other requirements specified in SB 1383. A more extensive collective infrastructure might (or might not) ultimately be required to make implementation and widespread dissemination of this bio-technological approach a reality. Still, the concept deserves a "good faith" evaluation by CA ARB and an assessment as to what might be needed to establish enhanced viability of this particular bio-technological methane capture approach in the future. [We also note that the technique developed by INTA also captures a substantial amount of rumen-generated carbon dioxide, which could constitute a source gas for future CO2 conversion into ethanol - see http://www.popularmechanics.com/science/green-tech/a23417/convert-co2-into-ethanol/]

In any case, the failure of CA ARB to address direct methane reduction alternatives concerning enteric emissions in the SLCP Reduction Strategy and the associated Revised Draft EA currently constitutes a glaring and transparent violation of CEQA.

Indirect Enteric Emission Reduction Alternatives: Cap and Trade, Metrics, Mandatory Reduction Targets, and Taxes

Enteric fermentation methane emissions from *dispersed*, pasture-based livestock should also be considered for incorporation within cap and trade, with auctioned pollution permits or offset credit

purchase costs based on one of the following alternatives:

- a short-term interval methane Global Warming Potential [GWP] value;
- a short-term interval Global Temperature Potential [GTP] value;
- an alternative measure based upon the radiative forcing/efficiency value of methane.[3]

Concerning the third bulleted point above, we include quoted summary language from two recent analyses by Lauder et al. (2013) and Pierrehumbert and Eshel (2015).[4]

---

[3]: "Based on background values of 378 ppm for CO2 and 1.75 ppm for CH4 prevailing circa 2005, the radiative efficiency of CO2 is 1.4 × 10−5 W/m2/ppb while that of CH4 is 3.7 × 10−4 W/m2/ppb, or a factor of 26 greater . . . ." (Page 349, Pierrehumbert, see below.) "A novel approach to multi-gas climate protection protocols, quite different from that used in the Kyoto Protocol, is required to properly deal with SLCP. In the context of a carbon tax, an emitter would pay a tax for each GtC of CO2 emitted but would be given a one-time tax credit for each Gt/year of methane emissions rate reduction, weighted according to the corresponding radiative forcing. If the emitter ever increased the methane emissions rate again, the tax credit would need to be paid back with interest . . . Related approaches to SLCP mitigation are discussed in Lauder et al. (2013)." *Short-Lived Climate Pollution,* R.T. Pierrehumbert Annu. Rev. Earth Planet. Sci. 2014. 42:341–79, page 374-375

[4]: "[A] one-off sequestration of 1 t of carbon would offset an ongoing methane emission in the range 0.90–1.05 kg CH4 per year . . . The conversion factors are more conveniently used in terms of carbon mass, giving 1.1 t C (4.07 t CO2) offsetting 1 kg CH4 per year with $R^{eff} = 0.3$… Larger values of R^{eff} mean more weight is given to the effect of CO2 on radiative forcing, and so the rate of 'equivalent' CH4 emissions must be correspondingly higher, giving 0.95 t C (3.5 t CO2) offsetting 1 kg CH4 per year if R^{eff} is set to 0.35." *Offsetting methane emissions — An alternative to emission equivalence metrics,* A.R. Lauder, I.G. Enting, J.O. Carter, N. Clisby, A.L. Cowie, B.K. Henry, M.R. Raupach, International Journal of Greenhouse Gas Control 12 (2013) 419–429, quotes taken from pages 419, 422. RT Pierrehumbert and G Eshel, *Climate impact of beef: an analysis considering multiple time scales and production methods without use of global warming potentials,* Environ. Res. Lett. 10 (2015) 085002 (Pierrehumbert [2014] also notes, on page 374: "Specifically, using Equation 2 we find that a permanent reduction of SLCP emission rate corresponding to 1 W/m2 is equivalent to a reduction of cumulative carbon emissions by 407 GtC, with regard to long-term radiative forcing . . .]

The authors of these studies have proposed scientifically-derived CO2 sequestration/CH4-N2O emission ratios through which the internalization of the social and environmental costs of methane and nitrous oxide emissions might be realized through compensatory CO2 sequestration.

Lauder et al. (2013):

"Using $R^{eff} = 0.35$, we have 1 kg CH4 per year offset by one-off uptake of 950 kg C, i.e. 3500 kg CO2" (See Lauder et al. [2013], page 426.)

Pierrehumbert and Eshel (2015):

"In the case of midwest feedlot beef, for example, the CH4 and N2O emissions associated with a sustained production of 1 kg yr−1 of beef would need to be offset by a reduction of 1460 kg in cumulative carbon from fossil fuel burning, in order to keep within an agreed climate objective." (See page 8 and Table 2 on page 7, Pierrehumbert and Eshel [2015].)

Pierrehumbert (2014) has also proposed mechanisms (involving carbon taxes and tax credits) through which the internalization of the social and environmental costs of methane and nitrous oxide emissions might also be realized. (See footnote 3.) We insist that CA ARB consider these mechanisms and disclose analysis concerning these mechanisms as an alternative.

For dairy-related CAFOs, there should be meaningful, mandatory reduction targets established for enteric emissions from all livestock such that a 75 percent reduction in enteric emissions statewide will be *required* by year 2030, relative to 2013. We propose a mandatory

25 percent reduction target for year 2020, a 50 percent mandatory reduction target for year 2025, and a 75 percent mandatory reduction target for year 2030. Obviously, SB1383 would need to be amended in the future to enable the institution of these proposed reduction targets

In addition, a stiff tax should be imposed on all other sources of uncaptured, unburnt methane emitted into the atmosphere that are not included in cap and trade. A methane tax could be based on the use of a short-term interval methane GWP or GTP. Since the best scientific estimate for the *effective* lifetime of methane in the atmosphere is a little over 12 years (12.4 years, IPCC AR^{5th} 2013, Chapter 8, Table 8.7, page 714), a methane GWP of 100 could be used, as that is the approximate methane GWP associated with the 12.4 year time interval (see Figure 8.29, page 712, chapter 8, IPCC AR^{5th}). A methane tax could also be based upon analysis produced by Dr. Drew Shindell 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. Finally, a methane tax could also be based on the CO2 sequestration/CH4-N2O emission ratios that Lauder et al. (2013) or Pierrehumbert and Eshel (2016) have derived. (We wish to note for the record that we submitted our methane tax proposal, based upon Shindell's analysis, to CA ARB on November 27, 2015 and again on May 26, 2016.)

In any case, the findings of these rigorous analyses should be factored/incorporated into a carbon tax framework (preferably) or cap and trade framework (less preferably) so that livestock and dairy product producers would be compelled to internalize (or "absorb") the social and environmental costs of CH4 and N20 emissions per kg

of beef or dairy product based upon honest, science-based, cumulative carbon equivalency ratio rates.[5]

Draft EA Carbon Tax Alternative

Concerning the current Revised Draft EA, we note that the CA ARB did not consider nor analyze a carbon/methane/SLCP tax-based alternative in this CEQA proceeding/CEQA process/CEQA document.

