California Air Resources Board

Public Hearing to Consider Amendments to the Low Carbon Fuel Standard

Final Statement of Reasons for Rulemaking

Appendix C Summary of Comments and Agency Response

Public Hearing Date: November 8, 2024 Agenda Item No.: 24-6-2

Table of Contents

II.	Application Submission and Review Process	
JJ.	Life Cycle Analysis	5
KK.	CA-GREET4.0	13
LL.	Lookup Table	
MM.	Lookup Table Pathways	
NN.	Tier 1 CI Calculators	
00.	Fuel Pathways – General	57
PP.	Temporary Fuel Pathways	61
QQ.	Deemed Complete Date	68
RR.	Margin of Safety	68
SS.	Credit True Up	68
TT.	Deficit Obligation	75
UU.	Verification	85
VV.	Vehicle EERs	
WW.	Dairy and Swine Manure (DSM) pathways	100
XX.	Project-Based Crediting	120
YY.	Crude Oil CI and OPGEE	127
ZZ.	Carbon Capture and Sequestration (CCS)	137
AAA.	Market Functioning	157
BBB.	Carbon Isotopic (C-14) Analysis	158
CCC.	Miscellaneous	

II. Application Submission and Review Process

II-1 Multiple Comments: Streamline pathway application processing and approval process

Comment: WPGA proposes that CARB adopt a streamlined approval process for the following additional delivery models of fuel:

1) Pathways that would incentivize production of electricity used in the charging of battery electric vehicles: Currently, renewable and conventional propane can be used in fast- charging mobile or stationary applications to charge battery electric vehicles across many classes. Offering a streamlined pathway to incorporate the delivery of already approved renewable propane to these charging applications is directly in line with existing LCFS intent and will provide greater reliability for electric vehicle charging networks within California.

2) Updated GREET model (and/or pathways) that incorporate the usage of renewable fuels or technologies within the transportation of renewable propane for delivery. In-state transportation emissions could further be reduced by using renewable propane to fuel the vehicles involved in transportation and delivery. WPGA is working with vendors to bring ultra-low-NOx renewable propane-powered Autogas vehicles to the California market to supplant diesel. CARB could create a streamlined process to incorporate those reductions in the CI of transportation within the CI of the fuel itself. (45d-182.4, Apr-127.9)

Comment: Finally, we believe that CARB should synchronize efforts with other agencies to utilize data and precedents to streamline processes. Doing so would be of significant value, both to increase access to new pathways/new producers and reduce burdens on CARB's resources and staff. For example, the EPA has a number of approved pathways based on GREET modeling for national and global feedstocks. CARB should explore whether these pathways could be leveraged to establish a wider range of temporary pathways that could be used until facility-specific pathways (based on operational data) are fully available. (45d-221.8)

Comment: CARB should accelerate temporary pathway approvals or provisional pathway approvals by creating a 30-day deadline to review a temporary approvals or provisional pathway approvals by creating a 30-day deadline to review a temporary fuel pathway application and provide initial feedback. (45d-241.17)

Comment: The current CI of renewable propane ranges from half- to one-quarter the CI of California's electric grid – and new sources are lower still. Like conventional propane, renewable propane has no methane. Therefore, it does not suffer leakage issues or fugitive GHG emissions like natural gas. It also does not run the risk of groundwater or soil intrusion from spills like liquid fuels or degrading electronic waste, such as batteries or solar panels.

There would be great air quality benefit to transitioning from fuels with significant air emissions like CARBOB (California gasoline blend), natural gas, and diesel, to the no-SOx, no-black-carbon, and ultra-low-NOx solution of renewable propane. To meet 2022 Scoping Plan goals and other emission reduction mandates such as the State Implementation Plan (SIP), renewable propane serves as the bridge fuel to meet timeline goals in fuel sectors where

electric technology is not yet affordable nor feasible. It is the perfect fuel for hard to decarbonize areas and sectors of the state, like off-road and heavy-duty transportation. Renewable propane can be prioritized in underserved communities where adequate electric infrastructure is not afforded to them or where service is intermittent due to power shutoffs and natural disasters. (Apr-127.3)

Comment: Acknowledging that the transportation of fuel is included in the CI, ideally renewable propane production would be in California. There are already in-state facilities producing renewable propane, with additional sources coming rapidly online. One source is Global Clean Energy, which utilizes the energy-rich cover crop camelina seed: currently qualified as an LCFS compliant fuel. While many renewable diesel and sustainable aviation fuel (SAF) plants produce renewable propane, it is currently being utilized onsite to lower the CI of other existing LCFS- compliant fuels. This limits the amount of renewable propane on the market. (Apr-127.4)

Comment: Fuel pathway applications are one of the most resource-intensive elements, involving a significant number of handoffs between parties and considerable delays with each step. Considerable time could be saved if CARB's completeness review and duplicative engineering review were eliminated. Applicants could have their pathway materials validated prior to submittal to CARB and the CARB-approved verifiers should be trusted to do the bulk of the analysis needed to ensure accuracy and completeness. We urge CARB to conduct a comprehensive review of the pathway application process with producers to look for opportunities for streamlining, including measures that emphasize third-party review of applications. CARB staff are currently over-burdened, and certifying third-party engineering firms to review and endorse pathway applications would not only free up constrained staff resources, but also allow for the work to adapt to the growth rate of low-carbon industries. (45d-165.4)

Comment: Braya Supports Streamlining and Updating the Application and Review Process for Pathway Approval. (45d-221.5)

Agency Response: No change was made in response to these comments. The initial rulemaking proposal had already incorporated several changes to streamline the application review and certification processes. Examples include aligning the deem complete quarter for Tier and Tier 2 applications, credit true up, updates to Tier 1 calculators and addition of a new Tier 1 hydrogen calculator.

The current regulation allows modeling of various uses of propane and renewable propane including production of electricity for EV charging and as a transportation fuel under a Tier 1/Tier 2 fuel pathway classification or as process energy in producing renewable diesel/alternative jet fuel. Developing a streamlined pathway approval process such as creation of a separate Tier 1 calculator for fossil/renewable propane pathways was not a priority for the current rulemaking because these applications are unlikely to be widely used.

No change was made with respect to the recommendation for CARB to impose a 30-day deadline to complete the review of temporary and provisional pathway applications. Staff strives to process pathway applications as quickly as possible on a

first come, first served basis. A 30-day deadline would not necessarily ensure faster review and approval when there are competing priorities, such as addressing potential legal challenges and a growing number of clean fuel and infrastructure applicants, and limited resources.

Staff performs a rigorous review of the available literature and lifecycle analysis, including U.S. EPA-approved fuel pathways, and leverages this information in developing carbon intensity scores for new fuel pathways, including new temporary fuel pathways when appropriate. Staff will continue to leverage the available literature to streamline the calculators to the extent possible such that they can be exportable to other jurisdictions and programs. Staff will continue to identify and implement opportunities to improve and streamline the application review process, including opportunities to alleviate staff demands by relying more on third-party verifiers. But the LCFS regulation appropriately specifies that the CARB Executive Officer (supported by assigned staff with delegated authority) is ultimately responsible for approving pathway applications.

JJ. Life Cycle Analysis

JJ-1 Multiple Comments: Comprehensive LCA for forest and agriculture biomass/residues

Comment: We urge CARB to urgently provide comprehensive guidance on biogenic carbon accounting for all biomass feedstocks within the LCFS program. Ideally, this guidance should:

Establish categories of biomass: By establishing clear categories for biomass types, considering

- factors such as their origin, properties, and potential uses, CARB can streamline the process of biogenic accounting. For instance, forestry residues and agricultural wastes represent major biomass categories that can be further refined based on geographical sources and potential alternative fates. Categories of biomass should include thinnings and slash, wildfire risk removal material, agricultural residues, urban wood waste, and purpose grown biomass.
- Align with established federal policies: Harmonizing with existing biogenic carbon accounting frameworks under programs like the RFS, where GREET serves as the accepted modeling tool and biogenic carbon is treated as carbon neutral, would streamline processes and promote clarity for developers.
- Acknowledge wildfire abatement contributions: Recognize the unique context of forestry materials sourced for wildfire abatement. Thinning and utilizing these materials can significantly reduce uncontrolled wildfire emissions, leading to orders of magnitude greater CO2 savings compared to the biogenic carbon sequestered in the feedstock itself due to the avoidance of collateral damage from catastrophic wildfires. A nuanced approach that factors in this mitigation potential is crucial.
- Offer flexible and practical pathways: Allow for flexibility for accommodate diverse feedstock types and projects. (45d-333.9).

Agency Response: No change was made in response to this comment. CARB staff is keeping abreast of the evolving science on the biogenic CO2 accounting applicable to various biomass types. Staff will consider the latest science when reviewing submissions of any fuel pathway applications using forest biomass, and also when considering any potential future updates to the regulation.

Comment: One suggestion, based on feedback from OPR's regional pilots, is to develop further guidance about how to more comprehensively evaluate the full emissions profile (e.g., emissions benefits from avoided pile burning, decay, etc.) for fuels created using biomass waste feedstocks, particularly forest and agricultural residues. It is currently unclear what an acceptable lifecycle assessment looks like for biomass waste-to-fuels pathways under the Low Carbon Fuel Standard. (45d-286.1)

Comment: Develop a near-term solution for biogenic carbon that enables future development by treating biomass from forest residues, crop residues, forest slash, and thinnings using the GREET modeling carbon-neutral framework.

Create a Tier 1 calculator framework for the conversion of biomass to synthetic fuels, ethanol, hydrogen, and CNG. (15d1-195.1)

Comment: Provide an initial 10-year implementation period based on carbon-neutral biomass. (15d1-195.3)

Comment: Organize annual woody biomass to energy/LCFS workshop to enhance understanding of biogenic carbon neutrality issues that builds upon the California 2024 biomass utilization workshop.

Participate in an interagency working group to develop a Tier 1 LCFS pathway for woody biomass to fuels and power.

Establish a working group of experts to investigate the biogenic treatment of forest material. (15d1-195.4)

Agency Response: No change was made in response to these comments. Development of specific guidance on lifecycle assessments for forestry and agriculture feedstocks is outside of the scope of this rulemaking. Stakeholders may perform a comprehensive life cycle analysis of fuels produced from agriculture and forestry biomass feedstocks and submit a report to CARB for consideration as part of the Tier 2 fuel pathway application process. As is the usual practice, staff will meet with all stakeholders and consider any information provided, and may propose future amendments to the program through the public rulemaking process, if needed.

Comment: We advocate for the inclusion of biomass as a process fuel within the LCFS program, recognizing its potential to contribute to GHG emission reductions and energy diversification (45d-333.8)

Agency Response: No change was made in response to this comment. Except for the exceptions listed in the Proposed Amendments, the LCFS program does not prohibit the use of biomass as process energy in alternative fuel production for the purposes of

generating credits provided that applicable documentation, sustainability and verification requirements are met.

Comment: We also urge CARB to consider carefully how to account for the lifecycle emissions involved in a pivot-rather than an expansion-of biofuels toward the aviation sector. As light and medium/heavy duty road transportation electrify, the 2022 Scoping Plan envisions a 94% reduction in demand for ethanol in California's transportation sector by 2045—an absolute decline of 1.6 billion gallons per year of biofuel. This presents a key opportunity to expand SAF production; at the national level, the 17B of ethanol currently blended into gasoline each year could become 10 billion gallons per year of SAF—more than triple the amount envisioned in the 2022 Scoping plan and the SAF Grand Challenge-with no net new ethanol demand. The emissions factors for land use change (LUC) under the LCFS are based largely on a shock in emissions from the initial land conversion, annualized over a project horizon of 30 years. However, if there is no net new ethanol demand, there can be no new land use change. As long as ethanol production does not substantially increase, LanzaJet recommends CARB maintain consistency with the assumptions that underlie the current LUC carbon intensity values by phasing out LUC emissions once emissions are amortized over the full 30-year project horizon land use change emissions have been fully accounted for. With nearly half of that amortization period over and the current rulemaking extending to 2045, LanzaJet believes it would be appropriate for CARB to include provisions for phasing out ILUC emissions in 2040, 30 years after the 2010 rulemaking, particularly for feedstocks like ethanol where significant demand destruction is forecasted and the "demand shock" rationale for ILUC cannot be reasonably maintained (45d-333.8)

Agency Response: No change was made in response to this comment. Because we are still more than a decade away from passing the 30-year milestone identified by the commenter, it would be premature to include a phase out of LUC emissions for ethanol at this time.

Comment: We are asking the Board to direct staff to investigate how the agriculture sector can be optimized to produce low-carbon biofuels to meet the state's SAF goal. Specifically, we are requesting the Board to prioritize policy discussions and the associated technical analysis related to low-carbon feedstocks for the production of SAF. This technical analysis should include a thorough lifecycle analysis to determine the extent to which supplies of sustainable biofuels produced from various feedstocks can be expanded while not converting additional land to agricultural uses. This technical analysis should be informed by the other primary LCA methodologies including Argonne GREET. To ensure the timely analysis of this information, we request that the Board direct staff to report back to the Board by the end of 2025 on the results of lifecycle analysis and progress toward developing policies to encourage the production of SAF. (15d1-109.3)

Agency Response: No change to the Proposed Amendments was made in response to this comment because the request is beyond the scope of the current rulemaking. Stakeholders may perform comprehensive analysis on LCA of low-CI feedstock and land use change, and submit a report to CARB for consideration as part of a fuel pathway application.

Comment: §95488.8 (i)(1)(B)(3) - Proposed amendments seek to ensure claimed GHG benefits satisfy tests of additionality by specifying that environmental attributes or certificates credited or used for compliance under any programs other than the RFS or the cap and trade program would be ineligible. As discussed in the section Reevaluating Previous Assumptions Around Additionality, above, existing approaches to additionality determination may deserve reconsideration, including the explicit eligibility of environmental instruments credited under the RFS and cap and trade programs, effectively exempting them from the requirements specified in this provision. As technologies, markets, and consumer behavior evolve, GHG assessment methodologies may need to evolve as well, particularly as it pertains to subjective determinations like system boundary establishment, counterfactual specification, and additionality determination. A comprehensive review of additionality in LCA contexts, including their use to inform policy, would help determine whether changes to this or other LCFS provisions is appropriate (45d-391.51).

Agency Response: No change was made in response to this comment. See CEQA RTC Master Response 5 (Life-Cycle Emissions Modeling).

JJ-2 Multiple Comments: LCA considerations

Comment: Moving forward, it is important that CARB advance an LCFS that:

• Focuses on vehicles and fuels used; (BH-031.2)

Comment:

 Centers on their well-to-wheel emissions, providing a level playing field for all. (BH-031.3)

Agency Response: No change was made or necessary in response to this comment. The LCFS does focus on transportation fuel used in California, assessing life cycle (well-to-wheel) greenhouse gas (GHG) emissions based on fuels reported used in various applications as specified in the regulations.

Comment: The California Air Resources Board's approach to renewable diesel biofuels, particularly those made from virgin food oils, is fundamentally flawed. CARB's carbon neutrality claim for tailpipe CO2 emissions arbitrarily eliminates three-quarters of the full lifecycle emissions of these biofuels from regulatory consideration. This profound greenhouse gas accounting ledger exclusion, for the renewable diesel tailpipe CO2 emissions exemption allowance, artificially lowers its regulatable GHG footprint, while masking its true environmental impact. (15d1-239.10)

Comment: If CARB established a new biofuel policy that eliminated renewable diesel's tailpipe CO2 emissions exemption allowance and also accurately accounted for refinery-level per barrel CO2 GHG emissions, the refineries would lose LCFS accreditation for making virgin food oil sourced renewable diesel. (15d1-239.13)

Comment: CARB's Stance on Carbon Neutrality: CARB asserts that "the tailpipe CO2 emitted from vehicles during biofuel combustion is considered carbon neutral, in accordance with IPCC and U.S. EPA GHG inventory guidelines, as the carbon released was uptaken from the atmosphere within a short timeframe by the plant that produced the oil".

In this case, CARB's cyclic net zero policy overlooks the significant carbon sequestration potential of natural landscapes while hiding the true environmental impact of virgin food-based renewable diesel (when production is expanded globally to merely serve the California fuels market). While petroleum extraction has huge problems of high-GHG flaring events and unregulated methane leakage, in addition to abandoned wells, taking farmland out of food production or removing a forest that had been a carbon sink is not a cost-effective or efficient method to reduce transportation CO2 GHGs. According to Statas Advisors in 2022, the amount of CARB LCFS credits combined with Federal credits is \$3.32 per gallon subsidization. (15d1-239.14)

Comment: CARB's current policy, based on 1995 IPCC guidelines, posits that "CO2 emissions from biofuel combustion should not be counted in the transportation sector's greenhouse gas inventory to avoid "double counting" since it is already accounted for in the Agriculture, Forestry, and Other Land Use (AFOLU) sector".

CARB's approach to avoiding "double counting" leads to conflicting accounting methods under its current policy. This pertains to CARB's certifying virgin food oil -based renewable diesel as "carbon neutral", via the tailpipe CO2 emissions exclusion allowance (from vehicular combustion) and providing it with LCFS low-carbon subsidies. (15d1-239.19)

Comment: Arbitrary Tailpipe CO2 Emissions Discount: Given that tailpipe CO2 emissions account for 70-80% of the total lifecycle greenhouse gases content for both petroleum and renewable diesel, one might wonder:

How does the California Air Resources Board (CARB) justify the Low Carbon Fuel Standard's tailpipe CO2 greenhouse gas exemption allowance for renewable diesel produced from virgin food oils, which ideally should be reserved for waste based feedstocks that would otherwise generate high-GHG methane in landfills. (15d1-239.21)

Comment: 3. Inaccurate Carbon Sequestration Claims: Consider that a mature forest can accumulate several hundred tons of carbon per acre over a century, compared to the mere yield of only 57 gallons of soybean oil per acre used for biofuel feedstock and combusted annually, but never sequestered. (5)

4. Given this (and without needing to consider the industrial-scale application of fertilizers and petrochemical herbicides needed for growing genetically-modified refinery soybean oil feedstock) one must question:

How does the California Air Resources Board (CARB) justify the "75%" carte blanche tailpipe CO2 emissions exemption allowance for renewable diesel, in light of the fact that while there is marginal carbon sequestration on an annual basis, over an entire century, soybean cultivation for biofuels results in absolutely no carbon sequestration (as forested lands)? (15d1-239.22)

Agency Response: No change was made in response to these comments. Many of these comments are focused on the accounting of biofuels in CARB's AB 32 GHG Emissions Inventory, which is outside the scope of this rulemaking. The treatment of tailpipe CO2 emissions of biofuels including renewable diesel as carbon neutral in CI calculations using the CA-GREET model is consistent with the life cycle analysis (LCA) convention. This principle is widely adopted by LCA practitioners, development of

greenhouse gas inventories, and policy makers. For example, the California Greenhouse Gas Emission Inventory and the EPA Inventory of Greenhouse Gas Emissions and Sinks treat biogenic CO2 as carbon neutral. Please see also CEQA RTC Master Response 5 (Life-Cycle Emissions Modeling).

JJ-3 Multiple Comments: Implement rigorous GHG accounting

Comment: It's imperative to introduce stringent, project specific GHG accounting, hydrogen accounting and auditing measures to ensure the veracity of claimed environmental benefits and prevent greenwashing. (45d-166.2)

Comment: Virgin food oil supply is becoming increasingly limited for various geopolitical, climate change, market structure and other reasons. The first step towards limiting the misuse of valuable virgin food resources is limiting their being misused for LCFS accreditation and government subsidies. The method to achieve LCFS truthfulness would be a loophole-free auditing of lifecycle CO2 GHGs for renewable diesel, on a per barrel basis with the full accounting of hydrogen production metrics and tailpipe emissions. (45d-166.3)

Agency Response: No change was made or necessary in response to these comments. The Proposed Amendments use the CA-GREET4.0 model and associated Tier 1 calculators, which provide robust life cycle GHG accounting, including indirect emissions, within the appropriate system boundary of a fuel pathway. As suggested by the commenter, the life cycle emissions of a renewable diesel pathway include all applicable GHG emission sources in the production, transport and use of renewable diesel including hydrogen use and tailpipe emissions. Please see also CEQA RTC Master Response 5 (Life-Cycle Emissions Modeling).

Comment: LCAs should be based on a counterfactual scenario that reflects the most climate beneficial outcome. At minimum, any methane that can be captured should be assigned a baseline counterfactual of capture and flare, which acknowledges the cost of methane pollution, the urgent need for controls, and the other economic and regulatory factors already driving abatement. In most scenarios, a more appropriate counterfactual would be diversion from productive use (e.g., another biogas/biomethane energy project) or the complete avoidance of methane creation via alternative management practices (e.g., waste prevention, composting, or alternative management).

Additionally, there should be feedstock eligibility requirements in place to ensure this program doesn't perversely lead to additional waste/methane generation by expanding operations. Qualifying sites should be required to monitor for fugitive emissions and demonstrate they are collecting methane and co-pollutants at the source to the maximum extent possible. (15d1-192.5)

Agency Response: No change was made in response to this comment. The Tier 1 calculators for biomethane capture appropriately modeled baselines (counterfactual scenarios) which are supported by science, established LCA methods, and applicable regulations. Applicants are required to follow the same principle in calculating CI scores for biomethane pathways under a Tier 2 classification. The proposed LCFS regulation includes specific traceability and other requirements for specified source feedstocks

including biomethane supplied using book-and-claim accounting. See also CEQA RTC Master Responses 1 and 5.

JJ-4 Multiple Comments: Harmonize LCA methodology and synchronize efforts with other agencies

Comment: In this LCFS rulemaking, CARB can and should harmonize the life cycle analysis ("LCA") methodology that underlies LCFS crediting for SAF with the federal LCA methodology for SAF.

By establishing an LCA methodology within the LCFS regulation for SAF that is consistent the 40B LCA methodology, CARB will facilitate greater development of this vitally important fuel source for the hard to abate aviation sector. Through this regulatory strategy, CARB will also achieve upstream emission reductions and stimulate expansion of Low-CI power generation capacity, storage and transmission during the peak spending period of IRA and Infrastructure Investment and Jobs Act ("IIJA").

As demonstrated in the prior analysis, the LCFS regulatory structure pertaining to Low-CI power sourcing has a material impact on the financial performance of a Fulcrum facility by altering the revenue stream that the LCFS programs provides to low carbon fuel production facilities that supply qualifying transportation fuels to California including SAF.

However, once the capital expenditure for the facility is recovered, the opportunity to make fuel from garbage is a highly attractive one. Over that 15-year period, the ability of a Fulcrum plant to source zero-CI power will deliver \$315 million in additional revenue in a medium LCFS market, over \$100 million in a low LCFS market, and over half a billion dollars in a high LCFS market. It is for this reason that low carbon fuel producers like Fulcrum are keen to access the Low-CI power market." (Apr-173.3)

Comment: Since the filing of our prior comment, new federal policy regarding Low-CI Power has changed the policy landscape favorably for eFuels. We are therefore updating our comments regarding the optimal LCFS regulatory structure to complement this federal policy. This comment highlights the benefits of aligning the LCFS with section 40B of the Inflation Act ("IRA") to standardize Low-CI Power sourcing rules, improve economics for eFuels and enable full commercialization of this vital fuel technology. (Apr-175.1)

Comment: In this LCFS rulemaking, CARB can and should harmonize the life cycle analysis ("LCA") methodology that underlies LCFS crediting for ethanol with the federal LCA methodology for SAF. By establishing an LCA methodology within the LCFS regulation for ethanol that is consistent the 40B LCA methodology, CARB will facilitate greater development of this vitally important fuel source for the gasoline sector that will ultimately serve as a feedstock for alcohol to jet that will supply the hard to abate aviation sector. Through this regulatory strategy, CARB will also achieve upstream emission reductions and stimulate expansion of Low-CI power generation capacity, storage and transmission during the peak spending period of IRA and Infrastructure Investment and Jobs Act ("IIJA"). (Apr-177.2)

Comment: Finally, we believe that CARB should synchronize efforts with other agencies to utilize data and precedents to streamline processes. Doing so would be of significant value, both to increase access to new pathways/new producers and reduce burdens on CARB's

resources and staff. For example, the EPA has a number of approved pathways based on GREET modeling for national and global feedstocks. CARB should explore whether these pathways could be leveraged to establish a wider range of temporary pathways that could be used until facility-specific pathways (based on operational data) are fully available." (Apr-079.22)

Agency Response: No change was made in response to these comments. Staff developed Tier 1 calculators with the intention of making these calculators and underlying input standardized and simple so that these calculators are easy to use and can be exportable to other jurisdiction and programs. However, staff did not propose to harmonize the low-CI electricity sourcing eligibility with the 40B LCA methodology for sustainable aviation fuel, which allows book and claim of low-CI electricity (RECs purchase) used in fuel production as process energy. See response L-14.

With regard to the comment on leveraging already approved pathways by other government agencies such as U.S. EPA to develop a wide range of temporary pathways, see response II-1.

JJ-5 Multiple Comments: Conduct lifecycle analysis of air pollution of fuel pathways and its implications for environmental justice in LCA

Comment Summary: The commenters recommend CARB conduct a full life cycle analysis of fuel pathways including non-GHG emissions and their impact (45d-134.1,45d-272.3, 45d-137.4, 45d-163.3).

Comment: Furthermore, Bloom Energy encourages CARB to allow LCFS to value environmental results beyond carbon reductions. Environmental benefits such as reduced criteria air pollutant emissions in particular warrant consideration as part of the calculation methodology. An increasing body of research has found the economic and health benefits associated with reducing NOx and PM emissions often exceed the economic and health benefits of reducing GHG emissions on a per ton basis. Currently, while biogas combustion narrowly serves LCFS program objectives, the associated air pollution runs counter to CARB's broader new and long-standing air quality goals. Alternatively, non-combustion biogas-to-electricity projects meet LCFS objectives while also reducing local air pollution and furthering air quality objectives. (15d1-062.4)

Agency Response: No change was made in response to this comment, as crediting of non-GHG pollutants is beyond the scope of the regulation. See CEQA RTC Master Responses 4 and 5.

JJ-6 Multiple Comments: Consider energy environmental efficiency (land use efficiency) and battery production in life cycle analysis

Comment: I'd like to introduce a new term/ measure when considering energy "Environmental Efficiency". For example, the average, grid-scale solar/ storage operation has an Environmental Efficiency of 1.1 MWh / acre. A large nuclear plant, with a large "safety barrier"; has an Environmental Efficiency of ~40 MWh / acre. And a next-ger natural gas fired generating station has an Environmental Efficiency of ~80 MWh / acre.

In other words, while a 24,000 MWh / day natural gas generating station might sit on a half-square mile of land, a similar solar, storage operation would require ~40 square miles of land; obscene: abusive and low Environmental Efficiency.

And that does not include any of the raw materiel/ rare earths mining, production in highly polluting countries such as China, the poor performance and accelerated life-time performance degradation. (45d.136.1)

Comment Summary: Valero urges CARB to consider indirect emissions associated with BEV technologies including battery production and raw material mining to make the treatment for electricity pathways consistent with biofuel pathways with indirect land use change. (15d1-087.5)

Agency Response: No change was made in response to these comments. The land use efficiency is already captured in the land use change analysis of fuel pathways, in particular for crop-based fuels. The land use change impact of fuel pathways such as solar/wind power projects is generally negligible. The GHG emissions from raw material extraction and battery production are not included in the LCA system boundary because construction material/equipment have been consistently excluded from the system boundary of all fuel pathways.

KK. CA-GREET4.0

KK-1 Fixing Errors

KK-1.1 Multiple Comments: *Fix index error*

Comments: In review of the default electricity emission factors in the CA-GREET model, an issue was identified in the regional refactoring by CARB staff that may need attention. U.S. Venture was evaluating the various calculation approaches utilized across the different methodologies (CA-GREET, National GREET, GHGenius, OpenLCA, etc.), when we ran into an issue which we could not reconcile. We found that the default electricity emission factors within CARB's Tier 1 calculators, which are derived from the CA-GREET model, (relative to the EPA eGRID 2021 numbers used in GREET) may be off by a significant amount.

CARB provided document "Appendix B: CA-GREET 4.0 Supplemental Document", which explains how they recalculated the electricity emission factors using the fuel mix from eGRID 2021. Unfortunately, as we reviewed the draft CA-GREET calculator to figure out how these fuel mix factors were utilized, we identified an issue. CARB adjusts the National GREET calculator, which uses an NERC region map (11 regions) to determine electricity emission profiles, to one that uses the eGRID subregions (27 regions). This appears to be okay on the surface, but there is a core INDEX formula inaccuracy in the CA-GREET calculator which is being caused by the adjustment of 11 regions to 27, and can't be fixed with the data which is available in the calculator. The formula inaccuracy is not easily noticeable, because there is an IFERROR correction in the formula which defaults ("value in error") to an incorrect conclusion, so the formula doesn't simply fail with reference errors. If this INDEX function was corrected, the default electricity emission factors could change significantly. (45d-034.1, 45d-240.11)

Agency Response: Changes were made to fix the index formula error in CA-GREET4.0 in response to the comment. The NERC region (11 regions) is now correctly mapped to the eGRID subregions (27 regions).

KK-1.2 Multiple Comments: *Fixing error in tailpipe emissions*

Comment: Per ICF's analysis, the Proposed Rule's decision to increase the CI of Ultra Low Sulfur Diesel from 100.45 g CO2e/MJ to 105.76 g CO2e/MJ has major unarticulated consequences. This change—especially without at least some analogous change for the N2O performance of Renewable Diesel pathways—has a material impact on the program's ambition, when expressed as a percentage of that baseline.

ICF analysis suggests that this will yield substantially more credit generation than previously forecast. CARB should better justify this change in diesel fuel baseline—with respect to alignment between tailpipe emissions performance of vehicles using both conventional and renewable diesel—or be sure to correct for this factor more transparently during final target setting. (45d-240.4)

Comment: WSPA requests that CARB justify why the USLD baseline values increase by more than 5 gCO2e/MJ starting in year 2025 at 105.76 gCO2e/MJ from 100.45 gCO2e/MJ in the current regulation. (45d-066.)

Comment: CA-GREET 4.0 Correction. The tailpipe emission factors for NOx and CH4 in CA-GREET 4.0 attributed to renewable diesel contain material inaccuracies. Although staff acknowledged the problem during the workshop, the subsequent correction was also inaccurate. The original error should be adjusted by 2.74 gCO2e/MJ rather than 4.78 gCO2e/MJ. This inaccuracy artificially increases the carbon intensity of renewable diesel and warrants immediate corrective action. (Apr-131.1)

Comment: We support the comments of the Clean Fuels Alliance America (CFAA) where CFAA highlights the error in the prior model correction. Specifically, the CA-GREET 4.0 tailpipe emission factors for NOx and CH4 for biodiesel and renewable diesel. In the prior correction staff, instead of adjusting emissions by 2.74 gCO2e/MJ, adjusted it by 4.78 gCO2e/MJ. This incorrectly lowers the emissions reductions from biodiesel and renewable diesel. (Apr-065.3)

Comment: We encourage CARB to fix an error in the proposed CA-GREET 4.0 to the tailpipe emission factors for NOx and CH4 for biodiesel and renewable diesel. This error is a result of increasing emissions from fossil diesel and should carry over to BMBD as well. At the April 10th workshop, staff acknowledged the mistake and said that the error had been corrected but the correction is also inaccurate; instead of adjusting emissions by 2.74 gCO2e/MJ, they adjusted it by 4.78 gCO2e/MJ. This overcorrection results in fewer GHG reductions occurring from the use of biodiesel and renewable diesel. (Apr-124.3)

Comment: DGD is concerned that CARB's proposal to increase tailpipe emission factors for renewable diesel in order to avoid additional crediting for diesel replacements could have unintended consequences for alternative jet fuel and renewable naphtha. The proposed HEFA Tier 1 Calculator applies the renewable diesel tailpipe emission factor to all HEFA fuels, including alternative jet fuel and renewable naphtha. However, the fossil jet fuel and gasoline baselines have not been increased by the same magnitude as the diesel baseline. Incorrectly

applying an increased tailpipe emission factor that is based on an updated ULSD baseline to alternative jet fuel and renewable naphtha would unfairly reduce the credit generation potential of these fuels when compared to their respective benchmarks.

DGD recommends that CARB does not apply an increased tailpipe emission factor to alternative jet fuel and renewable naphtha. DGD also encourages CARB to ensure that all revisions to carbon intensity data, including tailpipe emissions, are based on sound and documented technical justification. If CARB intends to increase the tailpipe emission factor for renewable diesel and biodiesel to reflect the increase to ULSD, it should provide justification that the increased emissions are similarly applicable to the combustion of renewable diesel and biodiesel. It is not a sufficient technical justification that staff is merely attempting to hold constant the carbon intensity delta between diesel replacements and ULSD. To this end, DGD looks forward to reviewing the updated lifecycle models and supporting documentation that reflect CARB's latest proposal, and defers further comments on updated tailpipe emission factors until it has a chance to review these documents. (Apr-139.4)

Comment: ICF found that CARB did not correctly calculate the fossil diesel baseline as part of the 45-day package. ICF determined that CARB should only add CH4 and N2O tailpipe emissions and not CO2 because they are biogenic. The diesel baseline should therefore be 103.19 g/MJ and not 105.76g/MJ. These further changes the CATS modeling results because the diesel baselines shift credit/deficit generation for diesel. (Apr-066.4, 15d1-228.26a)

Agency Response: The tailpipe emissions factor for biodiesel and renewable diesel was updated in the respective Tier 1 calculators. The tailpipe emissions include N₂O and methane emissions for biodiesel and renewable diesel. These revised emissions are based on the emissions of ultra-low sulfur diesel (ULSD) in the EMFAC2021 (v1.0.2) model. The USLD tailpipe emissions represent in-use emissions from heavy duty vehicles (old and new) operating in California in 2021, and updates to EMFAC resulted in increased emissions for ULSD. Staff proposed to revise the nitrous oxide (N2O) and methane (CH4) tailpipe emissions of renewable diesel and biodiesel to be consistent with the ULSD emission factor because N2O and methane emissions from renewable diesel use are similar to those from ultra-low sulfur diesel (ULSD) used in on-road heavy-duty engines.¹

Comment: The GREET 4.0 model Biodiesel Simplified Calculator includes an updated Tailpipe Emissions value in the Pathway Summary sheet cell F33 (linked to CA-GREET 4.0 cell E28. In GREET 3.0 this value was 0.76. CARB's CA-GREET4.0 Supplemental Document states, "The tailpipe emission factors for biodiesel, renewable diesel, and alternative jet fuel are derived from CA-GREET3.0." If that is the case, the GREET 4.0 model should use the 0.76 value. (15d2-274.12)

¹ Durbin et al, 2023. In-Use Emissions Testing and Fuel Usage Profile of On-Road Heavy-Duty Engines. Final Report. <u>https://www.energy.ca.gov/publications/2023/use-emissions-testing-and-activity-profiles-road-heavy-duty-vehicles-summary-200 (accessed October 9, 2024).</u>

Agency Response: Changes were made in response to this comment. Staff proposed to update the tailpipe emission factor for renewable diesel and biodiesel based on the EMFAC2021 (v1.0.2) model data in the first 15-day changes to the regulation order (see the Agency Response immediately above). However, staff inadvertently did not update the same information in the CA-GREET4.0 model documentation. Staff has corrected the text in the model documentation to reflect the change in emission factor from 0.76 g CO2e/MJ to 3.50g CO2e/MJ that staff had already made in the Tier 1 calculators in the rulemaking proposal.

