From: Todd Shuman
To: commentletters
Subject: Comment Letter – Climate Change Resolution
Date: Friday, February 17, 2017 11:23:18 AM
Attachments: WURU Amended Complaint 09 29 2016.pdf
SLCP RS Rev DEA Comments January 17 2017 Site Download.pdf

To SWRCB,

I have reviewed the proposed Climate Change Resolution.

It is inadequate. It needs to be informed by (and modified to incorporate) the information and arguments contained within the attached complaint that was submitted to SWRCB in late September, 2016. It needs to address the fundamental issue of water used to support livestock and dairy commodity production (especially livestock feed crop production) in California, considered in relation to enteric methane emissions from California livestock. Currently, the resolution does not meaningfully address such issues adequately. The resolution also needs to address related enteric emission-related issues raised in my recent comments to CA ARB concerning enteric emissions from livestock in CA. These comments are also attached and submitted for inclusion in the record.

Sincerely,

Todd Shuman, Camarillo, CA 805.987.8203

State of California
State Water Resources Control Board
DIVISION OF WATER RIGHTS
P.O. Box 2000, Sacramento, CA 95812-2000
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Complaint

I, Todd M. Shuman, Senior Analyst, Wasteful UnReasonable Use (WURU), P.O. Box 528, Camarillo, CA, 93011 present the following complaint to the SWRCB concerning the use of water by David Valadao, James O'Banion, James L. Nickel, Stewart/Lynda Resnick, and Donald Bransford to produce livestock feed crops and rice.

Introduction

Based on previously-submitted comments, I allege that the past use of water by David Valadao, James O'Banion, James L. Nickel, and Stewart/Lynda Resnick to produce livestock feed (and to produce crops which resulted in livestock feed crop tonnage) was wasteful, unreasonable, and unconstitutional. I request that the State Water Resources Control Board (SWRCB) issue a finding that past use of water by Valadao, O'Banion, Nickel, and the Resnicks to produce livestock feed (and to produce crops that resulted in livestock feed crop tonnage) was wasteful, unreasonable, and unconstitutional. I request that the SWRCB issue a finding that current use of water, by Valadao, O'Banion, Nickel, and the Resnicks, to produce livestock feed (and to produce crops that results in livestock feed crop tonnage) is wasteful, unreasonable, and unconstitutional. I further request that the SWRCB issue a finding that further use of water by Valadao, O'Banion, Nickel, and Cameron to produce livestock feed (and to produce crops that will likely result in livestock feed crop tonnage) will be considered by the SWRCB to be wasteful, unreasonable, and unconstitutional.

I also allege that the use of water by Donald R. Bransford to produce rice has been, is currently, and will likely be wasteful, unreasonable, and unconstitutional. I request that the SWRCB issue findings concerning rice that are comparable to findings that should be issued concerning livestock feed crops.

References and Summary of References

I incorporate by reference and summarize below:

A. July 6, 2015 comment titled "June 8, 2015 Temporary Urgency Change Petition Concerning SWP/CVP and Water Deliveries, in relation to the April 6, 2015 TUCO", submitted by Ara Marderosian (Sequoia ForestKeeper), Guy Saperstein, Alexandra Paul, Jon Marvel, Connie Hanson, Mike Hudak, Lorelei Plotczyk, Lorin Lindner, Marcia Hanscom, Robert Roy van de Hoek, and Todd M. Shuman (Wasteful UnReasonable Use). (http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/docs/sfk_marderosian070615.pdf)

This referenced document explored "waste or unreasonable use" claims with regard to flood irrigation of alfalfa and irrigated pasture in terms of both "method of water use" and "use of water", independent of method of application. It also presented claims of "unreasonable use" in the context of water exports to the San Joaquin River Exchange Contractors Water Authority, in which that exported water has been substantially applied to livestock feed crop production more generally. The commenters argued that water applied to grow livestock feed crops in a time of drought was wasteful and unreasonable, and that such exports and application aggravated conflicts that were central to the TUCPs that had been requested by DWR and USBR and the TUCOs that were adopted by the SWRCB. The executive summary of this extensive 37 page comment is provided below:

- The use of irrigated water for livestock feed crop production is both wasteful and unreasonable during this time of drought in California; such use also conflicts with the "waste or unreasonable use" section of the California Constitution.

- The wasteful, unreasonable use of irrigation water for livestock feed production is manifest within four areas of California water use and policy: hay exports, continued flood irrigation of alfalfa and irrigated pasture, the April 6, 2015, Temporary Urgency Change Order (TUCO), and the extreme groundwater depletion within the San Joaquin Valley.

- The applied water value for four livestock feed crops alone (alfalfa, irrigated pasture, corn, and almond hulls) constituted just over 42% of all water applied in California agriculture in 2012.

- It is wasteful for California irrigation water to be used to grow feed resources for the very inefficient animal-based protein/fat/carbohydrate production system when a smaller fraction of that irrigated water could be used to grow equivalent amounts of plant-based protein and carbohydrates.

- It is unreasonable for California water to be used during this time of drought for activities (such as alfalfa-related livestock feed production) that are likely to generate even more water scarcity in California (by way of livestock-associated methane emissions into the atmosphere.)

- California continues to unreasonably export some of its water in virtual form through significant international exports of alfalfa and other hay.

- Flood irrigation devoted to alfalfa and irrigated pasture production (nearly two million acres combined in 2010) is a wasteful and unreasonable method of use of water, as well as a wasteful and unreasonable use of water.

- Based on the analysis provided in the comment, the April 6, 2015, TUCO is likely promoting the wasteful and unreasonable use of irrigation water to produce livestock feed crops in the area associated with the San Joaquin River Exchange Contractors Water Authority (SJRECWA). Methane emissions associated with dairy cows in the SJRECWA service area are converted in CO2 equivalents using methane GWPs associated with both 20 year and 100 year intervals.

- The use of pumped groundwater from already-depleted groundwater aquifers in the southern Central Valley to produce livestock feed is a wasteful, unreasonable use of water. Scarce groundwater has been used for irrigation of crops in Tulare County that will be partially converted into significant amounts of methane and then emitted by livestock into the atmosphere. Such emissions will likely contribute to a long-term reduction in precipitation that will limit groundwater aquifer recharge in the future.

- The SWRCB is required to act on the matter of wasteful, unreasonable use of water being used to produce livestock feed. The mandatory legal authority to buttress SWRCB action has three components. First, the SWRCB and the courts can nullify "beneficial" use of water, if such use is wasteful and/or unreasonable. Second, the SWRCB can reduce and/or eliminate wasteful, unreasonable water use to re-balance an unbalanced situation. Third, the SWRCB is *required* to re-balance imbalanced situations.

- The SWRCB and the courts continue to use an anachronistic concept of "balancing" in relation to drought. New circumstances require a reconceptualization of "balancing" in order to reduce the strain that contemporary California society has been imposing on the natural world, including the native forests of California that are currently being adversely impacted by climate change.

- The April 6, 2015 TUCO does not accord with the Public Trust legal doctrine that the SWRCB is

required to enforce with regard to currently endangered native fish species, the environment, and the climate

B. August 16, 2015 comment titled "Unreasonable and Wasteful Water Use: Rice Cultivation, Livestock Feed Crop Production, the Sacramento River Settlement Contractors, and the July 3, 2015 TUCO", submitted by Ara Marderosian (Sequoia ForestKeeper) Todd M. Shuman (Wasteful UnReasonable Use), Mike Hudak (Ph.D.), and Megan E. Gallagher, Esq. (http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/docs/sfk_marderosian081615.pdf)

This referenced document explored "waste or unreasonable use" claims with regard to the use of irrigated water for rice cultivation, as well as substantial cultivation of livestock feed crops in the approximated Sacramento River Settlement Contractor-dominated areas north of Sacramento.