We insist that the CA ARB engage in a good faith and reasoned analysis of the benefits that a carbon/methane/SLCP tax might offer. Moreover, we insist that CA ARB go further and engage in a good faith and reasoned analysis of a broader Greenhouse Gas (GHG) Emissions tax that would apply to all the GHG emissions that flow from the Agriculture economic sector -- and include GHGs that are not carbon-based (such as nitrous oxide, N20), as well as GHGs that are both long-lived (e.g. CO2 and N20) and short-lived (e.g., methane).

The model for this particular unified GHG "Ag" taxation approach was recently published in "Mitigation potential and global health impacts from emissions pricing of food commodities", Marco Springmann, Daniel Mason-D'Croz, Sherman Robinson, KeithWiebe, H. Charles J. Godfray, Mike Rayner and Peter Scarborough, Nature Climate Change, 7 NOVEMBER 2016 | DOI: 10.1038/NCLIMATE3155.

---

[5]: Beef and dairy product producers should also be compelled to internalize [or "absorb"] additional meat/dairy-production-related *CO2* emission costs. Such costs, as documented by Pierrehumbert and Eshel [2015], are quite dramatic for certain meat production modes [Feedlot Midwest and Pastured Midwest] that are likely similar to meat/dairy production modes in California. Soil-related carbon emission environmental costs due to livestock feed row crop production (which were not documented by Pierrehumbert and Eshel [2015]) should also be "internalized" by beef and dairy product producers.

Springmann et al. (2016) explore and model a meat and dairy-based taxation approach to promote "cost internalization" of social and environmental costs associated with meat and dairy production by producers and direct consumers of such commodities.

[We note for the record that the approach proposed by Springmann et al. (2016) is consistent with the tax-related "cost internalization" approach recently proposed by Germany's Federal Environment Agency (UBA). The UBA recently concluded "that VAT (Value-Added Tax) reductions on animal products such as meat and cheese amount to environmentally harmful subsidies. It put the current value of this tax break at €5.2 billion. The agency criticised the fact that animal products benefit from a VAT rate of just 7%, the same rate as cereals, fruits or vegetables, despite the fact that they are far more damaging to the environment."

The UBA proposed a VAT differential of 7% versus 19% concerning plant-based food commodities relative to animal-based food commodities: "'In future, animal food products should be taxed at the regular 19% rate. In return, the state could use the billions this would generate to further lower the 7% reduced rate. This could help cut the cost of fruits and vegetables or public transport. Both would be good for the climate and benefit citizens,' said UBA President Maria Krautzberger."

"The [UBA] agency criticised the fact that animal products benefit from a VAT rate of just 7%, the same rate as cereals, fruits or vegetables, despite the fact that they are far more damaging to the environment. For example, one kilo of beef can generate up to 28kg of CO2 equivalent. For the same quantity of fruits and vegetables, emissions are typically less than 1kg."(See https://www.euractiv.com/section/agriculture-food/news/german-

environment-agency-tax-animal-products-to-tackle-climate-change/.)]

We are attaching for the record this recently published study to facilitate CA ARB development of a serious GHG-based direct taxation approach as part of this CEQA process. As such, we insist that CA ARB review this study and produce a good faith and reasoned analysis of a "Cap and Tax" alternative that is informed by the Springmann et al. (2016) study attached. Such an alternative should be designed to promote substantial livestock-related GHG emissions reductions concerning commodity production that involves both short-lived and long-lived climate pollutants.

We are also submitting for the record this article by Darien Shanske ("Can Formulary Apportionment Save the World? Apportionment and a State-Level Carbon Tax", Chapman Law Review, Vol. 18:1, 9/27/2014, pp. 191-210) concerning state-level Border Tax Adjustment for prospective state-level carbon taxes. (See http://heinonline.org/HOL/LandingPage?handle=hein.journals/chlr18&div=15&id=&page=)

The legal theory propounded and explored by Shanske addresses direct carbon tax mechanisms at the state level that would alleviate, minimize, and perhaps eliminate altogether concerns about GHG "leakage" concerns that are frequently expressed by the CA Dairy Industry, while also conforming to the Commerce Clause of the U.S. Constitution. (Shanske explores, most notably, carbon-based Border Tax Adjustments that are consistent with

"complementary tax doctrine" and Formulary Apportionment as a substitute for carbon-based Border Tax Adjustment.)[6]

In any case, the failure of CARB to address *indirect* methane reduction alternatives (especially a carbon/methane/SLCP/ or meat/dairy commodity-based tax alternative) concerning enteric emissions in the SLCP Reduction Strategy and the associated Revised Draft EA currently constitutes another glaring and transparent violation of CEQA.

Leakage

Dairy Cares, the Environmental Defense Fund, and the CA ARB itself have raised the issue of potential "leakage" to justify CA ARB inaction concerning enteric methane emissions related to livestock and dairy production in California. While the provisions of SB 1383 may render this point moot for now, the claims previously made still deserve a reply in this CEQA process, so we therefore re-submit what we submitted to CA ARB in 2016, with some minor amendments.

Comment A:

The CA ARB stated its perspective explicitly on page 67 of the SLCP Reduction Strategy, CA ARB, 04/11/2016:

---

[6] The "waste and unreasonable use of water" provision of the California Constitution (see attached Sept 29, 2016 WURU complaint) might need to be incorporated into this meat/dairy-tax framework to effectively address the major issue of California dairy and livestock commodities *intended for export*. This constitutional provision might need to be used and applied to ensure that all meat/dairy-taxable commodities produced in California (and produced through the use of California water) would be available only to California domestic commodity markets. Thus, all livestock/dairy commodities either produced in California or exported into California could then be taxed at the same meat/dairy tax rates at the retail commodity sales level.

“If regulations impose costs on the industry that cannot be recouped, a result could be emissions leakage, if some dairies relocate outside of California or herd sizes grow elsewhere. This could include places where milk production efficiencies are lower and associated enteric fermentation emissions are higher and could increase mobile source emissions from heavy duty vehicles associated with transport of dairy products to established processing facilities and distribution centers.”

We believe that Dairy Cares, the Environmental Defense Fund, and the CARB have politically deployed the concept of “leakage” to ignore and/or block initiatives that would compel an “internalization” of significant enteric-emission-related environmental costs by those legally responsible for California-based enteric methane emissions. We find such arguments dubious (at best) and disingenuous (at worst).

To start, we are not aware of any studies that indicate leakage would occur if animal-based agricultural industries were incorporated into a climate policy regime (as we recommend above), and no studies concerning animal agriculture and potential leakage have been cited by CA ARB either.

Second, we note that it is common for industries that are being considered for inclusion in a policy like cap-and-trade to argue that the policy costs will lead to job loss and leakage. Many industries have been successful in convincing regulators that leakage would occur absent additional policy incentives. This does not necessarily mean that there actually is a significant risk of leakage – it more typically means that regulators have become swayed by the immense political power of concentrated economic interests in California. We believe such a situation is occurring now.

Third, even if some of our proposed policies above were implemented and enforced and some leakage did occur such a result would not necessarily constitute a violation of AB 32. The state courts have applied broadly deferential review standards when CA ARB's policies have been challenged in the past; moreover, there is a list of eight or so objectives in AB 32 (including minimizing leakage), and the courts have basically held that CA ARB has discretion over how to prioritize among the competing objectives in AB 32.