KK-2 Independent replication of emission factors

Comment: Ability to independently replicate computation of the Carbon Intensity (CI) values using the CA-GREET models relative to published Low Carbon Fuel Standard Annual Updates to Lookup Table Pathways. After a concerted effort to use either the CA-GREET3.0 or CA-GREET4.0 models downloaded from the CARB's LCFS website, I was unable to replicate the computation of the CI's presented in the "Low Carbon Fuel Standard Annual Updates to Lookup Table Pathways" document posted on January 23, 2024. I believe there are several reasons for this:

a. Both the CA-GREET3.0 and CA-GREET 4.0 models have an incomplete and inconsistent indexing process to map various regions with their respective technology and emission factors. The original GREET model used the 10-region North American Electric Reliability Corporation ("NERC") breakdown to define regional characteristics regarding electric system technology configurations and operations. The GREET models later adopted the finer-grained USEPA, eGRID region map that contains 26 subregions. In neither the 3.0 nor 4.0 models are data mapped correctly. There appears to be no eGRID specific data in either version, but the model reverts to a table containing only the 10 NERC region data. In addition, when specifying "User Defined" data elements, the indexing mechanism selects NERC Region 2 data, which reflect data for NERC Region ASCC, the Alaska Systems Coordinating Council. This error is significant as it is not clear to the user that User Defined data are being used in the computations.

b. On a related matter, the GREET4.0 model contains a table of factors on a state basis, but there is no means to access that table directly. It appears that a user would have to cut and paste the state-specific data into the NERC ASCC column of Alaska factors and relabel in order to use that data. The same applies to entering California specific data as provided in the Annual Update document.

c. With respect to the Lookup Table Pathways document, the text states that "Feedstock Production" is computed from the "U.S Average Mix" (page 4). However, in the various computations of feedstock production Cls in the document (p9, pl0, pll, p12, and p13), it appears that California rather than US average fuel mixes are used.

d. In the CA-GREET4.0 model, the separate pulldown menus for "Feedstock" and "Fuel" to calculate respective emissions from two regions has either been dropped or otherwise obscured. This is an important distinction as Feedstock emissions are computed on an U.S. Average basis and Fuel emissions from use are computed on a localized basis, e.g., California state. Without a clear distinction and labeling, a user of CA-GREET4.0 would otherwise have

to compute results in two separate computation sets and independently add the results to compute the total. As a consequence of the above errors and discrepancies, proper computation of CIs would require substantial independent analysis and validation. It is essential that these errors be corrected. In addition, future releases of the Annual Updates to Lookup Table Pathways should be accompanied with a populated data set of the proposed changes in the CA-GREET model so users can follow how the CIs are computed in the model.

As a consequence of the above errors and discrepancies, proper computation of Cls would require substantial independent analysis and validation. It is essential that these errors be corrected. In addition, future releases of the Annual Updates to Lookup Table Pathways should be accompanied with a populated data set of the proposed changes in the CA-GREET model so users can follow how the Cls are computed in the model. (45d-394.1)

Agency Response: Please refer to the Response JJ-1.1 (Fix index error) above on correcting the index error. Staff addressed the data entry comment (subsection b of comment 45d-394.1) by fixing the index error.

In response to the rest of the comments, no changes were made. There is no mention of "Feedstock Production" being computed from the "US Average Mix" and therefore no action is required.

The commenter observation in subsection d of comment 45d-394.1 is correct. Users would need to record emission factors (EFs) for the feedstock and fuel production and sum them to generate total EFs.

KK-3 Inconsistencies in statistical methods used to compute CI values

Comment: While there may be documentation that describes various motivations for using certain statistical and technical conventions within the CA-GREET model and its GREET model predecessor, I was unable to determine reasoning for a few items that may have modest or significant impact on the computation of Cls.

With respect to statistical computations, two different methods are used to compute averages. In the Electric sheet for Power Plant Conversion Efficiencies for each technology within a fuel type, the average for the fuel type is calculated using a weighted harmonic mean. This appears to be consistent with good statistical practice that weighted harmonic mean determinations are appropriate when applied to rates as is the case with computations for Power Plant Energy Conversion Efficiency (e.g., Cells H60, H64, H69, and H72 on the Electric Sheet).

However, when computing the average emission factors for each fuel based on the same relative proportion of technology types for the fuel, arithmetic weighted averages are used (e.g., Cell B107 on the Electric sheet and Cell B579).

As both sets of computations deal with rates, it would be helpful to know if these disparate methods are intentional or an artifact of model construction. If an artifact, then appropriate reformulation of the calculations should be undertaken to maintain computational integrity. All mean calculations throughout the model should be examined and reformulated as required. (45d-394.3)

Agency Response: No change was made in response to this comment. The two types of rates are calculated differently because they are different in their physical meaning. Cells H60, H64, H69, and H72 on the Electric Sheet are the power generation efficiencies of different fuels. Therefore, they are dimensionless quantities with a possible range between 0% and 100%. On the other hand, Cell B107 represents the VOC emission factor from oil-fired power plants. The dimension of this quantity is [mass]/[energy]. Its value is dependent on the unit used and is not restricted to 0 to 1(g/kWh, g/mmBtu, etc.). The formulas used to calculate these quantities are determined by physical meaning and not due to considerations of statistical computations.

KK-4 Inconsistent use of emission factors

Comment: Comparable use of emission factors. The CA-GREET model provides several different sources to compute emission factors. Among these are computations from emission testing/monitoring of in-use combustion processes (e.g., oil-fired boilers, natural gas-fired combustion turbines, and IC engines) and theoretical computations based on the stoichiometric carbon content of the fuel of interest coupled with an estimate of the conversion efficiency of the corresponding technology. For example, it appears that US EPA's eGRID database uses emission factors based on actual prime mover performance whereas the CA-GREET model computes stochiometric based emission factors (see CO2 Emission Factor in Cell B16 on EF Sheet).

While it may be appropriate to use both emission factor methods to determine aggregate CO2e emission estimates for a particular fuel, there should be some discussion to maintain an "apples to apples" basis.

Specifically, the operation of any fuel combustion prime mover whether steam-fired boiler, combustion turbine, or IC engine, requires excess air to reduce NOx formation and optimization of efficiency.

For a gas-fired steam boiler, optimal excess air is approximately 10 percent, for a natural gas Fired combustion turbine, the optimal excess air percentage is 10 percent to 15 percent, and for an IC engine driven genset, the excess air optimal range is approximately 10 percent to 30 percent.

As the CO2 in atmospheric air is non-reactive in the combustion process but just passes through as part of the excess air mix, its presence in boiler, turbine, or engine exhaust is not derived from the carbon within the fuel.

Consequently, emission factors derived from exhaust measurements of combustion processes should be corrected to account for the portion of the non-reactive CO2 component of excess air in the CI computation. (45d-394.4)

Agency Response: No change was made in response to the comment. There is no inconsistency in electricity emission factors used in the CA-GREET4.0 model. The CO2 emissions are estimated based on the carbon content of fuel and the U.S. EPA eGRID emissions are not used. The U.S. EPA eGRID data base is used only for deriving electricity resource mixes in various eGrid regions.

KK-5 Transparency of posted application documents

Comment: Suggestions to aid fuel users make informed decisions regarding fuel supplier selections. At the end of the day, it would be desirable for California fuel users to access the posted Current Pathways database so they can make an informed decision regarding the Cls of available fuels to help them make an informed economic decision for the alternative fuel and technology that best meets their needs. That is not possible at the moment since fundamental fuel characteristics such as heat content and fuel density are not displayed in the Current Pathways database. Furthermore, it appears that fuel providers consider such information proprietary and redacted from most Application Packages. Consequently, rather than be able to conduct their own investigation of available fuel alternatives, fuel users need to rely on third party providers or direct contact with the producer to determine if a particular fuel will meet their needs.

It is unclear why such basic information is considered proprietary. Disclosure of such fundamental characteristics would facilitate more efficient market performance.

CARB should consider revising the current practice of withholding basic fuel specification as proprietary and encourage producers to post such information voluntarily. (45d-394.5)

Agency Response: No change was made in response to the comment. Basic fuel specifications such as energy density, carbon and sulfur content are available in Table 4 of the proposed regulation and Fuel-Specs tab of the CA-GREET4.0 model.

CARB is committed to ensuring transparency of application materials posted for public comments. Towards this goal, CARB had previously issued an LCFS guidance document (LCFS Guidance 20-05²) in 2020 that provides supplemental notification support for fuel pathways applicants regarding the information that is not appropriate to redact.

KK-6 Clarify assumptions and sources in CA-GREET4.0

Comment: WSPA requests that CARB provide data sources used to update electricity transmission and distribution losses in the model. (45d-241.67)

Agency Response: The electricity transmission and distribution losses in CA-GREET4.0 have remained unchanged at 6.5%. This value is adopted from the Argonne GREET1 2022 model.

KK-7 Technical workshop on CA-GREET4.0

Comment: We request that CARB present a technical workshop which goes over the key changes between CA-GREET3.0 and CA-GREET4.0. None of the workshops to date have discussed the model in detail, and we believe it is important for participants in the LCFS program to understand the changes and provide feedback on them. (Apr-034.7)

² CARB 2020. Low Carbon Fuel Standard (LCFS) Guidance 20-05: Redaction of Confidential Business Information under the Low Carbon Fuel Standard (LCFS). https://ww3.arb.ca.gov/fuels/lcfs/guidance/lcfsguidance_20-05_ADA.pdf (accessed November 30, 2024)

Agency Response: No change was made in response to the comment. CARB staff acknowledge that a technical workshop on the updates included in CA-GREET4.0 could have enhanced transparency and contributed to the better understanding of modifications incorporated in the CA-GREET4.0 model. But staff believe that CA-GREET4.0 model documentation and lookup table pathway documentation adequately explain the changes made in the CA-GREET4.0 model.

KK-8 Avoided N2O emissions from agriculture

Comment: The state can enable significant reductions in agricultural N2O emissions by accounting for avoided N2O emissions in LCFS pathways and taking additional steps to support markets for renewable fertilizers and organic agriculture.

There is already a precedent for considering N₂O emissions within LCFS pathways. CARB currently accounts for avoided N₂O emissions associated with composting food scraps in their Tier 1 Organic Waste (OW) calculator. Excluding similar considerations for agricultural feedstocks appears arbitrary, especially given the critical role N₂O emissions play in the agricultural sector. (45d-121.1)

Agency Response: No change was made in response to the comment. There is considerable uncertainty in measuring/estimating N2O emissions from the use of fertilizers including renewable/organic fertilizers and there is limited data and science to accurately calculate N2O reductions. Moreover, this proposal requires robust tracking and verification of individual cropping practices at the farm level which may pose implementation challenges to CARB and program participants. As the practice of alternative fertilizer use becomes widespread and robust N2O measurement/estimation and verification tools become available, CARB may consider such N2O reductions in a future rulemaking.

KK-9 Multiple Comments: Clarification on emission factors of tallow, UCO and natural gas

Comment: The emission factor for tallow rendering used in the draft HEFA Tier 1 calculator is almost 2.Sx the value in Argonne's GREET 2022 model (286 gCO2e/lb oil vs 119 gCO2e/lb oil). The draft HEFA Tier 1 calculator and CA-GREET 4.0 appear to use the same values for energy consumption in the tallow rendering process as CA-GREET 3.0, which was based on GREET 2016. Since the publication of GREET 2016, Argonne has updated their tallow rendering data and emission factors multiple times based on updated industry data. CARB should update the tallow rendering values in CA-GREET 4.0 to reflect the most current Argonne GREET 2022 model, to ensure consistency with the other feedstocks and processes that CARB has updated in CA-GREET 4.0. (45d-173.4)

Comment: Similarly, CA-GREET 4.0 uses a UCO rendering emission factor of 87 gCO2e/lb oil, compared to Argonne GREET 2022's UCO rendering emission factor of 81 gCO2e g/lb. CARB should update CA-GREET 4.0 consistently with GREET 2022 to reflect current industry practices for all feedstock and fuel production processes, regardless of technology. (45d-173.5)

Comment: It would be helpful to put together a document explaining the logic behind major changes in emissions factors such as the following:

- The emissions factor for UCO increased from 95 to 123 gCO2e/MJ.
- The natural gas emissions factor changed from 72,230 to 75,496 gCO2e/MMBTU. (45d-144.3)

Comment: The process energy natural gas emission factor for the Tier 1 Simplified Calculator Hydroprocessed Ester and Fatty Acid Fuels found in Tab "CA-GREET 4.0", cell E23 of 75,496 gCO2e/MMBtu NG, is greater than the same value calculated in CA-GREET 4.0. Summing the emissions found in CA-GREET 4.0, Tab "NG" for NG Extraction, NG Processing, NG Transport 680 miles pipeline, and the average of emissions for a Large Boiler and Small Boiler results in a NG emission factor of 74,788 gCO2e/MMBtu. MPC recommends CARB review the process energy natural gas emission factor value found in the Tier 1 Simplified Calculator to ensure it is correct, if the value is correct MPC requests CARB detail the method it used to derive the value as MPC cannot replicate it using CA GREET4.0. (45d-217.11)

Comment: The emission factor in CARB's proposed Tier 1 Simplified Calculator for Hydroprocessed Ester and Fatty Acid Fuels for Standard Value, US/Canadian Feedstocks, Animal Fat found on Tab "CA8. GREET 4.0" cell E14 of 286 gCO2e/lb includes a Residual Oil share of process fuels of 28.6. A 2022 publication in ACS identified that in the U.S., rendering facilities have "phased out residual oils and replaced them with natural gas" resulting in substantial emission reductions. MPC recommends CARB use this work and decrease the Standard Value for US/Canadian Feedstocks, Animal Fat to capture the transition of U.S. rendering facilities away from Residual Oil to natural gas. (45d-217.12)

Agency Response: No change was made in response to these comments. As stated in the CA-GREET4.0 documentation, UCO and Tallow rendering energy inputs from CA-GREET3.0 were retained in the CA-GREET4.0 model. Although the ACS study indicated that the surveyed US facilities phased out residual oil use in tallow rendering, staff believes the 3.0 rendering energy mix and amounts are still appropriate due to lack of comprehensive data outside of USA and Canada. It would provide a conservative rendering emission factors to accommodate non-US and non-Canadian tallow whose participation is growing in the LCFS program. An applicant may opt to use a user-defined tallow rendering emission factor in the Tier 1 calculator by providing site-specific rendering data for UCO and Tallow. The tallow rendering EF is the value obtained from cell BioOil!BX425 in the CA-GREET4.0 model. Whereas the EF for UCO rendering EF is the sum of the values in cells BioOil!EN425 and BioOil!EO425 in the CA-GREET4.0 model. The increase in the UCO EF is primarily due to increase in the UCO collection distance.

The increase in natural gas EF is due to the various updates in the Argonne GREET1 2022 model which are incorporated in the CA-GREET4.0 model. It is a combination of a natural gas feedstock emission factor and a utility industrial boiler in the CA-GREET4.0 model.

KK-10 Insufficient identification of source data

Comment: Insufficient identification of source data. The CA-GREET3.0 and CA-GREET4.0 models have no internal documentation other than a few generic cell comments about the sources of the various data sets used by the model. Without such documentation, it is impossible to determine the source data for emission factors, efficiencies, fuel characteristics, resource mixes, technology mixes, etc. The problem is compounded as the model draws upon U.S.EPA date from its eGrid model and AP-42 emissions data, U.S. Energy Information Administration for its State Energy Data System ("SEDS"), the California Energy Commission for California generation data by fuel and source, as well as CARB's own Emission Factor ("EMFAC") database, among other sources.

As most of the data sources are compiled on an ongoing basis, it is also important to know the year or vintage of each to make sure that computations can be constructed on a consistent basis as well as to facilitate data validation. Many of the data items in CA-GREET3.0 and CA-GREET4.0 appear to be cut and paste entries from other sources without appropriate attribution. While the Update document attempts to provide some source documentation, it is also incomplete. For example, in the current January 23, 2024 update, various references to Form EIA-923 data are made that state, "2022 Form EIA-2023 dataset for NG plants located in California [are being used whereas] in prior annual updates, the 2017 Form EIA-923 national dataset for NG plants was used." However, no such references are provided for data items used for oil, coal, or biomass. Were the oil, coal, and biomass data items similarly updated or are the 2017 data items still being used?

Another example of an inconsistent data item of substantial importance is the estimated electric system transmission and distribution losses. In the CA-GREET models, the loss factor is defined as 6.5 percent (Electric Sheet Cell D101). However, the US EPA eGRID 2022 database shows estimated average NERC WSCC Region (including California) and US wide T&D losses at 5.1 percent (eGRID2022,tab GGK22, Cells F7 and F8, respectively). There is no data source defined for the 6.5% loss factor. Should the loss factor be in error, the higher loss factor contributes to an across the board increase in Cls for all electric production.

In the interests of transparency and data integrity, all data items within the CA-GREET model should have a definitive source and vintage embedded within the model. A separate reference page with complete citations with a corresponding entry for each data table or data item (e.g., T&D losses) would be a substantial improvement. In addition, the annual updates should apply equal rigor to data sources. (45d-394.2)

Agency Response: No changes are made in response to this comment. The CA-GREET4.0 is a modified version of the Argonne GREET1 2002 model. The CA-GREET4.0 documentation lays out modifications made to Argonne GREET model in detail. The Argonne GREET model is a transparent, publicly available model with extensive documentation on primary and secondary data including methodologies used in obtaining secondary data. Thus, the current level of information and documentation is adequate to enable life cycle practitioners to find underlying data, references, and assumptions used in the CA-GREET4.0 model.

The electricity resources mix (natural gas, coal, biomass, etc.) for the purposes of calculating a California average grid emission factor when electricity is used directly in transportation (EV charging) is updated annually using process and data sources specified by subsections 95488.5(d) and (e), and the Technical Support Documentation for Lookup Table Pathways incorporated in subsection 95488.1(b) by reference. The electricity resources mix for other uses of electricity such as process energy in fuel production are updated in the CA-GREET model only at the time of a rulemaking update to the LCA models incorporated. A transmission and distribution loss factor of 6.5% used in CA-GREET4.0 comes from Argonne GREET1 2022 model.

KK-11 Agricultural Input and GHG emissions data for sorghum production

Comment Summary: National Sorghum Producers appreciates the continued update of the CA-GREET model and provides farming input and N2O emissions data collected from publicly available sources for CARB consideration. (45d-149.1)

Agency Response: Staff appreciates the support for CA-GREET updates. No change was made because the CA-GREET4.0 model already captures the updated US-wide farming data as reflected in the Argonne GREET1 2022 model.

KK-12 Multiple Comments: Support farm-specific GHG reductions

Comment Summary: Stakeholders have requested that CARB consider GHG reductions associated with climate-smart agricultural practices, such as soil carbon sequestration, precision farming, use of low-CI fertilizers, reduced/no till, cover crops, double cropping, and reduced fertilizer input and associated NOx emissions by allowing incorporation of site-specific agricultural inputs in carbon intensity (CI) calculations as part of fuel pathway applications. If sustainability certification is required, stakeholders argue that fuel producers should be able to adopt more tailored CI scores for LUC based on farming practices and local/regional production factors.

(45d-177.3, 45d-187.5, 45d-187.19, 45d-196.2, 45d-217.5-, 45d-243.4, 45d-253.6, 45d-362.9, 45d-295.5, 45d-297.12, 45d-300.7, 45d-369.7, 45d-367.3, 45d-367.1, Apr-189.1, Apr-128.8, Apr-128.9, Apr-034.4, Apr-035.6, Apr-035.8, Apr-036.5, Apr-038.4, Apr-046.4, Apr-048.5, Apr-049.1, Apr-060.2, Apr-063.9, Apr-063.10, Apr-065.2, Apr-066.12, Apr-067.12, Apr-078.11, Apr-085.6, Apr-088.10, Apr-088.12, Apr-090.5, Apr-093.12, Apr-093.14, Apr-094.9, Apr-101.19, Apr-105.3, Apr-112.8, Apr-112.12, Apr-120.3, Apr-128.8, Apr-130.1, Apr-140.12, Apr-140.14, Apr-146.2, Apr-168.1, Apr-168.8, Apr-170.4, Apr-182.4, Apr-183.2, Apr-189.3, 15d1-018.2, 15d1-021.5, 15d1-032.5, 15d1-036.1, 15d1-036.2, 15d1-036.3, 15d1-048.1, 15d1-048.2, 15d1-053.3, 15d1-056.2, 15d1-058.5, 15d1-064.7, 15d1-064.12, 15d1-077.4, 15d1-078.3, 15d1-082.3, 15d1-096.7, 15d1-102.3, 15d1-102.4, 15d1-109.1, 15d1-109.2, 15d1-110.4, 15d1-110.5, 15d1-115.5, 15d1-126.3, 15d1-139.2, 15d1-144.3, 15d1-153.1, 15d1-159.2, 15d1-186.3, 15d1-194.4, 15d1-228.32, 15d1-228.39, 15d1-236.16, 15d1-236.17, 15d1-244.2, 15d2-253.2, 15d2-254.5, BHT-118, 15d2-184.17, 15d2-255.12, 15d2-255.13, 15d2-197.19, 15d2-208.19, 15d2-239.19, 15d2-240.19, 15d2-243.19, 15d2-268.19, 15d2-285.19, 15d2-293.19, 15d2-286.5, 15d2-198.1, BHT-111, BHT-215, 15d2-253.5, 15d2-253.10, 15d2-300.9, BH-002.2, BH-059.3, BH-059.5, BH-059.6, BHT-81, BHT-118, BHT-120, Apr-036.5, Apr-048.5, Apr-140.14, 15d2-184.17, 15d2-255.12, 15d2-255.13,

15d2-197.19, 15d2-208.19, 15d2-214.19, 15d2-239.19, 15d2-240.19, 15d2-243.19, 15d2-268.19, 15d2-285.19, 15d2-253.5, 15d2-253.10)

Comment: Recommendation to Analyze and Develop Focused Reports on Climate-Smart Agriculture

We recognize that this is a rapidly evolving and complex area. To best integrate farming practices and climate-smart agriculture into the LCFS program structure, we encourage the Board to direct staff to dedicate time and resources to analyze the GHG reduction opportunities for crop-based feedstocks and report back to the Board. We would recommend that an initial report be presented to the Board by the end of 2025, and a final report by the end of 2026. This timeline is proposed to coincide with the proposed new LCFS regulatory requirement pursuant to section 95488.9(g)(1)(A) that all crop-based and forestry-based feedstocks used for LCFS fuel pathways must maintain continuous third-party sustainability certification with an original certification completed before January 1, 2028. The focused research, analysis, and reporting by CARB staff that will be necessary to develop the reports to the Board and also will inform CARB staff's and the Board's review of certification systems. This process will provide the foundation for potential future modifications to the LCFS regulations and CA-GREET to recognize climate-smart agricultural practices with the next update of the LCFS regulations.

In the interim period before January 1, 2028, we are requesting that the Board encourage CARB staff to consider and potentially evaluate Tier 2 pathways to credit climate-smart farming practices that enable feedstock to be produced in a less carbon intensive manner. In addition, we encourage CARB to allow the crediting of higher yields than the defaults in the GREET calculator, as well as indirect benefits potentially attained from producing oilseeds on fallow acres (e.g. negative land use change values as has been documented in published, peer reviewed studies.). We recommend that the total feedstock CI reduction for a qualifying fuel pathway be based on the aggregate net reduction achieved for all the farming practices as compared to the Tier 1 CA-GREET calculator standard value for these feedstock CI components. (Apr-168.2)

Comment: We are asking the Board to direct staff to investigate how the agriculture sector can be optimized to produce low-carbon biofuels to meet the state's SAF goal. Specifically, we are requesting the Board to prioritize policy discussions and the associated technical analysis related to low-carbon feedstocks for the production of SAF. This technical analysis should include a thorough lifecycle analysis to determine the extent to which supplies of sustainable biofuels produced from various feedstocks can be expanded while not converting additional land to agricultural uses. This technical analysis should be informed by the other primary LCA methodologies including Argonne GREET. To ensure the timely analysis of this information, we request that the Board direct staff to report back to the Board by the end of 2025 on the results of lifecycle analysis and progress toward developing policies to encourage the production of SAF.

For the foreseeable future, liquid fuels will be required to power the majority of airflight thus necessitating a rapid expansion in the supply of SAF. In order to create demand for the fuels with the lowest actual CI possible, ARB needs to account for and incentivize field-based

practices. Fortunately, the benefits of these sustainable agricultural practices go beyond their GHG savings, positively impacting our water, ecosystems, and soils. (15d1-036.6)

Comment: To inform CARB's approach toward climate-smart agriculture and the assessment of ILUC, we would recommend that CARB dedicate resources to engaging in the international dialogue on these issues. For example, the International Energy Agency very recently released an analysis entitled Carbon Accounting for Sustainable Biofuels that merits CARB review and consideration. (BH-059.5)

Comment: We also recommend the inclusion of the following paragraph into the Board Resolution: Be it further resolved that the Board directs the Executive Officer to convene a public forum in the next 12 months on the latest science on climate smart agriculture practices. Be it further resolved that the Board directs the Executive Officer to convene a public forum in the next 12 months on the latest science on climate smart agriculture practices related to feedstocks used to produce transportation fuels and the impact of climate smart agriculture on greenhouse gas emissions for consideration in a future LCFS update. This should include a public discussion and consider viewpoints from industry, environmental advocacy groups, academia, and government agencies such as the California Department of Food and Agriculture and the United States Department of Agriculture. (BH-059.6)

Comment: Work with farmers to implement regenerative agriculture which can provide a negative carbon footprint. (BH-021.5)

Comment: Creates investment certainty by continuing to reward agriculturally based reductions including those achieved by the production of biofuels, especially RNG and Hydrogen produced from RNG. (BH-031.4)

Agency Response: Increasing the deployment of climate smart agriculture practices is identified in the 2022 Scoping Plan Update as a GHG reduction and carbon sequestration strategy that can help California achieve its carbon neutrality goes. As such, staff is open to potentially amending the LCFS at a future date to recognize climate smart agricultural practices in the program, but did not include climate smart agriculture in this rulemaking for a number of reasons. First, unless appropriately designed, including climate smart agriculture in the LCFS may incentivize California fuel suppliers to simply switch to sourcing biofuel feedstock from farms that already have very low CI values, instead of increasing the use of climate smart agricultural practices. This potential outcome could arise because California consumes only a small percentage of the ethanol and biodiesel produced in the United States and these fuels in turn only consume a small portion of the total corn and oil-seed crops across the world.

Second, quantifying, reporting, and verifying the GHG reduction benefits of climate smart agricultural practices and improved soil carbon sequestration can require GHG measurement, reporting, and verification that is resource-intensive and subject to estimation uncertainties. Depending on the practice, some climate smart agriculture actions can also be prone to sequestration reversals. Directionally, staff recognizes that there are GHG and other ecosystem benefits associated with many such practices, but

the existing quantification methods and permanence criteria pose challenges to adoption for crediting at this time.

Finally, there are other important technical questions such as what specific inputs/areas should be targeted for consideration, as it may not be feasible to consider user-defined inputs for all farm specific parameters that impact GHG emissions. This is because data may not be available in all cases and verification and monitoring systems to verify and support such input may be hard to implement. In addition, there are questions related to uncertainty in quantifying farming GHG emissions.

It is possible that many of these reporting, verification, and quantification challenges/questions may be addressed in the coming years with the successful implementation of the additional traceability and sustainability certification requirements introduced with this current rulemaking and as advances are made on GHG emissions and carbon sequestration estimation methods/tools. CARB continues to engage with experts and fund work to develop a more robust understanding of soil dynamics and more rigorous methods to quantify the emission benefits of farming practices that enhance soil health or otherwise reduce emissions. Staff also believes that the steps that producers take to comply with the sustainability certification requirements developed as part of the Proposed Amendments in subsection 95488.9(g) may inform the development of potential future regulatory changes that support climate smart agricultural practice crediting under the LCFS; however, staff are not considering any such regulatory changes under the LCFS at this time.

KK-13 Global warming potential

Comment: Methane - global warming potential (GWP) should be calculated based on 20 years. Methane being a potent greenhouse gas which traps heat in the atmosphere and contributes to climate change. Over a 20-year period, methane's GWP is between 84 and 87, meanint that one ton of methane emitted today has the same GWP as 84 to 8: tons of carbon dioxide over the next 20 years. And methane also has a short half-life, and its impact is only in the first 20 years. Therefore, there is no reason to calculate its GWP over 100 years. (45d-258.2)

Comment: Because of its well-documented role as an indirect greenhouse gas, hydrogen must be factored into life cycle assessments through the CA-GREET model. Argonne has already been exploring the inclusion of hydrogen emissions into the GREET model. This can be done by using GWP values of 37 for GWP20 and 12 for GWP100.⁵¹ (45d-327.7)

Agency Response: No change was made in response to these comments. Assigning a GWP value to an indirect greenhouse gas for the purposes of GHG accounting and inventory development requires a state-wide coordination among different agencies and climate programs and long-term planning supported by a wide body of evidence and similar shifts in accounting for other regional inventories to ensure CARB is using the best available science and following widely accepted constructs in GHG accounting. Updating GWPs of direct or indirect greenhouse gases is outside the scope of this rulemaking.

KK-14 Multiple Comments: Transition to CA-GREET4.0

Comment: To maintain consistency in the program and minimize disruption, current pathways should remain open during the transition from GREET 3.0 to disruption. (45d-241.27, 45d-241.66)

Comment: To maintain consistency in the program and to minimize disruption, current pathways should remain open during the transition from GREET 3.0 to GREET 4.0. CARB should justify any incremental nitrous oxide (N20) emissions from renewable diesel and biodiesel before implementing these incremental emissions in GREET 4.0, and not just simply assume that renewable diesel and biodiesel have the same N20 emissions as petroleum diesel. (Apr-094.29)

Comment: Transition to CA-GREET 4.0: Given that the LCFS rulemaking is delayed, a 2024 start date for using CA-GREET 4.0 will not be feasible. The start date for using it should be 2025 or later, and for credit transactions it should be required in 2027 or later to give all stakeholders enough time to apply for new CARB fuel pathways. This should be reflected throughout the Proposed Regulation as it appears that a 2024 startup date was assumed. (45d-295.8)

Agency Response: No change was made in response to the comments on transitioning to the CA-GREET4.0 model. The Proposed Amendments specify in subsection 95488(c) that existing pathways will transition to CA-GREET4.0 as part of the 2024 annual verification in 2025. Because the new certified CIs based on 2025 verification will be effective and available for reporting for fuel transactions occurring on and after January 1, 2026, existing CA-GREET3.0 pathways may remain in effect (i.e., open) until the end of 2025. Therefore, unless 2024 Annual Fuel Pathway Report (AFPR) verification is deferred, existing certified pathways must be verified under CA-GREET4.0 by August 31, 2025, and reporting and crediting for these pathways will transition to CA-GREET4.0 by January 1, 2026. This specified approach reflected in the Proposed Amendments is consistent with the commenters' recommendation.

With regard to N₂O and methane tailpipe emission factors, see response KK-1.2.

Comment: Grandfather Existing Pathways Certified under GREET v3.0. CalBio is proposing CARB consider grandfathering in pathways which have already been certified under GREET v3.0. These pathways have already undergone the public review and comment period and should remain under models which have been validated and verified through the end of their crediting periods. It would be administratively burdensome to deviate from the modeling that has been established for existing pathways and require unnecessary adjustments to the information CARB and 3rd party verifier have already reviewed and approved. (Apr-155.9)

Agency Response: No change was made in response to this comment. Under the current transition proposal, an existing pathway certified using the CA-GREET3.0 modeling framework would seamlessly transition to a CA-GREET4.0 pathway via annual verification. There is no need to resubmit an application and undergo validation again to re-establish the CI score. Barring the addition of new features in few instances, the overall input structure in the Tier 1 calculators have not changed. Therefore, the

modeling update transition through annual verification in 2025 is not expected to impose significant or unnecessary administrative burdens.

Comment: CARB Should Phase in Changes to GREET Model for Existing Pathways

For existing pathways (including projects that qualified under Tier 2 CI calculations), CARB is proposing to require pathway holders to use the new CA-GREET 4.0 or the revised Tier 1 Calculators, and these new CI scores will be incorporated into fuel transactions starting January 1, 2026. DTE Vantage is concerned that the same project operating in the same manner with the same feedstocks may end up with a materially different CI score due to changes in the GREET model. For these reasons, DTE Vantage urges CARB to provide existing biomethane pathways with a fixed period (such as 5 years) where it can rely on the existing CI score properly calculated under CA-GREET 3.0 and/or Tier 1 before applying this new CI calculation for demonstrating compliance. (15d2-224.7)

Agency Response: No change was made in response to this comment. The Proposed Amendments specify that existing pathways certified with CA-GREET3.0 will transition to the updated CA-GREET4.0 modeling framework via annual verification of 2024 Annual Fuel Reports, which will occur in 2025. Carbon intensities calculated using the CA-GREET4.0 models, including the updated Tier 1 calculators, will more accurately reflect current emissions due to use of more up-to-date data. Thus, it will be most appropriate to use the CIs derived from the CA-GREET4.0 models for reporting for credit generation, performing credit adjustments and true ups rather than the CIs derived from the CA-GREET3.0 models. Therefore, allowing the transition to occur at the earliest possible date (January 1, 2026) is in the best interest of stakeholders and the program.

KK-15 Multiple Comments: Support for model updates

Comment: EcoEngineers fully supports updating LCA modeling tools and emission factors to ensure the modeling is reflective of the most up-to-date scientific, evidence-based information. The update of the GREET model will help ensure the LCFS remains at the forefront of science-based GHG reductions including the addition of a Tier 1 Calculator for hydrogen. (45d-176.6)

Comment: Braya Supports Streamlining and Updating the Application and Review Process for Pathway Approval.

By updating and improving the existing Lookup Table and Tier 1 calculators, in addition to adding new and/or separate Tier 1 calculators, CARB will be able to focus attention on critical new feedstock sources, availability, and supply, as well as new technologies, thereby expediting approvals for new Tier 2 pathways. (Apr-079.25).