It provided a documented estimate that just over 800 TAF (thousand acre feet) was applied to arable land for rice cultivation in the approximated area of four of the largest SRSCs in 2014. It presented a documented estimate of the atmospheric carbon dioxide equivalency emission of the methane associated with such rice cultivation in this approximated SRSC area. The estimated value was 3.16 billion pounds of CO_2e over a 20 year period. The commenters also documented substantial cultivation of livestock feed crops in the approximated SRSC-dominated area (28,000-37,000 acres) that required an estimated water use value of roughly 100 TAF in 2014.

C. October 14, 2015 comment, "Five Counties, Five Numbers: Livestock Feed Crop Production in the S. San Joaquin Valley, 2014", submitted by submitted by Ara Marderosian (Sequoia ForestKeeper) Todd M. Shuman (Wasteful UnReasonable Use), Mike Hudak (Ph.D.), and Megan E. Gallagher, Esq. (http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/docs/sfk_marderosian101415.pdf)

This referenced document explored "waste or unreasonable use" claims with regard to water, livestock feed crop production, and greenhouse gas emission in the southern San Joaquin Valley in 2014.

It documented that approximately 1.275 million acres were devoted to (or *resulted* in) livestock feed crop (LFC) production in these five counties in 2014. Approximately 4.55 million acre-feet (MAF) of water was used to cultivate acreage that *resulted* in LFC production in 2014. Approximately 14.257 million tons of livestock feed crop forage were produced from the application of this amount of water to the acreage cultivated in 2014. Assuming that such forage was fed to milking dairy cows, the commenters estimated that this amount of forage would have fed approximately 1.56 million lactating cows in 2014. They reiterated that livestock feed crops consumed by cows are partially converted by cows into significant atmospheric methane emissions. They provided science-based estimates that 1.56 million lactating cows would have collectively emitted (through the process of enteric fermentation) a quantity of methane that is equivalent to approximately 32.22 billion pounds of carbon dioxide trapping heat in the atmosphere over the next 20 years.

D. April 13, 2016 comment titled "Livestock Feed Crop Production in the San Joaquin Valley, 2014", submitted by Ara Marderosian (Sequoia ForestKeeper) Todd M. Shuman (Wasteful UnReasonable Use), and Jan Dietrick, (MPH).(http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/docs/sfk_marderosian041316.pdf)

This referenced document explored "waste or unreasonable use" claims with regard to water, livestock feed crop production, and methane gas emission in the total San Joaquin Valley (SJV) during 2014.

It documented that approximately 2.4 million acres were devoted to (or *resulted* in) livestock feed crop (LFC) production in these counties in 2014. Approximately 7.5 million acre-feet (MAF) of water was used to cultivate acreage that resulted in LFC production in 2014. Approximately 28 million tons of livestock feed crop forage were produced from the application of this amount of water to the acreage cultivated in 2014. The commenters

noted that this large amount of forage would have been primarily used to feed the cumulative California beef, dairy, heifer, bull, and steer populations in 2014. The cumulative 2014 California cattle population was 5.1 million, with the beef, dairy, heifer, bull, and steer populations cumulatively accounting for approximately 4.03 million, while calves accounted for the remaining 1.07 million.[1]

The commenters reiterated that livestock feed crops consumed by cows are partially converted (through enteric fermentation) into significant direct atmospheric methane emissions. Cattle manure channeled into anaerobic manure lagoons and liquefied slurry storage constitutes a second major source of atmospheric methane emission.

Cumulative cattle-associated methane emission values for California during 2013 have been released by the California Air Resources Control Board. Approximately 1,911,000,000 pounds of cattle-associated methane were released into the atmosphere in 2013 -- 997,000,000 pounds by way of enteric emissions and 914,000,000 pounds by way of manure-related emissions. Using the IPCC AR5th 20-year interval methane GWP, the carbon dioxide equivalent (CO2e) value associated with this mass of methane is comparable to an amount of carbon dioxide that would be annually released by 19.1 coal-fired electricity generation (CFEG) plants that would then trap heat in the atmosphere for 20 years before being sequestered. Using an IPCC AR5th 100-year interval methane GWP, the CO2e value associated this mass of methane is comparable to an amount of carbon dioxide that would be annually released by 6.36 CFEG plants that would then trap heat in the atmosphere for 100 years before being sequestered.

SWRCB Comment Analyses Conservative Bias

I note for the record that these analyses of livestock GHG impact in California that have been submitted to the SWRCB have been very conservative. They have focused only on the methane emissions from livestock, with the primary focus on enteric emissions. They have often excluded the methane emissions associated with livestock manure that has been concentrated in anaerobic dairy manure lagoons. (Only the April 13, 2016 analysis incorporated discussion of manure-associated methane emissions.)

The analyses have excluded the nitrous oxide emissions associated with use of synthetic and manure-based fertilizers typically used for livestock feed crop production. Application of 100 lbs. of nitrogen fertilizer per acre typically results in the emission of approximately 2 lbs. of N_2O. (Source: Page 5, Greenhouse Gas Working Group. 2010. Agriculture's Role in Greenhouse Gas Emissions & Capture Greenhouse Gas Working Group Rep. ASA, CSSA, and SSSA, Madison WI [American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, August 2010].

1: Comprehensive 2015 data concerning SJV livestock feed crop production is not yet available. Merced, Stanislaus, and San Joaquin counties have not yet released 2015 crop reports, as of September 25, 2016. For a limited sample of 2014/2015 crop acreage and tonnage comparisons for some southern SJV counties, see Appendix A. Most noteworthy is that Tulare County experienced an extraordinary expansion in silage acreage and silage tonnage during 2015 during one of the hottest and driest years in recorded California history! Page 2 of the 2015 Tulare County Annual Crop and Livestock Report states: "In 2015, Tulare County saw an increase of over $315,000,000 in field crop production value. This was primarily attributed to an increase of over 250% in small grain silage and a 46% increase in corn silage." Silage production also expanded in Kern County in 2015, and the tonnage value for Fresno County almond hulls increased in 2015, all relative to 2014.)

The analyses have also not included other GHG emissions associated with actual production of livestock feed crops. Globally, 45 percent of GHG emissions associated with the global livestock sector have been attributed to feed production and processing:

"Feed production and processing, and enteric fermentation from ruminants are the two main sources of emissions, representing 45 and 39 percent of sector emissions, respectively. Manure storage and processing represent 10 percent. The remainder is attributable to the processing and transportation of animal products. Included in feed production, the expansion of pasture and feed crops into forests accounts for about 9 percent of the sector's emissions. Cutting across categories, the consumption of fossil fuel along the sector supply chains accounts for about 20 percent of sector emissions."

Source: Gerber, P.J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A. & Tempio, G. 2013. Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities. Food and Agriculture Organization of the United Nations (FAO), Rome, page xii.