Most significantly, any amount of agriculture-emissions-related leakage that might occur must be placed in historical context. A much larger type of leakage, known as resource shuffling, occurred a few years ago, and the massive leakage associated with it had a pronounced impact on carbon market prices. Yet CA ARB enabled and authorized such large-scale leakage, and no legal violation of AB 32 was ever recognized by either CA ARB or a court of law. In light of the resource shuffling that occurred, we doubt that an agricultural emissions-related climate policy that generated some leakage would be considered illegal, given the way that other problems related to leakage have been previously handled within California's system.

In short, we interpret the discourse promulgated by Dairy Cares, EDF, and CA ARB as an attempt to shift the economic burden of CA ARB's overall SLCP regulatory strategy away from the dairy industry. We do not find disclosed within this discourse or the record a persuasive argument that CARB is effectively prohibited from meaningfully addressing livestock and dairy enteric methane emissions as a legal matter. In any case, we believe that the potential leadership and demonstration effects of compulsory inclusion of

livestock-associated enteric emissions within California's GHG emission control and reduction system would outweigh any risk or actual leakage that might occur.

It is our view that the economic concept of leakage, as enshrined in AB 32, must not be used to prevent California from exerting global leadership with regard to compulsory agricultural/livestock-related business internalization of ACD pollution costs associated with livestock enteric and manure-related methane emissions. If California has to wait until every other state and nation is willing to enact similar "internalization" policies at the same time, then such internalization will probably never occur -- or it will not occur soon enough to be able to promote a meaningful reduction in the atmospheric methane concentration and associated radiative-forcing rate that is aggravating and intensifying climate disruption on our already rapidly-heating planet.

Comment B:

In Comment A, we addressed the matter of "leakage" in the context of enteric emissions from livestock in California. (To refresh, emissions leakage occurs when an environmental regulation induces a shift in industrial or agricultural production [and associated emissions] to less stringently regulated areas.) We revisit this matter in the context of the Dairy Care comments that were submitted to CA ARB on May 26, 2016, as well as other material that was published after the draft EA comment deadline of May 26, 2016 passed.

1: Ramboll Analysis: GHG Intensity of Milk Production

The Dairy Care comment of May 26, 2016 includes a 5 page

analysis developed by Ramboll Environ (pp. 36-41 of pdf), accompanied by a 6 page "Attachment A Greenhouse Gas Analysis" (pp.41-46 of pdf). On page 2 of this analysis is a comparison of California and U.S. GHG Intensity/1000 lb milk presented in **Table 1a**. The **Table 1a** "GHG Intensity metric accounts for emissions from enteric fermentation from milking cows divided by milk production."

The year 2013 **Table 1a** difference between CA and US values is only 2.48% (0.004/0.161, as the CA value is 0.161, compared to the U.S. value is 0.165). In terms of the enteric emission-only-related GHG intensity/1000 1b milk, CA is slightly more efficient than US concerning the GHG intensity of milk. **This difference between CA and the U.S. is marginal.** Based upon this data, any hypothesized relocation of CA dairy operations to other U.S. states cannot be expected to significantly increase the *enteric-emission-only-related* Greenhouse Gas (GHG) intensity of milk with regard to either the overall milk consumption in California or the overall milk production and consumption within the United States.

The dairy industry and groups such as the Environmental Defense Fund (EDF) have asserted and/or implied that any dairy-related GHG "leakage" that might occur due to compulsory GHG-related internalization of the social and environmental costs of milk production will significantly increase the overall GHG intensity of milk production in the U.S. With regard to enteric emissions, these claims are not credible, *according to data that has been formally submitted to the CA ARB by the dairy industry itself.* Concerning enteric-emission-only-related GHG intensity, milk produced in other states is roughly comparable to milk produced in California. (We note for the record that CA ARB asserted these demonstrably exaggerated and fundamentally inaccurate claims in its SLCP RS

Revised Draft EA, most notably on page 7-10 [pg 170 of pdf] and page 7-11[pg 171 of pdf].)

2: Presumption of Leakage

We dispute again the presumption of leakage that is repeatedly asserted by the dairy industry and its allies such as EDF. Compulsory internalization of the social and environmental costs of milk production (with specific focus on enteric-emission-related costs) in California may not actually generate leakage, or such leakage that may occur may prove to be marginal in scale. Dairy Care's presumption of leakage is potentially contradicted by a number of factors.

First, the capture of enteric emission-related biogas could result in significant resale of biogas to utilities or other users of natural gas. This could constitute a significant revenue stream for ranchers/farmers/dairy owners. Alternatively, ranchers/farmers/dairy owners may use biogas (through combustion) to drive their own energy-dependent mechanical devices on the ranch/farm/dairy. Enteric emission-related biogas capture and combustion may reduce rancher/farmer/dairy owner need to purchase fuels from utilities or other 3rd Party fuel suppliers, thereby reducing energy purchase costs. Such biogas substitution might significantly, substantially, or completely compensate for any additional costs that would accrue concerning the purchase or development of enteric-related biogas capture and combustion technology and labor required to process captured biogas.

Second, a recent study of selected industries in CA that have been subject to AB-32-related cap and trade regulation has documented and suggested minimal overall economic and GHG-related leakage

impacts due to such regulation. (See http://legal-planet.org/2016/05/30/the-economic-impact-of-ab-32-on-california/.) Dan Farber (the Sho Sato Professor of Law at the UC Berkeley School of Law and Co-Director of the Center for Law, Energy & the Environment) wrote this observation in the May 30, 2016 Resources for the Future study: "[O]verall, the economic impact seems small. That's also important because it means that carbon leakage from production shifting is also probably small."

Third, any future dairy-related GHG-related leakage (which has been vigorously predicted by the dairy industry if dairy costs rise in the future as a result of increased compulsory internalization of GHG-related emission costs) would likely be mitigated by the increasing price-competitiveness of non-dairy, plant-based milks, such as almond, soy, rice, hemp, flax seed, coconut, and cashew-based milks.

As this phenomenon interacts with the increasing willingness of consumers to consider consumption of these non-dairy milk alternatives [see http://www.consumerreports.org/cro/2014/08/milk-substitutes-should-you-sip-or-skip/index.htm, http://www.foodnavigator.com/Market-Trends/Dairy-alternatives-on-the-up-Mintel, http://www.dairyreporter.com/Markets/Non-dairy-milk-market-vs.-dairy-milk-market-Mintel-market-research] and the increased economic elasticity of the milk (which has been noted by the agricultural industry itself [see http://www.agweb.com/article/why-dairy-demand-has-become-more-elastic-naa-catherine-merlo/]) it becomes reasonable to posit that any cost rise associated with milk production due to increased internalization of GHG-related social and environmental pollution costs might, in fact, lead to *lower* overall GHG emissions/overall radiative forcing.

In short, consumers may respond to the increased internalization of dairy-related GHG environmental costs by increasingly switching to increasingly price-competitive, non-dairy alternatives that are associated with far less GHG/radiative forcing impact per unit of purchased product.