Comment: The new versions of the calculators will help the industry streamline the pathway applications process for low carbon energy projects. In particular, we appreciate the new hydrogen calculator, building separate calculators for biodiesel and HEFA, and increasing the number of feedstocks that can be specified in the biodiesel calculator. I would also like to thank you for incorporating some of our previous comments into the new versions of the calculators. (15d1-031.1)

Comment: The new T1 Calculator for HEFA is a great step forward in the calculation of CI results for the increasing number of options for additional feedstock pathways. We like its transparency of data and calculations. (15d1-229.1)

Comment: First, I would like to thank you for your work in the new LCFS calculators, which incorporate some of our previous comments. In particular, we appreciate the new hydrogen calculator, building separate calculators for biodiesel and HEFA, and increasing the number of feedstocks that can be specified in the calculators. Below are our comments on the most recent version of the calculators: (15d2-002.1)

Agency Response: CARB appreciate the support for updates to the CA-GREET4.0 model, Tier 1 calculators, and proposed EFs. The model updates are designed to streamline the application and review process and capture up-to-date data and science to enable accurate accounting of life cycle GHG emissions of transportations fuels.

LL. Lookup Table

LL-1 Lookup Table pathway coverage

Comment: At a minimum, CARB should allow all zero-GHG resources to be included in the "Lookup Table Pathway" and eligible for "book and claim" accounting if they are tracked through WREGIS. As previously noted, this is consistent with California's requirements to transition to a 100% GHG free electric sector. (45d-375.8)

Agency Response: No change was made in response to this comment because the Lookup Table includes zero CI electricity pathways with book-and-claim.

MM. Lookup Table Pathways

MM-1 Multiple Comments: Correct the lookup table pathway Cl for propane

Comment Summary: WPGA urges CARB to revise the look-up table CI value for fossil propane based on the Argonne National Laboratory reporting on refining assumptions and industry reporting and best practices on final mile delivery. (45d-182.1)

Comment: We thank CARB staff for recognizing the value of renewable propane in decarbonizing "hard-to- electrify" segments of California, and for calculating a lower Carbon Intensity (CI) of conventional propane under the GREET4.0 proposed model (Lookup Table Pathways, Pg 24.

However, WPGA supports adjusting the baseline CI for propane further based upon corrected assumptions and modeling. See our letter dated April 29, 2023 for detailed CI calculations

In short, WPGA again proposes that CARB update its modelling of the CI for conventional propane within the lookup table to result in 80.06 gCO2eq/MJ due to corrections on:

- Upstream combustion emissions from a CI of 64.84 to 64.58 (determined by existing GREET 2021 model updates for school buses),
- Assumptions regarding refining source from 75% oil/25% natural gas mixture for conventional propane to 59.5% oil/40.5% natural gas within California per Argonne National Laboratory reporting and

• Transport distance for delivery – fewer than 100 miles traveled for final delivery, based upon industry reporting and best practices. Previous letters to CARB, which highlight the errors in modeling through the Lookup Table Pathways, have yet to be substantively addressed by staff. (Apr-127.1, Apr-127.2)

Comment: Despite repeated entreaties, CARB's GREET4.0 model still incorrectly calculates the baseline CI of conventional. See our letter dated April 29, 20231 for detailed CI calculations. With the consideration of more aggressive compliance targets under the 15-day language, this miscalculation would create further undue burden on compliance entities and end-users. WPGA again proposes that CARB update its modelling of the CI for conventional propane within the lookup table to result in 80.06 gCO2eq/MJ due to corrections on: Upstream combustion emissions – from a CI of 64.84 to 64.58 (determined by existing GREET 2021 model updates for school buses), Assumptions regarding refining source – from 75% oil/25% natural gas mixture for conventional propane to 59.5% oil/40.5% natural gas within California per Argonne National Laboratory reporting2, and Transport distance for delivery – fewer than 100 miles traveled for final delivery, based upon industry reporting and best practices. (15d1-163.2)

Comment: STILL INCORRECT CI FOR CONVENTIONAL PROPANE IN GREET MODEL.

For the fourth time, WPGA has attempted to correct the record on the baseline calculation of fossil propane under LCFS – which, as currently calculated, creates additional burdens onto propane consumers without justification.

CARB's GREET4.0 model still incorrectly calculates the baseline CI of conventional propane. See our letter dated April 29, 20231 for detailed CI calculations. With the consideration of more aggressive compliance targets under the first 15-day language, this miscalculation would create further undue burden on compliance entities and end-users.

WPGA yet again encourages CARB to update its modelling of the CI for conventional propane within the lookup table to result in 80.06 gCO2eq/MJ due to corrections on:

- Upstream combustion emissions from a CI of 64.84 to 64.58,
- Assumptions regarding refining source from 75% oil/25% natural gas mixture to 59.5% oil/40.5% natural gas within California per Argonne National Laboratory reporting, and
- Transport distance for delivery fewer than 100 miles traveled for final delivery, based upon industry reporting and best practices. (15d2-304.3)

Agency Response: No change was made in response to the comment. The Lookup Table CI values, by design, tend to be conservative to ensure that potential variation in carbon intensities of fuels delivered to California will not result in over-crediting.

NN. Tier 1 CI Calculators

NN-1 Tier 1 calculator for H2 from gasification of MSW

Comment: It is recommended to include thermochemical conversion of landfill diverted MSW (biogenic and non-biogenic component) with carbon capture in Tier 1 pathway for hydrogen.

Thermochemical conversion of organic component of MSW is well accepted technology for producing renewable hydrogen. Approval of CARB for landfill diverted MSW as feedstock for thermochemical conversion technology with carbon capture under Tier 1 pathway, will support rapid deployment of these projects. (45d-360.5)

Agency Response: No change was made in response to the comment. The current regulation allows modeling of hydrogen production from thermochemical conversion of municipal solid waste (MSW) under a Tier 2 fuel pathway framework (section 95488.7). Developing a Tier 1 calculator for hydrogen production from thermochemical conversion of MSW is not justifiable under the proposed regulation because the technology is not yet deployed widely at commercial scale. If such technology is widely deployed in the future, CARB staff may consider developing a Tier 1 calculator for thermochemical MSW fuel pathways.

NN-2 Multiple Comments: Fixing errors/typos and improvements

Comment: Consistency of by-product credit calculation in the HEFA calculator:

- Light hydrocarbon used as H2 feedstock gets full displacement credit for natural gas displaced.
- Light hydrocarbon used for alternate use gets energy allocation credit. Chevron continues to believe that the displacement method is the most appropriate approach to account for renewable propane and renewable fuel gas from hydrotreating lipids. That is because the renewable propane/fuel gas is routed to the refinery's fuel gas system where it displaces fossil hydrocarbons and purchased natural gas that is used as makeup to the refinery's fuel gas system. Further, the allocation includes ILUC which appears to be different than what CARB has done in the past (ILUC wasn't included when applying energy allocation).
- Light hydrocarbon to renewable propane sales gets energy allocation credit, but not on the ILUC piece. Again, renewable propane to non-transportation sales would most likely be displacing fossil propane or fossil natural gas (e.g., for home heating and therefore would be appropriate to credit with a displacement method. (45d-144.1).

Agency Response: No change was made in response to this comment. By assigning the displacement credits to the use of light hydrocarbon as feedstock in hydrogen production, LCFS is incenting the production of low-CI hydrogen for transportation use which is consistent with the decarbonization strategy identified in the 2022 Scoping Plan Update. For the same reason, propane has not been assigned displacements credits, so that there is incentive to direct renewable propane to renewable hydrogen production as light hydrocarbon gas.

Comment: LHV versus HHV calculations in the HEFA calculator: When calculating by-product credits in the "pathway summary" tab applying the first two methods above, it appears that the light hydrocarbons are expressed in a HHV-basis, and they are not converted to a LHV basis prior to applying the emission factors, which are expressed in an LHV-basis. We advise you to ensure that the heating values are consistently calculated on the same basis. (45d-144.2)

Agency Response: A change was made in response to this comment. Rather than converting the light hydrocarbons quantity to LHV, the modified Proposed Amendments convert the displacement credit from LHV to HHV basis.

Comment: Page 10, Section 95488.3 – Staff proposes to specify a process by which the Executive Officer may correct the Tier 1 CI Calculators to align more closely with the CA GREET 4.0 model and facilitate modeling consistency and efficiency. TTP believes this would be appropriate if the alignment mirrors the national GREET model. Specific CA parameters make sense if they are calculated using the methods of the national GREET model. (15d1-066.5)

Agency Response: CARB appreciates the support for this proposed amendment concept.

Comment: Hydrogen calculator:

- It is unclear how the CI of RNG is entered in the calculator when there's a direct connection instead of B&C? Are we expected to use the B&C section with 0 as the distance from RNG injection to H2 facility (5.4). Please clarify.
- This statement is confusing:

4.7 Submetered Electricity for Liquefaction (kWh)	Enter the quantity of submetered electricity used by the hydrogen production facility for liquefaction, if available. Electrolysis submetering is used to evaluate the quantities of grid electricity attributed to GH2 and LH2 pathways.
	Ene patinaja.

4.7 refers to kWh demand for liquefaction, yet the description specifies that the value will be used to evaluate electricity demand for both gaseous and liquid pathways.

- Please clarify whether we can use our own energy usage values, e.g. mmBTU of NG / kg of H2 or kWh/kg H2 in CA-GREET 4.0 tab without having to submit a Tier 2 application?
- Pathway Summary Tab: A T&D loss factor is applied to calculate the mass of H2 dispensed even if the H2 is produced and dispensed on-site. This factor should be proportional to the miles traveled and transloading OR use a conditional formula to apply it only when H2 is transported.

In the example below, all transportation distances are set to zero, yet the pathway gets penalized with a 0.5% T&D loss factor:

Hydrogen Production Quantities						
		Unit	Total	Gaseous Hydrogen (GH2)		Liquified Hydrogen (LH2)
Total Hydrogen Produced		kg	400,000	400,000		
		MJ, LHV	48,000,000	48,000,000		
	Produced	kg	400,000	400	,000	
H2 for LCES Bathway(c)	T&D Loss Factor	%	0.5%	0.5	5%	
FIZ TOT LCF5 Patriway(s)) Dispensed (Calculated)	kg	398,000	398,000		
		MJ, LHV	47,760,000	47,760,000		
			Without B&C	With B&C RNG	Without B&C	
Maximum Matchable B&C		MMBtu, HHV	100,000		100,000	
Hydrogen Reportable by Pathway		kg	400,000	80,000	320,000	
Delivered H2 for CI Calculations		MJ, LHV	47,760,000	9,552,000	38,208,000	

In the example above, 2,000 kg of H2 are subtracted from the dispensed H2 total due to T&D losses even though the H2 was produced on-site.

• CA-GREET 4.0 Tab: The following units are incorrect

[Process Fuels	Natural Gas	Combusted in Boiler or CHP	75,496	MMBtu, LHV

The correct units are gCO2e/mmBTU, LHV

• There isn't an option to input sub-metered compression or regasification or to change their emission factors, as they are lumped together. Please break out each component for transparency and to make it easier for the user to substitute default values with operational data, as needed. (15d1-031.2)

Fueling Station	GH2	Compression, Precooling and Pumping		
r denng station	LH2	Storage and Dispensing	4.22	geo ₂ e/wb H ₂ , Errv

Comment Summary: Chevron recommends CARB to correct the unit of natural gas emission factor in the proposed Tier 1 hydrogen calculator. (15d2-002.2)

Comment: There isn't an option to input sub-metered compression or regasification or to change their emission factors, as they are lumped together. Please break out each component for transparency and to make it easier for the user to substitute default values with operational data, as needed.

Fueling Station	GH2	Compression, Precooling and Pumping	3.41	
Tuening station	LH2	Storage and Dispensing	4.22	Bee 2 c / 103 H 2 / LITV
		I I		

(15d2-002.2)

Agency Response: Staff corrected the error in natural gas unit to gCO2e/MMbtu (LHV).

The Tier 1 calculator for hydrogen offers flexibility for modeling site-specific process energy use such as natural gas and electricity.

Note that the 0.5% T&D loss factor mentioned by the commenter refers to onsite fueling losses when there is no hydrogen transportation.

The direct supply of RNG to hydrogen facility has not been accommodated in the Tier 1 calculator because this has not historically been the common practice. To date, most applicants have utilized book and claim of biomethane to source RNG rather than arranging for a direct supply since the latter may be limited by RNG project locations

and transmission. In case RNG is supplied to the hydrogen production facility directly, the applicant can still be able to apply for a hydrogen fuel pathway under a Tier 2 fuel pathway classification by modifying the Tier 1 calculator for hydrogen.

The sub-metered electricity for liquefaction in section 4.7 is only attributable to liquefied hydrogen so that there is no mix-up with gaseous hydrogen.

A site-specific hydrogen compression, cooling and dispensing option has not been offered in the Tier 1 calculator since most applicants are expected to use default values. As stated above, applicants are welcome to apply under a Tier 2 classification by providing site-specific energy use data for hydrogen storage, cooling, compression and dispensing.

Comment: Biodiesel and HEFA Calculator:

- The flat tailpipe CI has changed from 0.76 to 3.497 gCO2e/MJ for BD/RD (a delta of 2.74 gCO2e/MJ) due to recent data from CARB's EMFAC2021 (v1.0.2), mainly N2O increases
- We request that CARB staff provide a clear and detailed explanation for assigning the same tailpipe score determined for ULSD to biodiesel and renewable diesel.
- We request that staff provide details on the assumptions driving the emission changes between the prior tailpipe emission factor of 0.76 gCO2e/MJ to the new tailpipe emission factor of 3.497. The explanation of the assumptions should be in plain language so that program participants who are not familiar with the EMFAC2021 model can understand the rationale. This explanation can be referenced in the GREET4.0 explanatory document since the relevant reference (7) is a placeholder and provides no information.
- The Simplified Calculators released for the 15 day comment period in August 2024 do not appear to have been updated with the feedstock emission factor information present in the updated CA-GREET4.0 model. The table below shows an example of the different values:

We request that CARB update the simplified calculators so that participants can use simplified calculators that match the CA-GREET4.0 calculator from the start of implementation. We want to avoid any unnecessary delays from known inconsistencies.

• The wording in section 6 of the manual does not match the spreadsheet:

	Sectio	n 6: Monthly Operationa	al Data				
	Coproducts Exported	Outside Fuel Pathway	Renewable Diesel (RD)				
6.6	6.7	6.8	6.9	6.10			
Hydrogen Produced On-Site	Light Hydrocarbons Used as H2 Feedstock	Light Hydrocarbons For Alternate Use	Beginning RD Inventory	Ending RD Inventory			
kg	MMBtu, HHV	MMBtu, HHV	gallons @ 60°F	gallons @ 60°F	e e		
1,000	300						

6.5 Alternate Fuel (MMBtu, HHV)

6.6 Imported Hydrogen (kg)

6.7 Hydrogen Produced On-Site (kg)

6.8 Light Hydrocarbons Used as H2 Feedstock (MMBtu, HHV)

Field Name

6.9 Light Hydrocarbons with Alternate Use (MMBtu, HHV)

6.10 Beginning RD Inventory (gallons @ 60°F)

6.11 Ending RD Inventory (gallons @ 60°F)

We request that the manual reflects the exact section numbers in the spreadsheet to avoid confusion. (15d1-031.3)

Comment Summary: Chevron recommends CARB to correct the mismatch between the wording in section 6 the instruction manual with the Tier 1 calculator for HEFA. (15d2-002.3)

Comment Summary: Chevron points out the feedstock emission factors used in the Tier 1 calculators such as soybean oil may not correspond to the updated values in the CA-GREET4.0 model. (15d2-002.3)

Comment Summary: Chevron requests CARB to provide detail explanations regarding the increase of renewable diesel tailpipe emission factor from 0.76 gCO2e/MJ to 3.497 gCO2e/MJ. (15d2-002.3)

Agency Response: Changes were made in response to these comments. A clarification on the increase of the renewable diesel/biodiesel tailpipe emission factor from 0.76 to 3.497 gCO2e/MJ is provided in response KK-1.2

Note that staff corrected an indexing error for electricity in CA-GREET4.0 as part of the First 15-day modifications package. The feedstock emission factor has remained unchanged despite this correction. The mismatch the commenter was seeing for feedstock emission factors in different versions is due to the selection of a different eGrid region for electricity mix in the inputs tab of CA-GREET4.0. The feedstock emission factors used in the Tier 1 calculators align with the feedstock GHG emissions presented in the CA-GREET4.0 model.

Staff corrected the wording in section 6 of the Tier 1 HEFA calculator to align it with the instruction manual.

Comment Summary: In the HEFA calculator, the non-CO2 tailpipe factor of renewable diesel is also consistently applied to the renewable naphtha, jet fuel and renewable propane. World Energy points out the non-CO2 tailpipe emissions of the corresponding petroleum fuels are lower. World Energy recommends that fuel-specific tailpipe emissions be applied to alternative jet fuel, renewable naphtha and renewable propane. (15d1-229.2)

Agency Response: No change was made in response to this comment. Due to insufficient data on the tailpipe emissions of renewable naphtha, alternative jet fuel and renewable propane, staff were not able to develop fuel pathway specific tailpipe emissions for these fuels. The standard principle in such a case is to apply a conservative tailpipe emission factor. Therefore, staff proposed to apply the tailpipe emissions of renewable diesel to other co-produced fuels as it represents a conservative value. If sufficient data are available in the future, staff may consider assigning pathway specific tailpipe emissions pursuant to section 95488.3(b).

Comment: "The proposed CA-GREET 4.0 and revised Tier 1 calculators should be updated with minor revisions to improve accounting for current practice:

- All biomethane pathway calculators should include the option to model biogas-to electricity carbon intensity scores.
- Applicants should be allowed to account for actual fugitive methane performance.
- The avoided emissions boundary should include biogas flared during normal operations.
- "The volatile solids table should be updated to include new technologies (e.g., Dissolved Air Flotation, Hydrocyclones)." (15d1-212.23)
Agency Response: No changes were made in response to this comment. Biogas to electricity pathways are not included in the proposed Tier 1 calculators for biomethane pathways. Applicants can modify the relevant Tier 1 biomethane calculator to develop a Tier 2 biogas to electricity pathway and submit an application under a Tier 2 fuel pathway classification. For example, the carbon intensity (CI) of dairy and swine manure biogas-to-electricity pathways can be determined by modifying the Tier 1 CI Calculator for Dairy and Swine Manure Biomethane, as described by LCFS Guidance 19-06. Staff may update that document or develop other compliance support materials to reflect the Proposed Amendments after the amendments become effective.

The flaring of biogas is included in the proposed Tier 1 calculators for biomethane either implicitly or explicitly. For example, the Tier 1 CI Calculators for Landfill Biomethane and Wastewater Sludge Biomethane implicitly include avoided emissions associated with biogas flaring by offsetting the tailpipe emissions. The other Tier 1 calculators for biomethane (organic waste and dairy/swine manure) explicitly model biogas flaring.

Regarding flaring, the Tier 1 CI Calculator for Wastewater Sludge Biomethane and Tier 1 CI Calculator for Dairy and Swine Manure Biomethane allow a calculation of a site-specific fugitive emissions based on energy balance. For the remaining landfill gas and wastewater sludge biomethane pathways, the corresponding Tier 1 calculators can be modified to incorporate site-specific fugitive losses based on energy balance of biomethane around the upgrading unit and applicants can submit an application under a Tier 2 classification after CARB approval.

The volatile solids table in the Tier 1 CI calculator for Dairy and Swine Manure Biomethane is adopted from the Compliance Offset Protocol for Livestock Projects (adopted November 14, 2014), reflects well-established data sources, and was developed through a robust public process. Currently, there is insufficient data available for staff to thoroughly evaluate the volatile solids removal efficiency of technologies such as dissolved air flotation and hydrocyclones. Therefore, staff is unable to incorporate these technologies into the table without further detailed examination.

Comment: "Clarification Needed in the new Tier 1 Calculator for "Hydroprocessed Ester and Fatty Acid Fuels":

Neste appreciates the creation of the new Tier 1 Calculator for "Hydroprocessed Ester and Fatty Acid Fuels" and we would like to request clarification the following two items:

- There was an increase from 0.76 to 3.497 gCO2e/MJ in the tailpipe emissions factor, but nothing to explain this large increase. Is this an error?
- As part of 95488.8 (i)(1) "Book-and-Claim Accounting for Low-CI Electricity Supplied as Transportation Fuel, Direct Air Capture projects, or Used to Produce Hydrogen as a transportation fuel", we would like to ensure that low-CI electricity used towards hydrogen production that is ultimately used to produce RD/SAF is accounted for in the Tier 1 calculator. We would appreciate it if CARB makes this clear in the Tier 1 calculator." (15d1-228.44)

Agency Response: No change was made in response to the comment on the tailpipe emission factor. The increase in the tailpipe emission factor of biodiesel and renewable diesel is due to the use of updated tailpipe emissions data for ULSD obtained from EMFAC as proxy. See response KK-1.2.

Book and claim of low-CI electricity for hydrogen production is not allowed if hydrogen used as feedstock to make a hydrocarbon fuel such as RD and SAF. See response L-10. The mention of grid-electricity in the book and claim field (4.2) in the instruction manual has been removed to avoid this confusion.

Comment Summary: Chevron suggests that macros in the Tier 1 calculator for hydrogen may not be working properly. When book and claim of electricity is selected by checking the boxes for low-CI electricity under process energy (section 2.8) and book and claim (section 2.8), the calculator only displays the hydrogen CI value without book and claim. In addition, when both gaseous hydrogen and liquid hydrogen production is chosen with book and claim of low-CI electricity, the calculator incorrectly displays of the hydrogen CIs for book and claim of biomethane rather than book and claim of low-CI electricity. (152d-002.2)

Agency Response: Changes were made in response to this comment. Users should select Grid Electricity in section 2.4 (process energy) and Low-CI electricity in section 2.8 (book and claim) to trigger book and claim of low-CI electricity. Since the commenter did not select the Grid Electricity option in section 2.4, the Tier 1 calculator did not display the H2 CI results for book and claim of low-CI electricity. As stated in the instruction manual, low-CI electricity should be selected only if it is supplied behind the meter to hydrogen production. To avoid this ambiguity, staff renamed Low-CI electricity as Direct Supply Low-CI Electricity in section 2.4.

When both gaseous and liquid hydrogen production methods were selected with book and claim of low-CI electricity, a macro error caused the Tier 1 calculator to display the hydrogen CI results under book and claim of biomethane (renewable natural gas or RNG). This macro error has been fixed.

NN-3 Multiple Comments: Tier 1 hydrogen calculator

Comment: §95488.1 (c) and (d) - Hydrogen pathways have been removed from the list of Tier 2 classification and moved to the Tier 1 list. Although hydrogen produced from steam methane reforming of methane and electrolysis are comparatively well understood and may appropriately belong in the Tier 1 classification, other methods for hydrogen production may emerge over time, and if so, would be most appropriately assessed by a Tier 2 classification. (45d-391.48)

Comment: Hydrogen Emission Factor. The hydrogen CO2 emissions component emission factor 13,588 gCO2e/kg shown in the Pathway Summary worksheet cell F27 and sourced in the CA-GREET4.0 tab cell E25 (labeled Default SMR to G.H2). This represents a14% increase in CO2e emissions per kg above our current Tier 2 pathway hydrogen CO2e emissions. We suspect this may be the result of an overly high pressure hydrogen gas stream that would be suitable for vehicle transportation (maybe 700 bar - 10,000 psi?), but is not the pressure we use for pipeline distribution from the SMR to the HEFA facility, which is 120 psi. If there is a

higher compression energy and associated CO2 emissions, it should be adjusted downward for a HEFA pipeline hydrogen supply. (15d1-229.3)

Comment: Additions to the Tier 1 Hydrogen Calculator and Instruction Manual.

In Section 2.1, Pathway Type, in Section 2, Pathway Inputs, on the Site-Specific Inputs tab of the proposed CA-GREET 4.0 Tier 1 Hydrogen Calculator, please add Steam Non-Methane Reforming as described above as a Pathway Input. In Section 2.3 of the same tab, please change the title to "SMR and Steam Non-Methane Reforming Feedstock" and add ethanol to the list of feedstocks. Please make the corresponding changes in the accompanying Instruction Manual. (15d1-126.6)

Agency Response: No change was made in response to these comments. The Tier 1 H2 calculator covers steam methane reforming and electrolysis. Any novel hydrogen pathways not included in the Tier 1 calculator including gasification and non-methane reformation can be processed under a Tier 2 classification.

The default H2 emission factors (EFs) are developed from the proposed Tier 1 hydrogen calculator using the default parameters for gaseous and liquid hydrogen produced using steam methane reforming. Since most of the data used in the Tier 1 calculator comes from the Argonne GREET1 model, the increases in the EFs are primarily attributed to the updated data in Argonne GREET model. The EFs do not include compression and hydrogen dispensing emissions.

Comment: §95488.8 (i)(3) - Proposed amendments specify the protocols by which hydrogen can be injected into a pipeline system and subsequently used to fuel vehicles, or as an input to other fuel production. This section omits requirements to regularly assess and report the leakage rate of hydrogen from pipelines and associated equipment. An extensive body of research has documented routine leaks from existing natural gas pipelines. Hydrogen, a much smaller molecule than methane, is likely to pose equal or greater risk of leakage from pipelines or related infrastructure. Given hydrogen's status as a secondary GHG, accurate assessment of the GHG impacts of fuels using pipeline-transported hydrogen requires accurate data about leakage rate. (45d-391.54)

Agency Response: No change was made in response to this comment. Fuel losses during production and transport by various modes including pipeline transport are part of life cycle analysis. The proposed Tier 1 hydrogen incorporates hydrogen losses from transportation, distribution and dispensing which includes pipeline transport.

Comment: The liquification energy needs appear to be higher than experienced by actual operation, prompting a need for further evaluation and adjustments to align with realistic energy requirements.

We urge consideration of broadening eligibility criteria by including "process energy" for book and claim in the Tier 1 calculator. The exclusion of process energy is highlighted through a sample calculation raising the possibility of necessitating Tier 2 pathway submissions solely for process energy credits. This approach is deemed burdensome for all parties involved and merits reconsideration. These suggestions aim to refine the Tier 1 Calculator, ensuring accuracy in energy needs and streamlining the credit allocation process for process energy without imposing undue administrative complexities. (45d-302.11)

Agency Response: Changes were made in the Tier 1 hydrogen calculator to allow book-and-claim of low-CI electricity used in liquefaction.

Comment: Consistent with the proposed change to extend low-CI electricity book-and-claim to both production and process energy under 95488.8(i)(1), please update the Tier 1 calculator to provide the necessary inputs and CI calculations to accommodate this proposal. (45d-214.30)

Agency Response: Changes were made in response to this comment by incorporating book-and-claim of low-CI electricity in hydrogen production and liquefaction for SMR and electrolytic pathways in the Tier 1 calculator. The instruction manual was also updated accordingly.

Comment: The emissions factor for liquid hydrogen storage and dispensing (cell E19 on CA-GREET4.0 sheet) is higher than the gaseous hydrogen factor. Does this result come from the CA-GREET4.0 model? Please provide more information on how that factor was determined. It's significantly higher than what we would expect for power consumption at a liquid hydrogen fueling station, so it is important to understand the assumptions behind the factor. (45d-214.30)

Agency Response: No change was made in response to this comment. The emission factor for liquid hydrogen storage and dispensing comes from the CA-GREET4.0 model. It incorporates liquid H2 storage, compression of resulting gaseous hydrogen and dispensing.

Comment: Air Products suggests that it would benefit all users of the model to build into the CA-GREET4.0 sheet, or the instruction manual, information on how to use the CA-GREET4.0 full model to calculate the emission factors given in the Tier 1 calculator. There would be two benefits to this: (1) increased awareness/confidence the Tier 1 calculator is consistent with CA-GREET4.0; and (2) providing a starting point for pathway applications which need to propose modifications to CA-GREET4.0 for Tier 2 applications of complex pathways. We recommend including this additional information. (45d-214.30)

Agency Response: Emission factors used in Tier 1 calculators are derived from CA-GREET4.0, which in turn is a modified version of the Argonne GREET1 2022 model. The CA-GREET4.0 documentation lays out changes made to Argonne GREET model in detail. The Argonne GREET model is a transparent model with substantial documentation about primary data sources and methods for obtaining secondary data. Because of this, staff believes that the current level of information and documentation is adequate to enable life cycle practitioners to trace emission factors back to the GREET model and find the underlying data and information used in the Tier 1 calculators.

Comment: We note the substantial decrease in the California average grid electricity CI used as a transportation fuel from a value of 93.75 gCO2e/MJ to 81 gCO2e/MJ in Table 7-1. A similar value should be applied as a default in the Tier 1 Simplified Hydrogen Calculator to grid connected electrolysis units that are deployed in California as this is incremental grid demand

similar to direct supply of electricity to charging. This would place hydrogen and electricity supply to zero-emission vehicles on a more level playing field. (45d-214.30)

Comment: Table 9, Field 2.1 Select Regional Electricity Mix for Biomethane: CARB publishes the prior year's grid electricity factors on an annual basis

(https://ww2.arb.ca.gov/resources/documents/lcfs-pathways-requiring-public-comments). CARB should explicitly allow applicants to enter the CARB-published values as a User Defined Mix by stating these instructions directly in the Instruction Manual, to more accurately reflect the emissions from electricity utilized at their facilities. (45d-289.9)

Agency Response: No change was made in response to this comment. There is a precedent of applying the grid average electricity value obtained from CA-GREET4.0 when electricity is used as process energy or as feedstock in making another fuel such as hydrogen. This value typically is updated at the time of an LCFS rulemaking, and is different than the annually updated CA-average grid CI for electricity used in EV charging (which is calculated using the methodology described in the Lookup Table Pathways Technical Support Documentation³).

Comment Summary: The Tier 1 Calculator for Hydrogen is a valuable addition to the program for both applicants and CARB staff as it reduces complexity and time. Shell asks that the calculator include "process energy," displacing natural gas, for book-and-claim. If it isn't included, this will force applicants to submit a Tier 2 pathway to get credits for the process energy utilized, which is counter to the goal of promoting low CI fuels. (45d-088.7)

Agency Response: No change was made in the Tier 1 Hydrogen calculator in response to the comment to allow book and claim of biomethane for natural gas used as process energy in hydrogen production. See response L-14.

Comment: We are very pleased with the inclusion of a Tier 1 Calculator for hydrogen and clarification that hydrogen plants that are not co-located with refineries are eligible under the project-based crediting provisions. (45d-214.7).

Agency Response: No change was made in response to the comment. CARB appreciates the support for the Tier 1 H2 Calculator, and the proposed project-based crediting provision which does not require a hydrogen facility to be co-located with the petroleum refinery.

Comment: Methane pyrolysis should also be included in a pathway for flexible access to low GHG methane sources to reduce both GHGs and the cost of hydrogen. (BH-010.4)

Agency Response: No change was made in response to this comment. The proposed Tier 1 calculator for hydrogen does not include methane pyrolysis. However, applicants

³ CARB, 2024. Lookup Table Pathways Technical Support Documentation.

https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-public-comment (accessed on November 2024).

may submit an application for a methane pyrolysis hydrogen pathway under a Tier 2 classification.

NN-4 Tier 1 calculator for sugarcane ethanol

NN-4.1 2G Ethanol (Cellulosic Feedstock)

Comment Summary: Company is urging CARB to adopt the 2G Ethanol Pathway into the Tier 1 Calculator framework (45d-234.2)

Agency Response: No change was made in response to this comment. CARB staff have previously carefully evaluated the inputs for the 2G process at the Raízen Energia Costa Pinto mill and come to the conclusion that the GHG life cycle impacts could only be modeled in the Tier 2 framework. This is because the chemicals and enzymes utilized in the 2G process are unique and their impacts must be calculated on a caseby-case basis. The energy inputs for 2G are also unique with due consideration to lignin recovery and electricity and steam generation requiring both energy and material balance reviews. We also believe that the public comment period for unique Tier 2 pathways is essential for vetting the application, pathway inputs, proposed emissions factors, and other sustainability issues with the scientific community.

NN-4.2 Multiple Comments: Ocean Transport – Backhaul Penalty

Comment Summary: Raízen echoes Shell's assertion that the addition of backhaul energy intensity to ocean tankers for Brazilian sugarcane is not a universally applicable condition. Raízen can provide evidence of its trading logistics, as it has done in the past, and is pleased to collaborate with CARB staff again to offer further information (45d-234.3).

Comment Summary: CARB's assertion that ocean tankers bringing ethanol fuel from Brazil to California will return empty to Brazil lacks evidence. UNICA member companies have tracked the vessels that transport their fuel to California and verified that they do not return empty to Brazil. Those companies traced at least 20 vessels from 2019 and 2020 shipments. The information provided by vessel's operators corroborate to our explanation about logistics regarding oil/chemicals ships discharging ethanol in California, that they do not travel back empty to Brazil in any circumstance. They normally reload in the same port or somewhere else around US West Coast. If no option there, they usually load vegetable oils out of Vancouver, or even Gasoline and Diesel in Central America. In the last case, they move to the Gulf Coast to load chemicals like Styrene, EDC, Caustic Soda and others. Brazil is a net oil products (derivates) importer, as our national refining capacity is much lower than the local demand for fossil fuels, mainly diesel and gasoline. Therefore, Brazil imports a significant amount of ethanol annually. This scenario results in an over-supply of ships available for loading ethanol for exports through our main ports. The reason is that these ships bring much more oil products and ethanol to Brazil than the amount of fuel we export. Using 2019 as reference year, Brazil has imported 36.8 and exported 13.7 billion liters of oil products, resulting in a 23.1 billion liters deficit of oil products. Also, Brazil has imported around 1.5 and exported 1.77 billion liters of ethanol. This shows that a significantly higher volume of fuels (oil derivatives) arrives in Brazil rather than leave the country annually. Brazilian fuel supplier companies do not need to hire empty vessels from over- seas to export their products. These vessels are

constantly available in our ports (mainly Santos port) and they have preference to load ethanol or oil products at the same port where they are discharged in Brazil than travel to another place to load again due to the simple fact that this is more economically attractive. UNICA member companies advocate that CARB not impose backhaul penalties on Brazilian sugarcane ethanol, since these penalties are not supported by data or shipping practices. Maritime logistics can be easily tracked, particularly now that the LCFS has third party verification, and the agency should defer to verification bodies to make a decision on such penalty, based on their traced data (45d-362.8).

Agency Response: No change was made in response to this comment. The CA-GREET4.0 model assumes ocean-going vessels that deliver ethanol from Brazil to California return empty to their port of origin and incorporates "back-haul" GHG emissions for the vessel that is assumed to return to the port of origin with a lesser load. This back-haul charge is estimated to be 84 percent of the onward journey when the vessel was fully loaded by Brazilian sugarcane ethanol. The commenter advocates that the "back-haul" emissions be removed as the vessels predominantly make onward journeys to other ports of call, and often return to Brazil with other goods, bulk liquids, or loaded containers. They have supported their claims with GPS-based tracking data that suggests onward journeys of the vessel occur after delivering sugarcane-derived ethanol to California.