Finally, the conservative bias in these earlier analyses is evidenced by exclusion of the extensive non-GHG nitrogen-based pollution that is also associated with livestock and livestock feed crop production (excluding alfalfa and clover production). Such pollution is substantial and worthy of recognition. Documentation concerning the magnitude of such nitrogen-based pollution in California was recently released in the California Nitrogen Assessment (2016). I provide for the record some relevant and illuminating excerpts from this report below:

"Synthetic fertilizer accounts for 32% (514,000 tons) new nitrogen entering CA each year, and animal feed accounts for another 12% (220,000 tons) … on average, about half the nitrogen applied to crops is lost to the environment, though this varies greatly by soil type, crop, and farm management practices … Annually, nearly 419,000 tons of nitrogen leach into groundwater. Nitrogen from cropland (including fertilizer and manure applications) is the largest contributor, accounting for 88% (367,000 tons) of nitrogen leaching to groundwater." [pages 7-8]

"Livestock consume 614,000 tons of nitrogen each year in their feed. Only 25% of that becomes meat or milk for our consumption; the rest is excreted in manure. Much of that manure is reapplied to cropland, where its nitrogen has the potential to leach into groundwater. Some of the nitrogen in manure is released into into the air or water or stored in soils." [page 8]"

"Data show that California crops recover, on average, less than half of applied synthetic nitrogen, with some crops capturing as little as 30%. Similar or even lower nitrogen recovery rates are found when organic nitrogen sources are used… " [page 5]

"Only a little over a third of the net annual nitrogen inputs to groundwater are extracted from wells for irrigation and drinking water or removed by denitrification in the aquifer, leaving two thirds of the additions each year to accumulate in groundwater. However, it can take years to millennia for excess nitrogen in soil to reach groundwater." [page 7]

(Source: California Nitrogen Assessment (2016), Dr. Tom Tomich, Principal Investigator, Agricultural Sustainability Institute, University of California, Davis.)

Finally, I note that the runoff of nitrogen fertilizers previously applied to livestock-feed-crop-associated agricultural lands is likely a contributing factor in the large number of toxic algae blooms that have occurred in California lakes, reservoirs, and other surface watercourses in 2016.

(See http://www.eastbaytimes.com/2016/09/17/toxic-algae-troubles-many-california-lakes-and-waterways/ and https://www.epa.gov/nutrientpollution/problem.)

Substantive Basis of Complaint

07/06/2015 SWRCB Comment: Wasteful Use

Water used by farmers during this time of drought for the irrigation of livestock feed crops is wasteful. Livestock are notoriously inefficient at converting water and other natural resources into protein available for human consumption, relative to plant-based sources of protein. With regard to water alone, the production of one pound of animal protein has been estimated to require nearly 100 times more water than the amount needed to produce one pound of plant-based grain protein, according to a study from researchers associated with Cornell University.

A more conservative, recent estimate has been provided by Mekonnen and Hoekstra (2010). They document that pulses (legumes), such as pinto beans, kidney beans, navy beans, dry peas, and lentils, have dramatically lower water footprints per unit protein than pig, sheep, goat, and bovine meat. Pulses use only one-sixth of the water that bovine meat requires to produce a comparable gram of protein (19 liters compared to 112 liters.) Pulses also require substantially less water to produce a gram of protein than milk (19 liters compared to 31 liters.)

Simply put, it is wasteful for California irrigation water to be used to grow feed resources for a very inefficient protein/fat/carbohydrate production system when a fraction of that irrigated water could be used to grow equivalent amounts of plant-based protein and carbohydrates. In our view, this judgment of "waste" resonates with great strength in this current time of severe drought and water-scarcity.

07/06/2015 SWRCB Comment: Unreasonable Use

Water used to irrigate livestock feed crops constitutes an unreasonable use of California water during this time of drought in California, especially in the context of climate change where California will only become even drier and warmer in the future. Livestock feed crops produced from California water are fed to livestock. Livestock then generate methane through enteric fermentation and emit methane into the atmosphere. Methane in the atmosphere is a highly potent greenhouse gas (GHG) that has contributed to the overall warming of the planet (see *05/26/2016 CA Enteric Emissions - Cumulative Effects of Enteric Methane Emissions from Livestock* below) and the rapid heating of the Arctic. Both global warming and rapid Arctic heating have now been strongly linked to the severe four-year drought in California that has adversely impacted the state's water supplies.

Three recent studies[2] have documented linkage between heightened greenhouse gas emission levels, increased atmospheric heat, and the high pressure ridge that has formed and persisted in the Pacific Ocean, known colloquially as the "Ridiculously Resilient Ridge" (RRR). This RRR high pressure ridge has been responsible for re-routing Pacific storm activity well to the north of California over the last few years.

2: The first study demonstrating this linkage was published by Stanford University researchers on September 29, 2014 (co-authors Diffenbaugh, Swain, Rajaratnam, et alia) in a supplement to the Bulletin of American Meteorological Society. The study was summarized extensively in the Stanford Report issue of September 30, 2014. http://news.stanford.edu/news/2014/september/drought-climate-change-092914.html. The second study demonstrating this linkage was published in Environmental Research Letters, Jan 6, 2015, and coauthored by Rutgers Professor Jennifer Francis and Stephen Vavrus. The title of the study is "Evidence for a wavier jet stream in response to rapid Arctic warming." (Source: http://iopscience.iop.org/1748-9326/10/1/014005). The third study was authored by Wang, S.-Y. (Simon Wang), Larry Hipps, Robert Gillies, and Jin-Ho Yoon, and is summarized in Fire and Ice—California Drought and "Polar Vortex" in a Changing Climate, Science and Technology Infusion Climate Bulletin NOAA's National Weather Service, 39th NOAA Annual Climate Diagnostics and Prediction Workshop St. Louis, MO, 20–23 October 2014.]

(Of the three studies noted above, one has also linked these three phenomena with rapid Arctic heating and decline in Arctic sea ice.) The Wang study, which did not assert a link to rapid Arctic warming, noted that "there is a traceable anthropogenic warming footprint in the enormous intensity of the anomalous ridge during winter 2013–2014 and the associated drought.") Finally, John P. Holdren, President Obama's senior science director, has argued powerfully that climate change should be considered one of the drought's major contributors. This can be accessed at:

https://www.whitehouse.gov/sites/default/files/microsites/ostp/critique_of_pielke_jr_statements_on_drought.pdf.

These findings were predicted in peer-reviewed scientific literature over ten years ago by Sewall and Sloan (2004). (For a full explanation and some thoughts on Sewall and Sloan's theory from prominent climatologists, see this 2014 article.) Moreover, anthropogenic climate change has already increased the probability that more megadroughts will occur in California. Ault et al. (2014) conclude:

In the current generation of global climate models, the risk of a decade-scale drought occurring this century is at least 50% for most of the greater southwestern United States and may indeed be closer to 80% ... The probability of multidecadal megadrought is also high: the likelihood of a 35-yr event is between 10% and 50% depending on how much climate change is realized during the coming century. The probability of even longer events (50-yr, or "permanent," megadrought) is non-negligible (5%–10%) for the most intense warming scenario (p. 7545).

Such megadroughts, if they occur, will undoubtedly exacerbate the water shortages and species extinction that are already afflicting California. (Cook, 2015; Diffenbaugh et al. 2015).

This assessment is also consistent with the argument presented in the recently-published study by Kevin Trenberth et al. (2015), which emphasizes how the impact of human-induced warming has affected the climate system's thermodynamic state and consequently intensified major climatic events in recent years. Trenberth et al. also summarize the Diffenbaugh et al. (2015) study in a manner that highlights how anthropogenic warming has already increased the odds of increased drought risk and drought risk severity:

Another very recent example is the California drought beginning in 2012. Whereas one study found no significant trends in winter precipitation in recent decades, another [the Diffenbaugh et al. 2015 study] pointed out the critical role of the record high annual mean temperatures in combination with record low annual mean precipitation for 2013 which led to increased evapotranspiration and more intense drought. The combination of these had impacts on water shortages, vegetation and agriculture, and increased wildfire risk. The odds of this combination have increased with human-induced climate change and anthropogenic warming has increased drought risk (footnote numbers removed). [Kevin Trenberth et al. (2015)]

We also note for the record that the U.S. Geological Survey just released a study: "Temperature Impacts on the Water Year 2014 Drought in California" by Shraddhanand Shukla et al. (http://onlinelibrary.wiley.com/wol1/doi/10.1002/2015GL063666/abstract), which finds that high heat has multiple damaging effects during drought, increasing the vulnerability of California's water resources and agricultural industry. Not only does high heat intensify evaporative stress on soil, it has a powerful effect in reducing snowpack, a key to reliable water supply for the state. In addition to decreased snowpack, higher temperatures can cause the snowpack to melt earlier, dramatically decreasing the amount of water available for agriculture in summer when it is most needed. "If average temperatures keep rising, we will be looking at more serious droughts, even if the historical variability of precipitation stays the same," Shukla said. "The importance of temperature in drought prediction is likely to become only more significant in the future."