Moreover, we believe that this consumer response will likely expand in scale, in part because of actions and statements by highly visible media personalities (such as former California Governor Arnold Swarzenegger, **Avatar/Titanic/Terminator 2** director James Cameron, and Moby) in which such influential people increasingly foreswear their own personal consumption of animal-based products in order to reduce their own personal climate footprint impact (and hence effectively discourage consumer consumption of meat and dairy products.) [See, for instance, https://www.theguardian.com/film/2016/jun/23/arnold-schwarzenegger-james-cameron-eat-less-meat-china.]

This phenomenon will also likely be enhanced by government actions throughout the planet that are intended to discourage meat and dairy production and consumption, such as the recent plan proposed by the Chinese government to reduce meat consumption in China by 50 percent. (See https://www.theguardian.com/world/2016/jun/20/chinas-meat-consumption-climate-change)

In any case, we assert that this counter-presumption articulated above is just as reasonable as (if not more reasonable than) the dairy industry presumption that substantial carbon leakage will occur if the dairy and broader livestock industry is compelled to absorb the GHG-related costs of animal-based commodity production in the future.]

Alternative CEQA Criterion

Dairy Cares presents an argument that the dairy industry in California currently operates on very narrow margins of profitability and economic viability, in spite of the fact that this industry currently externalizes its GHG pollution onto the broader society and environment. According to Dairy Cares, any compulsory internalization of GHG pollution might drive this industry into either economic extinction or toward out-of-state relocation. If this argument and its purported documentation are credible, this industry cannot survive unless California residents and the broader California environment continue to absorb the dairy industry's adverse impacts (including substantial GHG climate pollution impacts).

In light of this argument, we insist that CARB consider an alternative criterion during this CEQA environmental review: California residents, California state government, and the California environment should only absorb the adverse impacts of the dairy industry if it is clearly and indisputably beneficial to California society, the California environment, California native biodiversity, animal health and welfare, and the state's GHG reduction goals.

It is our view that the elimination of the deep and extensive subsidies (both direct and indirect) that sustain the dairy/livestock industry would result in a dramatically-reduced economic competitiveness of dairy-related products relative to plant-based substitute products that are healthier, less impactful on the global climate system, and, in our opinion, more humane.

Moreover, we assert that elimination of such dairy subsidies (both direct and indirect) is reasonable, as it is a wasteful and unreasonable

use of water (and arguably, unconstitutional) for California to support dairy and livestock industries that produce GHG pollution with such water and extensively externalize their GHG pollution costs onto the broader society and global environment.

With regard to land, water, and fertilizer resources used to produce livestock feed, the dairy industry can only be considered immensely wasteful, relative to the resources required to generate plant-based protein (which requires a small fraction of the same resources to generate a comparable amount of protein). With regard to the extensive GHG pollution associated with the industry (enteric and manure-based methane emissions, fertilizer-associated nitrous oxide emissions, and carbon dioxide emissions associated with soil tillage, machinery operation, and transportation of livestock feed crop-related inputs and outputs), the dairy commodity production can only be considered unreasonable relative to plant-based protein commodity production, which produces very low levels of GHG emission per unit protein concerning the latter two GHGs (nitrous oxide and carbon dioxide) and virtually no emission concerning the former GHG (methane). For a more extensive treatment of this argument, see the attached September 29, 2016 complaint submitted by Todd Shuman to CalEPA and the SWRCB, which summarizes the relevant comments that have been submitted to the CA State Water Resource Control Board (SWRCB) by SFK, WURU, and others over the last 18 months.

Responses to selected quotes from SLCP Reduction Strategy, 04/11/2016

A1: “The long-term operational impacts associated with the Proposed Strategy would reduce emissions of black carbon,

methane, and HFCs, thereby reducing GHG emissions in the State. Thus, the Proposed Strategy would result in a long-term beneficial effect and no significant cumulative effect would occur . . . Thus, short-term construction related GHG emissions impacts associated with reasonably-foreseeable compliance responses to the Proposed Strategy would be less-than-significant, when compared to the overall GHG reduction associated with implementation of the Proposed Strategy. Thus, the Proposed Strategy **would not make a considerable contribution (i.e., would be beneficial) such that a significant cumulative impact would occur** on GHG emissions." (Appendix C, 5-13/14 Draft EA for the Proposed SLCP Reduction Strategy, CA ARB, April 11, 2016.) A2: "The long-term operational impacts associated with the SLCP Strategy would reduce emissions of black carbon, methane, and HFCs, thereby reduce GHG emissions in the State. The short-term construction related GHG emissions impacts would be less-than-significant, when compared to the overall GHG reduction associated with implementation of the SLCP Strategy. Overall, the SLCP Strategy would result in a long-term beneficial effect and no significant cumulative adverse effect would occur. Thus, the SLCP Strategy **would not make a considerable contribution (i.e., would be beneficial) such that a significant cumulative impact would occur** on GHG emissions. SLCP Reduction Strategy Revised EA, CA ARB, November 28, 2016, Page 5-13.)

[Response: The premise underlying the Draft EA and Revised Draft EA text above is fallacious. Significant cumulative effects associated with livestock-associated enteric methane emissions have already been occurring, are continuing to occur, and will likely continue to occur unless meaningful mitigation measures are adopted, enacted, and enforced to reduce SLCP emissions from *all significant* anthropogenic SLCP emission sources. Without effective mitigation

of *all significant* anthropogenic SLCP emission sources, adverse global surface and ocean temperature change-related impacts are likely to continue in the future. CA ARB has proposed no mitigation measures concerning enteric emissions generated in California -- the single largest methane emission source in California. This failure constitutes a violation of CEQA.]

B: "California has the most dairy cows in the country and the highest aggregated dairy methane emissions. The State also has higher per-milking cow methane emissions than most of the rest of the United States, due to the widespread use of flush water lagoon systems for collecting and storing manure. Milk production feed efficiency at California dairies, however, is among the best in the world; California dairy cows produce low enteric fermentation emissions per gallon of milk. So 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." Page 65, SLCP Reduction Strategy, CA ARB, April 11, 2016

[Response: Utilizing a conservative estimate, we note that each milking cow – no matter how efficient a milk producer it is -- still emits approximately 240 lbs. of methane into the atmosphere per year. We find CA ARB's premise -- that low-GHG intensive milk status absolves the dairy industry from the ethical and environmental responsibility to drastically reduce enteric emissions by 2020, 2025, and 2030 -- to be ethically and politically reprehensible. Low GHG-intensive milk production helps generate significant global temperature change effects that are having, and will continue to have, adverse impact on native biodiversity, human populations, and the very fabric of life on this planet. In addition, see comments above concerning this claim in relation to the Ramboll Analysis:

GHG Intensity of Milk Production.]

C: "ARB and CDFA staff will establish a working group with other relevant agencies and stakeholders to focus specifically on solutions to barriers to dairy manure projects. The group will aim to ensure and accelerate market and institutional progress. It may cover several topics, including: project finance, permit coordination, CEQA, feed-in tariffs, simplified inter-connection procedures and contracts, credits under the LCFS, *increasing the market value of manure products*, and uniform biogas pipeline standards. This group will be coordinated with similar working group efforts related to anaerobic digestion, *composting*, energy, *healthy soils*, and water." (*Italics* added, Page 68, SLCP Reduction Strategy, CA ARB, April 11, 2016.)