Staff proposed to retain "back-haul" GHG emissions for ocean transport as a mode for transport of ethanol from Brazil to California. First, there is no conclusive evidence that ocean tankers do not return fully empty to the Brazilian ports. For example, a 2017 report⁴ on maritime transport estimated that a minimum of 45 percent of ocean freight carriers return empty after delivering freight to their intended destinations. Second, to ensure the manifest of each and every ocean tanker loaded with sugarcane ethanol transported from Brazil to California is verified (both inbound and return) places a burden on both third-party auditors and staff. This is further complicated if tankers do not return to their original port where the fuel was loaded. Also, since all fuel pathways are being assessed back-haul emissions, to ensure equitable treatment for all fuels, staff is including back-haul emissions for all ocean tankers transporting sugarcane-derived ethanol to California.

NN-4.3 Multiple Comments: N2O Emissions from Applied Fertilizer

Comment Summary: Commenter is urging CARB to consider lowering the N2O emissions factor from applied fertilizer citing published literature and research studies and IPCC recommendation to consider regional data.

Raízen claims that the emission factor (EF) for direct N20 emissions from N inputs considered by CA-GREET3.0 is 0.01 kg-N2O-N/kg N-fertilizer applied to soils, according to the IPCC recommendation (2006). They claim that recent independent studies have found that the emission factors for regional-specific conditions (Tier 2) on the direct GHG emissions for

⁴Geography, search frictions and endogenous trade costs, (No. w23581). National Bureau of Economic Research. Brancaccio, G., Kalouptsidi, M., & Papageorgiou, T. (2017).

sugarcane in Brazil are usually 40% below the IPCC Tier 1. This is supported in singular studies by (Carvalho et al, 2021) who found that the N2O EFs derived from sugarcane cultivated under green mechanized harvesting, (which dominates over 95% of the sugarcane cultivation area in the South-Central region of Brazil) was 0.006 kg-N2O-N/kg N-fertilizer, which better reflects the prevailing conditions in South-Central Brazil, and 33 percent lower than the IPCC Tier 1 value of 0.01 kg-N2O-N/kg N-fertilizer supported by the CA-GREET4.0 model (Wang et al, 2012). The (Carvalho et al, 2021) study further claims that the ratoon crop receives 89 percent of the total nitrogen fertilizer applied and represents 80 percent of the nitrogen application area. (45d-234.4).

Comment Summary: Currently CA-GREET3.0 considers 0.01 kg-N2O-N/kg N-fertilizer applied (IPCC recommendation). In- dependent studies found that the emission factors for regional-specific conditions (Tier 2) on the direct GHG emissions for sugarcane in Brazil are usually below the IPCC Tier 1 default value7 due to the good drainage properties of the deep Oxisols, where sugarcane is commonly cultivated in Brazil. Carvalho et al. (2021) developed an extensive work with field experiments combined with a thorough literature review. Its recommendation for the sugarcane ratoon, which receives most of the N application of the sugarcane areas and represents 4/5 of the sugarcane cycle, the average N2O–N EF from N fertilizer is 0.60% (45d-362.4).

Agency Response: No change was made in response to this comment. Staff does not support the change as IPCC Tier 1 factors are widely adopted in the CA-GREET4.0 model for all crops, and it is difficult to change the factors for a subset of the population without causing a bias. The adoption of a Tier 2 EF without a detailed study revisiting farming practices, crop turnover rates, regional applicability, and fertilizer application rates for all crops is not practical given the time and effort required to undertake such a study.

NN-4.4 Multiple Comments: CARB should recognize increases in mechanized harvesting practices

Comment Summary: Raízen feels that CARB is slow to recognize the increases in mechanized harvesting practices, which dominates sugarcane harvesting in Brazil's Center-South region, and representing more than 95 percent of the total sugarcane harvested. This assertion is substantiated by governmental data, and data audited by the Renovabio program and is also supported by remote sensing data using the Mapbiomas-Fire product, and UNICA sugarcane harvest vectors. Whereas CARB still advocates using 80 percent and 65 percent mechanical harvesting rates for sugarcane harvested in the State of São Paulo and outside São Paulo, respectively. (45d-234.5).

Comment Summary: The commenter supports a fact-based mechanized harvesting fraction for the south-central harvest regions where mechanized harvesting practices have nearly completely replaced manual harvesting practices involving burnt fields. They urge CARB to offer an option for self-declared mechanization percentage in the Tier 1 CI Calculator, or adjust the default mechanization values for Center-South Brazil to a value no lower than 95%. This reflects actual practice and will most likely avoid Tier 2 application requests from Brazilian mills, saving time and financial resources for both the Agency and the mills (45d-362.2, Apr-183.4).

Agency Response: No change was made in response to this comment. Staff further evaluated the increased farming energy expended as a result of increased mechanization rates based on documentation supporting the current regulatory CA-GREET3.0 lifecycle analysis model, and concluded that the net impact to the pathway CI is marginally negative due to increased diesel fuel use from higher levels of mechanized harvesting, such that no change to the models to be incorporated by this rulemaking is justified. The conclusion is derived from the following simulations:

The farming energy for sugarcane was estimated in the Seabra/Macedo paper (2011)⁵ to be 274 liters diesel fuel per hectare (reflecting a yield of 86.7 tonne/ha). By that analysis alone, the fuel use translates to an energy consumption of 107,265 Btu per metric ton; much higher than the 95,000 Btu per metric ton sugarcane supported by the CA-GREET3.0 model, which reflects a representative average number at a time when unburned cane was 48 percent (Seabra et al, 2012). With an increased level of mechanization, the energy consumption associated with total mechanized harvesting levels is estimated to be 123,758 Btu per metric ton sugarcane (obtained from the baseline farming energy used in the CA-GREET1.8b model of 41,592 Btu per tonne and applied to the fraction manually harvested). Fuel energy consumption for mechanically harvested cane is therefore estimated to be about 124,000 Btu per metric ton, which would therefore present a small disbenefit to the CI for sugarcane-derived ethanol. Thus, because the data and studies available to CARB in this rulemaking record do not support incorporating the modeling option proposed by commenters, it would be more appropriate for CARB to accommodate assessment of new data presented by fuel pathway applicants through the Tier 2 pathway application process.

NN-4.5 Multiple Comments: Displacement credit for export of surplus cogenerated electricity, off-seasonal electricity generation, and electricity from externally-sourced biomass

Comment Summary: Raízen Energia advocates that the displacement credit for export of surplus cogenerated electricity be based upon the "Marginal" electricity mix for the Country of Brazil instead of the "Average" resources used to calculate the impact of electricity generation in Brazil. The commenter further urges CARB to permit export of electricity during the non-harvest of sugarcane months (typically during the months of December to the following March), and additionally credit electricity exports from externally-sourced biomass (45d-234.6).

Comment Summary: UNICA states that the Brazilian grid mix is highly dependent upon hydroelectric generation which has a low point during winter/dry months due to low water levels and lack of rain. At that time, electricity cogeneration from bagasse generated at the sugar mills is at its peak and therefore surplus electricity exports from sugarcane mills should be credited at the "marginal" displacement rate of petroleum, and fossil-based generation.

⁵ See California Air Resources Board, *Public Hearing to Consider Proposed Amendments to the Low Carbon Fuel Standard Regulation and to the Regulation on Commercialization of Alternative Diesel Fuels*. Staff Report: Initial Statement of Reasons, Appendix C: CA-GREET3.0 Technical Support Documentation. March 8, 2018. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/

Further, CARB is excluding export of electricity credits generated in the off- season (non-harvest) months from sugarcane ethanol CI determinations (45d-362.6, Apr-183.4).

Agency Response: No change was made in response to this comment because the current GHG life cycle analysis (LCA) approach, which CARB does not propose to change with the Proposed Amendments, is more reasonable than the recommended change. Starting with the incorporation of the current CA-GREET3.0 LCA model by the 2018 LCFS Amendments, the model has credited displaced grid electricity for Brazilian sugarcane ethanol based on the "Average" rather than the "Marginal" electricity mix. This approach is reasonable because year over year, Brazil's electricity mix is fairly consistent and highly dependent upon both biomass resources as well as hydroelectric generation to meet demand. The displacement electricity factors based on the average mix are consistent and any trend in one direction of electricity generation or the other would be captured by CARB during the LCFS Amendments. Therefore, the argument that CARB credit electricity exports based on marginal generation does not reflect the reality that companies like Raízen Energia are not only ethanol and table sugar producers but also consistent biomass-based electricity providers.

In response to other arguments for electricity export crediting during the non-harvest months, CARB assumes that all bagasse generated from sourced sugarcane would be consumed during the ethanol production season and therefore would not be available for electricity generation in the off-season. Crediting for electricity exports after the harvest season has ended makes it difficult for verification staff as they must now account for monthly inventories of bagasse (not available in the Simplified CI Calculator for Sugarcane-derived Ethanol). With regards to crediting electricity exports from externally sourced biomass, CARB concludes that such a credit would lead to the concept in life cycle analysis called "gearing" in which the displacement credit could be infinite because the available amount of externally-sourced biomass is also infinite. Because gearing violates the rules of life cycle analysis and pathway system boundary assessments by improperly inflating emission benefits, CARB's models are structured to prohibit it.

NN-4.6 Multiple Comments: Discrepancy in straw yields

Comment Summary: Raízen Energia requests CARB to confirm the value of the Straw Yield calculated in the Tier 1 Calculator for Sugarcane-derived Ethanol. The sugarcane industry in Brazil supports a value of 0.14 dry tonne straw per metric tonne of sugarcane. The Company claims this value is also assumed in the current version of the GREET1 Model developed by Argonne National Laboratory (45d-234.7).

Comment Summary: Scientific literature is consistently indicating the ratio of straw (tops and leaves) to cane stalks of about 140 kg (dry) per ton (fresh weight) which is equivalent to 0.47 kg (dry) per kg (dry). More recent studies, on the other hand, have quantified the straw availability as 120 kg (dry) per ton (fresh), thus resulting in a 0.4 kg (dry) per kg (dry) ratio. UNICA claims that their specialists were unable to identify the source of this combination of values, which leads to a dry straw yield of 0.238 dry ton straw per ton cane. (45d-362.3, Apr-183.4).

Agency Response: No change was made in response to this comment. The straw yield proposed for the CA-GREET4.0 model are consistent with straw yields proposed for all previous CA-GREET models which were adopted by the California Air Resources Board.

Staff believes that we are looking at the same set of numbers; the differences arise due to assumptions on levels of mechanization, manual harvesting, and harvesting of straw fields. CARB research considered for previous rulemaking shows a well referenced value for straw availability was proposed by (Carvalho et al, 2013) as follows: "Several studies indicate that sugarcane fields contain an average of 8–30 Mg ha-¹ dry mass of straw (Trivelin et al., 1995; Hassuani et al., 2005; Vitti et al., 2008; Carvalho et al., 2013), and its production varies according to crop variety, vegetative stage, edaphoclimatic conditions, and management practices (Hames et al., 2003; Santos et al., 2014)." Staff believes that the average yield of straw from the Carvalho study (19 Mg per hectare) produced a dry straw yield that corroborates better with the CA-GREET3.0 proposed straw yield (0.253 versus 0.238 dry tonne straw per metric tonne sugarcane). In either case, values proposed by either study and further corroborated by (Leal et al, 2013) are not unreasonable values given the range of yields presented. We believe it is better to be on the side of caution than to err with the lowest available factor that may not be applicable to all regions.

The consequence of lower straw yield implies lower N2O emissions from above ground biomass left on the field after the sugarcane harvest (straw is the "trash" generated from dried tops and leaves of the sugarcane stalk after a mechanical harvest and the fraction that remains unburnt during a manual harvest).

In the CA-GREET3.0 model, the yield of straw is assumed to be equivalent to that of bagasse (0.28 tonne per tonne sugarcane). The factor 0.238 dry tonne straw per tonne sugarcane represents straw yield on a dry basis (15 percent moisture). The CA-GREET3.0 model further assumes that 80 percent of the straw is left on the ground after a mechanical harvest (corresponding to 80 percent Mechanical Harvesting fraction for State of Sao Paulo), and 10 percent of the straw remains on the ground after a manual harvest (90 percent is burned). The net availability of straw (which corresponds to the amount of straw contributing to N2O emissions from above-ground biomass) will depend upon how much straw is harvested (CARB conservatively assumes 25 percent of the straw will be harvested) for agricultural or cogeneration purposes. Hence, the net yield of straw calculated for the Tier 1 Simplified CI Calculator is

Net Straw Yield from mechanically harvested farms

= (0.28 straw /m.t. cane x (1- 0.15 moisture) x 0.80 mechanical x (1 - 0.25 harvested))

= 0.1428 dry tonne straw per tonne sugarcane

Net Straw Yield from manually harvested farms

= (0.28 straw /m.t. cane x (1- 0.15 moisture) x 0.20 manual x (1 - 0.90 burnt))

= 0.00476 dry tonne straw per tonne sugarcane

Total Straw Yield = (0.1428 + 0.00476)

Total Straw Yield = 0.1476 dry tonne straw per tonne sugarcane

While a higher assumption of straw yield may cause marginally higher N2O emissions from above-ground biomass, the benefits of straw accumulation manifests with return of nitrogen to the soil, and non-measurable impacts such as water conservation, soil erosion prevention, weed control, and reduced herbicide use.

In conclusion, the factors proposed by CARB are reasonably aligned with literature values given the range of straw yields measured and reported, and the assumptions CARB has made about harvesting practices.

NN-4.7 Overview of issues imperative to the Brazilian sugarcane ethanol and bioenergy industry

Comment Summary: UNICA is a consortium that represents the Brazilian sugarcane and bioenergy industry. This comment presents an overview of emissions factors and fuel pathway inputs they urge CARB to consider in their rulemaking process; not only because there is new data and scientific literature to support the issues they have raised but to also give Brazilian biofuels a fair score in the LCFS program. Each issue is discussed in the subsequent comments below. UNICA additionally asserts that CARB should consider revising sugarcane farming inputs (fertilizer usage, agricultural yields, energy use, and industry practices) for the Simplified CI Calculator for Sugarcane-derived ethanol. These inputs are based upon the Renovabio program, and include novel approaches such as multi-cropping which is presently making a contribution to Brazilian produced ethanol but is not recognized as a practice by CARB. (45d-362.1)

Agency Response: No change was made in response to this comment. Every CI score is backed by scientifically developed emission factors which give due consideration to the science of life cycle analysis and fuel pathway assessments. If CARB is unable to recognize or adopt a novel practice, it is largely due to limited data/information or the implementation burden placed on our limited resources. We believe the recognition of such practices will only improve over time, and for those that deserve immediate attention can take advantage of our Tier 2 application process that ensures a fair, scientific, and defensible process to pathway certification.

NN-4.8 GHG Emissions (N2O and CH4) from Vinasse Transportation

Comment Summary: Vinasse is the "Bottoms" product derived from the distillation process that produces ethanol. Unica estimates an impact of 0.24 gCO2e/MJ ethanol from CH4 and N2O emissions emanating from open channel (gravity flow) transportation of vinasse (CA-GREET3.0 Model assumption). They claim such transportation strategy does not reflect either the industry practices or the regulatory conditions of vinasse logistics in Brazil. Regulations in the state of São Paulo promulgated in 2005 had established schedules for impermeabilization of vinasse tanks and channels. Furthermore, mills have also adopted systems based on closed tanks and pipes, which further reduce methane emissions during vinasse transportation. Therefore, UNICA recommends CARB disregard CH4 and N2O emissions from open channel

transport of vinasse as such conditions does not represent real practice (45d-362.5, Apr-183.4).

Agency Response: No change was made in response to this comment. Staff concurs with UNICA's assessment that truck distribution of vinasse is an ongoing practice. However, staff could not corroborate what fraction of the sugarcane industry supports this conversion. In the absence of the comprehensive industry wide data, the Proposed Amendments retain the GREET transportation modeling for vinasse transport.

NN-4.9 Allow optimization of ocean transport route

Comment Summary: Sugarcane Ethanol fuel pathway applicants are required to declare their ocean transport route for ethanol fuel exported to California. Registration of more than one route (i.e., via the Panama Canal, or Cape Horn, or via the Strait of Magellan) is not a permissible input in the Tier 1 Calculator for Sugarcane-derived Ethanol. The sugarcane mills must therefore choose the most conservative route. UNICA believes the same latitude extended to renewable diesel and RNG producers who have been awarded multiple pathways for feedstock derived from multiple locations should be extended to Brazilian sugarcane ethanol producers (45d-362.7, Apr-183.4).

Agency Response: No change was made in response to this comment. Every sugarcane-derived ethanol pathway derives sugarcane from up to 5,000 sugarcane farms. With regards to fuel transport and distribution, the route is fixed for all fuel producers; whether they be biodiesel or renewable diesel producers, RNG and LNG distributors, or hydrogen refuelers. ARB asks applicants to choose the most conservative route to minimize burdens with annual verification and potential associated CI adjustments to the fuel pathway. The fuel pathway is a "wells-to-wheels" assessment of lifecycle GHG emissions impacts, and changing the route would necessitate changing the fuel pathway.

NN-4.10 By-product optimization

Comment Summary: Commenter wants CARB to support new processes that utilize byproducts for optimal energy and their nutrient recovery properties. An example of this is the production of biogas from vinasse and filter cake, whose energy content of these residual raw materials can be extracted via the metagenesis process, without removing its nutritional characteristics, which are reused in sugarcane fields. The generated biogas can be refined to produce biomethane that can displace fossil natural gas, and reduce the carbon intensity of the fuel produced (45d-362.10, Apr-183.4).

Agency Response: CARB has always supported innovative technologies that achieve further reductions in GHG emissions thereby bringing lower carbon fuels to market. The Tier 2 fuel pathway certification process in section 95488.7 of the existing LCFS regulation is designed for this purpose. Staff encourages applicants to take advantage of the Tier 2 process.

If these processes achieve widespread adoption by a majority of the sugarcane ethanol mills, CARB could consider incorporating it into the Tier 1 application framework as part of future LCFS amendments.

NN-5 Multiple Comments: Tier 1 HEFA calculator

Comment: The Tier 1 Calculator for HEFA: The "Pathway Summary " tab has automatic column and row hiding that is difficult to manage and Neste requests that it be removed. (45d-295.13)

Agency Response: No change was made in response to this comment. Column and row hiding occurs when there are no data entries in a given column/row. This is done to improve effective visualization of the spreadsheet.

Comment: The emission factor in CARB's proposed Tier 1 Simplified Calculator for Hydroprocessed Ester and Fatty Acid Fuels for Land Transport, Barge found on Tab "CA-GREET 4.0" cell E17 of 0.0212 gCO2e/lb-mile has doubled in comparison to the same emission factor found in CA-GREET 3.0. It appears CARB has accounted for backhaul emissions from the use of barges to transport renewable feedstocks and products. Barges themselves do not generate a significant amount of emissions as they do not have main engines that propel them through the water. Barges are either tethered to a tugboat or pushed by a tugboat when transporting cargo. The 2022 Commercial Harbor Craft Regulation (CHC) includes a requirement that both tugboats and barges utilize renewable diesel while operating in California waters, or approximately 24 nautical miles from the California coastline. MPC recommends CARB discount the barge emission factor for the biogenic portion of CO2 that is produced from the use of renewable diesel in CHC transporting renewable feedstocks and products within California waters. If CARB is not able to account for this in the Tier 1 simplified calculators, MPC recommends CARB allow pathway applicants provide documentation that identifies the barge and tug utilized to transport renewable feedstocks within California waters that utilized renewable diesel. (45d-217.13)

Agency Response: No change was made in response to this comment. The barge transport emission factor includes backhaul and is consistent with the GREET1 2022 model from which the CA-GREET4.0 model is derived. In cases where a barge uses alternative fuels such as renewable diesel, the stakeholder can request CARB to approve an alternate emission factor reflecting the reduced emissions from the use of alternative fuels under a Tier 2 fuel pathway classification.

Comment Summary: CARB has applied the non-CO2 tailpipe emissions of renewable diesel to renewable naphtha and alternative jet fuel. The non-CO2 tailpipe emission factor of renewable diesel is the same as the that of the ultra-low sulfur diesel (ULSD). Petroleum naphtha and jet fuel have significantly lower non-CO2 emissions as shown in the Lookup Table documentation. Therefore, World Energy recommends that CARB revise the non-CO2 tailpipe emissions of Renewable Naphtha and Alternative Jet Fuel to match with those of CARBOB and petroleum jet fuel. (15d1-219.2)

Comment: Several changes were introduced in the tier 1 HEFA calculator. First, the GHG emissions from tailpipe from diesel increased from 0.76 to 3.5 g CO2e/MJ. This large increase is due to the higher rate of N2O emissions from diesel vehicles in the future based on the EMFAC model which are readily confirmed by running the on-line EMFAC model. While the N2O emissions from heavy-duty vehicles are likely part of another CARB comment process, the significant impact on GHG emissions is so noteworthy that the phenomenon could be

discussed. A N2O emissions increasing due to NOx controls? Is this an appropriate trade-off? Note that the increase in N2O our emissions has little effect on credit generation for HEFA diesel as the baseline will also increase and more credits will be generated from zero emission vehicles. However, the same N2O a factor is applied to SAF. There is no reason to expect N2O emissions from jet turbine engines to increase in the future as the fleet is not turning over and the core engine technology is based on combustion with high excess air rates and low N2O emissions. The solution to this calculator issues is simple. Simply add several more rows to the calculator with exhaust emissions and a total CI for each fuel product. This approach is only reasonable as each fuel product is assigned its own fuel pathway code. Since the fuel pathway code can accommodate a unique CI providing the unique CI for SAF would be a very simple solution to this issue. (15d1-180.8)

Agency Response: Conclusive data are not available on tailpipe emissions from the actual use of alternative jet fuel and renewable naphtha in airplanes and light duty vehicles. In the case of renewable diesel, emission test results suggest the tailpipe CH4 and N2O emissions are similar to those of ULSD and therefore the ULSD emission factor was applied to renewable diesel. The Proposed Amendments apply the tailpipe emission factor of ULSD to alternative jet fuel and renewable naphtha as a conservative proxy emission factor.

Comment: Finally, the tier 1 HEFA calculator allows for the use of source specific CI values for hydrogen. These CI values are based on the Tier 1 hydrogen calculator. However, they include standard values for compression and chilling. Hydrogen used in HEFA facilities which is transported by pipeline would not require the same level of compression and chilling as a hydrogen fueling station. We recommend that either these emission sources are excluded or that the hydrogen producer could provide data in the Tier 1 hydrogen calculator for HEFA supply. This level of detail is relatively straightforward and should not require a tier 2 out application. (15d1-180.9)

Agency Response: No change was made in response to this comment. The default H2 emission factors used in the Tier 1 HEFA calculator are derived from the Tier 1 hydrogen calculator using the default options for hydrogen produced using steam methane reforming. This emission factors exclude emissions from hydrogen compression and dispensing. Applicants can also use a site-specific hydrogen emission factor which will exclude compression and dispensing GHG emissions at fueling stations.

NN-6 Multiple Comments: Tier 1 Organic Waste calculator

Comment: Recommendation for Tier 1 Organic Waste (OW) Calculator: Recognize Diversity and Address N2O Emissions in all Waste Treatments

California has seen an increase in composted materials since the implementation of SB1383. However, the Tier 1 Organic Waste (OW) calculator has not been updated to reflect these changes in waste management. We suggest:

• Introducing options to indicate the percentage of Other Organic Waste (OOW) diverted from composting, in addition to landfilling.

- Incorporating user inputs for site-specific baseline CH4 emissions.
- Including user inputs for site-specific baseline N2O emissions (45d-305.1)

Comment: To accommodate the diverse nature of waste and the myriad waste management systems across California, the Organic Waste calculator would benefit from minor adjustments. We suggest:

- Introducing options to indicate the percentage of Other Organic Waste (OOW) diverted from composting, in addition to landfilling.
- Incorporating user inputs for site-specific baseline CH4 emissions.
- Including user inputs for site-specific baseline N2O emissions. (45d-313.1)

Comment: The Tier1 OW calculator is limited to CNG production via anaerobic digestion. We recommend that the calculator should apply to all fuels including hydrogen, FT jet, and others and not be limited to CNG via anaerobic digestion. Digestate from AD systems also becomes CO2 just like feedstock into gasification systems and CARB should not delay the adoption of these technologies. (45d-319.2)

Agency Response: In response to this comment staff incorporated avoided composting emissions (CH4 and N2O) in the version of the Tier 1 calculator (field 3.11) released with the First 15-day modifications package. However, it is not practical to allow user-defined baselines for methane and N2O emissions due to complexities involved in user- specific methodologies, data collection/analysis and verification.

The proposed Tier 1 H2 calculator has an option linking hydrogen production with book-and-claim of biomethane produced from various sources including anaerobic digestion. Therefore, the organic waste to hydrogen pathway has not been excluded from the Tier 1 framework. For novel pathways such as organic waste to jet fuel, applicants may submit applications under a Tier 2 fuel pathway classification.

Comment: "BAC urges CARB to correct the 45-day language on avoided methane emissions from diverted organic waste projects in the following ways:

A. Update the calculation of landfill methane leakage to reflect actual monitoring data rather than outdated estimates. The Tier 1 calculator bases avoided methane emissions on significant underestimates of landfill methane emissions from poorly controlled landfills. According to a recent study by Harvard, actual emissions at those landfills is 50 percent greater than prior estimates. CarbonMapper, using monitoring data from NASA's Jet Propulsion Lab, has found that landfill methane leakage is three times higher than reported.

To accurately account for avoided landfill emissions, it is critical to start with an accurate baseline of methane leakage at landfills." (Apr-150.7)

Comment: Part and parcel with maintaining avoided methane crediting is ensuring the Tier 1 simplified calculator for Biomethane from Anaerobic Digestion (AD) of Organic Waste (OW) accurately quantifies the carbon intensity of biomethane from landfill-diverted organics.

However, more changes to the calculator's default assumptions are necessary to match the latest science, including recent US EPA findings published in October 2023.

This value, which the EPA study itself identifies as a placeholder value in the absence of more data, has been repeatedly shown to be a severe underestimate by more recent work leveraging advanced data collection methodology in California, the US, and worldwide. A 2019 study by NASA JPL estimates that landfills' contribution to the state's methane emissions is double current estimates – approximately 41% of all methane point source emissions in California. This conclusion is supported by a report published by the Maryland Department of Energy finding that emissions from landfills were "four times greater" than previous estimates and were the leading source of methane emissions (37%) in the state.

With CARB's endorsement of EPA as standard-bearer for capture rate, this EPA-quantified value should immediately replace a previous, outdated estimate. It is critical that CARB utilize the findings of improved monitoring and analysis techniques from the last quarter-century to inform and update the default landfill GCE. We strongly urge CARB to update its 75% methane landfill capture assumption in the LCFS Tier 1 Calculator to reflect this latest EPA-published value, which clearly affirms that landfill GCE in use at the State and national levels are well below the current default assumption.

Updating the fugitive methane emission factor will more accurately reflect the avoided carbon emissions associated from biomethane produced from anaerobic digestion of landfill-diverted organic waste. (45d-043.3)

Comment: According to EPA, landfill gas when captured is not more 50%. Not all California Landfills are capped for gas. Therefore, we recommend CARB use EPA statistic and only 50% of landfill gas can be captured. (45d-258.3)

Comment: 1. Landfill Capture Rate: Landfill capture rate of 75% (1997 EPA modeling study) must change to current value of 34% backed by latest and most accurate science (EPA 2023, Science, Nature, NASA/JPL). (Apr-167.1)

Comment: Second, the 75% landfill capture rate still needs to be changed. In addition to the Oct 2023 EPA paper stating 39% landfill capture for national average this paper from Science is corroborating the same finding the landfills emit far more methane than assumed. The evidence from Nature, Science, and EPA is overwhelmingly clear - 75% is scientifically wrong. (*https://www.science.org/doi/10.1126/science.adi7735#tab-contributors*) (Apr-008.2)

Comment: 1. Landfill capture rate: still 75% (wrong figure according to multiple scientific studies, EPA and CA studies show 36% and Canadian Clean Fuel Program adopted the 36% figure to match science). Changing landfill capture rate of methane from 75% (1997 EPA incorrect number) to 36% (correct scientific number, EPA 2023, NASA/JPL Nature 2020, numerous other studies) properly values and appropriately incentivizes California food waste AD plants. The 75% is also dangerous because it sets incorrect standard and precedent for CI calculation in SB 1440. Canadian CFR has referenced the latest science and determined landfill capture rate of 36% (see slide 19 of presentation in this link:

https://drive.google.com/file/d/1OoJXYAsApJI7MDH4PyU1IGjWMLHKfonQ/view?usp=drive_lin k) (15d1-027.1)

Comment: EPA and CA satellite studies show actual landfill methane capture rates are not as high as currently included in the Tier 1 Organic Waste GREET calculator, some studies showed only 36% of landfill methane is captured, and Canadian Clean Fuel Program adopted a 36% rate. Adapting landfill capture rates of methane changing the current 75% to the latest scientific understanding would properly value and appropriately incentivize organic waste diversion into beneficial RNG. (15d1-235a)

Agency Response: Changes were made in response to these comments. Rather than relying on the existing standard 75% landfill gas capture assumption, which represents the average collection efficiency for mixed waste over the lifetime of decomposition in landfills, CARB staff applied a feedstock-specific modeling approach to determine avoided landfill methane emissions in the proposed Tier 1 CI Calculator for Biomethane from Anaerobic Digestion of Organic Waste. This modeling approach reflects component-specific degradable organic carbon content, national average decay rates, and other parameters similar to the approach used by U.S. EPA to model methane emissions attributable to food waste.⁶ However, scenarios described by U.S. EPA reflect national average installation timelines for gas collection infrastructure at landfills, which is not representative of the California regulatory context. U.S. EPA found that landfills subject to federal rules typically do not install gas collection until five years after waste is deposited (worst case scenario). In 2010, CARB adopted the Landfill Methane Regulation which included the nation's most stringent threshold for installing landfill gas collection and control systems as well as monitoring and operational requirements intended to minimize methane emissions at landfills. These requirements result in collection system installation within one to three years at controlled landfills, which collectively contain approximately 95% of historically disposed waste in the State. Therefore, the proposed Tier 1 calculator determines avoided landfill methane emissions using waste decomposition parameters that reflect national average assumptions, as well as the regulatory conditions applicable to California landfills. Calculations and data sources are documented in the proposed calculator.

CARB staff appreciate the work by U.S. EPA, NASA/JPL and others to assess, refine, and compare methodologies for estimating methane emissions across the country. The studies referenced by commenters use a variety of modeling and measurement approaches, including low-altitude aerial measurements,^{7,8} satellite-based measurements,⁹ and existing emissions modeling methods with updated assumptions or inputs.

⁶ Quantifying Methane Emissions from Landfilled Food Waste (epa.gov)

⁷ California's methane super-emitters | Nature

⁸ Quantifying methane emissions from United States landfills | Science

⁹ ACP - High-resolution US methane emissions inferred from an inversion of 2019 TROPOMI satellite data: contributions from individual states, urban areas, and landfills (copernicus.org)

Low-altitude aerial measurements (as well as many other measurement technologies, such as the use of flux chambers and, airborne mass balance) provide point-in-time estimates or "snapshots" of methane emission rates at a subset of landfills. These instantaneous observations are then extrapolated over time to estimate annual emissions, and often scaled up to represent emissions from sites that were not observed. Given the variability and intermittent behavior of landfill emissions observed in flyover campaigns and other measurement-based studies, estimates have not yet been demonstrated to be sufficiently representative for conservative for use in regulatory crediting contexts. The limitations associated with the use of various measurement technologies to quantify emissions were covered extensively during a CARB workshop in December 2022.¹⁰

Satellite-based monitoring has the potential to address the shortcomings of low-altitude flyover measurements by providing more frequent observations of methane emissions. Through the *California Satellite Partnership* and \$100 million the State allocated for the *purchase of methane plume satellite data*, CARB plans to utilize this technology to enable rapid leak detection and mitigation of large leaks from landfills and other methane sources. However, landfill emissions tend to behave as diffuse sources (i.e., low concentrations of methane emitted over a large surface area), presenting a challenge for the use of this technology for crediting quantification purposes given the expected methane detection limit of approximately 100 kilograms per hour.

Given the limitations of existing measurement-based estimation approaches, staff have determined that a model-based approach provides the most reliable option for conservatively estimating avoided methane emissions for LCFS crediting at this time.

NN-7 Multiple Comments: Tier 1 calculator for biogas to electricity pathway

Comment: We thank CARB for developing a book and-claim pathway for biomethane to EV charging, and respectfully request an amendment to expand the eligibility to allow book-and-claim for biomethane via renewable natural gas and hydrogen (meeting all appropriate deliverability and other requirements) used by offsite systems generating electricity exclusively for EV charging services as well. (45d-282.1)

Mainspring recommends that the biogas-to electricity book-and-claim pathway for EV charging should be transitioned to a Tier 1 pathway to meet California's/CARB's (e.g. ACF) EV targets. (45d-282.2)

Comment: Tier 1 Calculator for Biogas-to-Electricity. For certain fuel pathways the LCFS currently provides Tier 1 CI calculators that help to streamline the application review and validation process. As part of the proposed amendments, Staff proposes to update the calculators to increase usability and further reduce administrative burden on applicants and agency staff. Additionally, the proposed amendments would create a new Tier 1 CI calculator

¹⁰ Public Workshop: Landfill Methane Emissions in California | California Air Resources Board

for hydrogen. While the Staff Report justifies the existing Tier I option due to extensive experience reviewing certain pathways, no such claim can be made of hydrogen, which is relatively new and still emerging. This acknowledges the benefits of streamlining without risking the integrity of an existing and robust process. Bloom supports both of these proposals and the Tier 1 calculators in general. Additionally, we respectfully request that a Tier 1 calculator or other streamlining option be made available for biogas-to-electricity projects. Given the fact that this option is already available for RNG, this would help to provide equal treatment for pathways dependent on the same feedstock. (15d1-062.5)

Agency Response: Changes were made in response to this comment. Efficient and non-combustion power technologies such as solid-oxide fuel cell are emerging which have potential to generate electricity from biomethane for EV charging with significantly lower air pollution than traditional combustion technologies. Therefore, the Proposed Amendments as modified include a new temporary pathway CI for electricity produced from fuel cell using dairy/swine manure biogas as feedstock in support of such innovative and non-combustion gas-to-power technologies. In Resolution 24-14, CARB directed staff to monitor the need for new provisions that accelerate the deployment of new technologies that support low-carbon electricity for electric vehicle charging in the near-term, such as linear generators.