Thus, the best available science demonstrates that continued GHG emissions in the present and near future are likely to further accelerate the warming of the planet generally and heating of the Arctic in particular. Such heating will likely increase the probability that more high pressure ridges will form in the Pacific. These high

pressure ridges will then likely continue steering Pacific storm activity around (but not through) California in the future, thus aggravating the California drought. This best available science also indicates that GHG-associated global warming is likely to intensify the duration and severity of such future droughts and the adverse impacts associated with such projected future droughts.

In short, it is profoundly unreasonable—indeed, intensely irrational—for the SWRCB to continue to allow California water to be used during this time of drought for activities (such as alfalfa-related livestock production) that are likely to generate even more water scarcity in California, both for the short and long term future.

08/16/2015 SWRCB Comment: Rice Cultivation, Methane Emission, and Unreasonable Use

Calculation incorporating application of a Methane GWP of 86 (IPCC, AR5th, 2013) to denote a CO_2e that traps heat in the atmosphere for a period of 20 years:

(190.926 lbs. CH_4 per rice-acre-cultivated) X (192,503.5 acres) X (86) = 3,160,837,399 lbs. (CO_2e) released in 2014, or 3.16 billion pounds of CO_2 equivalency (20 year interval), or 3/8 of the amount of CO_2e (20-year heat-trapping period) that a year 2010 coal plant would have emitted into the atmosphere in 2014 (EPA).

The 190 lbs. CH_4/acre figure concerning rice cultivation comes from the conversion of the 2013 CA ARB figure of 214,000 g/ha as the annual amount of methane released per land unit area due to rice cultivation in California. (See http://www.arb.ca.gov/cc/inventory/doc/docs3/3c7_ricecultivation_ricecroparea_ch4_2013.htm)

We assert that it was unreasonable (and hence, unconstitutional) for these large SRSCs to use water for rice cultivation when such rice cultivation likely generated an additional, large, and significant emission level of CO_2 equivalency (20-year interval) on an already warming planet. This use was especially unreasonable when such water use occurred at the expense of imperiled native aquatic species in the Delta and along the Sacramento River during the 2014 drought year.

10/14/2015 SWRCB Comment: Unreasonable Use: Atmospheric Carbon Emissions

Livestock-associated carbon emissions should not be considered insignificant. (32 billion lbs. of heat-trapping $CO2e^{20yr}$ is just under the amount of CO2 that would be emitted by four *yr*2010 coal-fired electricity-generation plants [33.6 billion lbs.]). Moreover, it is likely that these emissions have already contributed (and are currently contributing) to the further warming of our planet and the associated severe drought that has afflicted California. We note for the record that this claim is consistent with yet another recently published scientific study concerning this matter: Williams et al. (2015) concluded that “anthropogenic warming is estimated to have accounted for 8–27% of the observed drought anomaly [in California] in 2012–2014 and 5–18% in 2014. . . . anthropogenic warming has substantially increased the overall likelihood of extreme California droughts.” [Williams, A. P., R. Seager, J. T. Abatzoglou, B. I. Cook, J. E. Smerdon, and E. R. Cook (2015), Contribution of anthropogenic warming to California drought during 2012–2014, Geophys. Res. Lett., 42, 6819–6828, doi:10.1002/2015GL064924.] http://onlinelibrary.wiley.com/doi/10.1002/2015GL064924/full

The prominent Stanford University scientist and professor Noah Diffenbaugh has also noted recently that "We have a very high statistical confidence that the warming of California would not happen without human influence, and the amount of years that are warm and dry would not have happened without humans. . . . Continued human emissions are likely to lead to the continued warming of California, increased co-occurrence of dry years and warm conditions and the increased occurrence of extremely low precipitation seasons." [http://www.appeal-democrat.com/news/scientists-blame-human-activity-for-climate-change/article_c26d333e-4b8b-11e5-ab6d-ab7bd68872bc.html]

Diffenbaugh was quoted in another article stating that "High temperatures plus low precipitation are more likely to produce a drought, and this will increase with climate change. . . .Global warming has at least tripled the probability of the atmospheric condition that brought the resilient high-pressure ridge" – the phenomenon that has been the primary cause of the California drought. [http://www.dailybreeze.com/environment-and-nature/20150825/california-climate-researchers-sound-the-alarm-at-symposium-theres-no-way-out]

Thus, the best available science continues to assert that continued greenhouse gas emissions in the present and near future are likely to further accelerate the warming of the planet generally and increase the probability that California will be adversely impacted by more frequent high-temperature droughts in the future.

We must, therefore, re-assert our previous claim: it is profoundly unreasonable—indeed, intensely irrational—for the SWRCB to continue to allow California water to be used during this time of drought for activities that are likely to generate even more water scarcity in California.

04/13/2016 SWRCB Comment: LFC Production, Methane Emission, and Extreme Weather

It is likely that livestock-associated methane emissions generated in California in 2014 have already contributed to the further warming of our planet. It is also likely that such livestock-associated methane-related atmospheric heat trapping has increased the probability that certain types of extreme weather-related events will become even more likely to occur in California and the U.S. in the future. It is also likely that these types of extreme weather-related events (triggered in part by livestock-related methane emission) will generate significant adverse impacts on human health, essential infrastructure, and vulnerable coastal populations. A number of recently published studies over the last eight months provide evidentiary support for the latter two claims:

1: A recent peer-reviewed study has directly linked human-caused global warming to the catastrophic flooding in Texas and Oklahoma in spring of 2015. (In May, more than 35 trillion gallons of water fell on Texas—enough to cover the entire state in eight inches of water. More than two dozen people were killed, and it was the wettest single month on record in both Texas and Oklahoma.) The new peer-reviewed study from Utah State and Taiwanese researchers concluded, "There was a detectable effect of anthropogenic [manmade] global warming in the physical processes that caused the persistent precipitation in May of 2015 over the southern Great Plains."2 (See Simon Wang, S.-Y., W.-R. Huang, H.-H. Hsu, and R. R. Gillies (2015), Role of the strengthened El Niño teleconnection in the May 2015 floods over the southern Great Plains, Geophys. Res. Lett., 42, 8140–8146, doi:10.1002/2015GL065211.

[We note that a recently released National Academies of Science study also notes the high confidence level of extreme event attribution modelling studies that are clearly related to heat and temperature, such as the Wang et al. study summarized above: "**Confidence in attribution findings of anthropogenic influence is greatest for those extreme events that are related to an aspect of temperature, such as the observed long-term warming of the regional or global climate, where there is little doubt that human activities have caused an observed change**. For example, a warmer atmosphere is associated with higher evapotranspiration rates and heavier precipitation events through changes in the air's capacity to absorb moisture . . .**Confidence in attribution analyses of specific extreme events is highest for extreme heat and cold events, followed by hydrological drought and heavy precipitation.**" (National Academies of Sciences, Engineering, and Medicine. 2016. *Attribution of Extreme Weather Events in the Context of Climate Change*. Washington, DC: The National Academies Press. doi: 10.17226/21852. Page 106.)]

