December 21, 2022

Cheryl Laskowski
Branch Chief, Transportation
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

RE: Description of Opportunity and Proposed Method to Maximize Landfill Gas Methane Emission Reductions under the Low Carbon Fuel Standard

(Comment submitted electronically)

Dear Dr. Laskowski,

On behalf of Loci Controls, Inc. ("Loci"), I am writing to recommend that due to the shortfall identified in the Final 2022 Scoping Plan regarding short-lived climate pollutant ("SLCP") emission reductions, the California Air Resources Board ("CARB") should provide recognition to automated landfill monitoring and control technologies within the Low Carbon Fuel Standard program ("LCFS") to speed methane emissions from landfills. Loci recognizes CARB's ground-breaking work in quantifying fugitive methane emissions, and in deploying policy strategies to maximize the capture and upgrading of biogas so that it can be beneficially used as renewable natural gas ("RNG") to displace fossil natural gas. We appreciate the opportunity to provide this Comment.

Summary of Comment

As discussed in our comment letter of September 19, 2022, Loci is a world leader in the development of automated landfill gas ("LFG") monitoring and control technology ("Automated Control Technology"). Last year, the American Carbon Registry ("ACR") affirmed the environmental value of Loci's Automated Control Technology with the approval of a methodology which enables landfills to go beyond existing regulations to prevent the release of methane and other gases into the atmosphere, thereby "offering the potential for hundreds of millions of tons of additional emission reductions over the next decade."[1] Because Loci's technology goes beyond current regulatory requirements, its deployment offers real-world reductions of LFG emissions. The Final 2022 Scoping Plan describes the shortfall in methane emissions as compared to CARB's Short-lived Climate Pollutant Strategy. This Comment quantifies the methane emission reduction potential of Automated Control Technology in California based on the verified methane capture capabilities of Loci's technology. This analysis was developed by Loci's technical experts utilizing Scoping Plan projections of LFG methane

[1] "Methodology for the Quantification Monitoring, Reporting and Verification of Greenhouse Gas Emissions Reductions and Removals from Landfill Gas Destruction and Beneficial Use Projects, version 2.0," available at https://americancarbonregistry.org/carbon-accounting/standards-methodologies/landfill-gas-destruction-and-beneficial-use-projects/lfg-methodology-v2-f_2021-05-05.pdf , press release with quote at https://americancarbonregistry.org/carbon-accounting/standards-methodologies/landfill-gas-destruction-and-beneficial-use-projects/lfg-methodology-v2-f_2021-05-05.pdf

emissions and the same models and assumptions regarding LFG inventory and LFG collection efficiencies as CARB utilizes.

In order to facilitate the deployment of Automated Control Technology in California, the Comment then provides a step-by-step description of how the existing Tier 1 calculator could be modified to enable LCFS crediting for LFG from landfills that have successfully deployed Automated Control Technologies whether provided by Loci or other companies. By integrating this new Tier 1 component into the LCFS, CARB will hasten the deployment of this vital technology both in California and in other states. Notably, because SB 1383 did not provide safe-harbor LCFS crediting provisions for enhanced landfill gas collection as it did for the dairy and swine manure pathways and for qualified organics diversion, such crediting would not be protected for a 10-year period by §95488.9(f)(3) in the event that CARB mandates Automated Control Technologies in the future.[2]

Current Shortfall in Projected Landfill Gas Methane Reductions

As stated in the Final 2022 Scoping Plan:

> *"Achieving the 75 percent organic waste disposal reduction target of SB 1383, and maintaining that level of disposal in subsequent years, would bring annual landfill emissions in 2030 to just below the 2013 baseline. Annual methane emissions will be higher through 2030 than originally anticipated by the SLCP Strategy because the state did not achieve the anticipated reductions in organic waste disposal of 50 percent below 2014 levels by 2020. SB 1383 prohibited the organic disposal regulations from taking effect until 2022, and, as a result, emissions have continued to increase.*
>
> *Due to the multidecadal time frame required to break down landfilled organic material, the emissions reductions from diverting organic material in one year are realized over the course of several decades. For example, one year of waste diversion in 2030 is expected to avoid 8 MMTCO2e of landfill emissions, cumulatively, over the lifetime of that waste's decomposition. Near-term diversion efforts are critical to avoid locking in future landfill methane emissions. (…)*
>
> *While reducing organic waste disposal is the most effective means of achieving reductions in waste sector methane, strategies to reduce emissions from waste already in place in landfills also will play a role in achieving near-term reductions. As Figure 4-16 shows, the total degradable carbon (a measure of the amount of waste with potential to generate methane) that is accumulated from waste deposited in previous years is over 20 times greater than the amount added each year. This illustrates that even if we were able to entirely phase out landfilling of organic waste today, the existing waste in place at landfills would continue to generate methane for decades into the future.*

[2] See LCFS Regulation entitled "Special Circumstances for Fuel Pathway Applications at §95488.9(f)(3) that provides for 10-year crediting periods for avoided methane emissions for dairy and swine manure pathways and for landfill-diversion pathways but provides no comparable provision for avoided methane emissions from enhanced landfill gas collection.