[Response: It takes a large quantity of cow manure (78,000 lbs) to produce the large quantity of composted manure (62,400 lbs) needed for an acre of land to achieve a net soil sequestration of atmospheric carbon (i.e. CO2) in the range of 150-990 lbs/yr/acre (converting from the original 51-333g/m2/of C results for all three years presented in Ryals and Silver, [2013]). Since carbon is 27.291 percent of CO2 by mass, the amount of net atmospheric CO2 that is sequestered on this acre of land is likely in the range of 553-3627 lbs./year.

It takes 3.616 years for a beef cow to produce 78,000 lbs. of manure. Over that time, the beef cow will emit 477.3 pounds of methane (at 60 KG/yr). At GWP 34 (100 year interval), that is 16,228 CO2 equivalents, at GWP 86 (20 year interval), that is 41,047 equivalents. It takes a lactating dairy cow 2.6712 years to produce that much manure. Over that time, a lactating dairy cow will emit

641.1 pounds of methane (at 109 KG/yr). At GWP 34, that is 21,796 CO2 equivalents, at GWP 86, that is 55,133 CO2 equivalents.

It is going to take a number of years before the soil organic carbon sequestration levels created by the compost treatment exceed/counterbalance the CO2 equivalency emissions associated with the enteric fermentation methane emissions coming from the cows, depending on the GWP used. It is not really known what the soil carbon sequestration levels will be over time, though DeLonge argues elsewhere that it might continue for 20 years. If one uses the GWP of 34 and the maximum number in the soil sequestration range, the equalization/counterbalanced point occurs in 4.47-6.00 years (beef cow-lactating cow). If one uses the maximum range number and the GWP of 86, the equalization point occurs in 11.32-15.20 years (beef cow-lactating cow).

As one can see, whether this approach works with composted manure depends on the assumptions and numbers that are used. If the compost is plant-based, then there are no problems. With regard to soil carbon sequestration: Plant-based compost -- good! Cow-based compost -- maybe, but probably not (if one uses mean range sequestration values and the much higher methane GWPs associated with shorter-time intervals) though maybe so (if one uses high end range values and much lower methane GWPs associated with long-time intervals). This manure composting approach would work best for chicken, turkey, and pig-based manure (as there are no methane emissions due to enteric fermentation from these animals).

We believe that wherever there are large concentrations of manure, the manure should be composted and applied to the land. Now whether we want to encourage the creation of such large concentrations of manure, well . . . that is another matter altogether.

We do not believe that the people of California should encourage compost production associated with ruminants that emit copious amounts of methane via enteric fermentation. Cattle and sheep ranchers receiving carbon credit-related payments for creating such concentrations of ruminant manure would encourage a widespread ruminant-based manure compost production system. We are opposed to such a system that would continue to generate substantial GHG emissions.

(See Ryals, Rebecca and Whendee L. Silver, *Effects of organic matter amendments on net primary productivity and greenhouse gas emissions in annual grasslands*, Ecological Applications, 23(1), 2013, pp. 46–59; Marcia S. DeLonge, Rebecca Ryals, and Whendee L. Silver, *A Lifecycle Model to Evaluate Carbon Sequestration Potential and Greenhouse Gas Dynamics of Managed Grasslands*, Ecosystems (2013) 16: 962–979. Note: the Ryals, Silver, and DeLonge-authored California Soil Carbon Sequestration/ Composted Manure studies form the foundation upon which the ACR composted manure carbon sequestration protocol is based.)

D. "Almost all of methane's impact occurs within the first two decades after it is emitted." SLCP Reduction Strategy Revised EA, CA ARB, November 28, 2016, Page 4-48.) Global Surface Temperature Change (GSTC) effects from methane emission continue significantly (in a direct, indirect, and cumulative manner) for a period twice as long as CA ARB asserts, with GSTC effects most substantial over the full 30-year post-emission period. (See Figure 2d of Allen et al. (2016), in Appendix A.)

Amended SLCP RS Scoping Comments

We are also resubmitting for the record the amended scoping comments that Todd Shuman submitted to CA ARB on October 30, 2015, as well as a related follow-up letter emailed to CA ARB in December, 2015. These comments still provide relevant suggestions and information that CA ARB should consider before any final SLCP RS is released. Most of these early comments appear to have been discounted or ignored by CA ARB so far. The comments are included in Appendix C.

Sincerely,

Todd Shuman, Senior Analyst, Wasteful Unreasonable Methane Uprising (WUMU), P.O. Box 528, Camarillo, CA, 93011, tshublu@yahoo.com, 805.987.8203, 805.236.1422 (cell)
http://wumu-wuru.my-free.website/

Ara Marderosian, Executive Director, SequoiaForestKeeper, Kernville, CA 760.376-4434

Jan Dietrick, MPH, Steering Committee, Ventura County Climate Hub, Ventura, CA 805.746.5365

Appendix A:

The relationship between CH4 mass emission and global temperature change values in Figures 2a and 2d of Allen et al. (2016) appears to be largely linear and directly proportional (i.e. 110 Mt of CH4 generates X degrees of change, 330 Mt of CH4 generates 3X degrees of change, 1320 Mt generates 12X degrees of change, 1360 MT generates 12.36X degrees of change.) [Email communication with Dr. Myles Allen, May 15, 2016)

Todd Shuman extracted global mass emission estimates for the different anthropogenic methane emission sources and linked these values with the global temperature change (GTC) values in Figure 2d. For the mass values for the different sources, the "bottom up" methane source mass values in IPCC AR5, Chapter 6, page 507 are used. For enteric emissions for total livestock and for cattle, the Food and Agriculture Organization numbers (FAOSTAT) for year 2011 are used. Here are the numbers for the year 2011:

Enteric - 98 Mt (with the cattle subcomponent at 72 Mt)

Fossil Fuel – 96 Mt

Landfill/Waste – 75 Mt

Rice – 36 Mt

Biomass Burning – 35 Mt

From Allen et al. (2016), the total cumulative anthropogenic 2011 CH4 mass emission estimate (330 Mt, email communication with Myles Allen, May 11, 2016) is associated with a GTC value (in degrees C) of 0.015 for year 2015, 0.02066 for year 2021-2022, 0.016 for year 2031-2032, 0.005066 for year 2050, and 0.0005 for year 2100.

Todd Shuman performed some simple cross-multiplication arithmetic calculations to derive CH4-related sectoral GTC estimates below. Using the fossil fuel number as an example, here is the arithmetic method used:

For year 2015: 330/0.015=96/x=0.00436 degrees GTC; for year 2021/2022, 330/0.02066=96/x=0.006 degrees GTC; for year 2050, 330/0.005066=96/x=0.0015.

(The GTC for the total CH4 value in Year 2031/2032 is just slightly larger than for year 2015 GTC value, so Todd Shuman just added a + to the 2015 sectoral GTC values below to serve as the 2031/2032 sectoral GTC values.)

Below are the sectoral GTC values (in degrees Celsius) proportionally associated with the 330 Mt methane emission pulse in 2011 for years 2015, 2021/2022, 2031/2032, and 2050.