2: A recently-published study by Swain, Horton, Singh, and Diffenbaugh (2016) has documented that the number of very dry atmospheric patterns in California has increased in recent decades, while the number of "average" moisture atmospheric patterns has declined. Swain noted: "We're seeing an increase in certain atmospheric patterns that have historically resulted in extremely dry conditions…What seems to be happening is that we're having fewer 'average' years, and instead we're seeing more extremes on both sides. This means

that California is indeed experiencing more warm and dry periods, punctuated by wet conditions." https://www.sciencedaily.com/releases/2016/04/160401144457.htm)

While the authors of this study have deployed careful and highly technical language in their study, they have, nonetheless, written a crucially important statement concerning an apparent positive statistical relationship between global greenhouse gas forcing and the specific extreme atmospheric configurations that have been manifest in the northeastern Pacific over the last 65 years:

"The results presented in the current study therefore confirm that the observed pattern of the long-term GPH [geopotential height field] trend in the NPD [Northern Pacific domain] is spatially nonuniform, strongly positive in the mean, driven by the specific pattern of lower tropospheric warming, and characterized by an amplification of the West Coast mean ridge highly reminiscent of that which occurred during historical dry and warm years in California. These empirical findings demonstrate a complex evolution over the northeastern Pacific between 1949 and 2015, with 500-mb GPH and SLP [sea level pressure] trends of generally the same sign occurring "in-phase" with the mean West Coast cool-season ridge (Fig. 1, A to C, and fig. S1) and the largest trends occurring just east of the terminus of the East Pacific storm track (33). This is especially interesting in light of recent investigations into the physical structure of anthropogenically forced trends in regional atmospheric circulation, which have suggested that changes in mean flow (via momentum/energy fluxes driven by embedded transient cyclones) may reinforce planetary-scale stationary waves in the upper atmosphere under certain conditions(37, 45, 54, 56)."

"Additionally, because the location and amplitude of atmospheric stationary waves are dictated by the relative placement and orography of global landmasses, the observed alignment of the nonuniform spatial pattern of thermal dilation with the North American continent (Fig. 1B) supports the notion that *at least some of the observed trend in GPH—and thus specific extreme atmospheric configurations—may be due to increasing land-sea thermal contrasts. Enhanced warming over the continents is a predicted (and observed) response to global greenhouse forcing and has the potential to influence broader circulation regimes* (57, 58)." [emphasis added, see Daniel L. Swain, Daniel E. Horton, Deepti Singh, and Noah S. Diffenbaugh. Trends in atmospheric patterns conducive to seasonal precipitation and temperature extremes in California. Science Advances, March 2016, page 9 DOI: 10.1126/sciadv.1501344]

3: A comprehensive meta-study recently released by the Federal Government (U.S. Global Change Research Program, April 2016) has documented numerous significant adverse impacts associated with "Extreme Events" driven by anthropogenic forcing (greenhouse gas emissions). The key findings of this study, summarized on page 100, are provided below:

"Increased Exposure to Extreme Events-Key Finding 1: Health impacts associated with climate-related changes in exposure to extreme events include death, injury, or illness; exacerbation of underlying medical conditions; and adverse effects on mental health [High Confidence]. Climate change will increase exposure risk in some regions of the United States due to projected increases in the frequency and/or intensity of drought, wildfires, and flooding related to extreme precipitation and hurricanes [Medium Confidence]. . . Key Finding 2: Many types of extreme events related to climate change cause disruption of infrastructure, including power, water, transportation, and communication systems, that are essential to maintaining access to health care and emergency response services and safeguarding human health [High Confidence]. . . Key Finding 3: Coastal populations with greater vulnerability to health impacts from coastal flooding include persons with disabilities or other access and functional needs, certain populations of color, older adults, pregnant women and children, low-income populations, and some occupational groups [High Confidence]. Climate change will increase exposure risk to coastal flooding due to increases in extreme precipitation and in hurricane intensity and rainfall rates, as well as sea level rise and the resulting increases in storm surge [High Confidence]." (See Bell, J.E., S.C. Herring, L. Jantarasami, C. Adrianopoli, K. Benedict, K. Conlon, V. Escobar, J. Hess, J. Luvall, C.P. Garcia-Pando, D. Quattrochi, J. Runkle, and C.J. Schreck, III, 2016: Ch. 4: Impacts of Extreme Events on Human Health. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment.

U.S. Global Change Research Program, Washington, DC, 99–128. http://dx.doi.org/10.7930/J0BZ63ZV.)

04/13/2016 SWRCB Comment: Unreasonable Water Use and Extreme Weather

On the basis of all of the studies that we have summarized and cited in all of our SWRCB comments since June 19, 2015, we re-assert our previous claim: it is profoundly unreasonable—indeed, intensely irrational—for the SWRCB to continue to allow California water to be used for activities that are likely to promote an increased frequency of drought events in California's future, and hence, further water scarcity in California. We add to our assertion that it is unreasonable for the SWRCB to continue to allow California water to be used for activities that are likely to promote extreme weather conditions throughout California, the United States, and the rest of the planet. Given the severe adverse impacts that have been, and will likely be, partially generated by anthropogenically-forced extreme weather events, we assert that it is unreasonable (and hence unconstitutional) for California water to be used for agricultural production when such production is likely to result in livestock feed crops -- even when drought conditions in California are absent.

05/26/2016 CARB SLCP Reduction Strategy Draft EA Comment: CA Enteric Emissions - Cumulative Effects of Enteric Methane Emissions from Livestock
(https://www.arb.ca.gov/lispub/comm/bccomdisp.php?listname=slcp2016&comment_num=73&virt_num=66 or https://www.arb.ca.gov/lispub/comm/bccommlog.php?listname=slcp2016, then select Attachment for Comment #66, Todd Shuman, WUMU)

1: Enteric emissions from livestock (which is mostly from dairy and non-dairy cattle in California) constitute about 30 percent of methane emissions in California in a normal year. This methane emission source constitutes just under a billion pounds of methane emission per year in California, as of 2013, (or 0.452022 Megatonnes [Mt] or million metric tonnes [MMT]. (Total *cumulative* California-associated methane emissions due to dairy and livestock production – both enteric and manure-related - are typically just under one Mt per year – 0.867 Mt.)

A billion pounds of methane emitted per year from this specific methane emission source 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 years. A recently published analysis has provided information that now enables us to estimate much more precisely the degree to which past global enteric methane emissions have been, and will be, changing the environment of our planet. Based upon Figure 2d in "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, May 2, 2016, http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate2998.html), past and future global temperature change (GTC) values (in degrees Celsius) associated with the cumulative year 2011 global anthropogenic livestock and cattle-related methane emission (expressed as a pulse) are presented below:

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, cumulative 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. The 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. (Note: the global anthropogenic methane emission value used for Figure 2d was 330 Mt; the total enteric livestock methane emission value for year 2011 was projected at 98 Mt; the total cattle methane emission value for year 2011 was projected at 72 Mt. The latter two values come from FAOSTAT. The first value was provided by Myles R. Allen, email communication, May 15, 2016.)

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: a 0.00004545+ degrees Celsius global temperature rise for the year 2031-2032 and a 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 29thMarch, 2016, Drew Shindell, Professor of Climate Sciences, Duke University, CCAC Science Advisory Panel Chair 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."

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

[September 26, 2016 update: "Not only did Earth witness its hottest August on record, according to NOAA, but it also extended its streak of record-warm months to 16. Such a lengthy period of record-setting warmth is unprecedented in 137 years of temperature observation, NOAA said … August's average temperature was 1.66 degrees above the 20th century average, 0.09 degrees above the previous warmest August — set just one year ago. (Source: https://www.washingtonpost.com/news/capital-weather-gang/wp/2016/09/20/earth-posts-hottest-august-on-record-and-16th-straight-month-of-unsurpassed-heat/)

On September 25, 2016, Dr. Juan Cole, the Richard P. Mitchell Collegiate Professor of History at the University of Michigan, quoted eminent climate scientist Michael Mann asserting that there is "tentative but compelling evidence" that it was hotter this past summer on Earth than it has been at any point in the past 100,000

years. (Source:http://www.truthdig.com/report/item/the_last_time_summer_was_this_hot_human_beings_hadnt_left_africa_20160925.)