NN-8 Support Tier 1 calculators

Comment: Chevron applauds CARB's work to establish a Tier 1 calculator for hydrogen pathways. This will greatly increase speed to market implementation. CARB's incorporation of feedback from industry is appreciated as well. This enables a more accurate and realistic approach from the beginning. (45d-048.4)

Agency Response: Staff appreciates the support for Tier 1 calculators for alternative fuels including hydrogen.

NN-9 VOC emissions from biogenic sources

Comment: We wish to draw attention to an issue regarding the treatment of biogenic VOC emissions within the ethanol production and T&D phases, which have been incorrectly categorized as fully oxidized GHG emissions. Both the prior and current versions of GREET have incorporated fugitive VOC emissions as fully oxidized GHG emissions, thereby adding to the carbon intensity of corn ethanol's well-to-tank phase. Such miscalculation within GREET1 models has carried forward to CA-GREET models as well, permeating this issue to CA LCFS. (45d-318.1)

Agency Response: Changes were made in the Tier 1 calculator for starch/fiber ethanol in response to this comment by removing the GHG contribution of VOC emissions (evaporative emissions) from ethanol production in the formula used to calculate ethanol carbon intensity. The LCFS program treats biogenic VOC emissions as carbon neutral. If the applicant wishes to modify the CA-GREET4.0 model to calculate life cycle GHG emissions of novel pathways, a Tier 2 fuel pathway applicant may propose to remove any GHG contributions of biogenic VOC emissions from the GHG emission calculations for CARB review and approval.

NN-10 Avoided N2O emissions in Tier 1 calculators

Comment: The LCFS has proven one of the most powerful programs in the world for reducing potent short-lived climate pollutants. It similarly can be applied to reduce even more potent N2O emissions. Tier 1 calculators, especially for organic waste, should include accounting for avoided N2O emissions. (Apr-026.6)

Agency Response: No change was made in response to this comment. The Tier 1 calculator for Organic Waste includes avoided N2O emissions from composting. Also see the response to KK-8 Avoided N2O emissions from agriculture.

OO. Fuel Pathways – General

OO-1 Pathway retirement

Comment: Expiring Fuel Pathways. Consistent with WSPA's prior comment letters, WSPA urges CARB to keep pathway codes active for two quarters after their expiration date. Under the current LCFS Regulation, regulated entities can sell volumes up to two quarters after purchasing them. CARB should keep these pathway codes active for two quarters after their expiration date, to allow for follow-on downstream activity to be reported. Any new production would not be allowed to be reported during those two quarters. This would eliminate a substantial amount of ongoing rework when downstream parties report a legitimate resale of a pathway purchased, only to find later that CARB has deactivated it. (45d-241.16)

Agency Response: No changes were made in response to this comment. CARB updates the CI score for a pathway when it is either replaced by a newer pathway under a different application or following Annual Fuel Pathway Report (AFPR) verification that results in a new verified CI score. In both cases, CARB retires the old pathway score to ensure it cannot be used beyond its designated CI end date.

The Western States Petroleum Association's (WSPA) suggestion raises concerns because it would result in a discrepancy between the published CI end date and the actual retirement date. This inconsistency could confuse fuel providers who rely on the published end date for business planning. Additionally, it could prevent entities from retiring pathways when desired or from ceasing their reporting obligations if they close their business. Accurate CI end dates are essential to ensure compliance and prevent unnecessary Low Carbon Fuel Standard (LCFS) reporting.

For WSPA members who conduct transactions two quarters downstream, the CI end date can typically be anticipated for AFPR-reported pathways as December 31 of the reporting year. For pathways replaced under a different application, the pathway holder should promptly notify business partners about the replacement. In both cases, there are no gaps in the effective periods of the old and new pathway codes. For example, an AFPR-reported pathway typically expires on December 31 of the AFPR reporting year (the year following the data year shown in the AFPR), with the new pathway code becoming effective immediately on January 1 of the following year. Pathway codes and CI scores maintain continuity unless a pathway is fully retired.

All transactions must use the most current pathway information. If a pathway expires at the end of a transaction period, the replacement pathway code should be used in subsequent transactions. Using expired codes for reporting could result in inaccurate credit or deficit calculations. Fuel volumes transacted two quarters after purchase must align with the latest fuel codes and CI scores.

Currently, the Fuel Pathway Code (FPC) tab in the LRT or AFP provides a comprehensive list of pathways, including their FPC code generations, CI scores, effective periods, and descriptions. This resource should be referenced when planning future fuel transaction reporting. An exportable file is also available for distribution to downstream reporting entities.

To further enhance clarity and efficiency, CARB could consider developing LCFS program data system updates that provide live updates on the latest FPC codes and CI scores. Such enhancements would ensure that expirations and replacements are clearly communicated, reducing reporting errors and minimizing rework.

OO-2 Tier 1 fuel pathway classification

Comment: The classifications list different fuel pathways for hydrogen but does not list biomass gasification to hydrogen. The omission of renewable hydrogen from biogenic sources also slows our efforts to capture methane emissions. In 2016, the Legislature adopted, and Governor Brown signed the Short-Lived Climate Pollutant Strategy requiring deep emissions reductions. According to the 2020 Lawrence Livermore "Getting to Neutral" analysis, there are fifty-six million bone dry tons of organic waste produced per year and "gasifying biomass to make hydrogen fuel and CO2 has the largest promise for CO2 removal at the lowest cost and aligns with the state's goals on renewable hydrogen". The State has also funded projects to utilize forest waste for hydrogen generation (through the Department of Conservation) to help meet its wildfire reduction and clean energy goals, but this proposal would exclude those projects from permit streamlining and other incentives. This policy package should be expanded to ensure these facilities qualify for fuels production thus incentivizing development with as much offtake as possible.

Recommendation: Include biomass gasification in this section. (15d1-245.26)

Agency Response: No change was made in response this comment. The Tier 1 hydrogen calculator includes steam methane reforming and hydrogen pathways since these are mature technologies and staff have sufficient knowledge and data to model these pathways for the Tier 1 calculator. CARB recognizes that biomass gasification can be one potential option for producing low-CI hydrogen and has included it in the definition of renewable hydrogen. However, thus far there have been no LCFS applications for hydrogen production through biomass gasification. Therefore, staff has not included this pathway in the Tier 1 calculator due to limited knowledge and available data. Fuel producers can still apply for a biomass-derived hydrogen pathway under a Tier 2 fuel pathway or Design-based Pathway classification and therefore are not precluded from participating in the LCFS program. Tier 2 pathway or Design-based Pathway review and certification will build staff's knowledge-base with regard to

biomass gasification pathways and will make a Tier 1 pathway option more likely in the future.

OO-3 Maintaining fuel pathways

Comment: For the Modifications to Section 95488.10—Maintaining Fuel Pathways, clarification on how great of a CI difference is considered critical to trigger this issue. If 1 or less, it means that the verified CI must be higher than any variability in process operations that impact CI. (15d1-213.9)

Agency Response: The CI score is considered to be significant up to two decimal places. Therefore, as long as the CI difference between the verified operational CI and the certified CI lies within the two decimal places, it will trigger a credit true up or credit adjustments/deficit obligation depending on whether the verified operational CI is lower or higher.

OO-4 Multiple Comments: Tier 2 fuel pathway descriptions

Comment: CARB Should Expressly Include Alcohol-to-Hydrocarbons in the Tier 2 Classification Provisions (§95488.1(d)(4)): While Gevo understands that the Tier 2 pathway classification is not limited to the production processes listed in this section of the proposed regulation, we are concerned that the omission of the alcohol-to-hydrocarbon conversion process might be misread as an exclusion. Therefore, as noted in our February 20 comments, we suggest that CARB revise the language associated with Tier 2 classification to explicitly mention alcohol-to-hydrocarbon conversion technology, as follows (proposed addition underlined and bolded, while the strikethroughs are in CARB's proposal):

(4) Drop-in fuels (renewable biomass-derived hydrocarbons using processes such as gasification and pyrolysis, synthetic hydrocarbons, and <u>alcohol to hydrocarbon conversion</u>) except for renewable diesel hydrocarbon fuels produced from feedstocks described in section 95488.1(c)(3). This category includes fuels produced from low carbon feedstocks co-processed with fossil feedstocks in petroleum refineries; (Apr-078.4)

Comment: On the other hand, in subsection 95488.1(d)(4), we strongly support the proposal to add "alcohol to hydrocarbons" to the illustrative list of drop in fuels, in order to clarify that drop in fuels include hydrocarbon fuels (e.g., sustainable aviation fuel (SAF)) derived from alcohols. A robust SAF market is absolutely critical to decarbonize aviation. Adding additional sources of SAF beyond lipids is prudent and smart policy. (15d1-236.9)

Agency Response: Staff made a minor edit to specify alcohol to hydrocarbon conversion in the definition of drop-in fuels. This helps clarify that alcohol to hydrocarbon pathways such as corn ethanol to alternative jet fuel will be modeled as a Tier 2 fuel pathway.

OO-5 Multiple comments: Miscellaneous fuel pathway issues

Comment: In addition, we wish to express our deep concern with and opposition to the numerous ways that the LCFS will incentivize the conversion of municipal solid waste (MSW) into fuel, particularly MSW containing plastic. Data show that the two most common technologies used for such conversion will be pyrolysis and gasification4, both of which are

regulated as incineration under federal law.5 While the emissions from pyrolysis and gasification are concerning no matter what the feedstock, they are particularly toxic when the feedstocks include plastic—either directly or as a component of MSW. According to the Environmental Protection Agency's most recent data (2018), plastics typically comprise over 12 percent of municipal solid waste.

Pyrolysis and gasification emit hazardous air pollutants including benzene, toluene, styrene, formaldehyde, ethyl benzene, and dioxans/furans when they incinerate plastic. Pyrolysis and gasification facilities also generate large amounts of hazardous waste; one pyrolysis facility alone generated 484,000 pounds of hazardous waste in 2019.

Pyrolysis and gasification facilities tend to be located in communities that are disproportionately low income, people of color, or both.9 If the LCFS is incentivizing the building of new pyrolysis and gasification incinerators in California (and/or elsewhere), they will most likely be sited in environmental justice communities. These communities will bear the brunt of the toxic impacts of the hazardous air pollutants and waste that is generated.

In summary, to protect the health of California communities and prevent the building of large numbers of new incinerators, we urge CARB to (1) finalize the strike-out of the previously proposed language that explicitly and inappropriately excluded plastics from the definition of petroleum products in the LCFS; and (2) remove incentives for the conversion of municipal solid waste to fuel, especially when this conversion involves pyrolysis or gasification. (15d1-83.2)

Agency Response: The Proposed Amendments are not incentivizing pyrolysis and gasification of plastics in California or elsewhere. Staff adjusted the specified source feedstocks in section 95488.8(g)(1)(A) to incentivize fuel production from the organic portion of municipal solid waste and not plastics. Pyrolysis and gasification are not currently being utilized for certified fuel pathways in California, but could potentially be a useful technology for producing low-carbon fuels that displace fossil fuels, and which reduce methane emissions by diverting organic waste from landfills.

Comment: We also express our gratitude for your engagement and support for DME and we note with pleasure the inclusion of DME on Table 4. Energy Densities and Conversion Factors for LCFS Fuels and Blendstocks. (15d2-278,2)

Agency Response: No change was made in response to this comment. Staff notes the appreciation for including DME energy density in Table 4.

Comment: research that is used in making renewable diesel or SAF, by employing solar-powered hydrolysis. (15d1-239.16b)

Comment: by subsidizing algal biofuels production and research. (15d1-239.17)

Agency Response: No changes were made in response to these comments. The LCFS supports fuel pathway applications for renewable diesel or SAF produced using hydrogen from electrolysis powered by solar electricity provided that electricity is supplied behind the meter. Likewise, the LCFS allows application submission for algae-derived fuels under a Tier 2 classification.

Comment: subsidize green hydrogen production (15d1-239.16a)

Comment: Incentivizing more production of clean fuels needed in the future, such as low-carbon hydrogen;

I noticed you don't speak about nuclear power? Why not, I live near a recently shut down nuclear power plant. What a mess up that was shutting it down. To do SOME of the things you want done would require...that is right doing more than one thing at once...explore nuclear power and the mini versions of it. Additionally, why do WE have to pay for this, if it is a great idea all around, then the private sector would jump on it with less bureaucracy, fraud, waste, abuse with "programs" or "contracts". But, certainly, explore low-carbon hydrogen. (BH-071.5)

Agency Response: No change was made in response to this comment. The proposed regulation offers incentives for low-CI hydrogen by introducing a Tier 1 hydrogen calculator and incorporating book-and-claim of low-CI electricity/biomethane for hydrogen production as well as book-and-claim of low CI hydrogen. Nuclear power used to generate low-CI hydrogen may be eligible to participate in the LCFS program under a Tier 2 classification (section 95488.7) provided that the applicable provisions for low-CI electricity and application requirements are met.

Comment: Additionally, CARB markedly underreports renewable diesel's refinery-level per barrel hydrogen requirements and per barrel CO2 GHG emissions, as clearly evidenced by the Contra Costa County Environmental Impact Report data, published after CARB approval. (15d1-239.11)

Comment: Renewable Diesel Refinery Emissions and Higher Per Barrel Carbon Intensity: The Environmental Impact Reports (EIRs) for the Contra Costa County refineries' shift to renewable diesel production reveal that the process nearly doubles the hydrogen requirements and CO2 greenhouse gas emissions per barrel compared to the two refineries' traditional heavy petroleum diesel. Given this information:

How does CARB justify disregarding renewable diesel's substantial increase in refinery-level per barrel hydrogen needs and per barrel carbon intensity, compared to during the refineries' previous petroleum refining operations? (15d1-239.24)

Agency Response: No change was made in response to these comments. Applicants are required to report actual hydrogen use data for the purpose of fuel pathway review and certification. All relevant GHG emissions in the life cycle of renewable diesel are accounted for when certifying renewable diesel pathways and all emissions are included as part of annual fuel pathway reporting and verification.

PP. Temporary Fuel Pathways

PP-1 Multiple Comments: Establish new temporary fuel pathways

PP-1.1 Multiple Comments: *Temporary fuel pathway CI for biogas for biogas to electricity*

Comment: Currently there is no temporary pathway for electricity generated from dairy or swine manure. The LCA inputs for this type of project are very similar to biomethane CNG and

LNG from dairy and swine manure, which received a temporary pathway of -150 in the 2018 updates. As of January 2024, there were 24 dairy manure-to-electricity Tier 2 pathways with certified CIs of between -353 and -790. It should be possible for ARB staff to follow the methodology outlined in Appendix E: Purpose and Rational for LCFS Amendments, page 74 and determine a pathway of -330 gCO2/MJ for electricity from dairy and swine manure. Project owners commencing new manure to electricity projects may have to wait two years for provisional CI pathway approval resulting in significant lost revenues (see previous comment). Permitting these projects to use a temporary pathway while waiting would help to mitigate this impact, remove a disincentive to generate electricity versus CNG from animal waste and support the continued growth of the EV sector. (45d-160.3)

Comment: It is of great concern to CalBio that no Temporary CI exists for Dairy Biogas-to-Electricity pathways has been established in the LCFS since the program's inception and that CARB has not sought to correct for this in the proposed amendments. The failure to include this provision discriminates and disadvantages in-state dairy digester projects which contribute to California's SB 1383 goals and provide renewable electricity as a grid resource and transportation fuel. As referenced in the ISOR and guoted in CalBio's comments under topic #2 above, one of the primary purposes of the LCFS regulation is to incentivize the production of low-carbon and renewable alternatives, such as low-CI electricity. CARB should correct this oversight given dairy biogas-to-electricity pathways fully reduce methane in the same manner as dairy biogas-to-RNG pathways and thus should be treated equally. Project economics for dairy biogas-to-electricity are generally more challenging than RNG projects given they are currently not eligible to parŸcipate under the RFS program or BioMAT. Failure to allow electric projects to receive a Temporary CI score further exacerbates the concerns expressed in CalBio's comments under topic #3 by preventing beneficial projects from receiving revenue until the provisional certification is achieved, a process which can last several months to years. It should be noted that CalBio has made significant financial investments in cleaner electricity generating technologies such as Bloom Fuel Cells and Mainspring Linear Generators which convert methane into electricity without combustion. These technologies should alleviate concerns around NOx emissions associated with internal combustion engines. CalBio would be supportive of CARB unlocking the Temporary CI for dairy biogas-to-electricity if it meant requiring the use of a non-combustion technology such as a fuel cell or linear generator. (45d-288.7) (Apr-155.8)

Comment: For small facilities looking for a simple way to participate in the LCFS, CARB could offer a Lookup Table Pathway option, with a CI score set at the lower of the score of the highest currently approved dairy manure to electricity fuel pathway in the program or 0. After ensuring that facilities meet a minimum eligibility criteria, projects would then be able to be approved for immediate participation into the program. (45d-356.1)

Comment: No temporary CI exists for dairy biogas-to-electricity pathways, which arbitrarily disadvantages dairy digester projects contributing to California's SB 1383 goals and providing renewable electricity for EV charging. The lack of a temporary CI for these pathways adds unnecessary costs and delay to these projects, which are already more challenging than other dairy biogas pathways given that they are not currently eligible to participate in the federal Renewable Fuel Standard. Dairy biogas-to-electricity pathways directly align with the priorities of the LCFS, program, which as referenced in the ISOR and quoted in previous comments,

include supporting electric and hydrogen truck refueling, supporting methane emissions reductions and deploying biomethane for best uses across transportation. (15d1-240.12)

Comment: No temporary CI exists for dairy biogas-to-electricity projects and CARB's failure to correct this discriminates and disadvantages the use of Low-CI electricity in electric vehicles. CARB staff must remedy this oversight by establishing a temporary pathway for biogas-to-electricity with dairy manure or swine manure feedstock. Because biogas-to-electricity from dairy manure projects consistently have a lower (more negative) CI than bio-CNG, CleanFuture suggests a temporary CI of -200 gCO2e/MJ for these biogas-to-electricity projects. (15d1-243.1)

Comment: Unfortunately, with no temporary CI for Dairy Biogas-to-Electricity, these projects are ineligible to be retroactively credited and are further disadvantaged. They are also exempt from the Tier 1 pathway approach since no Tier 1 GREET model was developed for electric projects. This means that biogas-to-electricity projects are subject to approximately two years of review time and therefore two years without credit generation and are denied a True-up as a temporary pathway. (15d1-243.3)

Comment: 5. Establish a Temporary CI for Dairy Biogas to Electricity

It is of great concern to CalBio that no Temporary CI for Dairy Biogas-to-Electricity pathways has been established in the LCFS since the program's inception and that CARB has not sought to correct for this in the proposed amendments. The failure to include this provision discriminates and disadvantages in-state dairy digester projects which contribute to California's SB 1383 goals and provide renewable electricity as a grid resource and transportation fuel. As referenced in the ISOR and quoted in CalBio's comments under topic #4 above, one of the primary purposes of the LCFS regulation is to incentivize the production low-carbon and renewable alternatives, such as low-CI electricity.

CARB should correct this oversight given dairy biogas-to-electricity pathways fully reduce methane in the same manner as dairy biogas-to-RNG pathways and thus should be treated equally. Project economics for dairy biogas-to-electricity are generally more challenging than RNG projects given they are currently not eligible to participate under the EPA's Renewable Fuel Standard program or participate in the LCFS and BioMAT simultaneously. Failure to allow electric projects to receive a Temporary CI score further exacerbates the concerns expressed in CalBio's comments under topic #3 by preventing beneficia projects from receiving revenue until the provisional certification is achieved, a process which can last close to two years.

It should be noted that CalBio has made significant financial investments in cleaner electricity generating technologies such as Bloom Fuel Cells and Mainspring Linear Generators which convert methane into electricity without combustion. These technologies should alleviate concerns around NOx emissions associated with internal combustion engines. CalBio would be supportive of CARB unlocking the Temporary CI for dairy biogas-to-electricity if it meant requiring the use of a non-combustion technology such as a fuel cell or linear generator. (Apr-155.8)

Comment: Finally, we urge CARB to establish a temporary CI pathway for biogas-to-electricity projects, as the absence of such a pathway currently puts biogas-to-electricity at a

disadvantage compared to biomethane projects, which already have access to temporary CI pathway. (14d-052.7)

Comment Summary: Bioenergy Association of California supports creation of a temporary fuel pathway for dairy biomethane to electricity conversion. A temporary CI for biomethane to electricity pathways will enable transition to zero emission vehicles by giving a value to biomethane producers. (15d1-136.7)

Comment: We would also encourage CARB to consider making high-efficiency (> 40% electrical efficiency), low-NOX ICE genset projects that break ground during 2025 eligible for a temporary CI for projects as a practical transition to the non-combustion future, noting solid oxide fuel cell production is just getting geared up and will generally not be available until 2026 or 2027. (15d2-202.3)

Comment: CalBio appreciates CARB's recognition of innovative non-combustion electric generation technologies, such as fuel cells, within the "book & claim" framework of the LCFS program. Moreover, the inclusion of temporary pathways for dairy biogas-to-electricity is crucial in ensuring that these advanced technologies can contribute meaningfully to emissions reductions. This support for innovative non-combustion electric generation technologies is consistent with Public Resources Code AB 1921 which was moved through the legislature and recently signed by the Governor. (15d2-215.4)

Comment: Newtrient would also like to express our approval of the addition of a temporary pathway for low carbon intensity (CI) electricity produced by a fuel cell from biomethane from dairy or swine manure as well as the clarification on the temporary fuel pathway for hydrogen produced from dairy or swine biomethane. Similarly, the 15-day changes propose to allow for book-and-claim accounting of biomethane to produce electricity for electric vehicle charging, but only if the electricity generated is from a fuel cell. Both modifications increase the application of biomethane beyond its traditional uses in other technologies. Recognizing the importance that biomethane has in advancing non-combustion technologies is a critical part of the energy transition and will help California meet its climate goals. Newtrient would suggest that the pathway language could be more inclusive recognizing "non-combustion technologies" in general instead of specifying only "fuel cell technology". (15d2-260.2)

Comment: We support a new CI for low-CI electricity produced by fuel cell from biomethane. It is crucial that as technology advances, we will be facing different and increased opportunities in the coming years than we see today. It is critical that we not tie our hands tomorrow in any decisions made today. (15d2-291.5)

Agency Response: Changes were made in response to these comments. The Proposed Amendments as modified include a new temporary pathway CI for electricity produced from fuel cell using dairy/swine manure biogas as feedstock in support of this innovative and non-combustion gas-to-power technology. By considering that the biomethane from dairy and swine manure receives a temporary pathway of - 150 gCO₂/MJ and approximate 50% efficiency of fuel cell, -300 gCO₂/MJ is considered a conservative temporary CI for electricity produced from fuel cell. Staff believes that this addition increases flexibility for biomethane projects to produce low-CI electricity

and supports California's zero emission vehicle goals, while also prioritizing electricity generated using non-combustion technology.

Comment: Establish temporary carbon intensity scores for biomethane-to-electricity and hydrogen-to-electricity EV charging pathways. (15d1-204.4)

Comment Summary: The commenters recommend CARB to establish a temporary carbon intensity (CI) for biogas-to-electricity pathways and hydrogen-to-electricity pathways such electricity generated from hydrogen using fuel cells and linear generators. (15d1-204.4, 15d1-204.12, 15d1-204.13)

Comment: Additionally, the ABC would like to express our approval of the addition of a temporary pathway for low-carbon intensity (CI) electricity produced by a fuel cell from biomethane from dairy or swine manure as well as the clarification on the temporary fuel pathway for hydrogen produced from dairy or swine biomethane. It is also our understanding that, in principle, the addition of this temporary pathway utilizing fuel cell technology is about uplifting non-combustion technologies, thus supporting other innovative, non-combustion technologies such as linear generators operating on renewable fuels. Similarly, the 15-day changes propose to allow for book-and-claim accounting of biomethane to produce electricity for electric vehicle charging, but only if the electricity generated is from a fuel cell. Both of these modifications increase the application of biomethane has in advancing non-combustion technologies, such as fuel cells, is a critical part of the energy transition and will help California meet its climate goals. (15d2-256.4)

Agency Response: Staff created a new temporary fuel pathway for dairy-biogas to electricity produced using fuel cells in response to this comment and similar other comments (see response PP-1). At this time, staff is not proposing creating temporary fuel pathway CIs for hydrogen to electricity pathways because such projects are expected to be less common. Staff will continue to monitor the prevalence of hydrogen to electricity and will consider proposing any temporary fuel pathways CIs in the future through the specified process if appropriate.

Comment: Promus requests that CARB include linear generators as eligible generation technology for a temporary CI pathway. Linear generators are a non-combustion technology that meet the strictest air emission requirements in CA. This is backed up by extensive publicly available data from dozens of source tests. The recently signed AB 1921 recognizes linear generators in addition to fuel cells as renewable power technology that complies with CA's Renewable Portfolio Standard program. To ensure consistency across programs, CARB should make linear generators put linear generators on equal footing with fuel cells. Promus proposes that CARB replace "fuel cells" with "fuel cells or linear generators" in the final rule language to ensure that they receive the same treatment in the LCFS program. (15d2-202.2)

Agency Response: No change was made in response to these comments. With regard to the reason behind the exclusion of linear generators from the temporary fuel pathway list, see response L-7.

Comment: ...we ask CARB to consider developing a temporary fuel pathway code for ethanol with CCS. (45d-312.1)

Comment: Establish a temporary fuel pathway code that has a safety margin for carbon neutrality. Create a temporary fuel pathway code for biomass fuels and fuel production with CCS. (15d1-195.2)

Agency Response: No change was made in response to the comment. Carbon capture and sequestration (CCS) will be integrated into the existing ethanol facilities, which in most cases already have certified ethanol pathways to report in the LCFS program during the period in which CCS ethanol pathway applications are being processed. If an ethanol plant adds CCS technology to its process, the corresponding CI will be reduced, either through a new fuel pathway application or potentially through annual verification. Note that applicants can also request that CARB issue a new temporary for the ethanol CCS pathway pursuant to section 95488.9(b) of the LCFS regulation. Applicants need to obtain permanence certification from CARB as specified in section 95490 before a fuel pathway involving CCS (temporary or Tier 2 fuel pathway) can be certified for credit generation.

Comment: TES recommends CARB develop either a Temporary or Tier 1 pathway for synthetic fuels or e-fuels that convert CO2 to common products (e.g., methane, methanol, liquid hydrocarbon fuels). This would help support technology developers and fuel producers to bring these low-CI, drop-in fuels to market, thereby accelerating California's transition away from fossil fuels. (45d-325.3)

Comment: TES would like to note that the current LCFS regulation does not include any Tier 1 or Temporary fuel pathways specific to synthetic natural gas or other e-fuels with CO2 conversion. TES recommends CARB develop either a Temporary or Tier 1 pathway for synthetic fuels or e-fuels that convert CO2 to common products (e.g., methane, methanol, liquid hydrocarbon fuels). This would help support technology developers and fuel producers to bring these low-CI, drop-in fuels to market, thereby accelerating California's transition away from fossil fuels while minimizing overall cost of infrastructure development." (Apr-064.4)

Agency Response: No change was made in response to the comment. The synthetic fuel (e-fuel) pathway technologies that produce synthetic fuels (methane/liquid hydrocarbon) from captured CO2 and hydrogen have not been fully commercialized yet. Given their novelty, limited available data and understanding of the processes, staff did not develop a temporary CI or Tier 1 pathway at this time. However, fuel producers may request that CARB develop a new temporary fuel pathway for synthetic fuel (e-fuels) pursuant to section 95488.9(b) of the LCFS regulation. Given the possibility for growth of e-fuels in the future, Board Resolution 24-14 also directs the Executive Officer to, "continue to monitor the development and commercialization of electrofuels ("e-fuels") for inclusion in the next Scoping Plan Update and a potential future LCFS update."

Comment: Temporary Alternative Jet Fuel Pathways Should Include a Specific Corn Starch ATJ Pathway (§95488.9(b)). (Apr-078.2)

Agency Response: No change was made in response this comment. The starting feedstock for this alternative jet fuel is corn ethanol. The approved temporary fuel pathway CI for corn ethanol is 90g CO2e/MJ. There are additional processing emissions to convert ethanol to jet fuel. Therefore, it is likely that a proposed temporary fuel

pathway CI for a corn ethanol (without CCS) to alternative jet fuel pathway would have been greater than 100 gCO2e/MJ. Because this would be a deficit generating pathway, staff believes that reporting of this fuel under a temporary pathway is unlikely.

Comment: Tier 1 Hydrogen Calculator Process – Retroactive Crediting Regulation: 95488.9.(b) Temporary Fuel Pathways

Concern: CARB has proposed a new Tier 1 Calculator for hydrogen, however, applicants need to provide three months of production data to apply for the new pathway. As a result, applicants can only apply for a Tier 1 pathway three months after production begins.

We understand that due to the length of the approval process, which may be estimated between 4-12 months, CARB has proposed a new temporary pathway for electrolytic hydrogen that meets a CI of 55gCO2e/MJ (6.6kg CO2/kg H2). Although applicants can use temporary pathway, while awaiting CARB approval of official pathway, our concern is that the CI identified is high for the temporary pathway and therefore applicants could lose the opportunity to claim LCFS credits when using the high CI from the temporary pathway versus if they were able to use their lower CI pathway from the start of production.

Recommendation: Fortescue appreciates CARB's creation of the temporary pathway to alleviate wait times and proposes that CARB provide retroactive credits for any underestimation of LCFS credits resulting from using the temporary CI, should the CI from the temporary pathway be higher than the CI approved after the full application process. This approach would ensure fairness and encourage early hydrogen adoption while maintaining the integrity of the final CI determination process. (BH-088.2)

Agency Response: No change was made in response to this comment. The temporary fuel pathway CIs including the proposed temporary fuel pathway CI for electrolytic hydrogen are, by design, meant to be conservative CIs. The methods for developing the temporary fuel pathway CIs are described in the Initial Statement of Reasons. The proposed credit true up for temporary fuel pathways allow the fuel pathway holder to recover surplus credits if the verified operational CI is lower than the corresponding temporary fuel pathway CI.

PP-2 Multiple Comments: Clarification on calculation of proposed temporary pathway Cls

Comment Summary: The commenters seek clarifications on how the proposed temporary pathway CIs were derived. (45d-241.59, 45d-295.9)

Agency Response: No change is made in response to these comments. The details on how the proposed temporary fuel pathway CIs are developed are provided in the Initial Statement of Reasons. See Section 95488.9(b) Temporary Fuel Pathways (pages 74-74), Appendix E: Purpose and Rationale for Low Carbon Fuel Standards Amendments.¹¹

¹¹ <u>Appendix E: Purpose and Rationale for Low Carbon Fuel Standards Amendments</u>

QQ. Deemed Complete Date

QQ-1 Moving deemed complete date

Comment: In section (b)(2)(A), the deemed completed date should remain when CARB approved the submission, before the fuel pathway application is routed to the third-party verifier. Otherwise, submission, before the fuel pathway application is routed to the third-party verifier. Otherwise, the fuel pathway applicant will likely need to report for an extra quarter with the temporary CI. (45d-241.14)

Agency Response: No change was made in response to this comment. Due to Tier 1 calculator model updates, most applications are expected to fall under a Tier 1 classification. Staff also proposed to expand the credit true up provision to include temporary fuel pathways. Therefore, alignment of the deemed complete date for Tier 1 and Tier 2 fuel pathway applications will streamline the application process while not adversely impacting credit generation.

RR. Margin of Safety

RR-1 Implement a quantitative variability approach to margin of safety

Comment: Application of a Margin of Safety

- Oregon CFP has adopted a quantitative variability approach to determine a margin of safety for their fuel pathways, requiring pathway holders to submit their quantitative variability analysis to support the margin of safety election.
- We find that the quantitative approach under the Oregon CFP may be an appropriate framework for calculating the conservative margin of safety "of a magnitude determined by the applicant", within California's LCFS.
- We recommend inclusion of a similar provision to prevent election of overly conservative MOS as a way to entirely avoid CI non-conformance while creating a significantly large true-up accounting burden on CARB. (45d-306.2)

Agency Response: No change was made in response to this comment. Fuel pathway holders may determine and request to add an appropriate margin of safety for their pathway(s). Fuel pathway holders may use whatever method they prefer to determine a margin of safety, including the suggested method.

SS. Credit True Up

SS-1 Multiple Comments: Support credit true up proposal

Comment Summary: These commenters support inclusion of credit true up of Tier 1 and Tier 2 fuel pathways following annual verification. (45d-199.3, 45d-201.3, 45d-363.8, 45d-320.4, 45d-171.5, 45d-165.2, 45d-160.2, 45d-240.18, 45d-092.5, 45d-211.5, 45d-232.7, 45d-187,4, Apr-078.8, Apr-069.6, Apr-079.21, Apr-098.7, Apr-101.5, Apr-180.6, Apr-160.4, 15d1-212.5, 15d2-219.6)

Agency Response: No changes were made in response to these comments. Staff appreciates the support for the credit true up proposal.

This proposal would reduce any incentive for applicants to re-apply for minor changes in CI because credit true ups would eventually award additional credits beyond the initially reported CI due to CI improvements following annual verification. The addition of true ups may also reduce credit adjustments and enforcement proceedings following annual verification because the proposal should strengthen the signal to fuel pathway holders that they should add a conservative margin of safety to their operational CI. Associated program administrative efficiency improvements could improve staff availability to review novel fuel pathways.

Comment: Finally, we reiterate our support for the proposed true-up mechanism and request that CARB allow adjustments as needed, and at a minimum, quarterly, to the margin of safety ("MOS") that a pathway may apply as operational data becomes available. This will allow a pathway holder to adjust a CI proactively to prevent a CI exceedance. We also request that an MOS be allowed for temporary Cls. (152d-172.7)

Agency Response: No change was made in response to this comment. A Margin of Safety (MOS) can be added at the time of initial pathway certification if requested by fuel pathway applicants. Fuel pathway holders may also request to add an MOS after the completion of annual verification. Frequent adjustments to the pathway CI (e.g. quarterly) are not recommended because it could result in multiple reportable pathways for the same feedstock combination in a given compliance year, which could increase annual fuel pathway report complexity and verification cost. Because the Proposed Amendments include both credit true up and a deficit obligation associated with for verified CI exceedances, the strong signal encouraging fuel pathway holders to add a conservative MOS should make frequent changes to MOS should be unnecessary.