Livestock enteric: 0.0044, 0.0061, 0.0044+, and 0.0015

(Cattle enteric: 0.0033, 0.0045, 0.0033+, and 0.0011)

Fossil fuel: 0.0044, 0.006, 0.0044+, and 0.0015

Landfill waste: 0.0034, 0.0047, 0.0034+, and 0.0012

Rice: 0.0016, 0.0023, 0.0016+, and 0.00056

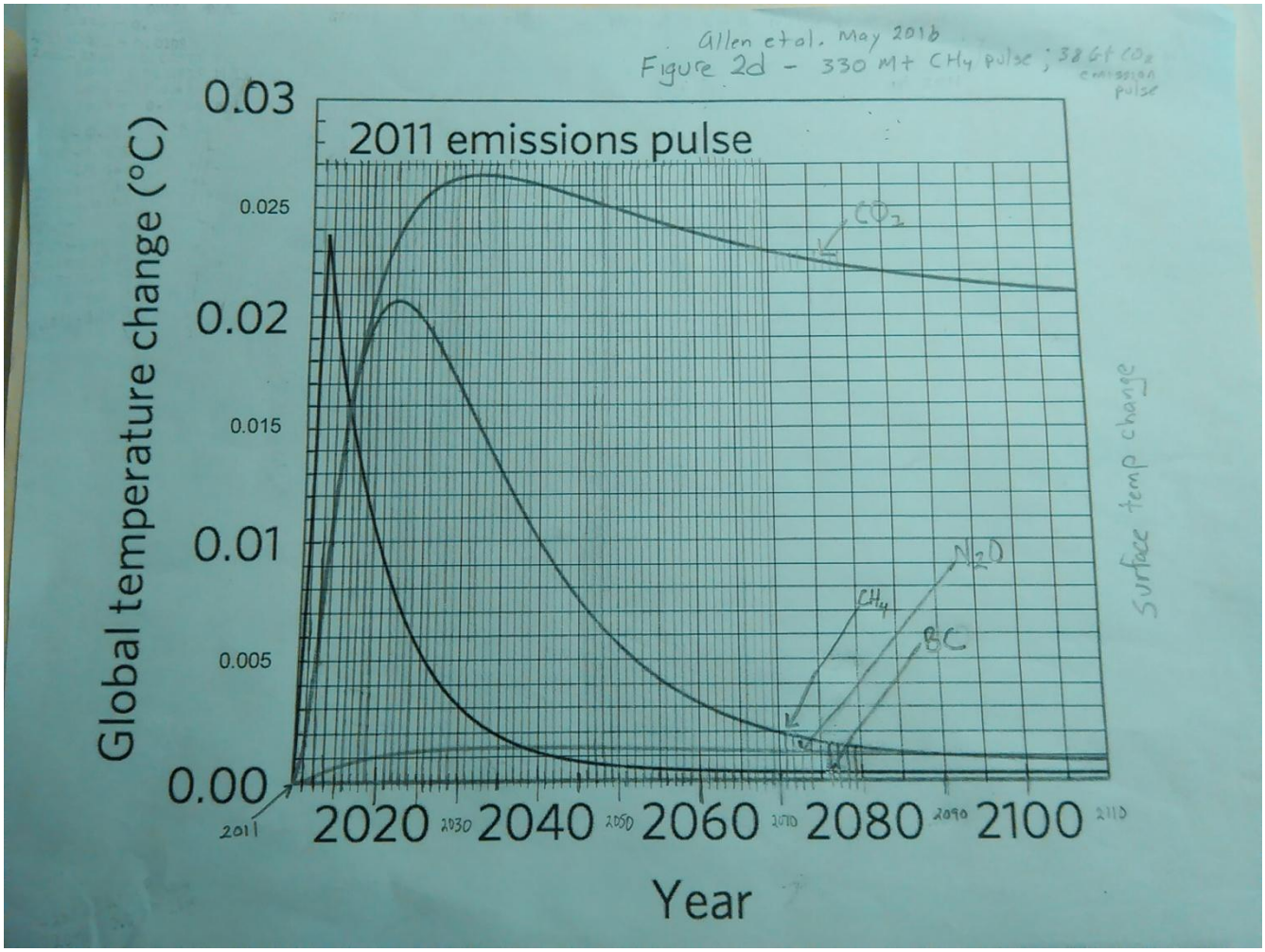
Biomass Burning: 0.0016, 0.0022, 0.0016+, and 0.00054

(For reference, the corresponding GTC values for the CO2 emission pulse for those years [based upon a mass of 38,000 Mt] are approximately 0.015, 0.024, 0.026, 0.024, and 0.021.)

Myles R. Allen, Jan S. Fuglestvedt, Keith P. Shine, Andy Reisinger, Raymond T. Pierrehumbert and Piers M. Forster, *New use of global warming potentials to compare cumulative and short-lived climate pollutants*, Nature Climate Change, PUBLISHED ONLINE: 2 MAY 2016 | DOI: 10.1038/ NCLIMATE2998

Figure 2d, with grid superimposed upon Figure 2d:

Allen et al. May 2016
Figure 2d - 330 Mt CH_4 pulse; 38 Gt CO_2 emission pulse



Appendix B:

1: FAO Cattle-Related Statistics for 1962 and 2012

Country	Item	Element	Unit	Y1962	Y2012
World	Cattle	Emissions (CH4) (Enteric)	Gigagrams	50,491.3724	72,289.6713

Food and Agriculture Organization of the United Nations, Statistics Division (FAOSTAT)
http://faostat3.fao.org/download/G1/GE/E

Year 1962

50,491.3724 Gg of CH4 emitted
$5.04913724 * 10^4$ Gg * 2.20462262 * 10^6 lbs./Gg = $11.13144217 * 10^{10}$ lbs.

1.113144217 * 1011 lbs., or 111,314,421,700 lbs. of CH4, or 111.314 billion lbs. emitted

Year 2012

72,289.67 Gg of CH4 emitted
$7.228967 * 10^4$ Gg * 2.20462262 * 10^6 lbs./Gg = $15.93714417 * 10^{10}$ lbs.

1.593714417 * 1011 lbs., or 159,371,441,700 lbs. of CH4, or 159.371 billion lbs. emitted

2: For the 1962–2012 period: +0.90/+0.67 degree Celsius rise for land/land-ocean combined

1958-1965 (1962) 1988-1995 (1992) 2008-2015 (2012) relative to 1880-1920 (1900)
0.36/0.27 0.80/0.62 1.26/0.94 relative to 1900 land/land-ocean value of 0 degrees C

1962-1992 increase: +0.44/+0.35; 1992-2012 increase: +0.46/+0.32;
1962-2012 increase +0.90/+0.67

Source: http://data.giss.nasa.gov/gistemp/maps/. [Note: Todd Shuman consulted with Dr. Ron Miller, Deputy Chief of Lab, NASA Goddard Institute of Space Studies concerning proper parameters for input. Dr. Miller recommended "smoothing" anomalies over 7-year time frames; use Anomalies, not Trend; define Mean Period as Annual (Jan-Dec); defined base period 1880-1920 was considered reasonable. Use 1200 KM Smoothing Radius, and Robinson Map Projection. For Land: use GISS analysis; For Ocean: use ERSST v.4.]