From *USA Today*, September 21, 2016: "Before 1880, scientists rely on paleoclimatic records such as ice cores, tree rings and lake sediments that provide an ever further look back in time: 'It is plausible that this summer was the warmest in thousands of years, perhaps even longer,' said meteorologist Michael Mann of Penn State University. 'There is now very robust paleoclimate evidence that the past decade was likely Earth's warmest in more than a thousand years, and there is somewhat more tentative but nonetheless compelling evidence that we have moved into territory unseen in more than a hundred thousand years,' he added. Another climate scientist, Gavin Schmidt of NASA, agrees that while individual seasons may be hard to quantify in terms of record warmth, the unusual warmth over the past few decades 'seems exceptional in many hundreds and perhaps thousands of years. 'Glacier retreat is indicative of this, since they are unearthing soil, debris, and trees that were buried 1,000, to 4,000, years ago,' he said." (Source: http://www.usatoday.com/story/weather/2016/09/20/earth-hottest-summer-record/90731548/)]

[September 29, 2016 update, from The World Meteorological Organization: "28 September 2016 (WMO) - Dramatic and unprecedented warming in the Arctic is driving sea level rise, affecting weather patterns around the world and may trigger even more changes in the climate system . . . 'The Arctic is a principal, global driver of the climate system and is undergoing an unprecedented rate of change with consequences far beyond its boundaries,' said WMO President David Grimes . . . Global temperatures are rising as a result of climate change, with 2014, 2015 and the first eight months of 2016 breaking records. The Arctic is warming at least twice as fast as the world average, in places even faster. For instance, Inuvik in the Northwest Territories in Canada has warmed by almost 4° Celsius since 1948 . . . 'The melting of snow and ice cover is having far reaching environmental consequences and may potentially contribute to changes in circulation patterns in the ocean and atmosphere. The Arctic changes have also been a factor in unusual winter weather patterns in North America and Europe, The thawing of the frozen permafrost in Arctic regions has the potential to release vast quantities of greenhouse gases into the atmosphere. These are part of the vicious circles of climate change which are the subject of intense scientific research,' said WMO Secretary-General Petteri Taalas." Source: http://public.wmo.int/en?utm_source=Climate+News+Network&utm_campaign=196b8196a7-Arctic_changes_fast9_29_2016&utm_medium=email&utm_term=0_1198ea8936-196b8196a7-38788029]

Past, present, and reasonably-foreseeable enteric-associated global temperature change is an effect which has been partially generated by the many individually minor, but collectively significant livestock-related methane emissions taking place in California yearly and over an extended period of time. Such emissions have been fueled by the water that has been used to grow livestock feed in California. (Methane emissions associated with rice cultivation are also implicated in global temperature change.)

07/06/2015 SWRCB Comment: Imbalance and Unreasonable Water Use

The conservation of the waters of the state is of paramount importance. We believe that we have presented sufficient evidence in this comment to establish that water used to grow livestock feed crops is, on its face, wasteful and unreasonable, and the consequences of such use adversely impact California society and natural ecosystems across a number of different yet inter-related economic, political, social, and ecological spheres. The cumulative impact of all these effects has now created in California a phenomenon of "transcendent importance" (*Joslin v. Marin Mun. Water Dist., 67 Cal.2d 132, [1967]).* What is this phenomenon? California is out of balance, and the use of water to produce livestock feed crops promotes further imbalance between the human species and California's native ecosystems. The path to balance requires actions that reduce and/or eliminate these wasteful and unreasonable uses that have been contributing to the imbalance between the human species and California's native ecosystems.

We believe that the SWRCB is required to act on the matter of wasteful, unreasonable use of water being used to produce livestock feed. The mandatory legal authority to buttress SWRCB action has three components. First, the SWRCB and the courts can nullify "beneficial" use of water, if such use is wasteful and/or unreasonable *(Joslin, 1967, Forni, 1976, Light v. SWRCB, 2014)*. Second, the SWRCB can reduce and/or eliminate wasteful, unreasonable water use to rebalance an unbalanced situation *(U.S. v. SWRCB, 1986)*. Third, the SWRCB is *required* to re-balance imbalanced situations *(Audubon, 1983, Cal Trout II.)*.

Concerning our first point, we rely primarily on *Joslin (1967),* but also *Forni (1976).* In *Joslin*, the CA Supreme Court commented about the plaintiffs' claim:

[5] In essence their position is that such use is a [67 Cal.2d 143] beneficial one encompassed within their riparian rights and that all beneficial uses are reasonable uses. Such a position ignores rather than observes the constitutional mandate. Article XIV, section 3, does not equate "beneficial use" with "reasonable use."... the mere fact that a use may be beneficial to a riparian's lands is not sufficient if the use is not also reasonable within the meaning of section 3 of article XIV and, as indicated ... use must be deemed unreasonable. (*Joslin v. Marin Mun. Water Dist., (1967)*)

Concerning *Forni (1976),* Littleworth and Garner (2007) note, "Forni followed Joslin in holding that a beneficial use could nonetheless be unreasonable (p. 111)." Finally, *Light v. SWRCB* (which the CA Supreme Court declined to review on Oct 1, 2014) appears to also reinforce the previous holdings of the court in both Joslin and Forni.

Concerning our second point, we rely primarily on *U.S. v. SWRCB (1986).* In this case, the court upheld a decision in which the SWRCB made an "implicit finding" of unreasonable use to justify a curtailment of CVP and SWP project activities that resulted in a reduction of water storage and a reduction in water exports. The SWRCB made this decision on the basis of new information documenting "adverse impacts of the projects upon the Delta." We assert that it is reasonable to interpret the SWRCB's decision as an act of "balancing": the SWRCB discerned an imbalance in the relationship between human activities and the Delta ecosystem and curtailed the unreason-able use of water that was generating the imbalance. By reducing an unreasonable use of water, the SWRCB promoted balance in the relationship between humans and the natural world.

As for our last point, we rely upon *Audubon (1983)* and *Cal Trout II (1990*). In both of these cases, the SWRCB had refused, over extended periods, to take actions that would compel a re-balancing of the severely imbalanced relationships between the City of Los Angeles, the Mono Lake ecosystem, and the fisheries of Mono Lake's feeder streams. While neither of these cases focused on Article X, Section 2 of the California Constitution, the courts in both of these cases clearly ruled that the SWRCB had a legal duty to re-balance relationships between human institutions and natural ecosystems that had been clearly unbalanced for significant periods of time. In both of these cases, the court stepped in to "re-balance" when the SWRCB failed to meet its legal duty to "re-balance" an unbalanced situation.

Almond Hulls and Wasteful, Unreasonable Water Usage

In this complaint, I consider a significant proportion of water applied to almond orchards as wasteful and unreasonable – that proportion that can be reasonably associated with the almond hulls that are typically sold to dairies and then fed to dairy livestock. I acknowledge that such an assumption is controversial. Most people tend to assess the value of water in relation to the money that is generated by the sale of products grown due to the application of that water. For most, that is the only value criteria that can be conceived, and that can be the only acceptable criteria to apply with regard to a wasteful and/or unreasonable water usage analysis.

According to such narrowly-defined economic criteria, almond kernel production must constitute a social good with virtually no downside. It is indisputable that almond growers make large amounts (and nearly all of their) money by selling the almond kernels, not by selling almond hulls (or almond shells for that matter). It is also not in dispute that water is applied to almond orchards by almond farmers with the sole intention of producing almond meats for sale.