> ***Through a combination of improvements in operational practices, use of lower permeability covers, advanced landfill gas collection systems, and increased monitoring to detect and repair leaks, it is estimated that a direct emission reduction of 10 percent is achievable across the state's landfills by 2030****. Technologies to utilize landfill gas efficiently can contribute further emission reductions in the energy sector.*[3]

Landfill Gas Reduction Potential in California

Automated Control Technology such as Loci's delivers the key improvements in capability identified in the 2022 Scoping Plan: **improvements in operational practices**, **advanced landfill collection systems**, and **improved monitoring to detect and repair leaks**. As discussed in the 2022 Scoping Plan, California landfill methane emissions in 2019 represented 21% of the state's total methane emissions, at an estimated 8.17 MMT CO_2e.[4] LCFS recognition of enhanced methane capture at landfills beyond the assumed capture efficiency level would provide a powerful market signal to drive adoption of Automated Control Technology on a voluntary basis. While it is difficult to accurately predict the exact rate of adoption, it is expected that LCFS recognition in 2024 would be sufficient to incentivize 20% adoption at large landfills by 2030 and 45% by 2035. These market penetration percentages are based on the methane emissions inventory of California landfills rather than the number of landfills given that the larger scale methane reduction opportunities exist at large landfills. This estimate is grounded on the fact that about 50% of landfills that are subject to federal gas collection regulations have implemented either renewable natural gas or electricity projects. We would expect the highest rate of early adoption of Automated Control Technology to occur where already there are beneficial uses for the landfill gas that is collected.

Using the existing Loci Automated Control Technology as a benchmark, it has been recognized by the previously discussed ACR Protocol that methane capture reductions of 13-24% can be achieved compared to the landfill's previously document LFG capture performance. Utilizing a conservative estimate of average performance improvement of 15% for implementation of Automated Control Technology would result in the following decreases in methane emissions from California landfills.

[3] California Air Resources Board, "2022 Scoping Plan for Achieving Carbon Neutrality," (November 16, 2022), from Landfill Methane section at p. 233-234 (emphasis supplied, footnotes omitted), available at https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp.pdf

[4] Id., Figure 4-12: Sources of California Methane Emissions (2019), at p. 226, available at https://ww2.arb.ca.gov/sites/default/files/2022-12/2022-sp.pdf .

Year	% of California Landfill AGCCS Adoption (methane inventory basis)	Emissions Reduction Annually from Landfills with AGCCS - in metric tons/year CO2e	% reduction of Estimated CA Landfill Emissions relative to 2019 estimated baseline
2024	3%	163,400	2%
2025	6%	245,100	3%
2026	9%	408,500	5%
2027	12%	571,900	7%
2028	15%	653,600	8%
2029	18%	817,000	10%
2030	**21%**	**898,700**	**11%**
2031	25%	1,143,800	14%
2032	30%	1,307,200	16%
2033	35%	1,552,300	19%
2034	40%	1,797,400	22%
2035	**45%**	**2,042,500**	**25%**

Proposed Updates to CA-GREET Model

To achieve these estimated methane reductions from California's landfills, Loci proposes that the Tier 1 landfill gas (LFG)-to-biomethane fuel pathways under the LCFS be expanded to account for the incremental avoided methane associated with use of LoCI's and other's automated gas monitoring and collection technologies. The recognition would be limited to methane capture methods that exceed the current landfill capture regulatory obligations applicable to California landfills. Loci also encourages CARB to include LFG-to-electricity as eligible Tier 1 fuel pathways. These pathways are no more complex than LFG-to-biomethane pathways. As a result of the market signal that LCFS eligibility would send to landfills, LFG-to-electricity generation facilities equipped with automated monitoring and collection equipment are likely to increase more rapidly over the coming years relative to the current rate of adoption. These pathway expansions will significantly assist California in meeting Scoping Plan and SB 1383 goals and can be easily accomplished through straightforward updates to the *Tier 1 Simplified CI Calculator for Biomethane from North American Landfills*.

We propose that new columns be added between sections 2.5 and 2.6 for users to enter the baseline and total LFG collection efficiencies. These efficiencies will be based on verified 6 month-average values. As an alternative approach, the user could input the kilograms or metric tons of incremental LFG captured based on the verified collection efficiencies. Either approach (collection efficiencies or incremental methane captured) can be used in the tool to calculate the avoided emission credit based on the global warming potential ("GWP") of methane under the LCFS and the quantity of biomethane or electricity sold as transport fuel in California. The net credit would be summarized in the "CI Calculation Details" in section 4. This approach would be a simple modification of the existing simplified calculator tool and would be consistent with existing, certified LFG-to-biomethane pathways that do not employ advanced monitoring and collection technologies.

Secondly, we propose adding a new tab to the simplified calculator tool for LFG-to-electricity facilities, based on the existing "LFG" tab in the tool where section 3 represents the conversion of LFG to electricity rather than the production of CNG, LNG and L-CNG. This revised section would include a column for inputting the net electricity generated and exported to the grid. Combustion methane and nitrous oxide emissions can be calculated based on equipment-specific emission factors from the CA-GREET model or can be accounted for based on actual emissions reported to CARB and/or EPA. Like the avoided methane credit, this modification is simple and straight forward and merely changes the denominator of the CI results from gCO_2e/MJ biomethane to gCO_2e/MJ electricity while accounting for LFG combustion emissions and downstream transmission and distribution losses, based on the CA-GREET default loss factor. The disaggregated LFG-to-electricity emission results would be summarized in the "CI Calculation Details" in section 4.

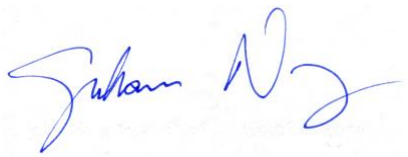
The LFG-to-electricity pathway CI would be summarized in the "LFG Summary" tab, next to the CI results for CNG, LNG and L-CNG produced from LFG, like the summary tab in the biodiesel/renewable diesel simplified calculator tool, which summarizes the CI results of both transport fuels.

Please let us know if you have questions about the proposed modifications to the *Tier 1 Simplified CI Calculator for Biomethane from North American Landfills* or if you would like for us to implement these changes to demonstrate a working tool that incorporates these proposed modifications.

Conclusion

We would welcome the opportunity to provide any further information that would be value to ARB on this subject.

Respectfully,



Graham Noyes
Representing Loci Controls, Inc.