3: "NASA recently released data showing that the planet has just seen seven straight months of not just record-breaking, but record-shattering heat. It is clear, through the space agency's data, that this year we are already well on track to see what will likely be the largest increase in global temperature a single year has ever seen. The NASA data also show that April was the hottest April ever recorded, as well as the fact that it crushed the previous April record by the largest margin of increase ever recorded. That makes it three months in a row that the monthly record has been broken, and easily at that, by the largest margin ever." Dahr Jamail, May 23, 2016, http://www.truth-out.org/news/item/36133-atmospheric-carbon-dioxide-concentration-has-passed-the-point-of-no-return

Appendix C:

Amended Pre-Draft EA Scoping Comments and Other Relevant Comments by Todd Shuman

#1

On behalf of Wasteful Unreasonable Use (WURU), I request that CAARB use a yr2013 Intergovernmental Panel on Climate Change (IPCC) 20-year interval methane Global Warming Potential (GWP) constant for all of its methane-to-CO2 equivalency conversion calculations, as well as require the use of the most current IPCC 20-year interval methane GWP constant in all of its various programs (cap and trade [c&t], compliance offsets under c&t, greenhouse gas [GHG] inventories, existing compliance offset protocols under c&t, future compliance offset protocols that have been proposed for incorporation into c&t, pollution permits, etc.)

I request that CA ARB institute mandatory annual dairy manure and enteric fermentation methane emissions reduction targets of 25% by 2020, 50% by 2025, and 75% by 2030.

I make such requests for the following reasons: the IPCC (5th, 2013) concludes that at the 10-year timescale, the current global release of methane from all anthropogenic sources exceeds (slightly) all anthropogenic carbon dioxide emissions as an agent of global warming; that is, methane emissions are as significant as carbon dioxide emissions in driving the current rate of global warming. At the 20-year timescale, total global emissions of methane are equivalent to over 80% of global carbon dioxide emissions. (At the 100-year timescale, current global methane emissions are equivalent to slightly less than 30% of carbon dioxide emission.)

[Source: Intergovernmental Panel on Climate Change, Climate Change 2013: The Physical Science Basis, page 719, Figure 8.32, https://www.ipcc.ch/report/ar5/wg1/]

Because of the above information, all anthropogenic sources of methane emission need to be dramatically reduced as quickly as possible in order to decelerate further short-term global warming. Continued rapid global warming could trigger the onset of positive climate change feedbacks that might dramatically accelerate the warming of our planet. Since the two biggest sources of anthropogenic methane emissions in California are enteric fermentation occurring within the stomachs of livestock and anaerobic dairy manure lagoons, these two sources need to be strictly regulated under mandatory emission reduction provisions in the near future.

#2

These comments below supplement my previous oral and written comments that I have submitted concerning this process. What follows are my written comments based largely on my testimony at the CA ARB SLCP Reduction Draft Strategy on October 14, 2015 in Diamond Bar, CA at the CA ARB SLCP Reduction Strategy Workshop.

1: CA ARB needs to align its methane GWP policy across all CA ARB policy spheres with recent legislative and executive recognition of the importance of considering 20-year interval methane GWP constants in evaluating methane's atmospheric heat-trapping impacts. This recognition has been recently enshrined into California state law, in AB 1496, Section 1(a).

2: Please specify in the EA very specifically why CA ARB is not, will not, and/or cannot use a 2013 IPCC (AR 5th) 20-yr interval methane GWP when preparing CA ARB-related GHG inventories and calculating other CO2 equivalencies related to other CA ARB programs (cap and trade, offsets, pollution permits, proposed ACR offset protocols, etc).

3: I request that CA ARB prepare and present an alternative statewide GHG inventory utilizing 2013 IPCC (AR5th) 10-year interval and 20-yr interval methane GWP constants side-by-side with a statewide GHG inventory utilizing the 2007 IPCC 100-yr methane GWP constant currently used by CA ARB.

4: Specify in the EA what barriers exist to incorporating enteric emissions from livestock into CA ARB programs (such as cap and

trade), and why enteric emissions are not already incorporated into these programs.

5: The cap and trade program should include enteric emissions from dispersed livestock as a source of methane emission that must be significantly and rapidly reduced. Ranchers and smaller dairy owners who produce livestock in relatively dispersed locations should be required to purchase pollution permits and offset credits just like any other GHG emitter.

6: CA ARB should enact significant mandatory annual reduction targets for methane emissions associated with anaerobic manure lagoons and enteric emissions.

7: The annual methane emission reduction targets specified in the Draft Strategy for dairy manure should also be applied to enteric emissions (20 percent by 2020, 50 percent by 2025, and 75 percent by 2030), though these targets should be mandatory for both dairy manure and enteric fermentation. I recommend increasing the reduction target from 20 percent to 25 percent for yr 2020. I feel strongly that the CA ARB proposed annual emission reduction of only 5 methane-related MMTCO2e for dairy and livestock enteric fermentation (Table 6, page 43) by 2030 is embarrassingly low and ethically unacceptable.

8: Reliance upon weak, voluntary dairy industry methane reduction targets is grossly inadequate and ethically irresponsible, given the speed and scale with which global warming impacts are manifesting themselves. CA ARB needs to lead, not follow, concerning the matter of enteric emissions. CA ARB should be prodding the industry to fund necessary independent research in

order to enable compliance with mandatory annual methane reduction targets of 25 percent by 2020, 50 percent by 2025 and 75 percent by 2030.

9: CA ARB should require the dairy and livestock industry to fund further independent research that explores the viability of methane gas bio-filtration/bioreactors at dairy and beef-product CAFOs, as well as feed/drink-accessible cow methane respirators/gas bag capture (backpack) technology . CA ARB should also require that independent research into other significant methane-reduction strategies be funded at significant levels by private industry. No public funding should be used for any of this research. No further Greenhouse Gas Reduction Fund (GGRF) resources should be allocated to subsidizing the dairy and livestock industries in any manner, due to the intrinsically anti-social and anti-ecological methane-emission-related consequences of these industries.

10: CA ARB should modify any American Carbon Registry offset protocols currently in use and up for consideration to incorporate either an updated 10-year interval or 20-year interval methane GWP constant. ACR protocols retain a very low, outdated 100-year interval methane GWP constant to preserve carbon credit fungibility over a 100-year period. It is irresponsible for CA ARB to concur with such narrow economic logic in the face of the disturbing climate change-related effects increasingly appearing on our rapidly-warming planet.

11: Mandatory carbon credit insurance should also be incorporated into the cost of any carbon offset credit sold to enable new scientific information to be rapidly reflected in updated and revised SLCP GWP constants.

12: Claims made by previous commenters concerning the methane-related emission of grass-fed versus grain-fed livestock are questionable. Various claims and the research supporting such claims conflict within the scientific literature. It is not clear that enteric emissions from livestock on pasture are less than livestock enteric emissions from livestock in CAFOs.