However, I assert that other "value" criteria exist – including criteria that consider or integrate the broader social and environmental costs associated with water use that results in the production of such almond kernels Water applied to almond orchards results in three commodities that are sold each year. Roughly half of the cumulative mass of all those almond-related commodities that get sold and which result from that application of water are almond hulls, a crop almost exclusively sold to the dairy and livestock industries as a nutritional feed input. *In short, half of the water applied to almond orchards results in a livestock feed crop commodity mass that is ultimately sold to dairies and fed to dairy cows and then partially converted into methane that is then emitted into the atmosphere*. That is a fact that must be factored into an analysis of the ultimate social and environmental utility of almond kernel production – and the applied water that gives rise to the almond-orchard-related commodities ultimately sold.

I note for the record that the county almond hull values per unit are typically three or more times as great as silage, which is the primary feed for diary production in California in terms of sheer tonnage.

David Valadao, James O'Banion, James L. Nickel, Stewart/Lynda Resnick, and Donald Bransford Biographies

David G. Valadao

http://valadao.house.gov/biography/

"The Valadao family immigrated from the Azores Islands of Portugal to the United States in 1969. After settling in the Central Valley, Valadao's father started a small dairy farm in the Central Valley in 1973. Valadao was born on April 14, 1977. The business now consists of two dairies, as well as over 1,000 acres of farmland in Kings and western Tulare County, on which Valadao and his family grow alfalfa, corn, and wheat as dairy feed stock."

http://www.latimes.com/politics/la-pol-ca-poorest-in-congress-david-valadao-story.html

He listed a minimum of $1.3 million in assets that he and his wife, Terra, hold for the family farms, Valadao and Triple V Dairies. Valadao Dairy - 17293 9 1/2 Avenue, Hanford; Triple V Dairy 18183 I Dr. Tulare, California 93274 (559) 584-9108

congressmanvaladao@mail.house.gov

James O'Banion

http://www.ccidwater.org/board.html

James O'Banion, Chairman, San Joaquin River Exchange Contractors Water Authority; President of CCID Board of Directors; O'Banion Ranches. Occupation: Farmer and Dairyman; 2492 acres; Crops: Alfalfa, Cotton, Corn, Wheat, Wheat Grass, Permanent Pasture; 475 head dairy herd; Director, San Luis & Delta-Mendota Water Authority, President, Poso Canal Company

15775 Indiana Rd, Dos Palos, CA 93620 Phone: (209) 387-4651

contactus@sjrecwa.net

James L Nickel

James L Nickel, Nickel Family LLC, Treasurer and member of the Board of Directors, San Joaquin River Exchange Contractors Water Authority

"Rio Bravo Ranch . . . Eventually, the 30,000 acre ranch was divided in two, and George W. Nickel bought the lower 16,000 acres. Today, the Nickel family farms citrus, almonds, and walnuts, and cattle feed on the land's dry

pastures." http://www.riobravoranch.com/the-ranch/

"Nickel Family LLC is a multi-generational, family-owned grower of citrus, nuts, tomatoes, grapes and alfalfa. They own and farm on more than 9,000 acres throughout California." http://theproducenews.com/more-people-articles/people/17548-nickel-family-llc-hires-darren-filkins-as-ceo

15701 Highway 178 Bakersfield, CA 93306 661.872.5050;

http://www.riobravoranch.com/the-ranch/; jlnickel@nfllc.net; asembach@nfllc.net,

Stewart and Lynda Resnick

http://www.forbes.com/sites/chloesorvino/2015/11/04/americas-nuttiest-billionaire-couple-amid-drought-stewart-and-lynda-resnick-are-richer-than-ever/#63df4ca543d6

"Here there are rows upon rows of green–some 70,000 lush acres of water-hungry pistachio and almond trees. Come at the right time of year and you'll see the almond trees blossoming, covering the valley in a blanket of light pink petals. This land belongs to the billionaire Resnicks, Stewart, 77, and Lynda, 72. . . ."

The Wonderful Company, Wonderful Citrus, Wonderful Pistachios & Almonds, Teleflora, FIJI, Wonderful Sales, 11444 Olympic Blvd., Los Angeles, CA 90064, (310) 966-5700

https://www.wonderful.com/; comments@wonderful.com

Donald Bransford

https://www.cdfa.ca.gov/state_board/BrdBios/bioDonaldBransford.html

Donald Bransford, President of the Board of Directors for the Glenn-Colusa Irrigation District, is the owner of Bransford Farms, a 1,200 acre ranch that include almonds, prunes and rice.

Don Bransford formed Bransford Farms with his wife and partner Diane in 1980
Donald R. Bransford, President, PO Box 809 Colusa, CA 95932 Phone: 530-304-7768 Fax: 530-458-4715

http://www.bransfordfarms.com/; donald.bransford@gmail.com

Under what conditions may this complaint be disregarded and dismissed?

The SWRCB issues a finding that past use of water by Valadao, O'Banion, Nickel, the Resnicks, and Bransford to produce livestock feed, crops which resulted in livestock feed crop tonnage, and/or rice was wasteful, unreasonable, and unconstitutional.

The SWRCB issues a finding that current use of water by Valadao, O'Banion, Nickel, the Resnicks, and Branford to produce livestock feed, crops which resulted in livestock feed crop tonnage, and/or rice is considered by the SWRCB to be wasteful, unreasonable, and unconstitutional.

The SWRCB issues a finding that further use of water by Valadao, O'Banion, Nickel, and the Resnicks to produce livestock feed, crops which resulted in livestock feed crop tonnage, and/or rice will be considered by the SWRCB to be wasteful, unreasonable, and unconstitutional unless the following remedies are widely implemented.

Remedies concerning the “unreasonable” criteria:

Ranchers and dairy owners capture at least 80 percent of the enteric methane emissions of livestock and at least 80 percent of the methane emissions from anaerobic manure lagoons and then pay a carbon-dioxide-related tax/fee concerning the combustion of that captured methane biogas. Alternatively, they are required to purchase pollution credits (allowances) or offsets concerning such resulting carbon dioxide emissions; or they are required to compensate for livestock-related methane emissions through mandatory one-off carbon sequestration measures; or they are required to pay methane emission taxes concerning emissions of uncaptured methane; or they are required to purchase CA ARB auction pollution permit/allowances or offsets concerning uncaptured methane. [With these remedies implemented, water use for livestock feed production is no longer unreasonable but it is still wasteful]

Remedies concerning both “wasteful” and “unreasonable” criteria:

Almond growers find alternative uses for almond hulls and no longer sell hulls to dairies as livestock feed. (Compost could be generated and then applied to soil to promote carbon sequestration; hulls could be used as human health supplements, given that USDA Agricultural Research Service chemist Gary R. Takeoka and colleagues in Albany, Calif., have shown that hulls are a rich source of natural compounds.) [With these remedies, water use that results in almond hull tonnage is no longer wasteful or unreasonable]

Rice growers use different (non-flood) irrigation techniques for rice farming that eliminate methane emission during the rice production farming cycle. Alternatives include direct seeding of rice into fields rather than transplanting rice into flooded paddies; drip irrigation, use of center pivot sprinkler systems, pressurized water application methods, upland cultivars of rice, and alternation between wetting and drying the fields. (In this latter process, the field is supplied with water, then allowed to completely dry before the next watering. Not only does this cut down on water usage, but it also minimizes the methane gas that is produced due to anaerobic decomposition of organic matter in flooded fields.) [Water use for rice production is no longer wasteful or unreasonable]

[Concerning the “rice fields drying” alternative discussed above, we note that alternative, lower-methane-emitting compensatory habitat for migrating bird species should be created as compensation for the prospective loss of flood-irrigated rice cultivation acreage that concurrently functions as water fowl habitat. Other areas, cumulatively equal in size (and preferably where historic valley lakes existed), should be established so that water fowl have alternative, non-toxic resting and feeding locations. Additionally, non-methane-emitting methods for groundwater aquifer recharge in the rice cultivation fields of the Sacramento Valley (and further north) should also be deployed.]