Comment: Credit True Up After Annual Verification

MRL strongly supports the proposed amendment to 17 CCR 95488.10(b), which would authorize the Executive Officer to perform a credit true-up for a fuel pathway that has a lower verified operational CI, as evidenced in its annual fuel pathway report, than the CI for which the fuel pathway was previously approved. We believe this amendment properly rewards producers that invest in emission reduction improvements or are otherwise able to "overcomply" with their registered pathways. In addition, the proposed amendment should encourage producers to conservatively calculate and assign margins of safety to their CI scores during the pathway registration process, since the benefits of overcomplying would be returned to the producer in the credit true-up rather than being lost to the LCFS buffer account (as is the case in the current regulations). We request that CARB make the credit true up provisions effective immediately, meaning that the first opportunity for such true up would occur after the submission of Annual Fuel Pathway reports in March 2025 (for calendar year 2023/2024 data). (45d-255.4)

Agency Response: No change was made in response to this comment. The credit true up provision becomes effective beginning with the 2025 annual fuel pathway reports (AFPRs), which will be submitted in 2026. The verified CI from the 2025 AFPR will be used to perform a credit true up for the CI reported in 2025.

Comment: Project developers are seeing waiting times of between 18 and 24 months from project commencement to provisional CI approval. Even using book-and-claim this can result in a low-CI project foregoing a year's worth of LCFS credits. Allowing credit true-ups through the provisional and initial certification would reduce pressure on staff and developers to process applications and updates as quickly as possible and reduce uncertainty for project owners and developers and LCFS credit counterparties. ARBs penalty mechanism as proposed under 95486.1(g) would discourage projects from over crediting and in the event a project over credited and was unable to surrender sufficient credits to match its over credited amount the credit buffer account could be used to ensure the program's environmental integrity.

If ARB does not agree with a true-up for projects undergoing provisional and initial certification we suggest that it considers doubling the book-and-claim period from three quarters to six quarters for projects that have received provisional pathways but have not yet received final certified pathways. Oregon, for example, permits electricity projects to use up to a six-quarter book-and-claim period. (45d-160.2)

Agency Response: A change was made in response to this comment. Staff included a true up provision for a Tier 1/Tier 2 pathways in the 45-day proposal which was later extended to also include temporary fuel pathways in the First 15-day modifications proposal. Because a full credit true up will including temporary pathways as suggested, extending the book and claim matching period for low-CI electricity and biomethane from three quarters to six quarters is not necessary.

SS-2 Oppose credit true up for non-zero emission fuels

Comment: ...allows retroactive crediting for pathways that favor non-zero-emission fuels. (45d-210.2)

Agency Response: No change was made in response to this comment. Staff believes that it is appropriate to provide consistent treatment to all low-carbon fuels that generate credits in the LCFS.

SS-3 Multiple Comments: Support/include temporary pathway credit true up

Comment Summary: The commenters support and urge CARB to include a credit true up for temporary fuel pathways in addition to a credit true up for Tier 1/Tier 2 fuel pathways. The temporary fuel pathway CIs are conservative and result in substantial credit losses. A credit true up helps fuel reporting entities recover these credits. It is critical for CARB to ensure that adequate resources are available to process fuel pathway applications and credit true ups in a timely manner. (45d-187.4, 45d-199.3, 45d-201.3, 45d-237.7, 45d-363.7, 45d-320.4, 45d-171.5, 45d-169.8, 45d-168.14, 45d-165.2, 45d-160.2, 45d-240.8, 45d-140.7, 45d-96.12, 45d-94.8, 45d-221.3, 45d-232.7, 45d-094.8, 45d-382.6, Apr-098.10, Apr-101.5, Apr-180.6, Apr-164.8, Apr-160.4, Apr-158.5, Apr-155.6, 15d1-120.1b, 15d1-171.25, 15d1-214.16, 15d1-249.8, 15d1-045.4, 15d1-064.6, 15d1-212.5, 15d1-212.12, 15d1-214.6, 15d1-214.16, 15d1-220.16, 15d1-241.3, 15d1-243.2, 15d2-212.5)

Agency Response: Staff extended the credit true up to include temporary pathways in response to these comments. The rationale for making these changes is described in

page 13 of the First 15-day Notice (Notice of Public Availability of Modified Text and Availability of Additional Documents and/or Information¹²). CARB is committed to efficient implementation of the proposed provisions including fuel pathway certification and credit true ups in a timely manner.

SS-4 Multiple Comments: Revision to credit true up proposal

Comment: CARB should revise the proposed regulatory language to specify that CARB "shall" perform a credit true up for a fuel pathway. As drafted, the current language states only "shall" perform a credit true up for a fuel pathway. (45d-241.18)

Comment: Further, the language indicates that in the event the operationally verified CI is lower than the certified CI (i.e., it failed to generate as many credits as it could have) the Executive Offer (EO) "may" make the appropriate adjustment (true-up) by awarding additional credits to the applicable fuel reporting entity. The word "may" should be deleted. If the operationally verified CI, including an affirmative verification statement, is lower than the certified CI that was the basis for credit generation, the EO "must" award the supplemental credits supported by the underlying documentation. (45d-168.13, 45d-169.7, 45d-094.7, 45d-96.11).

Agency Response: No change was made in response to these comments. The language as drafted accurately and clearly specifies that the Executive Officer (EO) may perform credit true ups for fuel pathways if the specified conditions are met. Generally, the EO will carry out credit true ups, but the permissive "may" rather than "shall" is more accurate because one important narrowing clarification ("Only reporting quarters for which complete operational data are reported in the applicable AFPR are eligible for credit true up of a temporary fuel pathway.") to the general true up condition is identified in the final sentence of the provision (title 17, California Code of Regulations, § 95488.10(b)).

Comment Summary: Commenters recommend CARB to perform the credit true up of temporary fuel pathways after the certification of fuel pathways rather than awaiting until the completion of annual verification. This will allow fuel pathway holders to retrieve surplus credits, especially for dairy/swine manure biogas applications which may take more than 2 years to get annually verified from the time of initial submission (15d1-206.4, 15d1-209.2)

Agency Response: No change was made in response to these comments. Tier 1 and Tier 2 fuel pathways are subject to credit true ups after annual verification; therefore, it is reasonable to align a credit true up of the temporary fuel pathway with the same timeline to be consistent. More importantly, a representative verified operational CI can be obtained for a credit true up from annual verification because the annual fuel pathway report would most likely include more operational data than the application submitted for initial certification.

Comment: Credit True Ups: We appreciate the clarification that credit true ups after annual verification will include the period during which a temporary pathway was in place. This is

¹² https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/15day_notice.pdf

critical to addressing the extended time period that can take place while operating data is collected and CARB staff reviews submitted pathway applications prior to establishing a provisional pathway.

Regarding the added language requiring complete operational data to be eligible for a true up, it is critical that CARB clarify that this includes quarters during which an approved alternative method is used to represent any missing or invalid data. This can occur over very short periods and for perfectly valid operational reasons (e.g. the replacement of a meter). It would be wrong to deny a true up for a full quarter in such circumstances.

We also request that CARB clarify in the regulatory language that these true ups would apply for the full period during which a temporary or provisional pathway was used, even if the associated compliance periods have passed. That appears to be the intent, but it should be stated in the regulatory language to avoid confusion. (15d1-042.12)

Comment: CARB's updated proposal also explains that "Only reporting quarters for which complete operational data are reported in the applicable AFPR are eligible for credit true up of a temporary fuel pathway" (emphasis added). WSPA recommends that CARB provide a reasonable definition for "complete operational data" that makes clear that entities will not be penalized for receiving LCFS credits after the annual verification process. (15d1-171.26)

Agency Response: No change was made in response to this comment. Staff proposed to extend credit true up to certified temporary fuel pathways in the First 15-day change modifications package provided that operational data from the temporary fuel pathway reporting period are included the applicable Annual Fuel Pathway Report (AFPR).

If missing or invalid data are replaced by the substitute data obtained using the CARB approved alternate method, the substitute data are considered as valid operational data and will count towards complete operational data.

The complete operational data in a given quarter implies that the fuel volume reported to generate credits under a temporary pathway coincides with the operational data included in AFPR. If fuel produced outside of the operational data reporting period in the AFPR generated credits under a temporary fuel pathway, this volume will not be subject to credit true up because the associated operational data with this volume was not included in the AFPR. For example, if a facility begins producing fuel in January 1, 2025 but the annual fuel pathway report includes operational data only after January 30, only the fuel volume produced after January 30 will be subject to credit true up.

Comment: Due to aforementioned dynamic factors that impact biological systems, CARB should implement the following changes as they impact the true-up and associated deficit obligations provisions:

• CARB should allow adjustments to the margin of safety ("MOS") a pathway may apply as needed throughout the year, as operational data becomes available, and at a minimum quarterly. This will allow a pathway to adjust the CI of the pathway to ensure a pathway holder can correct CI exceedance proactively.
A MOS should be allowed to be added to a temporary CI. As Section 95488.10(a)(7) includes the verified CI to be compared to a temporary pathway CI, a margin of safety should be allowed to be added at the time of requesting a temporary CI and at a minimum quarterly. As a pathway is waiting in the Tier 1/Tier 2 process, a developer's forecasted CI will change as operational data comes in and have no recourse to correct a CI exceedance once validation is completed. (15d1-212.13)

Comment: Finally, we reiterate our support for the proposed true-up mechanism and request that CARB allow adjustments as needed, and at a minimum, quarterly, to the margin of safety ("MOS") that a pathway may apply as operational data becomes available. This will allow a pathway holder to adjust a CI proactively to prevent a CI exceedance. We also request that an MOS be allowed for temporary Cls. (15d2-172.2)

Agency Response: No change was made in response to this comment. A dynamic or more frequent change in the margin of safety is not practical because it is logistically challenging to implement in the current LCFS Data Management System (i.e., Alternative Fuel Portal). Typically, a margin of safety is applied to the fuel pathway carbon intensity either at the time of initial certification or after completion of annual verification each year. This is done to avoid creation of multiple fuel pathways codes for the same fuel in same compliance year, which would complicate annual fuel pathway reporting, verification, and subsequent certification and credit adjustments.

Temporary fuel pathway CIs are designed to be conservative and are offered to applicants for a short duration (up to two quarters with a possibility of extension). Since a temporary fuel pathway is not subject to deficit obligation and the CI itself is conservative, staff believes that applying a margin of safety to a temporary fuel pathway CI would complicate the program implementation with little or no benefits.

Comment: We also respectfully request that CARB consider allowing a portfolio-wide true up as opposed to providing for true ups solely on a project-specific basis. Given that LCFS credits are fungible and are not associated with a specific project once generated, we believe allowing pathway holders to true up based on the performance of a portfolio would make it easier for participants to accurately align credit generation to the actual performance of projects. (15d1-220.18)

Agency Response: No change was made in response to this comment. A portfolio-wide credit true up implies that surplus credits generated from a credit true up for pathways with lower verified CIs can potentially offset the deficits accrued by the pathways with CI exceedance in the same portfolio. This would be a significant departure from the proposed approach and reduces the incentive to avoid CI non-compliance through process improvements and margin of safety addition.

SS-5 Clarification on credit true up

Comment: One additional note on this issue is that the proposed regulations need more clarification for entities utilizing Temporary CI scores. RPMG requests CARB provide further guidance document(s) to provide instructions on completing a credit true up for pathway holders who may have Temporary CI scores and certified or provisionally certified CI scores within the same compliance year. (45d-092.6)

Agency Response: No change was made in response to this comment. CARB will consider developing compliance support materials to help provide notice of the process and timeline for completing credit true ups for Tier 1/Tier 2 and temporary fuel pathways.

Comment: We continue to believe that CARB should allow retroactive credit generation as early as the 2024 annual Fuel Pathway Report (for the data reporting period covering 2023 and 2024), since verification of such report data will completed after the effective date of this rulemaking. (15d2-219.7)

Comment: Newtrient is pleased to see the proposed amendments to expand the credit true-up to include periods using temporary pathway CIs after annual verification following stakeholder input highlighting the benefits of the credit true-up. Based on our understanding of the language, reporting that is submitted March 31, 2025, will cover the years 2023-2024 and include a credit true-up back to 2023. (15d2-260.5)

Agency Response: No change was made in response to these comments. The earliest that credit true ups can be applied is for the fuel and corresponding CI reported in 2025 after the completion of annual verification of the 2025 AFPR (due in 2026). The 2025 AFPR contains operational data from 2024 and 2025. The credit true up cannot be applied to 2024 or earlier because the amended LCFS regulation will not be effective in 2024.

SS-6 Multiple Comments: Implication of credit true up and deficit obligation

Comment: Incentives to Be Below Certified CI: In Section 95488.10, lists that CARB is willing to issue credits for those pathway holders with a verified CI that is below the certified CI. To further incentivize CI reductions, CARB should also have a multiplier when below the certified CI just as imposed when the verified CI is above the certified CI. This will incentivize investments in emissions reductions more quickly. (45d-295.10)

Agency Response: No change was made in response to this comment. A multiplier for credit true up when the verified CI is lower than the certified CI is not practical and would result in credits being generated that do not reflect GHG benefits.

Comment: §95488.10 The proposed amendments to this provision may result in reduced credit flows to and/or increased credit flows from the administrative buffer account used to protect against some forms of credit invalidation risk, and to help facilitate certain administrative transactions.

No analysis is provided to characterize the anticipated changes to credit flows through the buffer account, the risk of buffer account insufficiency, or the impacts of such insufficiency. It is difficult to evaluate the likely impact of these amendments without such analysis. (45d-391.59)

Agency Response: No change was made in response to this comment. The LCFS program has not faced a need to draw credits from the buffer account to maintain program integrity in a case of unreconciled deficits. Furthermore, with the powerful CI compliance signals sent by the combined introduction through the amendments of credit true ups and a deficit obligation for CI exceedances, the risk of CI and associated credit

generation non-compliance should greatly diminish. Therefore, staff does not have serious concerns with diminished flows of credits towards the buffer account due to credit true ups.

Comment: True up and 4:1 penalty: We support clarification made for true ups to actual verified CI versus the temporary pathway CIs or when no temporary pathway is offered. (15d1-231.7)

Comment: True up and 4:1 penalty

We support a clarification made for true ups to actual verified CI versus the temporary pathway CIs or when no temporary pathway is offered, to also include projects under construction and those using TPCs when the regulation takes effect. (15d2-188.6)

Agency Response: No change was made in response to these comments. A credit true up of a temporary fuel pathway occurs when the verified CI obtained from annual verification is lower than the temporary fuel pathway CI. Credit true ups for temporary fuel pathways apply to reporting quarters for which complete operational data are reported in the applicable Annual Fuel Pathway Reports. In rare cases, if the verified CI turns out to be higher than the applicable temporary fuel pathway CI (which is designed to be conservative), CARB will invalidate credits as appropriate pursuant to section 95495. If a temporary fuel pathway has not been used for reporting of fuel volumes by the fuel pathway holder, credit true ups will be limited to Tier 1 or Tier 2 pathways.

Comment: The Proposed Penalties for CI Variations are Extreme. CARB has proposed to quadruple the penalization of carbon intensity scores that exceed the previously approved level. The language proposed makes no allowance for unplanned event that may impact a facility's score and would penalize good-faith operations that happen to see moderate changes in energy inputs and outputs. The LCFS already contains provisions to adjust credit balances based on such exceedances and CARB has the authority to pursue enforcement actions should a producer's actions demonstrate irresponsible behavior or ill intent. The proposed language seems intended to punish good actors for unplanned impacts, given that CARB already has sufficient authority to take action against bad actors. (45d-165.5)

Agency Response: No change was made in response to this comment. Section 95491.2(b)(3) of the Proposed Amendments requires fuel pathway holders to notify CARB in the event of a facility shutdown or disruption drastically affecting production attributable to a force majeure event. On a case-by-case basis, the CARB Executive Officer may invalidate or recalculate deficits pursuant to the bases listed in section 95495(b).

TT. Deficit Obligation

TT-1 Support deficit obligation for verified CI exceedance

Comment: We support the proposed Calculation of Deficit Obligation for Verified CI Exceedance concept in Section 95486.1(g), but recommend applying this to the 2024 fuel transaction year, rather than starting in 2025. (Apr-101.7)

Agency Response: No change was made in response to this comment. CARB appreciates the support for the deficit obligation provision. Because the Proposed Amendments introduce a credit true up beginning with the 2025 reporting year, it is appropriate to phase in the provision adding a deficit generation for verified CI exceedance (specified in section 95486.1(g)) for the same compliance and data reporting year for policy signal alignment.

TT-2 Multiple Comments: Oppose/reduce deficit generation for verified CI exceedance specified in section 95486.1(g)

Comment: However, the proposed measure to allocate deficits to entities with a CI exceedance is disproportionate to the treatment of entities achieving a lower verified operational CI and is unnecessarily punitive, as the number of deficits is four times the difference between the verified operational fuel pathway CI and the reported CI, multiplied by the quantity of fuel. A more equitable treatment of these mirror-image cases would be merited, and the deficit multiplier should be eliminated or greatly reduced. (45d-171.5)

Comment: The rationale for a 4X spread is unclear as a smaller spread (e.g., 2X) serves as a significant disincentive to producers for being overconfident in their analysis. (45d-168.12)

Comment: While we are supportive of the True Up change because it fairly addresses overcompliance, we oppose the current proposal for Deficit Obligation as it is unnecessarily punitive. If a pathway holder overperforms they receive a 1:1 credit, but if there is an underperformance, then the penalty is 4:1. An objective of the LCFS has always been to ensure that the environmental integrity of the market remains whole. Therefore, requiring a 1:1 adjustment of any deficit obligation before an enforcement action is initiated remains an appropriate remedy.

This two-step process would be a more balanced approach to pathway holders seeking to recertify under the new CA-GREET 4.0 model update required by the regulation. Each, and every, pathway will be updated in short order, and therefore each LCFS stakeholder will be tasked with the same decision of how much Margin of Safety to apply. With the current 4:1 vs 1:1 risk/reward structure, it can be imagined that more conservative CI scores will be requested. This will lead to a market lag in actual credit generation, a deferred return on investment, and potential unintended market consequences such as the impacts to the new Auto Acceleration Mechanism based on credit-deficit numbers that may not accurately reflect market conditions in real-time. (45d-092.7)

Comment: However, we fail to understand why CARB proposes to penalize CI exceedances by four times the difference in credits between the verified operational fuel pathway CI and the reported CI. Obviously, the agency has regulatory options at its discretion currently, including issuing notices of violation and levying financial penalties. If staff believe an additional deterrent is needed, two times the exceedance would seem more than sufficient to deter such activity. Four times the exceedance is simply unfair to producers and will result in less accurate CI values as well as an entirely different set of administrative challenges. (45d-211.6)

Comment: In (g) and (g)(1), Calculation of Deficit Obligation for Verified CI Exceedance, CARB should not apply a penalty of four to five times (when including the penalty for the pathway holder as a first reporter) the deficits if the fuel pathway CI is higher. This is

excessive. CARB should apply one times the deficit and reset the CI score to the verified value and allow for rebalancing and readjustments by affected parties. (45d-241.56)

Comment: However, we do not support the Proposed Rule's approach requiring a 4x "pay back" in cases where a verified CI exceeds the certified CI. This is overly punitive and not symmetrical. Instead, we recommend that if the verified CI is higher than the certified CI, the project should simply repay CARB for any excess credits claimed, and not be subject to any further enforcement liability unless there is malfeasance or other conduct contrary to the objectives of the program. (45d-363.9)

Comment: Newtrient is pleased to see the proposed amendments to expand the credit true-up to include periods using temporary pathway CIs after annual verification following stakeholder input highlighting the benefits of the credit true-up. Based on our understanding of the language, reporting that is submitted March 31, 2025, will cover the years 2023-2024 and include a credit true-up back to 2023. We do however take issue with the proposal including true-up provisions that adjust credits based on verified operational CIs relative to certified CIs, applying a penalty of four times the spread for shortfalls. The justification for this 4X multiplier is unclear, as a smaller multiplier, such as 2X, would still discourage overconfidence in CI analysis. (15d1-052.6)

Comment: Oberon strongly supports CARB's proposal to expand the LCFS credit true-up provisions to include periods using temporary pathway CIs after annual verification. This is a highly positive change, particularly for projects that operate with conservative, temporary CI

scores. By allowing these projects to reconcile their credits based on verified CI data, this helps to protect the financial viability of low carbon fuel projects by allowing them to recover lost value that might otherwise be forfeited due to conservative early reporting. Moreover, it promotes greater accuracy and transparency in the program, ensuring that stakeholders are rewarded based on their true environmental performance. This adjustment ultimately strengthens the LCFS program by fostering a more accurate and equitable system. We commend CARB for recognizing the importance of this adjustment and for taking steps to support the integrity and financial viability of renewable fuel projects. The proposal also includes true-up provisions that adjust credits based on verified operational CIs relative to certified CIs, applying a penalty of four times the spread for shortfalls. However, the justification for this 4X multiplier is unclear, as a smaller multiplier, such as 2X, would still effectively discourage overconfidence in CI analysis. (15d1-105.7)

Comment: PROPOSED AMENDMENT: we urge CARB NOT to adopt a penalty mechanism for CI changes at a project. Projects are biological in nature and can experience changes in CI due to many factors, including but not limited to, ambient temperature, energy input increases and/or decreases, cloud cover, etc. When these types of natural changes occur, the operator of the low carbon project, like an anaerobic digester, will properly manage the fluctuating project CI and credits being generated. In the event the CI changes unfavorably resulting in an over-generation of credits, normal course of operations is to bank these credits for retirement through the Annual Fuel Pathway Reporting (AFPR) process.

Unfortunately, the proposed regulation would apply a four-to-one penalty to the CI if it moves unfavorably to the credit generating CI. Because of this, an operator will be forced to apply a

very conservative margin of safety to the CI of their project, thus reducing its quarterly revenues. Those intending to comply with the true-up in good faith but fall short will be harmed, and thus a disincentive for investment. We don't believe this should be the tool for enforcement or a bad actor outcome.

As it stands today, the pathway approval process takes nearly two years to complete, resulting in lower revenues at the beginning of a project and now you will also see lower revenues during a project while it goes through the AFPR process, which can take up to two years. This proposed change will not provide any CI emissions benefit to the program and puts additional financial strain on low carbon investments. (15d1-209.7)

Comment: Pathway Holder Deficit Obligation. CARB should lessen deficit obligations for pathway holders that exceed their CI in a 24-month period. Under the proposed amendments, pathway holders would incur a deficit four times the amount of the annual excess CI generated, and have excess credits invalidated, which effectively creates a penalty of five times the amount of the annual excess CI generated. This penalty is disproportionate to the severity of the violation and will likely have an outsized impact on pathway holders, particularly since any true up benefit in a CI is provided to the importer, not the pathway holder. Both the benefit and the obligation should be with the same party. CARB should lessen the severity of this obligation and either (1) impose the deficit on the importer, or (2) provide true up benefits to the pathway holder as well. Imposing deficit obligations on pathway holders who do not produce fuel in the State, import fuel into the State, or sell fuel into the State, may also unduly burden interstate commerce in violation of the Commerce Clause, by requiring out-of-State pathway holders to suddenly participate in the credit/deficit market, which creates significant new obligations compared to being a pathway holder participant. WSPA also requests clarity on when fuel pathway holders would need to register in the LCFS Reporting Tool and Credit Bank & Transfer System (LRT/CBTS) and when they would become subject to the reporting requirements in § 95491. (45d-241.15)

Comment: CI Exceedance - Section 95486.1 (g)

Although not a change from the "45-day" package published in January 2024, Phillips 66 requests that CARB removes the four times penalty when the CI is verified above the operational CI. This penalty defeats the purpose of auto-adjustments of fuel CI. CARB should instead reset the CI score to the verified CI and true-up the credits and deficits, without adding an unjustified penalty of four times the incremental credit generation This substantial penalty will force obligated parties to set overestimated CI scores, well above the actual pathway CI score to reduce the risk of a penalty. The LCFS program could not capture the full benefit of greenhouse gas reductions, while the CI standards become ever more stringent, and the benefit of this provision will be muted. (15d1-079.7)

Comment: However, we were disappointed that the "4-to-1" penalty remains for verified CI exceedance and that it may be applied to the temporary pathway period. We find this penalty is excessively harsh, especially since there is no requirement to prove intentional wrongdoing. Implementing this penalty in the current context will result in overly cautious pathway estimates that could potentially diminish projected revenue recovery over time and further disincentivize future investments. This would be counterproductive to the dairy sector methane abatement goals under SB 1383 and CARB's stated objectives for achieving these goals in the 2022

Scoping Plan, especially since dairy operations are subject to seasonal operations and temperatures. We strongly urge staff not to adopt this penalty mechanism. We support administrative reforms that streamline the process instead. (15d1-249.9)

Comment Summary: The 4 to 1 penalty is punitive and unnecessary and should be removed, especially if the underestimation of CI is not intentional and made in good faith.

(45d-171.5, 45d-195.5, 45d-295.10, 45d-354.15, 15d1-066.8, 15d1-206.5, 15d1-147.4, 15d1-214.5, 15d1-214.15, 15d1-220.17, 15d1-231.8, 15d1-243.6, 15d1-042.8, 15d1-045.4)

Comment: The rationale for a 4X spread is unclear as a smaller spread (e.g., 2X) serves as a significant disincentive to producers for being overconfident in their analysis. (45d-169.6)

Comment: MRL strongly supports the 15-Day Changes' expansion of the proposed credit true up opportunity in Section 95488.10(b) of the LCFS regulations to include temporary pathways. We believe this justifiably rewards producers whose validated/verified CI scores outperform their previously registered CI scores,

including temporary pathway CIs, with credits corresponding with actual emission reductions for fuels delivered to California.

We understand that part of the rationale for authorizing credit true-ups is that fuel producers are also now subject to a punitive four times (4x) credit retirement obligation in the event that their verified operational CIs are greater than the previously registered CIs. This signals that producers should conservatively set margins of safety in their registered fuel pathways to avoid over-generation; the credit true-up opportunity, therefore, avoids penalizing producers for acting conservatively.

Based on our reading of the proposal, the 4x credit retirement obligation would become effective the same year as the proposed amendments – if correct, it would mean such obligation would be applicable to producers' 2024 Annual Fuel Pathway Reports (covering 2023 and 2024 operational data) verified in August 2025. In contrast, the credit true-up opportunity described in proposed Section 95488.10(b) would not occur until the 2025 Annual Fuel Pathway Report (covering 2024 and 2025 operational data) is verifier in August 2026. We see no reason for producers to be immediately at risk of penalty but to have to continue to wait another year for the return of credits reflecting actual emission reductions. Put simply, California should not get another year of "free" emission reduction; we urge CARB to align the penalty and true-up provisions by making the true up opportunity effective immediately and assessed following pathway validations or verifications completed in calendar 2025. (15d1-235.12)

Comment:

 CI exceedances are often out of the control of fuel producers, often arising from black swan events outside the scope of a facility's operational control. Black swan examples include extreme weather events or global/regional supply chain disruptions due to the war in Ukraine or COVID-19. These events can create a discrepancy between the certified CI and operational CI for many fuel pathway holders, unrelated to their operation.

- In such situations, fuel producers should not receive high penalties for exceedances that they are unable to mitigate.
- High margins of safety results in skewing of credit reporting and deferred cash flow. (45d-306.1)

Comment: We recommend inclusion of a provision that allows for reduced penalty consideration for specific cases:

 If a fuel producer informs CARB well in advance, in writing, of projected CI exceedance and retains a matching credit balance in their LCFS Reporting Tool (LRT) account at the end of the reporting year, CARB may reduce the CI exceedance factor from 4.0 to 2.0.

• Such a relief should be strongly considered for CI exceedances arising from black swan events. (45d-306.3)

Comment: Four-To-One CI Penalty: we do not recommend CARB adopt a penalty mechanism for CI changes at a project. Projects are biological in nature and can experience changes in CI due to many factors, including but not limited to, ambient temperature, energy input increases and/or decreases, cloud cover, etc. When these types of natural changes occur, the operator of the low carbon project, like an anaerobic digester, will properly manage the fluctuating project CI and credits being generated. In the event the CI changes unfavorably resulting in an over-generation of credits, normal course of operations is to bank these credits for retirement through the Annual Fuel Pathway Reporting (AFPR) process.

Unfortunately, the proposed regulation will apply a four-to-one penalty to the CI if it moves unfavorably to the credit generating CI. Because of this, an operator will be forced to apply a very conservative margin of safety to the CI of their project, thus reducing its quarterly revenues. As it stands today, the pathway approval process takes nearly two years to complete, resulting in lower revenues at the beginning of a project and now you will also see lower revenues during a project while it goes through the AFPR process, which can take up to two years. This proposed change will not provide any CI emissions benefit to the program and puts additional financial strain on low carbon investments. (Apr-160.7)

Comment: Furthermore, the penalty for inadvertently overstated carbon intensities during the true-up should be revised to1.25x rather than 4.0x to penalize but not bankrupt producers that do not achieve carbon intensity modelled with best available information but fall short due to factors outside their control. (Apr-158.6)

Comment: CARB's Proposed Remedy of a 4x Penalty for CI Exceedance is Excessive and will Disproportionately Impact Agriculture Facilities. (Apr-061.4)

Comment: Similarly, a project which experiences a CI exceedance to what was previously certified should not be subject to the draconian 4x credit penalties contemplated in the proposed regulation. This rule will only cause projects to report unnecessarily high conservative margins of safety, making already financially challenged projects even more difficult to build, and leaving carbon reduction opportunities on the table. CARB must recognize that CI scores are extremely dynamic at dairy projects given they are based on biological conditions over which the operator has very little control due to shifts in herd populations, temperature, manure management practices, and natural variations in biogas production. An

increase in CI is often the result of improved performance and efficiency at a digester, and the project should not be penalized for that. (Apr-155.6)

Comment: WSPA strongly encourages CARB to reconsider penalties under § 95486.1(g)(1), whereby pathway holders would incur a deficit of four times the amount of the annual excess CI generated – and have excess credits invalidated. This provision effectively creates a penalty of five times the amount of the annual excess CI generated, which is disproportionate to the severity of the violation and will likely have an outsized impact on pathway holders. This penalty would likely lead fuel producers to be unreasonably conservative and, as a result, the true-up provision would likely not be used effectively. WSPA requests that the language related to four times penalty be removed in the final proposed regulation. (15d1-171.27)

Comment: WSPA generally supports proposed clarifications for credit true-up after annual verifications, but CARB should remove the penalty if the verified carbon intensity (CI) is higher than the operational CI to enable this provision. (15d1-171.7)

Comment Summary: DTE Vantage opposes the proposed deficit obligation since it disproportionately impacts dairy manure biogas-based fuel pathways. The digester biogas production varies from year to year and which has an outsize impact on the negative carbon score of the bio-gas based pathways which is outside the control of the fuel producers. (45d-199.3)

Comment: Force Majeure Events. If a site has a force majeure event and shuts down for months, the CI score will be heavily impacted, and at that point it will be too late to add an additional margin of safety to the score. We ask CARB to clarify how such situations will be addressed in the Final Statement of Reasons. (45d-240.16)

Comment: Based on our understanding of the language, reporting that is submitted March 31, 2025, will cover the years 2023-2024 and include a credit true-up back to 2023. The proposal includes true-up provisions that adjust credits based on verified operational CIs relative to certified CIs, applying a penalty of four times the spread for shortfalls; however, the justification for this 4X multiplier is unclear, as a smaller multiplier, such as 2X, would still effectively discourage overconfidence in CI analysis. Lastly, we urge CARB to establish a temporary CI pathway for biogas-to-electricity projects, as the absence of such a pathway currently puts biogas-to-electricity at a disadvantage compared to biomethane projects, which already have access to temporary CI pathways. (15d1-178.3)

Comment: We also highly recommend removing the newly proposed 4:1 penalty on actual versus temporary or provisional CI, which may be due to factors outside the registrant's control. (15d2-188.7)

Comment: We continue to oppose the proposed approach requiring a 4x "pay back" in cases where a verified CI exceeds the certified CI. As we have stated previously, this is overly punitive and not symmetrical. Instead, we recommend that if the verified CI is higher than the certified CI, the project should simply repay CARB for any excess credits claimed, and not be subject to any further enforcement liability unless there is malfeasance or other conduct contrary to the objectives of the program. (15d2-212.9)

Comment: CARB's Proposed Remedy of a 4x Penalty for CI Exceedance is Excessive and will Disproportionately Impact Agriculture Facilities

DTE remains concerned with the continued inclusion of a 4x penalty for adjustments when the verified CI exceeds the certified CI for a pathway. Digester-sourced biogas projects have inherent CI variability due to uncontrollable factors like livestock population, manure collection, and weather, which could drastically change the CI score from year to year. Imposing a 4x penalty for adjustments not resulting from misconduct is unwarranted and unfair. DTE Vantage supports adopting a mechanism for refunding excess credits but opposes the punitive 4x penalty, as there is no historical justification for it. (15d2-224.5)

Comment: As stated in our February 16, 2024, comment letter on the 45-Day package, the proposal indicates that a shortfall (i.e., a verified operational CI that is higher than the certified CI upon which project credits were generated) is subject to a "penalty" that is 4 times the spread for the applicable volume of fuel.4 The rationale for a 4X spread is unclear as a smaller spread (e.g., 2X) serves as a significant disincentive to producers for being overconfident in their analysis. The ABC asks CARB to explain their rational for including this provision and to consider a more balanced response that provides flexibility to consider situation-specific factors rather than defaulting to a 4X penalty. (15d2-256.7)

Comment: Newtrient continues take issue with the proposed true-up provisions that adjust credits based on verified operational CIs relative to certified CIs, applying a penalty of four times the spread for shortfalls. The rationale for a 4X spread is unclear as a smaller spread (e.g., 2X) serves as a significant disincentive to producers for being overconfident in their analysis. Newtrient asks CARB to explain their rational for including this provision and to consider a more balanced response that provides flexibility to consider situation-specific factors rather than defaulting to a 4X penalty. (15d2-260.6)

Comment: Dairy projects are biological in nature and are impacted by many factors, including but not limited to, ambient temperature, energy input increases and/or decreases, cloud cover, manure quality, herd count, etc., which ultimately can adjust a project's CI. When these types of natural changes occur, the operator of an anaerobic digester will manage the fluctuating project CI and subsequent change in credits being generated. In the event the CI changes unfavorably (moves towards 0, i.e., from -250 to -200) resulting in an over-generation of credits, the appropriate step is to "bank or inventory" these credits in your LCFS LRT account for retirement through the Annual Fuel Pathway Reporting (AFPR) process. This is the normal course of operation and best practice in the industry.

Unfortunately, the proposed regulation would apply a four-to-one penalty to the project if the "operational CI" moves unfavorably compared to the credit generating CI. The four-to-one penalty concept is taken from Cap-and-Trade regulation which levies the penalty against an obligated party that falls outside its threshold, but a low CI project in the LCFS, like a dairy farm, is not an obligated party. To our knowledge, there is no precedent to use a Cap-and-Trade like penalty in the LCFS and doing so would have a material impact on the market.