Moreover, claims concerning the value of pasture-based dairy operation concerning soil carbon sequestration are especially questionable. Typically, the effective GHG impact of enteric emissions occurring on such operations have been discounted in the most frequently-cited studies by ignoring enteric emissions altogether or through the use of very low and outdated methane GWPs in the GHG-balancing methodologies of such studies.

Nonetheless, methane emissions from pasture-based operations will be less overall relative to CAFO dairy operations due to much smaller manure-related methane emissions and the smaller numbers of livestock that are typically involved. In this light, I concur with the CRPE June 10, 2015 comment: "Pasture-based systems stock fewer cows per acre than confinement systems, which reduces enteric emissions. 'The amount of methane emitted by animals is directly related to the number of animals, so that a more intensive farm will have higher emissions…'" Pasture-based dairy systems that involve low manure-related methane emissions and low numbers of livestock relative to current CAFO dairy systems are superior in terms of SLCP reduction value. In addition, water usage devoted to livestock and dairy production would also likely decline if pasture-based dairy systems become ascendant economically and the overall numbers of livestock in pasture-based systems remain cumulatively and substantially lower than in CAFO-based dairy systems.

Regardless, all livestock producers need to be treated like the operators of coal-fired electricity generation providers -- they need to be prodded into stopping the externalization of their private production-related environmental costs onto the broader societies and natural ecosystems on this planet.

Methane polluters should be taxed or fined for the methane pollution they generate, with the tax or fine based upon a methane-into-CO2-equivalency conversion algorithm that incorporates a 10-year interval methane GWP (at best) or a 20-year interval methane GWP (at worst)…

#3

We support the adoption and widespread use of a more scientifically-defensible methane GWP value that is consistent with methane's expected lifespan in the atmosphere. Since methane does not remain in the atmosphere for 100 years, it is not reasonable for CA ARB to continue using a methane GWP based upon a 100-year interval. Even use of a 20-year methane GWP is questionable, given that methane has an approximate atmospheric half-life of 7 years and a generally stated lifespan of 12 years. CA ARB use of a 10-year interval methane GWP makes the most sense to us, as such use would comport CA ARB policy with the actual science concerning methane and provide California with a strong, short-term policy lever to control the progression of global warming. Such a policy lever may be essential in the near future to help prevent the onset of positive climate change feedbacks that might dramatically accelerate the warming of our planet.

In any case, we believe strongly that polluters should be required to pay for the methane pollution they generate, based upon a methane-into-CO2-equivalency conversion algorithm that incorporates a 10-year interval methane GWP (at best) or a 20-year interval methane GWP (at worst). Whatever methane GWP constant is used should be based upon the most recent IPCC GWP values.

We believe that these requests are reasonable and prudent for the following reasons.

1: Use of a 10-year methane GWP would promote a much more rapid reduction in annual methane emissions than continued use of a long-interval methane GWP. Annual methane emissions need to be reduced as quickly as possible if we are to slow down the rapid rate of planetary warming that is occurring. The IPCC (AR5th, 2013) has concluded that at the 10-year timescale, the current global release of methane from all anthropogenic sources will exceed (slightly) all anthropogenic carbon dioxide emissions as an agent of global warming; that is, methane emissions will be as significant as carbon dioxide emissions in driving the rate of global warming in the near future. At the 20-year timescale, the IPCC notes that total global emissions of methane will be equivalent to over 80% of global carbon dioxide emissions. [Source: Intergovernmental Panel on Climate Change, Climate Change 2013: The Physical Science Basis, page 719, Figure 8.32, https://www.ipcc.ch/report/ar5/wg1/]

2: The rationale for using a short-interval methane GWP is provided within the CA ARB Draft SLCP Reduction Strategy document itself: "Climate change is no longer a problem to be defined simply in terms of a legacy we leave to our grandchildren or impacts in the year 2100. It is affecting us now, and will only accelerate in our

lifetime. Due to the urgency of the issue, and the need to recognize the costs and benefits of addressing it immediately, we use 20-year GWPs in this report to quantify emissions of SLCPs." [See page ES-6.]

The rationale is also supported by recent actions taken by the California Legislature and Governor Brown. The State of California, in AB 1496, has now officially acknowledged the importance of considering the heat-trapping impacts of methane over a much-shorter timescale: “The people of the State of California do enact as follows: SECTION 1. The Legislature finds and declares all of the following: (a) Methane is . . . an extremely potent greenhouse gas, with 20 to 30 times the warming power of carbon dioxide over a 100-year period and more than 80 times over a 20-year period.”….

#4

In light of events in Paris in 2015 (in particular, the adoption of the Paris Agreement at the UNFCCC COP21), I request that CA ARB immediately modify its draft “comprehensive strategy to reduce emissions of SLCPs” to strongly promote achievement of the aim of the Paris Agreement parties to limit global temperature increase to no more than 1.5 degrees Celsius above pre-industrial levels. Below is the language from the agreement concerning this objective and aim:

Annex PARIS AGREEMENT Article 2

1. This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global

response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

(a) Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to *pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels . . .* (emphasis added).

To achieve such an aim, SLCP emissions will need to be dramatically reduced very soon.

Dr. Robert Howarth, a professor at Cornell University in New York, emphasized this fact in an article recently published in The Nation: "If we continue methane production at current rates, the world will run up against the 1.5 degrees limit in 12 to 15 years,"[http://www.thenation.com/article/scientists-warn-paris-climate-agreement-needs-massive-improvement/]

Dr. Drew Shindell, Professor of Climate Sciences at Duke University and Chair of the Climate and Clean Air Coalition (CCAC) Scientific Advisory Panel, also emphasized the urgency in aggressively targeting SLCPs for emission reduction: "we cannot get down to 1.5°C without targeting both SLCPs and CO2. We can't even keep below two degrees without targeting both," [http://www.ccacoalition.org/en/news/efforts-reduce-short-lived-climate-pollutants-strengthened-cop21]

According to the 2013 IPCC AR5th, SLCPs already in the atmosphere will account for most of the positive atmospheric radiative forcing that will occur over the next 10 years. Even over the 20-year Time Horizon, roughly 60 percent of the positive radiative forcing that will occur in the atmosphere will be due to

SLCPs. This will be only temporarily mitigated by the short-term negative radiative forcing effect of sulfur dioxide concentrations in the atmosphere. (See attachment summarizing the IPCC tables and figures that contain the information concerning positive radiative forcing agents.)

To strongly promote achievement of this aim, the CA ARB will need to modify its "comprehensive strategy to reduce emissions of SLCPs" and incorporate strong, substantive mandatory annual SLCP emission reduction targets for all SLCPs and all sources of SLCPs. CA ARB will also need to change its accounting mechanism concerning SLCPs to conform to the 2013 IPCC AR5th recommendations, which currently constitute the best available science concerning this matter. I recommend one set of state emission reduction targets for CO2, and another set for the SLCPs, using SLCP radiative forcing values as the metric for the latter. In practice, this would be roughly equivalent to using a 10-year or 20-year interval GWP with regard to methane.

I recommend once again that CA ARB "put a price" on a ton of uncaptured, unburnt methane emission. This price should be substantial, so that it will drive meaningful reductions in methane emission in California in the near future….