Sincerely,

Todd Shuman, Senior Analyst, Wasteful UnReasonable Use (WURU),
P.O. Box 528, Camarillo, CA 93011, 805.236.1422, tshublu@yahoo.com
September 29, 2016

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Appendix A: Select 2014/2015 SJV County Crop Production Values (Acres and Tonnage)

Kern County		*Acres*	*Production/Unit*
Silage and Forage	2015	93,000	1,769,000 Ton
	2014	85,000	1,632,000 Ton
Hay, Alfalfa	2015	101,000	723,000 Ton
	2014	109,000	922,000 Ton
Almonds Meats	2015	210,000	197,000 Ton
	2014	199,000	201,000 Ton
Almond By-Products	2015	--- ---	300,000 Ton
	2014	--- ---	329,000 Ton

Tulare County		*Acres*	*Production/Unit*
Corn–Silage	2015	158,000	4,866,000 Ton
	2014	117,000	2,948,400 Ton
Silage-Small Grain	2015	287,000	5,769,000 Ton
	2014	75,100	1,232,000 Ton
Alfalfa-Hay	2015	60,500	592,000 Ton
	2014	60,000	612,000 Ton
Alfalfa-Silage	2015	--- ---	1,077,000 Ton
	2014	--- ---	492,000 Ton
Almond Meats	2015	45,300	43,000 Ton
	2014	46,400	48,700 Ton
Almond Hulls	2015	--- ---	86,100 Ton
	2014	--- ---	97,500 Ton

Fresno County		*Acres*	*Production/Unit*
Corn-Silage	2015	26,450	626,000 Ton
	2014	28,100	649,000 Ton
Alfalfa Hay	2015	43,500	294,000 Ton
	2014	52,200	338,000 Ton
Almond Meats	2015	186,229	186,000 Ton
	2014	170,711	184,000 Ton
Almond Hulls	2015	--- ---	348,000 Ton
	2014	--- ---	326,000 Ton

Sources: 2015 Kern County Agricultural Crop Report; 2015 Tulare County Annual Crop and Livestock Report; 2015 Fresno County Agricultural Crop and Livestock Report

Appendix B: WURU Comments to SWRCB and CA ARB: Documentation, and Download Links

SWRCB Comments:

http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/docs/sfk_marderosian041316.pdf

http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/docs/sfk_marderosian101415.pdf

http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/docs/sfk_marderosian081615.pdf

http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/docs/sfk_marderosian070615.pdf

http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/docs/sequoiaforestkeeper_marderosian.pdf

http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/docs/public_tshuman061915.pdf

CA ARB Comments:

May 26, 2016 SLCP RS (CA ARB) Comments and Attachments are accessible at:

https://www.arb.ca.gov/lispub/comm/bccomdisp.php?listname=slcp2016&comment_num=73&virt_num=66

https://www.arb.ca.gov/lispub/comm/bccommlog.php?listname=slcp2016, then select Attachment for Comment #66, Todd Shuman, WUMU)

October 30, 2016 SLCP RS (CA ARB) comments are accessible at

https://www.arb.ca.gov/lispub/comm2/bccomdisp.php?listname=slcpdraftstrategy-ws&comment_num=72&virt_num=66

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]

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[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]

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[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.

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[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:

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[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/

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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

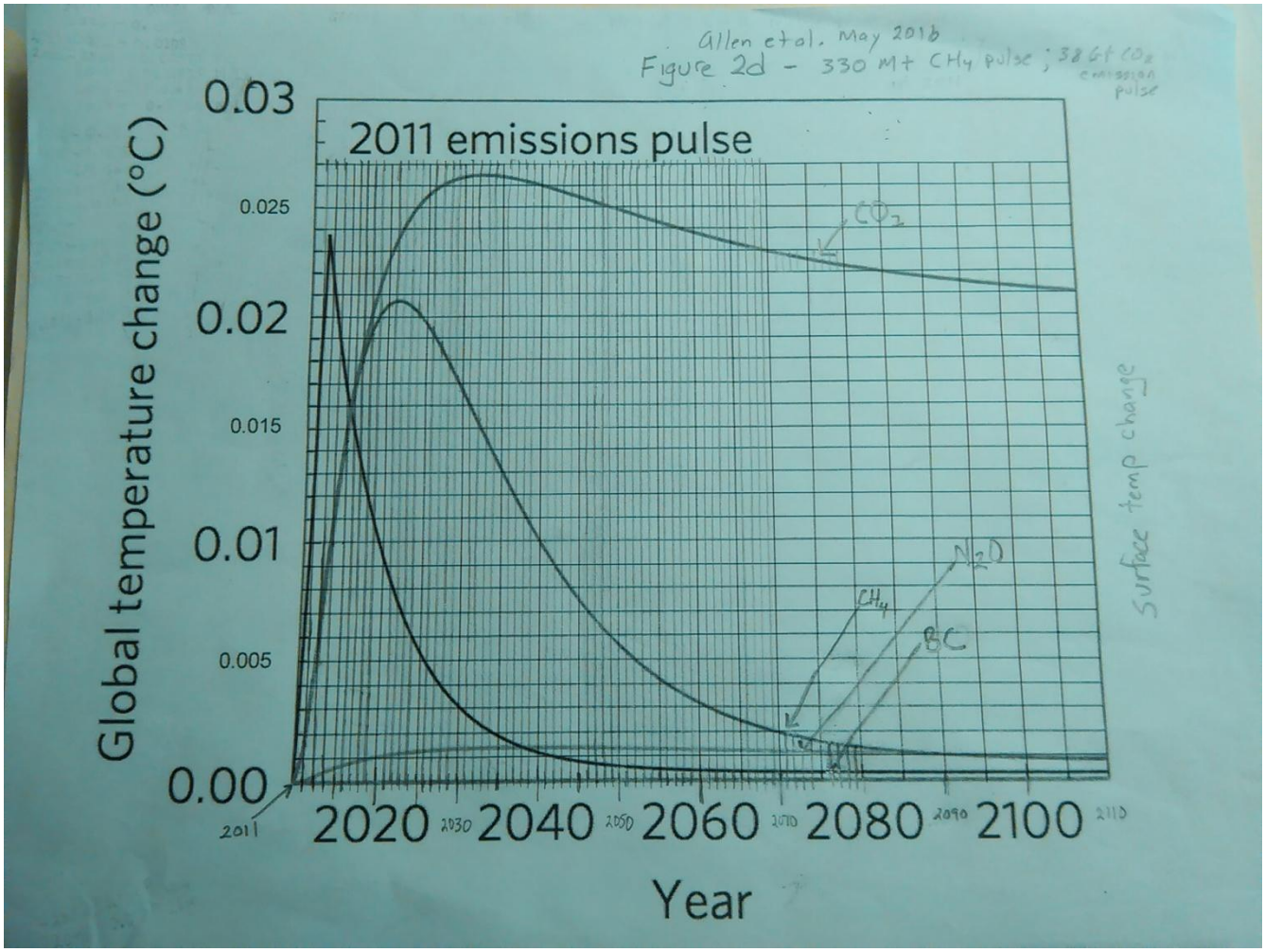
Biomass Burning: 0.0016, 0.0022, 0.0016+, and 0.00054

(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….