As an example, and for illustrative purposes only, a 182,500 MMBtu per year (1.46M GGE) dairy project with a CI of -250 would generate approximately 57,232 credits per year. Assuming the project had operational changes resulting in an AFPR CI of -200, the effective

credits would be 48,527. But because the LCFS only allows you to change your CI in the LRT system once per year, the project over-generated 8,705 credits. Under the proposed four-to-one penalty, the project would retire the 8,705 credits in the LRT system and then pay a penalty to the state which would be equivalent 8,705 credits x 4 x an assumed LCFS credit price. At a \$60 LCFS the cost is \$2.08M and at a \$120 LCFS the cost is \$4.17M. This undoubtedly creates massive exposure and risk to the project with no real net environmental benefit to the state.

Because the four-to-one penalty is so severe, the only opportunity to mitigate it would be to leverage the Margin of Safety ("MOS") mechanism in the regulation which allows you to apply an additional CI adder to your official CI score. A project may have a certified CI score of -250, but the owner of the facility may elect to apply a 50 CI MOS yielding an effective credit generation score of -200. Again, this provides no net environmental benefit to the state of project, but ensures the project is not left with an egregious penalty by generating at a low CI than the AFPR CI. The material downside of being conservative through a MOS is that any "true-up" credits due back to the project, i.e. the MOS CI is -200 but the AFPR CI is -225, means you will not get those credits back for nearly two years. This results in long-term revenue deferral and LCFS price spread risk at the project.

PROPOSED AMENDMENT: CARB should eliminate the Four-to-One penalty as it provides no environmental benefit to the state and only encumbers a project with more financial risk and liability. If the proposed penalty stays, projects will be ultra conservative with their CI and forced to wait nearly two years to get their "true-up" credits after going through the AFPR and verification process. The state will not realize the actual emissions reductions occurring at the projects as they occur. (15d2-266.4)

Comment: Oberon strongly supports CARB's proposal to expand the LCFS credit true-up provisions to include periods using temporary pathway CIs after annual verification. This is a highly positive change, particularly for projects that operate with conservative, temporary CI scores. By allowing these projects to reconcile their credits based on verified CI data, this helps to protect the financial viability of low carbon fuel projects by allowing them to recover lost value that might otherwise be forfeited due to conservative early reporting. Moreover, it promotes greater accuracy and transparency in the program, ensuring that stakeholders are rewarded based on their true environmental performance. This adjustment ultimately strengthens the LCFS program by fostering a more accurate and equitable system. We commend CARB for recognizing the importance of this adjustment and for taking steps to support the integrity and financial viability of renewable fuel projects. The proposal also includes true-up provisions that adjust credits based on verified Operational CIs relative to certified CIs, applying a penalty of four times the spread for shortfalls. However, the justification for this 4X multiplier is unclear, as a smaller multiplier, such as 2X, would still effectively discourage overconfidence in CI analysis. (15d2-278.8)

Comment: and the overly punitive 4X penalty for CI exceedances. (BHT-165)

Agency Response: No changes were made in response to these comments. The deficit obligation for verified CI exceedance (four deficits to one credit generated on the basis of a CI exceedance) only applies to non-provisional pathways. Staff understands that fuel pathway holders should have sufficient knowledge of variability in their

operations by the time the pathway becomes non-provisional (after at least 24 months of steady state operational data are available), which will enable them to request an adequate margin of safety to be added.

Section 95488.4(a) of the LCFS regulation requires that "Fuel reporting entities shall not report fuel sales under any LCFS CI unless the actual CI of that fuel, calculated as described in this subarticle, is equal to or less than the LCFS CI under which sales of that fuel are reported in the LRT-CBTS system." Without the proposed deficit obligation, pathways that do exceed their certified CI over-generate credits in violation of that requirement until credit adjustments occur following annual verification removing the excess credits from their account. The time gap between certification and the completion of annual verification (about two years) could give an unfair advantage to fuel pathway holders who take risks of not-being CI-compliant. The deficit obligation is designed as a reasonable deterrent to prevent non-compliance and associated generation of credits that are unrepresentative of the actual verified operational carbon intensity of the fuel. The deficit multiplier of four rather than two or three is adapted from a similar requirement in section 95857 of California's Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms regulations (Cap-and-Trade regulations) set forth in title 17, California Code of Regulations Chapter 1, Subchapter 10, article 5 (commencing with section 95800) specifying a compliance obligation for untimely surrender of four times an entity's excess emissions. In the Cap-and-Trade regulation, that four times excess emissions multiplier has served as an effective deterrent to support timely compliance, especially in the context of a system with tradable compliance instruments where supply and demand set fundamental credit prices.

Because the Proposed Amendments include a credit-true up provision, the amended regulatory framework will much more strongly encourage fuel pathway holders to add a conservative margin of safety in order to reduce noncompliance, while ensuring that entities will generate credits eventually associated with the actual verified operational CI of the fuel production process. As explained in the rationale for the addition of the deficit obligation for verified CI exceedances in the Initial Statement of Reasons:

"Adding a specific deficit obligation created as a result of CI exceedances encourages fuel pathway holders to add a margin of safety on their verified CI to keep from exceeding their certified operational CI. In addition, the credit-true up provision (Sections 95488.10(b) and 95486(a)(3)(B)) provides a mechanism to retroactively provide credits to fuel pathway holders when the verified operational CI is lower than the certified CI, which further encourages use of a margin of safety."

Fuel pathway holders are subject to deficit obligation after the completion of the annual verification of 2025 Annual Fuel Pathway Reports which are submitted in 2026. Consistent with past practice, CARB staff may update or otherwise develop compliance support materials for fuel pathway holders explaining all the elements of the transition to CA-GREET4.0 and implementation of the amended LCFS regulation including credit

true up, the deficit obligation for CI exceedances, and the LRT-CBTS registration process.

With regard to the comments about granting relief from deficit obligations on a case-by-case basis or seeking clarification, see response to SS-6 above.

Comment: The change proposed in Section 95486.1(g) is at odds with the accurate statement in Section 95488.4 that CIs will inherently vary and should not be penalized for such natural variance. It also potentially treats pathway holders worse than petroleum refiners, who have from January 1st through April 30th of each year to acquire Carryback Credits to satisfy prior year credit deficiencies under Section 95486(a)(5). As written, the corrective procedure of Section 95486(a)(5) is available to obligated parties, but it is not clear that it is available to pathway holders. On page 29 of Appendix E, Purpose and Rationale for Low Carbon Fuel Standard Amendments, the rational for the change to Section 95486.1(g) includes the statement that mechanisms exist to retroactively provide credits to fuel pathway holders when the verified operational CI is lower than the certified CI, but Section 95486(a)(5) is not mentioned. Pathway holders should either not be subject to the proposed penalty or should have a similar opportunity to acquire Carryback Credits. (45d-141.6)

Agency Response: No change was made in response to this comment. The deficit obligation applies to alternative fuels that are expected to generate credits unlike petroleum fuels. Allowing credit carryover to avoid the deficit obligation would defeat the purpose of the deficit obligation.

UU. Verification

UU-1 Multiple Comments: Verification body rotation

Summary: Removing the rotation requirements for verifiers would improve the flexibility of the Low Carbon Fuel Standard. Current rotation requirements are disruptive and costly. In the least, CARB should consider exceptions to firm rotation requirements for licensed CPA firms.

(45d-008.1, 45d-009.1, 45d-014.1, 45d-019.1, 45d-031.1, 45d-035.1, 45d-067.1, 45d-092.3, 45d-138.1, 45d-159.1, 45d-165.7, 45d-171.6, 45d-177.4, 45d-221.6, 45d-248.3, 15d2-211.1, 15d2-211.2)

Agency Response: No change was made in response to these comments. Rotation of verification bodies and verifiers is needed to avoid potential conflict of interest issues from lengthy business relationships between verifiers and their clients. This rotation results in a new set of eyes to review the emissions estimates or LCFS data provided by the reporting entity. This requirement will reduce complacency that may occur given the comfort and familiarity a verification body may feel toward a reporting entity after the six-year time period. Responsible entities can reduce onboarding time for new verifiers by continually improving their documented monitoring plans. CARB expects that verification firms will be able to switch clients and effectively bring their knowledge of similar and different data systems to bear during verifications with the new clients. There are currently 30 active accredited verification bodies, and CARB anticipates two training classes to accredit new verifiers in 2025 which may result in addition verification

body accreditations as well. This is a sufficient number of verification bodies to allow for verifier rotation every six years.

UU-2 Multiple Comments: Extend Less Intensive Verification

Summary: Commenters agree with CARB staff's proposal to allow for less intensive verifications for entities where electricity is used as transportation fuel. Less intensive verifications would permit verification bodies to forego site visits so long as they have visited the site within the last two (2) years and have issued a positive verification statement. Commenters agree with CARB staff that for entities where electricity is used as transportation fuel there is little change of operation from reporting period to reporting period thus reducing the benefit of annual site visits, there is no or little risk to the integrity of the LCFS program to allow for less intensive verification services without a site visit in the annual verifications for the following two years, and that this will reduce the cost of verification services which is often passed on to program participants. While there is general support for the allowance of less intensive verifications for entities where electricity is used as transportation fuel, commenters believe that for the same reasons, the allowance of less intensive verifications should be extended to other and/or all fuel types.

(45d- 008.2, 45d- 009.2, 45d- 014.2, 45d- 019.2, 45d- 031.2, 45d- 035.2, 45d- 067.2, 45d-138.2, 45d- 165.6, 45d- 173.3, 45d- 177.5, 45d- 221.7, 45d- 224.1, 45d- 227.2, 45d-240.14, 45d- 241.19, 45d- 248.2, 45d- 255.11, 45d- 303.4, Apr-079.26, Apr-101.6, Apr-147.4, 15d-184.3, 15d-141.6, 15d-212.20)

Agency Response: No change was made in response to these comments. As proposed, only entities that supply electricity used as a transportation fuel will be eligible for less intensive verifications. These report types experience little change of operation from reporting period to reporting period, which minimizes the risk of allowing less intensive verification if entities meet the requirements for less intensive verification. CARB staff believes that there is more risk or uncertainty with other pathways or report types and therefore, at this time, does not think it is appropriate to extend less intensive verification.

UU-3 Multiple Comments: General Concerns and Questions surrounding Third Party Verification for Newly Subject Electricity and Hydrogen Transactions.

Summary: Commenters are concerned that requiring third party verification for electricity and hydrogen fuel transactions as proposed may create unnecessary administrative and financial burden without any additional data integrity guarantees. Additionally, because of the nature of these newly subject sources, certain requirements may be impossible to meet such as site visit and metering requirements.

(45d-147.1, 45d- 153.2, 45d- 180.3, 45d- 188.5, 45d- 218.5, 45d- 228.5, 45d- 236.3, 45d-237.9, 45d- 238.3, 45d-256.16, 45d-284.4, 45d-285.8, 285.9, 45d-287.2, 45d- 303.3, 45d-393.5, APR-054.6, 15d-029.5, 15d-035.4, 15d-061.1, 15d-112.2, 15d-150.2, 15d-184.1, 15d-184.2, 15d-203.1, 15d-203.6, 15d-203.14, 15d-208.9, 15d-220.23, 15d-227.11, 15d-227.3, 15d-227.9, 15d2-216.1, 15d2-216.2, 15d2-216.5, 15d2-216.6, 15d2-216.7, 15d2-216-8, BHT-123, BHT-132, BHT-133, BHT-186)

Agency Response: No changes were made in response to these comments. Since the original verification requirements were incorporated, electricity has grown as a credit generator and accounted for a substantial fraction of total LCFS credits (approximately 25% of total annual credits in 2022). Additionally, the 2022 Scoping Plan Update points to an expanded role for electricity usage in transportation and an increase in hydrogen supply to achieve the State's emission reduction goals over the coming decades. Several recent vehicle regulations have established requirements that have already set the expected increase in motion. With this shift, CARB no longer believes that the data assurance needs for electricity and hydrogen sources can be met only within the staffing capacity of CARB. The LCFS program must ensure that the electricity and hydrogen associated transaction types are held to the same rigorous standard of data quality through third-party verification as the rest of the LCFS program.

As proposed, the requirements for verification services are outlined in Section 95501. Section 95501(b) outlines what must be included in the annual verification which include, but are not limited to, a verification plan, annual site visits, sampling plan, data checks, any report modifications, any findings that came from the verification, as well as a log of issues. The verification plan is to be developed by the verification body, using their professional judgement to evaluate the risk associated with equipment and process to determine the outcome (positive, qualified positive, negative) of the quarterly fuel transactions report (QFTR). All aspects of the verification, including the site visit, serve an important role in the verification outcome as well as in ensuring the integrity of the LCFS program.

Staff recognize the financial impact of requiring verification and has included cost-saving mechanisms such as deferred verification and less intensive verification if certain requirements are met. The Board also directed CARB staff in Board Resolution 24-14 to monitor the impact of verification requirements on the broader program, and propose future changes if necessary. CARB staff believe that the electricity and hydrogen associated transaction types must be held to the same standard of data quality to ensure the integrity of the LCFS program, but is open to evaluating alternative options that achieve the same outcome. Additionally, the cost of verification is assumed to be balanced by increased revenues from increased sales of LCFS credits.

UU-4 Eliminate 3rd Party Verification Requirements for Small Dairies

Comment: The requirement to have a Third-Party Verifier review the annual fuel reports represents a significant cost for small biodigesters and prohibits the participation of more small dairies, limiting LCFS to only the largest biodigesters. Eliminating this requirement will allow more small farms to participate in the program. (45d-287.6)

Agency Response: No change was made in response to these comments. The verification of AFPRs is the responsibility of fuel pathway holders (rather than dairies, regardless of being small or large in size) that participate in the LCFS program for credits and revenue generation. The LCFS program is a market-based program with credits fungible among all entities; therefore, each entity must be held to the same rigorous standards. These amendments propose adding verification to new sectors

(electricity and hydrogen) rather than removing verification. There is an exception for small credit generators to defer verification for up to two years (three years of verification can occur simultaneously) to help minimize the financial impact of verification.

UU-5 Multiple Comments: General Concerns about Metering of Charging Stations

Summary: Commenters are concerned that the requirement for internal meters to be calibrated sets an impossible standard for many devices that will be classified as "internal meters" by the Greenhouse Gas Mandatory Reporting Regulation (or the MRR) to meet. The negative impact of trying to squeeze charging stations into the existing MRR framework will be significant on business and customers, especially fleet chargers. Commenters also expect that if unaddressed, this issue will create implementation difficulty for CARB and/or third-party verifiers, which may lead to a significant disruption in the LCFS program. If CARB implements the verification rules as proposed that reference MRR, this could result in the disqualification of tens of thousands of EV charging stations from the LCFS program and/or significant additional verification costs on the industry.

Additionally, commentors asked for additional guidance, training, and clarity on existing meter accuracy regulations established by other governmental agencies and how they may aid in verifications. (15d-161.1, 15d-161.2, 15d-161.3, 15d-161.4, 15d-161.5, 15d2-193.6)

Agency Response: No change was made in response to these comments. Since the original verification requirements were incorporated, electricity has grown as a credit generator and accounted for a substantial fraction of total LCFS credits (approximately 25% of total annual credits in 2022). Additionally, the 2022 Scoping Plan Update points to an expanded role for electricity usage in transportation and an increase in hydrogen supply to achieve the State's emission reduction goals over the coming decades. Several recent vehicle regulations have established requirements that have already set the expected increase in motion. With this shift, CARB no longer believes that the data assurance needs for electricity and hydrogen sources can be met only within the staffing capacity of CARB. The LCFS program must ensure that the electricity and hydrogen associated transaction types are held to the same rigorous standard of data quality through third-party verification as the rest of the LCFS program.

As proposed, the requirements for verification services are outlined in section 95501. Section 95501(b) outlines what must be included in the annual verification which include, but are not limited to, a verification plan, annual site visits, sampling plan, data checks, any report modifications, any findings that came from the verification, as well as a log of issues. The verification plan is to be developed by the verification body, using their professional judgement to evaluate the risk associated with equipment and process to determine the outcome (positive, qualified positive, negative) of the QFTR. All aspects of the verification, including the site visit, serve an important role in the verification outcome as well as in ensuring the integrity of the LCFS program.

Staff recognize the financial impact of requiring verification and has included cost-saving mechanisms such as deferred verification and less intensive verification if certain requirements are met. CARB staff believe that the electricity and hydrogen

associated transaction types must be held to the same standard of data quality to ensure the integrity of the LCFS program, but are open to evaluating alternative options that achieve the same outcome. Additionally, the cost of verification is assumed to be balanced by increased revenues from increased sales of LCFS credits.

In addition to the requirements for verification, section 95491.1 outlines recordkeeping and auditing requirements. Specifically, subsection 95491.1(c)(1)(g) points to the MRR regulation on measurement accuracy and allows for exemptions for financial transaction meters, as well as ways to allow for internal meters to comply with the measurement accuracy requirements that CARB believes are sufficient.

CARB staff is unclear why verification would lead to the disqualification of a large number of charging stations. All changing stations and associated data in the program should already meet all program requirements and are currently reviewed by CARB staff for eligibility and accuracy. If verifiers uncover issues with charging stations it could be that they should not have been in the program in the first place. There are no requirements for verification of each individual charging station. Verification occurs at the central records location, likely a corporate office. Verifiers may, but are not required to, verify chargers based on risk. CARB staff will continue to provide compliance support to entities subject to verification and verifiers in order to ensure that the verification requirements are met.

UU-6 Multiple Comments: Concerns about Site Visits for Electricity QFTRs.

Comment: Commenters are concerned that the site visit requirements could cause confusion about which facility and/or equipment would need to be visited to satisfy the site visit requirements. Commentors also note that certain aspects of the site visit could be done virtually for additional efficiency, cost savings, and environmental benefits. (Apr-053.3, Apr-151.10, 15d-035.2, 15d-035.3, 15d-050.2, 15d-069.5, 15d-080.6, 15d-107.6, 15d-112.3, 15d-150.1, 15d-224.17, 15d-243.7, 15d-243.8, 15d-243.9, 15d2-193.5, 15d2-195.25, 15d2-204-10, 15d2-207.25, 15d2-209.1, 15d2-212.16, 15d2-218.5, 15d2-218.6, 15d2-225.5, 15d2-265.3, 15d2-288.6)

Agency Response: A regulatory change has been made to clarify the site visit requirements. The amendments as modified now explicitly indicate that, to verify a QFTR, at least one lead LCFS verifier must annually visit the central records location. In addition, verifiers may conduct risk-based site visits to fueling supply equipment (FSE) or fuel dispensing facilities, based on the verifiers' professional judgment.

CARB staff recognize the financial impact of requiring verification and has included cost-saving mechanisms such as deferred verification and less intensive verification if certain requirements are met. However, CARB staff believe that the electricity and hydrogen associated transaction types must be held to the same standard of data quality to ensure the integrity of the LCFS program, including site visit requirements. Additionally, the cost of verification is assumed to be balanced by increased revenues from increased sales of LCFS credits.

UU-7 Multiple Comments: Section 95491.2 Missing Data Provisions Requires Significant Reforms

Comment: 95501(13)(A) - Review of Missing Data Substitution. CARB, like many regulatory bodies, has previously recognized the use of "reasonable temporary methods" to address data gaps, noting operational realities result in varying gaps that can be reliably filled in reasonable ways that consider the context of each situation. RNG Coalition urges CARB to continue to allow those participating in the LCFS to be able to use "a reasonable temporary method," rather than prescribing the limited data substitution tactics specified under 95491.2(b)(2)(B)'s Table 13 unless such additional flexibility is already allowed under the use of an "Executive Office approved alternate method". (45d-240.17)

Comment: The requirements for submitting an Alternate Method Request (AMR) within 10 days after submitting an Annual Fuel Pathway Report (AFPR) as written in Section 95491.2 will be challenging if not impossible to comply with. This is a technical issue and discussion yet important nevertheless to manage projects.

There are often situations when missing data or other situations requiring an AMR are identified after these deadlines and are deemed necessary after review by a verifier after consulting with CARB. For example, we had a case where a dairy temporarily used a diesel vacuum truck to haul manure from a few pens for two weeks of the year. This information was not reported by the dairy owner until the AFPR site visit, which occurred well after the annual AFPR report deadline. CARB's program should be designed around flexibility and the ability to report accurately without prohibiting the ability to generate credits wholly on account of missing this 10-day deadline. Such an approach is overly punitive for small issues that have a negligible impact on the CI and will not solve CARB's well-intentioned approach to reduce staff time reviewing these issues.

A couple of potential suggestions:

- We suggest a more reasonable 30-day deadline from the date a reason for an AMR is identified by the applicant, the verifier, or CARB. This will allow AMRs to be submitted and reviewed throughout the year and not burden CARB staff time all at once, consistent with CARB's goals.
- Alternatively, we suggest a calendar-based requirement that the AMR be submitted no later than 10-days after the August 31 annual verification deadline which will allow the pathway holder to complete verification and work with CARB and the verifier to determine an Executive Officer-approved method.

Note, this appears to be consistent with the intent as stated in the Appendix E: Purpose and Rationale of Proposed Amendments for the Low Carbon Fuel Standard Requirements:

Providing 10 days after report submittal allows the applicant to ensure they can complete the reporting process and still have up to 10 days to provide the necessary documentation to CARB as part of the alternate method request.

This implies CARB's intent is to allow flexibility on behalf of the pathway holder, but the plain language suggests credits will be invalidated if an AMR is not submitted for an issue that is not

known by the pathway holder at the time of the deadline. Furthermore, LCFS credit generators should be afforded the opportunity to work with CARB to "assign a conservative alternate method for use during the missing data timeframe" in the same way that is allowed for deficit generators. (Apr-155.10)

Comment: Separately, CARB should specify a lower threshold for "Missing Data" where the requirements to use Table 13 are only triggered if a certain duration or volume of missing data is observed. For instance, if >95% of the data is available, then the default should be that any missing data should be left to a verifier to review and confirm reasonableness rather than prescribing a one-size-fits-all approach. This will reduce the burden on CARB staff while still maintaining a high level of integrity for the data used in a pathway. (Apr-155.11)

Agency Response: The proposed missing data substitution requirements are intended to (1) ensure consistent treatment of missing data, (2) streamline the reporting and verification process to address the vast majority of cases of missing data, incentivize the collection of quality-assured data, and (3) still allow for the use of an alternative method when methods in Table 13 are not applicable. Missing data provisions are consistent with missing data provision used under MRR and Cap-and-Trade.

The proposed 10-day deadline to submit an alternative method request to CARB is critically important to allow staff sufficient time to review and approve requests. The annual report submittal deadline is March 31 for the data from the previous calendar year. That gives reporters over three months to identify missing data and submit an alternative request which is sufficient time. Reporters should be doing due diligence and checking the quality of all data during report development (and before the report submittal deadline of March 31) and not relying on verifiers to identify missing data during the verification process. There is nothing the verifier does during verification that the reporter cannot do prior to report submittal.

Third-party independent verifiers are not expected to serve as consultants to the reporters. The reporters or their consultants should identify missing data as early as possible when they prepare the report. Once submitted to CARB, the report should be accurate and reflect the reporter's best effort and due diligence. However, CARB acknowledges unexpected situations and, therefore, allows the reporting entity to have 10 extra days after submitting their annual or quarterly report to request approval of an alternate method.

UU-8 Multiple Comments: Alternate Method Request (AMR) and Data Period

Comment: The proposed "Missing Data Provisions" in Section 95491.2(b)(2)(B) Table 13 are based on a data year, however data substitution is often required to be completed monthly to determine fuel allocations for Pathways with multiple fuel pathway codes. If missing data substitution is required to be completed annually instead of monthly, it will create issues with monthly fuel allocation and dispensing for pathways, as well as quarterly fuel transaction reporting, which will require quarters 1, 2, and 3 to be re-opened and re-reported every year.

Amp requests that the use of "reasonable temporary methods" continue to be allowed to address missing data, which allows for operational realities and engineering best practices to

be used. As the majority of data being substituted is continuous data (e.g. 15-minute data), data substitution using data directly prior and after is likely to be more accurate than a 30-day average or highest/lowest value over a one- to two-year time period. As the reports that fall under 95491.2 are all required to undergo third party verification, it ensures that all "reasonable temporary methods" are deemed conservative and accurate. (45d-323.29)

Comment: Data substitution the Missing Data Provisions, Section 959491.2(b)(2)(B), are based on a calendar year; however data substitution is required to be completed monthly to determine fuel allocations for Pathways with multiple fuel pathway codes. If the quantity of data substitution changes over a year, the data substitution methodology will change, which will change fuel allocation and require all entities, not just the fuel pathway holder, to re-open and re-report every all four QFTR annually. Amp requests that the use of "reasonable temporary methods" continue to be allowed to address missing data, which allows for operational realities and engineering best practices to be used. As the majority of data being substituted is continuous data (e.g., 15-minute data), data substitution using data directly prior and after is likely to be more accurate than a 30-day average or highest/lowest value over a one- to two-year time period. (15d1-212.21)

Comment: Lastly, three out of four data substitution methods in Table 13 require calculations that rely on "quality assured values from the current data year". Using data from the entire data year is unreasonable and will be highly problematic to implement for Quarterly Fuel Pathway Reports. For instance, if there is a metering data outage lasting 20 days covering a period between March and April, according to the guidance this would trigger data substitution requiring use of the "10th or 90th percentile of quality assured value from current data year". However, given that data will continually be collected throughout the remainder of the year, the substituted values will similarly need to change all the way until December 31 of that year. That means potentially every quarter, the previous Quarterly Fuel Pathway Reports which had the affected data period will need to be re-opened to modify values according to the newly collected data. Instead, CalBio strongly recommends CARB limit the substitution to occur using data only within a fixed number of days (30 days before or after), or within the calendar month or calendar quarter as opposed to the entire calendar year (Jan to Dec). Otherwise, this will lead to reporting volumes in the LRT continually needing to be opened up to revise, requiring CARB staff time review and approval for an insignificant change in the number of credits. (Apr-155.12)

Agency Response: CARB staff realizes the QFTRs pose an issue with reporting missing data. However, it is necessary to have a representatively large data sample to provide the most accurate missing data replacement methods. Reporters can report a conservative value or zero for the period of the missing data during QFTR submittal and revise in the Annual Compliance Report replacing missing data following the regulatory requirements.

UU-9 Multiple Comments: Request to Delay Implementation of Verification for Electricity QFTRs.

Comment: Commenters are concerned that the entities that will be newly subject to the verification requirements proposed will not have the time or resources in order to prepare for

the verification requirements and as such have requested that the implementation date be delayed. (15d2-193.4, 15d2-216.11, 15d2-216.9, 15d2-265.2)

Agency Response: The Proposed Amendments set an implementation expectation for the electricity- or hydrogen-based transaction types, beginning in 2027 for 2026 data, meaning that the first data year to be subject to verification will be the 2026 data year. Staff introduced and discussed the proposed changes over a few years, including workshops and releases of proposed draft regulatory text. Staff believe that the specified timing to prepare for the new requirements is sufficient.

UU-10 Multiple Comments: Exempt Residential EV Charging from Verification Requirements.

Comment: Commenters are concerned that private individuals that own EVs and EV charging equipment may be subject to verification which would require site visits to take place at private residence. (15d-208.8, 15d2-185.2, 15d2-225.6)

Agency Response: The applicability requirements for the newly subject transactions specify that EV charging transactions specified under 95491(d)(3)(A) are not subject to verifications of quarterly fuel transactions reports as described in 95500(c).

A regulatory change has been made to clarify the site visit requirements. As modified, the Proposed Amendments explicitly indicate that to verify a QFTR, at least one lead LCFS verifier must annually visit the central records location. In addition, verifiers may conduct risk-based site visits to fueling supply equipment (FSE) or fuel dispensing facilities, based on the verifiers' professional judgment.

UU-11 Multiple Comments: Apply Increased 10,000 Credit Limit for Deferred Verification to Quarterly Fuel Transactions Reports

Comment: Commenters request that the increased deferral limit proposed in 95500(b)(2)(B) for verification of annual fuel pathway reports be extended to section 95500(c)(2)(B) and quarterly fuel transactions reports. (15d2-93.3, 15d2-216.10, 15d2-216.3)

Agency Response: Changes were made in response to these comments. As identified in the Second Notice of Public Availability of Modified Text and Availability of Additional Documents and/or Information (Deadline to Comment: October 16, 2024), in response to public comments, CARB proposed to increase the threshold for verification deferral for hydrogen and electricity-based transactions from 6,000 credits to 10,000 credits. Staff mistakenly applied this increase in the deferral threshold to the Annual Fuel Pathway Report (AFPR) section of the regulation, rather than the Quarterly Fuel Transaction Report (QFTR) section, as intended and specified in the Second 15-day Notice. As described in this FSOR's list of non-substantial modifications, staff have corrected this typographical error in the final regulation order.

VV. Vehicle EERs

VV-1 Multiple Comments: Increase light-duty ZEV EER

Comment: CARB should update the Energy Economy Ratio (EER) for light duty plug-in electric vehicles to reflect the current efficiency of vehicles sold. Based on sales over the prior 5 years, the sales-weighted and utility factor-weighted average efficiency of plug-in light duty EVs was 0.305 kWh/mi.1 When compared to the most recent average fuel economy for the light duty fleet (26.0 mpg), an EER of 4.2 is justified.2 At a minimum, CARB should increase the EER to 4.0 from the current value of 3.4 approved for light duty electric vehicles. (45d-276.11)

Comment: Update the Light Duty BEV Energy Efficiency Ratio (EER) and Provide a Pathway for OEM-Specific EERs

CARB should also use this rulemaking as an opportunity to update the Energy Efficiency Ratio (EER) for Light Duty Battery Electric Vehicles (LD BEV). The current 3.4 EER was adopted by CARB in 2011 and has not been updated in the 13 years since. As described in the 2011 Initial Statement of Reasons (ISOR) (Appendix A, Page 67),59 the 3.4 EER was an average of the EERs of two vehicle comparisons. The first was a PHEV-to-ICE comparison between a 2011 Chevy Volt compared to a 2011 Chevy Cruze (93 MPGe combined fuel economy / 28.3 MPG combined fuel economy = 3.29 EER). The second was a BEV-to-ICE comparison between a 2011 Nissan Leaf and a 2011 Nissan Versa (99 MPGe combined fuel economy / 28.4 MPG combined fuel economy = 3.49 EER). The fuel economy numbers can be viewed on www.fueleconomy.gov. The 28.3 MPG fuel economy for the Chevy Cruze was presumably a simple average of the automatic transmission versions of the three engine trims offered. The 28.4 MPG fuel economy for the Nissan Versa was presumably a simple average of the automatic transmission versions of the two engine trims offered. Given the immense change in EV adoption in recent years, and the remarkable improvements in the efficiency of EVs today, it is simply inappropriate to use an EER that is 13 years old. As an illustrative example, a 2024 Hyundai Ioniq 6 has a 140 MPGe, which is a 40% improvement on the 2011 Nissan Leaf.

If CARB were to keep the 2011 (existing) EER methodology and simply update the calculation using the most current version of the cars included in that calculation, the EER would rise from 3.4 to 3.8. However, for the first comparison between a PHEV and ICE vehicle, CARB chose the Chevy Volt and Chevy Cruze; unfortunately, General Motors ceased production of both vehicles in 2019.60 In leu of these vehicles, CARB would need to add another comparison. A similar comparison can be done between the 2024 Prius Prime, which achieves a 127 MPGe combined fuel economy,61 and the conventional ICE 2024 Toyota Corolla (both are classified as compact cars), which achieves a 28.5 MPG combined fuel economy across the simple weighted average of the automatic transmission versions of the two non-hybrid engine trims. This is a PHEV-to-ICE EER of 4.46. Nissan continues to sell the Leaf and the Versa. The Nissan Leaf energy efficiency has improved from 99 MPGe in 2011 to 111 MPGe for the 2024 model year.62 The Nissan Versa energy efficiency has improved from 28.4 MPG in 2011 to 35 MPG for the automatic transmission version of the only engine trim.63 This translates to an EER of 3.17 for BEV-to-ICE. Using the simple average of the BEV and PHEV EERs, we arrive at an overall Light Duty EER of 3.8. Another apt comparison would be the Hyundai Ionig 6 and the Hyundai Elantra. As stated earlier, the lonig 6 gets 140 MPGe, while the Elantra's weighted average of the automatic transmission versions of the two non-hybrid engine trims is 35 MPG. This is a BEV-to-ICE EER of 4. Using a sales-weighted BEV-to-ICE ratio would likely result in an EER over 4.0.

California would not be alone in modernizing its EERs for LD BEVs. Canada's Clean Fuel Regulations use a 4.1 EER for light duty EV Charging. This was calculated based on the ratio of the sales-weighted average efficiencies of electric vehicles to the sales-weighted fuel efficiency of the ICEVs in the same class, with efficiency data came from the 5-cycle testing procedure.64 The Netherlands' Energy Transport Regulation currently uses an EER of 4.0.65 The European Union recently passed the third version of its Renewable Energy Directive (REDIII). This directive increases the targets for EU member states transportation GHG reductions and guides them to use a 4.0 EER.66 Updating the EER is important to ensure that electric vehicle charging is properly credited and continues to be incentivized appropriately. Utilizing a higher EER can support a steeper step change and a steeper compliance curve for this program.

In addition, CARB should allow an OEM to submit an application for an EER based upon that OEM's real-world fleet. CARB has created a precedent for this by approving the Lime scooter Tier 2 pathway which included a company-specific EER factor.67 Allowing OEMs to submit applications for company-specific EERs would better reflect the actual efficiency of electric vehicles in the market and allow those vehicles to be properly credited. This would also incentivize each OEM to focus on improving vehicle efficiency. (45d-353.8)

Comment: Update the Light Duty BEV Energy Efficiency Ratio (EER).CARB should update the Energy Efficiency Ratio (EER) for Light Duty Battery Electric Vehicles (LD BEV). The current 3.4 EER was adopted by CARB in 2011 and has not been updated in the 13 years since. California now lags other jurisdictions which have more accurate EERs, such as The Netherlands (4.0 EER) 13, The European Union (4.0 EER) 14, and Canada (4.1 EER).15 As described in our previous comment, a more thorough analysis would likely result in an EER over 4.0. (Apr-091.18)

Comment: At the same time, the EER classes for LMDV and HDV need to be maintained for accurate credit calculation. (Apr-103.19)

Comment: Updates to the Light-Duty ("LD") EER and Geofencing Radius Still Merit Consideration

Rivian has previously raised the need to implement technical adjustments to the LD EV EER and geofencing radius used to identify eligible telematics-recorded charging activity. Unfortunately, the latest package of modified text does not include any discussion of potential changes to these aspects of the LCFS.

We acknowledge that updating the EER would represent a relatively substantial change at this stage in the rulemaking process. Nonetheless, we want to take this opportunity to reiterate a summary of our findings in this regard and encourage continued deliberation on this important aspect of the regulation. If the staff consider proposing further modifications to the regulatory text before the hearing, we recommend an update to the EER be included...

Revise the LD EER. The current value of 3.4 stems from a determination originally made by CARB in the 2011 rulemaking—and is thus now more than a decade old.6 Continuing to use an outdated EER systematically undervalues the real-world displacement of fossil fuels achieved by EVs, and the true role EVs play in decarbonizing the transportation fuel pool in support of the LCFS' objectives. Examples of more appropriate EER values exist. For instance: A National Renewable Energy Laboratory analysis of the U.S. passenger vehicle fleet found an EER of 4.4.7...

Canada's clean fuels regulation specifies an EER of 4.1 for LD vehicles.8

Rivian compared the R1S to comparable three-row internal combustion engine ("ICE") SUVs and estimated an EER of 4.05.9

We encourage CARB to take this opportunity to calculate a revised EER. (15d1-107.7)

Comment: Here, I encourage CARB to consider providing adjustments to Section 95488.7(a)(3) specifically to allow for stakeholders to file innovative Economic Efficiency Ratios (EERs), even in scenarios where the fuel-vehicle combination is a variation of the EERs that are already included in the Regulation's Table 5.3 At this time, Tier 2 EER pathways are only allowed for fuel-vehicle combinations not already included in the Regulation's Table 5, which I believe may unintentionally deter some entities within the e-mobility sector from exploring EER innovation.

The current regulation states that for:

"Tier 2 Pathways for EER-Adjusted Carbon Intensity. Applicants supplying fuel for a transportation application that is not included in Table 5 may apply for an EER-adjusted carbon intensity for reporting and credit generation purposes."

To embolden EER innovations, I would recommend the following adjustment (see underlined):

"Tier 2 Pathways for EER-Adjusted Carbon Intensity. Applicants supplying fuel for a transportation application that is not included in (or is a scientifically justifiable variation or combination of EERs from) Table 5 may apply for an EER-adjusted carbon intensity for reporting and credit generation purposes."

Allowing for EER innovation in this manner would embolden the e-mobility sector to utilize the Tier 2 Pathway process to work with CARB to develop innovative solutions that help meet CARB's objectives. Moreover, I envision that the e-mobility sector can indeed demonstrate and prove additional EER value to CARB within the LCFS regulatory regime while fortifying proposed methodology consistent with the scientific defensibility that CARB requires.4 Moreover, this adjustment would simply allow for entities to be considered eligible to apply for the Tier 2 Pathway review process, where deeper review and methodology critique occurs.

Indeed, there are multiple scenarios related to a vehicle's capacity, efficiency, technology use, vehicle utilization, and other factors that (if more precisely captured within the LCFS program) may result in added benefits (environmental and otherwise) from the program. As such, I would encourage CARB to consider the exploration of EER innovation as part of its final decision within this Rulemaking, and consider making the adjustments as proposed earlier with respect to Table 5. (15d2-189.3)

Agency Response: No changes were made in response to these comments. Commenters requested updates to the LD EV EER and OEM-specific EERs. These changes are out-of-scope for the current rulemaking. Staff did not pursue wholesale updates to Table 5 EERs. Updates to forklifts EERs were made to better reflect baseline conditions regarding the percentage of the fleet that were originally electric. Updates to the fixed guideway EER were in acknowledgement that all sections of all-electric rail are needed to provide an alternative to driving for passengers and that operational improvements can result in nonlinear ridership improvements, thereby reducing the energy use per passenger. Staff will consider proposing updates to EERs in the next LCFS rulemaking if vehicle performance data across a sector indicates significant changes.

VV-2 Increase medium- and heavy-duty BEV EER

Comment: While not quite as dated, the current 5.0 EER for Heavy Duty battery electric vehicles is also due for an update. This EER was set during the 2018 rulemaking and the methodology for calculating this EER is described in the ISOR Appendix H, Section E.68 Unlike the Light Duty EER calculation, which was based on just two vehicle comparisons, the MHD EER calculation is based on an analysis of a number of papers comparing the efficiency of transit buses, drayage trucks, parcel trucks, and many other MHD vehicle types. Tesla believes this more comprehensive EER methodology is preferable and encourages CARB to update the MHD EER based on the current state of vehicle efficiency research.

In the current EER table (Table 5) CARB has Light and Medium Duty electric vehicles lumped together into a single EER and Heavy Duty EERs as another single EER. Light Duty vehicles are defined as vehicles with a GVWR of 8,500 pounds or less, while Medium Duty Vehicles are defined as vehicles with a GVWR between 8,501 and 14,000 pounds. Anything over 14,001 pounds GVWR is classified as Heavy Duty. This combining of Light and Medium duty in the EER table conflicts with the combining of Medium and Heavy Duty in the Fast Charge Infrastructure (FCI) program. As part of the EER update, Tesla encourages CARB to either create a separate EER for Medium and Heavy Duty BEVs or allow for OEM-specific EERs. (45d-353.9)

Agency Response: No changes were made in response to these comments. See Agency Response to VV-1.

VV-3 ZEV crediting calculation

Comment: Lastly, I have a question about Zero-Emission Vehicle crediting in the future with respect to ACCII. As the regulation goes into effect that requires a certain percentage of new car sales be Zero-Emission Vehicles, will LCFS crediting be adjusted to reflect the fact that each ZEV is not replacing an ICE vehicle? As soon as 2026, the status quo baseline alternative to purchasing and operating 100 new ZEVs will be purchasing and operating a fleet of 65 new ICE vehicles and 35 new ZEV vehicles. The overall fleet of vehicles will also shift more towards ZEV vehicles, making the concept that each ZEV displaces one ICE's worth of gasoline incorrect. How does LCFS plan to incorporate this into their crediting methodology, and is this consistent with other technologies? (45d-352.4)

Agency Response: No change was made in response to this comment. LCFS defines baselines for each technology based on 2010 data, to reflect the pre-regulation state of technology adoption so that there remains an incentive to continue to increase action to support the goals of the program. As fleets transition to ZEVs in higher quantities, staff is open to considering potential revisions to the methodology for assigning EERs to reflect the current state of technologies in use.

VV-4 Multiple Comments: Create EER for new off-road

Comment: Allow credits for zero-emission transportation fuels used for ocean-going vessels, and simplifying the process for credits for shore power installations serving electrified harbor crafts and for dispensing green hydrogen. (45d-134.7, 45d-137.7)

Comment: EVCA and CalETC continue to recommend the new LCFS create a level playing field for emerging transportation electrification end-uses in airports, agriculture, mining, marine, aviation, and recreation by adding conservative default EER of 2.0. while excluding certain end-uses such as golf carts and indoor sweeper/scrubbers that are already electric (45d-188.8)

Comment: We encourage ARB to add electric ground support equipment (eGSE) as an eligible credit-generating technology.

3Degrees recommends that ARB use this rulemaking opportunity to explicitly include eGSE as an eligible credit-generating technology type under the LCFS. eGSE are eligible for crediting under the programs in both Oregon and Washington, and incorporating eGSE into the LCFS would serve to incentivize an industry that is in the early stages of electrification. This would help ensure that the California LCFS remains a driving force for new technologies to transition away from fossil fuels. An EER for eGSE can be easily developed using a similar methodology to that of electric cargo handling equipment (eCHE). This category of electric off road equipment charging should, in line with other clean fuels programs, assign the owner of the FSE as the fuel reporting entity and the credit generator. (45d-195.7)

Comment: FuSE supports the inclusion of other equipment types, though we suggest CARB establish EER values for GSE and agriculture equipment. During the July 7 workshop, CARB mentioned that staff is considering the inclusion or addition of zero-emission applications for rail, agricultural equipment, commercial harbor craft and airport GSE under the Tier 2 EER-adjusted CI pathway application process. We highlight that these application opportunities are already present under the current regulation and any pathway applicant may submit an EER-adjusted Tier 2 pathway application. Using other studies, such as the CAC's EER RFP6, CARB should consider the additions of these equipment types to Table 5, significantly improving the likelihood of LCFS participation of these new technologies and would route badly needed funding toward fleets considering deployment. (45d-218.7)

Comment: CARB should establish default EERs for equipment, vehicles, and vessels in emerging electrification applications such as agriculture and forest management, mining, marine, aviation, and other off-road to facilitate market participation and encourage greater electrification. (45d-276.19)

Comment: Allow emerging types of transportation electrification to earn credits without a Tier 2 application (45d-279.6)

Comment: Ocean Going Vessels (OGVs): Facing increasing CI reduction targets proposed by the International Maritime Organization (IMO), shipping companies are looking to renewable fuels as a way to reduce their emissions. CARB should consider including fuel used in those ocean going vessels within the LCFS to support and accelerate the decarbonization of large container ships, tankers, and other OGVs. (45d-295.14)

Comment: We encourage CARB to add electric ground support equipment (eGSE) as an eligible credit-generating technology.

3Degrees recommends that CARB use this rulemaking opportunity to explicitly include eGSE as an eligible credit-generating technology type under the LCFS. eGSE are eligible for crediting under the programs in both Oregon and Washington, and incorporating eGSE into the LCFS would serve to incentivize an industry that is in the early stages of electrification. This would help ensure that the California LCFS remains a driving force for new technologies to transition away from fossil fuels. Since CARB is now proposing that fossil jet fuel continue to be exempt from generating deficits, adding eGSE to the program would be a way that the agency could promote emissions reductions at airports - an issue that numerous stakeholders testified was of key importance during several hearings and workshops. An EER for eGSE can be easily developed using a similar methodology to that of electric cargo handling equipment (eCHE). This category of electric off road equipment charging should, in line with other clean fuels programs, assign the owner of the FSE as the fuel reporting entity and the credit generator. (15d1-050.4)

Comment: FuSE supports the inclusion of other equipment types, though we suggest CARB establish EER values for GSE and agricultural equipment. During the July 7 workshop, CARB mentioned that staff are considering the inclusion or addition of zero-emission applications for rail, agricultural equipment, commercial harbor craft and airport GSE under the Tier 2 EER-adjusted CI pathway application process. We highlight that these application opportunities are already present under the current regulation and any pathway applicant may submit an EER-adjusted Tier 2 pathway application. Using other studies, such as the CAC's EER RFP6, CARB should consider the additions of these equipment types to Table 5, significantly improving the likelihood of LCFS participation of these new technologies and would route badly needed funding toward fleets considering deployment. (Apr-054.7)

Comment: (...) there's other opportunities through the Tier 2 revision process that allow for E-mobility entities to also gain from the Program. (BHT-248)

Agency Response: No change was made in response to this comment. Staff appreciate the need for additional financial support of low-CI off-road and marine fuels. Staff establish Table 5 EERs for fuel-vehicle pairs when ample data are available that ensure that an EER is generally representative of the technology available.

Table 5 of the LCFS regulation provides Energy Economy Ratio (EER) values for several fuel-vehicle combinations, which are used for calculating credits or deficits as per section 95486.1(a). If a fuel-vehicle combination is not represented by an EER value in Table 5, and both the fuel and vehicle type are eligible pursuant to section 95482 of

the LCFS regulation, then the reporting entity may request an EER-adjusted carbon intensity (CI). An EER-adjusted CI is determined using a Tier 2 pathway application pursuant to section 95488.7(a)(3) of the LCFS regulation. Staff may consider developing appropriate regulatory updates in the next LCFS rulemaking if sufficient data are available to substantiate an average EER within a fuel-vehicle pairing.

WW. Dairy and Swine Manure (DSM) pathways

WW-1 Pausing LCFS pathways certification due to rulemaking

Comment: CARB must commit in the Scoping Plan to examining the life cycle impacts of dairy biogas to ensure the state is relying on the most accurate assessments of the technologies and fuels making up California's long term GHG reduction strategy. If a rulemaking is not already underway, the Scoping Plan must commit to addressing the problems and impacts of dairy biogas in a dedicated Low Carbon Fuel Standard (LCFS) rulemaking. LCFS Pathways certifications for dairy biogas should be paused until the conclusion of the rulemaking. (45d-200.3)

Agency Response: No change was made in response to these comments. The recommendations for the 2022 Scoping Plan Update falls outside the scope of the LCFS rulemaking process. CARB did not pause the certification of LCFS pathways, which are a routine aspect of implementation LCFS regulation, during the development of this rulemaking. It would have been inappropriate to do so.

WW-2 Multiple Comments: Support DSM biogas to electricity Tier 1 calculator

Comment: Bloom supports both of these proposals and the Tier 1 calculators in general. Additionally, we respectfully request that a Tier 1 calculator or other streamlining option be made available for biogas-to-electricity projects. Given the fact that this option is already available for RNG, this would help to provide equal treatment for pathways dependent on the same feedstock. (45d-181.5)

Comment: CalBio strongly recommends that CARB develop a separate DSM biogas-toelectricity Tier 1 CI Calculator for such pathways to streamline the process for reviewing and approving biogas-to-electricity projects. The proposed CI Calculator would inherently include all the modifications and technical guidance included in CARB's LCFS Guidance 19-06 document. Absent a standard Tier 1 CI Calculator for biogas-to-electricity, all such projects will be forced into a Tier 2 application. This disadvantages in-state projects which help California to achieve its methane reduction goals and support electrification. (45d-289.1)

Agency Response: No change was made in response to these comments. The carbon intensity (CI) of dairy and swine manure biogas-to-electricity pathways can be determined by modifying the Tier 1 CI Calculator for Dairy and Swine Manure Biomethane, as described in LCFS Guidance 19-06. The LCFS Guidance 19-06 document may be updated or replaced as needed to reflect the proposed amendments.

WW-3 Multiple Comments: Eliminate credits for combustion technology

Comment: The Amendments do not place a restriction on pathways where factory farm gas is burned in internal combustion engines to produce electricity, apparently leaving that fuel type

eligible for up to 30 years of avoided methane crediting regardless when the project broke ground or applies for a pathway. ... massively encourage burning factory farm gas in dirty internal combustion engines in the San Joaquin Valley for the long-term. (45d-368.12)

Comment: Additionally, flaring of excess biogas and use of combustion engines to convert biogas into electricity will increase NOx emissions in the San Joaquin Valley. (45d-368.49)

Agency Response: Changes were made in response to these comments. Staff updated Section 95488.8(i)(2) to only allow indirect accounting for RNG to electricity when the electricity is produced from a fuel cell, which has significantly lower emissions than an electricity produced from an internal combustion engine. Please see also CEQA RTC Master Responses 1 and 4 and CEQA RTC-377-26.

WW-4 Multiple Comments: Need full emissions accounting and corrected CI for dairy and swine pathways

Comment: Conduct a full accounting of GHG and air pollution emissions associated with pathways relying on the production of fuel from livestock and dairy manure. (45d-001.2)

Comment: We strongly recommend that CARB to correct the oversized negative CI scores awarded to biogases. (45d-011.2)

Comment: The "avoided methane" crediting policy assumes that open air flaring is the only option for dairy, beef or hog producers and that captured methane is an "avoided emission." This ignores alternative approaches to raising animals (such as on appropriately scaled, pasture-based systems that avoid giant liquid manure lagoons all together) and better manure management (such as lower-emitting dried manure systems). In other words, the CAFO system itself and its management of manure is demonstrably avoidable.

The state does not account for several major sources of CAFO emissions within its biogas scoring system. CAFO systems are entirely dependent on low cost (sometimes below cost) feed often from off the farm, just as ethanol or biodiesel are entirely dependent on corn and soy production. The LCA for biogas from beef, dairy and hog CAFOs does not include the significant emissions associated with feed, including nitrous oxide emissions associated with fertilizer use (particularly for corn) and emissions associated with the harvest, processing and transport of feed to the CAFO. The LCA also doesn't include emissions from cows themselves in the case of dairy and beef. Finally, the LCFS does not count the emissions associated with the application of biogas digestate on the land, which can emit more methane and nitrous oxide than undigested manure. (45d-042.1, Apr-010.5)

Comment: The LCFS incorrectly assigns factory farm gas an extremely large negative Carbon Intensity (CI) score. This is flawed for a number of reasons. First, CARB completely disregards the greenhouse gas emissions from the underlying factory farming operations as well as the increased greenhouse gas emissions when operators use and dispose of the digester waste. (45d-208.2)

Comment: Second, maintaining massive quantities of liquid manure is not a given; it is a choice - one that the LCFS rewards and reinforces. (45d-208.3)

Comment: There are alternative manure management practices that have lower methaneemissions and are more sustainable. (45d-208.4)

Comment: Addressing inaccuracies in the Life Cycle Assessment that ignore associated up and downstream greenhouse gas emissions from factory farm gas production. (45d-027.3, (45d-030.2, 45d-184.3, 45d-339.2, 45d-381.2, 45d-398.2, 45d-8608-8727.3, 45d-8756-8763.3, Apr-077.4, 15d1-043.2)

Comment: Critically, enteric emissions are currently not included in the LCFS's lifecycle emissions analysis for biomethane from manure. While CARB does not account for these upstream emissions, if there is an increase in enteric emissions as a direct effect of LCFS policy, progress toward meeting the SB 1383 target for livestock methane emissions reductions may be negatively affected. (45d-206.2)

Comment: CARB should account for potential unintended increases in emissions at the farm level (from manure management and/or digestate management) and potential risk to accelerate rate-of-farm consolidation in the amendment Appendix D, attachment B, Summary of Environmental Impacts and Mitigation Measures. The goal is to have these issues clearly mapped by CARB and added to the broader discussion of reduction in methane emissions from the dairy sector. (45d-206.5)

Comment: In the Petition for Rulemaking, Petitioners asked CARB to amend the LCFS to exclude all fuels derived from factory farm gas or, in the alternative, to reform the LCFS to account for the full life cycle of factory farm gas production emissions—including all upstream and downstream emissions from activities and inputs at the source dairy and pig factory farms—and exclude non additional emission reductions that occur as a result of other factory farm gas incentives. (45d-368.14)

Comment: First, factory farm gas pathways fail to achieve the maximum technologically feasible and cost-effective emissions reductions, as Assembly Bill 32 (AB 32) requires, because they fail to incorporate proper lifecycle analyses (LCAs), leading to indefensibly low carbon intensity scores and, in turn, an indefensibly high number of credits generated for factory farm gas production. (45d-368.15)

Comment: Ensuring credits derived from livestock manure include all GHGs from producing manure-based fuels. CARB's current implementation of the LCFS improperly ignores the greenhouse gas emissions from the production of manure and the handling of manure digestate, a practice which over-values the carbon intensity of manure-based fuels and leads to excessive credit generation. (45d-379.17)

Comment: Despite the significant emissions coming from the CAFO system, CARB's current emissions intensity analysis gives biogas a negative carbon intensity score, lower than any other transportation fuel, including electricity produced by solar and wind energy which produce no discernable waste, emissions or water pollution. (Apr-010.2)

Comment: Change LCA standards to penalize leakage levels that make biogas carbon intensive –including nitrous oxide emissions from spreading of the digestate. (Apr-030.7)

Comment: Correcting the spurious avoided emission carbon intensity scores will allow CARB to award the lowest score, and greatest value, to clean, renewable electricity, and accelerate the LCFS goal of supplanting biofuels with electricity. Providing a credit multiplier for zero-emission fuels would also accelerate this shift. (Apr-030.8)

Agency Response: Refer to CEQA RTC Master Responses 1 and 5.

WW-5 Methane emissions associated with manure or gas trucking

Comment: CARB doesn't adequately consider new models of methane digesters, where manure or gas are trucked from several surrounding CAFOs to a centralized digester. For example, a Wisconsin digester project is accessing LCFS credits sources from three local dairies. A proposed Minnesota digester would collect manure from four dairies in three counties. Each project includes an enormous amount of additional truck traffic and fuel use to be workable, not to mention the emissions associated with each individual CAFO. (45d-042.1, Apr-010.6)

Agency Response: No change was made in response to this comment. The greenhouse gas emissions associated with manure trucking or biomethane trucking have always been accounted for in lifecycle analyses for applicable LCFS fuel pathways.

WW-6 Multiple Comments: Modifications to Tier 1 calculator for DSM to RNG

Comment: we ask that ARB revert to the original language requiring that site-specific data take precedence over values from Table A.9 of the Compliance Offset Protocol - Livestock Projects (LOP) as an input to the calculator for solid separation equipment. (45d-195.6)

Agency Response: No change was made in response to this comment. Table A.9 in the Tier 1 CI calculator for Dairy and Swine Manure Biomethane is referenced from the Compliance Offset Protocol for Livestock Projects (adopted November 14, 2014) and reflects well-established data sources. If solids separation equipment, which is outlined in Table A.9, is used, the solid separation efficiency specified in Table A.9 must be used. For other solid separation equipment not listed in Table A.9, applicants may submit site-specific data for staff review prior to its use in the Tier 1 CI calculator for Dairy and Swine Manure Biomethane.

Comment: Field 2.7 Flared Biogas Biomethane Content: The proposed calculator does not appear to include an emissions factor for the newly added Flared Biogas field in the LCFS pathway system boundary or resulting CI calculations. To solve this, CalBio proposes applying the same emission factor used in Sections 2.20 and 2.30 to apply to the CO2 emitted from the combustion of biogas based on the inputs to Sections 2.6 and 2.7. CalBio believes flared biogas at the digester should be treated consistently with how flared biomethane is accounted for at the upgrading facility, and the resulting emissions should be included in the LCFS pathway system boundary regardless of the biogas handling method (i.e., flaring or venting). The project should also demonstrate the flare was operational through a thermocouple or other instrument to demonstrate the gas was truly combusted. In the absence of operational data demonstrating combustion, the biogas flow should be treated as vented.

Suggested Modification: Include an Emission Factor calculation in Cell F57. Also, include row in the Raw Biogas Production-Digester in Section 4 to include Biogas (flaring). (45d-289.3)

Agency Response: No change was made in response to this comment. If the raw biogas is directly flared, it is excluded from the system boundary of the dairy and swine manure to biomethane pathway in LCFS. As such any flared raw biogas at project is not vehicle fuel, and so may not be reported as a credit generating transportation fuel. Any flaring activities must be in compliance with local, state, and federal permits and laws.

Comment: Field 2.22 On-Site Electricity from Biogas (upgrading and compression):

- CARB has emphasized its goals for producers to choose more efficient, cleaner technologies for on-site power generation. In alignment with these goals, CalBio recommends that CARB recognize the biogenic nature of the CO2 emissions occurring from the combustion of biogas for on-site electricity use. The default emission factor for the use of on-site electricity from biogas (641 gCO2e/kWh) assumes the fuel is fossil based natural gas and is more than double the default emission factor for grid electricity in all but six of the eGRID regions. Thus, most renewable fuel producers are penalized if they choose to offset some of the power for their facilities using on-site electricity fueled by biogas rather than grid electricity.
- For facilities that use biogas for electricity production, CARB's Instruction Manual instructs applicants to choose the User Defined Mix electricity option for Field 2.1 Select Regional Electricity Mix, however that User Defined Mix emission factor flows into all the Grid Electricity Fields, rather than the On-Site Electricity from Biogas (Field 2.22). CalBio recommends CARB allow users to select an electricity mix for each electricity field.
- CalBio also recommends that CARB include a User-Defined Option for electricity generation equipment and associated technology-specific emission factors so users can appropriately model emissions from technologies other than conventional stationary reciprocating engines, such as fuel cells, linear generators, etc. Similar to the guidance issued for User-Defined Fuels in Section 2 of the calculator, applicants can consult with CARB Staff to develop the technology-specific emission factors.

Suggested Modification: RNG producers which use biogas to generate electricity should be able to replace the Emission Factor calculation in Cell U57 with 0 recognizing that the CO2 emissions are biogenic. (45d-289.4)

Agency Response: No change was made in response to this comment. This emission factor of on-site electricity generated from biogas cited by the commenter (641 gCo2e/kWh) represents only the combustion emissions for on-site electricity produced from biogas. The proposed Tier 1 calculator separately accounts for the upstream GHG emissions of on-site electricity produced from the biogas, including the avoided biomethane emissions from dairy/swine manure biogas, and allocates them to the applicable fuel pathway (RNG or electricity) being modeled. When the upstream GHG emissions, combustion emissions, and avoided emissions are combined, the actual emission factor for on-site electricity derived from dairy/swine manure biogas falls within a negative range, making it significantly lower than the grid electricity emission factors in

any eGrid region. For this reason, the proposed default electricity emission factor in Cell U57 is appropriate, even considering the biogenic nature of the CO2 emissions.

The "User Defined Mix" electricity option for Field 2.1 is intended for modeling grid electricity used in digester heating, upgrading, or other relevant operations within the system boundary. This approach ensures that these inputs correctly flow into the corresponding cells of the calculator. Applicants wishing to model equipment-specific emissions for on-site electricity generation—such as emissions from linear generators—may submit a proposed emission factor along with supporting data and calculations for CARB review and approval under a Tier 2 fuel pathway classification.

Comment: Field 2.6 Flared Biogas Flow (metered): User Input cells are formatted as "Percentage," but should be formatted as "Number" like Sections 2.4 and 2.8. The formatting of cell E52 could also be updated to use the 1000 separator (,). (45d-289.5)

Agency Response: Changes were made in response to this comment. The formats in the specified cells in the calculator have been updated.

Comment: Accounting Errors in Cells C45 and C47 for Projects that use Biogas to Generate On-site Electricity: If a project seeks to generate on-site electricity from biogas, it is assumed the Biogas in MMBTUs will be entered into "2.20 Raw Biogas (as Process Fuel for upgrading and compression)" and the electricity generation will be entered into "2.22 On-Site Electricity from Biogas (upgrading and compression)" on the 'Biogas-to-RNG' Worksheet. However, when these values are entered, the "RNG associated with onsite electricity production" is not recognized in Cell C45 in the 'Avoided Emissions' Worksheet. The CI impact should be the same if the electricity is derived from Biogas as opposed to Biomethane.

Similarly, Cell C47 contains a note where CARB recognizes that if on-site power generation is used in the LCFS system boundary, the value of "RNG associated with onsite electricity production" can be included in the avoided CH4 calculation here. CARB should modify these cells to treat on-site electricity derived from biogas consistently since electricity can be generated from both and still be considered within the RNG production boundary.

Suggested Modification: In the scenario described above, Cell C45 should be revised to the following =('Biogas-to-RNG'!S52+'Biogas-to-RNG'!AE52)/Reference!D16*Reference!E16 and Cell C47 should be revised to equal SUM(C45,C41)/C40. (45d-289.6)

Agency Response: No change was made in response to this comment. Biogas used for generating electricity is excluded from the system boundary of LCFS dairy and swine manure to RNG pathways. If all produced biogas is used to generate electricity, the CI of dairy and swine manure biogas-to-electricity pathways can be determined by modifying the Tier 1 CI Calculator for Dairy and Swine Manure Biomethane, in accordance with LCFS Guidance 19-06. The LCFS Guidance 19-06 document may be updated or replaced as needed to reflect the proposed amendments.

Comment: Field L3.7 Biomethane Content in Vented Biogas (metered): User Input cells are formatted as "Number" but should be "Percentage" for consistency with units identified in cell H53. (45d-289.7)

Agency Response: Changes were made in response to this comment. The formats in the specified cells in the calculator have been updated.

Comment: The Description and Instructions for this Field states: "...For modeling the manure (volatile solids) from more than six livestock categories/sources, please use a separate worksheet to calculate the weighted fraction of manure (volatile solids) average for each livestock category, and use the calculated weighted average as the inputs to Fields L1.(1-6).12." However, Fields L1.(1-6).12 is the Van't Hoff-Arrhenius factor and is not a User Input. The calculated weighted average be the inputs to Fields L1.(1-6).13. (45d-289.8)

Agency Response: Changes were made in response to this comment. The specified description in the instruction manual has been updated.

Comment: Anew supports allowing fuel pathway applicants to submit site specific inputs to demonstrate fugitive emissions on the 'Biogas-to-RNG' tab as outlined in comments submitted by the Coalition for Renewable Natural Gas in response to the draft Tier 1 Calculator. In addition, Anew requests that CARB allow fuel pathway applicants to submit site specific inputs to demonstrate digester leakage emissions on the 'Avoided Emissions' tab. This would allow projects to provide actual operating values that may differ from the default values of 2% for enclosed vessels and 5% for covered lagoons. (45d-363.10, 15d1-220.19)

Agency Response: No change was made in response to this comment. The fugitive emissions are calculated based on the energy balance which is conservative to estimate the fugitive methane emissions from upgrading. Table A.3 for the biogas collection efficiency by digester type in the Tier 1 CI calculator for Dairy and Swine Manure Biomethane is referenced from the Compliance Offset Protocol for Livestock Projects (adopted November 14, 2014) and reflects well-established data sources. Currently, there is insufficient data available for staff to thoroughly evaluate the biogas collection efficiency for a specific digester. If stakeholders provide staff with sufficient information in the future, staff can review and evaluate it accordingly.

Comment: CARB staff propose to alter text in the Instruction Manual for the Tier 1 Simplified Calculator for Biomethane from Anaerobic Digestion of Dairy and Swine Manure to more expressly allow herd expansions. Staff propose to change the instruction that factory farm gas projects "must not exceed the herd size limit set by any applicable local or state regulatory or other legal requirements" to "must be in compliance with any herd size limit...." This change accommodates the many jurisdictions that do not limit factory farm herd sizes and those that expressly countenance herd expansions when done in conjunction with digester evelopments. This technical change illustrates that CARB staff know and accept that herd expansions are allowed and a likely response to staff's proposed LCFS amendments at factory farms generating the manure used to produce LCFS credits. (15d2-301.5)

Agency Response: No change was made in response to this comment. CARB does not regulate herd sizes and the LCFS does not prohibit herd size changes. Herd sizes are typically permitted and/or limited by a local oversight agency/body or a state agency other than CARB. CARB staff included the additional text in the Instruction Manual to clarify that CARB will not certify biomethane applications under the LCFS with herd sizes that are greater that what is permitted or approved by the relevant local or state oversight body. For comments regarding herd size expansions, please refer to CEQA RTC Master Response 1 and CEQA RTC-R14-7.

WW-7 Modifications to Tier 1 calculator for DSM to Electricity

Comment: CalBio recommends updating the guidance that CARB issued in LCFS Guidance 19-06 document to divide the final biogas electricity CI by the efficiency of the electric generator used in the project. The approach appears to introduce a cap in the CI value when the engine efficiency exceeds the 50% benchmark. When the CI is divided by a higher efficiency value, it effectively penalizes the project for being more efficient. CalBio proposes using the benchmark efficiency instead, which allows the credits to remain linear with increased generator efficiency. The CI calculator already caps avoided methane crediting based on either the lesser of biogas produced and the modeled emission reductions. It does not seem reasonable to further cap based on efficiency, especially when CARB's motivation has been to encourage projects to use more efficient and cleaner fuel cell technology. *Suggested Modification:* In Cell E91 of the "Manure-to-Biogas" Worksheet, the formula for the Final Electricity CI for the 2018 CARB-modified electricity calculator should be: =IF(W52=0,0,(G68+G75+G88+G89+G90)/(IF('EF Table'!E89>0.5,'EF Table'!E91,'EF Table'!E89))). An equivalent formula should be added to a 2024 DSM biogas-to-electricity Tier 1 CI Calculator. (45d-289.2)

Agency Response: No change was made in response to these comments. The suggested equation would introduce inconsistencies of how to calculate the final CI of the dairy and swine manure-to-electricity pathway. The LCFS Guidance 19-06 document may be updated or replaced as needed to reflect the proposed amendments.

WW-8 Multiple Comments: Expand crediting to beef and poultry

Comment: CARB's draft regulatory language is silent on avoided emissions credits from feedstocks other than dairy, swine, and organics diverted from landfill. While we believe the current Tier 2 process is sufficient for a user to develop and CARB to approve avoided emissions credits for feedstocks such as poultry manure, project developers and users may benefit from further regulatory clarity. (45d-094.3, Apr-087.3)

Comment: The Livestock Offset Protocol (LOP) uses methane conversion factors taken from Chapter 10 of the 2006 Intergovernmental Panel on Climate Change ("IPCC") entitled Emissions from Livestock and Manure Management ("Chapter 10"). Section 10.4 of Chapter 10 (pp.35 – 52) provides these factors for many types of livestock in addition to dairy and swine, including poultry (both layers and broilers) and beef cattle. CARB may amend the LOP or create a separate LOP for the LCFS to add user clarity for other feedstocks. (45d-094.4, Apr-087.4)

Comment: We suggest minor changes to align the tier 1 DSM with CA GREET4.0: CARB should incorporate beef and poultry manure categories into the DSM, using corresponding baseline manure management emissions described in CAGREET4.0. To reflect these changes, we propose renaming the Tier 1 Dairy and Swine Manure Calculator to the Tier 1 Livestock Manure calculator.

We also note that livestock manures, and especially poultry manure, emit significant amounts of N₂O under traditional management systems. These emissions are amplified by the

increasing concentration of modern livestock and poultry operations. This concentration leads to an overabundance of nutrients, exceeding the capacity of nearby crops to absorb them. Without effective manure management solutions to distribute these excess nutrients, they accumulate in concentrated areas, creating hotspots with devastating environmental consequences. These consequences include, but are not limited to, the eutrophication of water bodies and the proliferation of harmful algal blooms.

1.3) Assumptions for Anaerobic Digestion of Animal Waste

Source of Assumptions:	U.S.					
U.S.						
	Beef	Dairy Cow	Dairy Heifer	Swine	Layer	Broiler and Turkey
Share of Livestocks	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%

Figure 2. Snapshot of CA GREET4.0 RNG Tab showing livestock categories

	Beef Feedlots ²		Layer Operati	on	Broiler and	Turkey Operation
	Dry Lot	Liquid/Slurry	Anaerobic La	Poultry w/o	Pasture	Poultry w/o Litter
Manure Region Management System Usage (MS%)						
U.S. Average	100.0%	0.7%	12.9%	87.1%	1.0%	99.0%
Manure Management System MCFs						
U.S. Average	1.2%	30.4%	71.5%	1.5%	1.2%	1.5%
Direct N2O Emission Factors (kg N2O N/kg N)	0.02	0.005	0	0.001	0	0.001
N Loss Factors through Volatilization of NH3	23%	26%	54%	34%	0%	34%

Figure 3. Snapshot of CA GREET4.0 RNG Tab showing livestock categories

We also note that livestock manures, and especially poultry manure, emit significant amounts of N2O under traditional management systems. These emissions are amplified by the increasing concentration of modern livestock and poultry operations. This concentration leads to an overabundance of nutrients, exceeding the capacity of nearby crops to absorb them. Without effective manure management solutions to distribute these excess nutrients, they accumulate in concentrated areas, creating hotspots with devastating environmental consequences. These consequences include, but are not limited to, the eutrophication of water bodies and the proliferation of harmful algal blooms. (45d-305.2, 45d-313.2)

Comment: Protecting technology neutrality and enabling innovation is central to the success of the LCFS. We recommend minor 15-day changes, as specified in our previous comments, to ensure new biogas pathways, including from poultry litter, are clearly supported by the regulation. (Apr-026.7)

Comment: CARB's draft regulatory language is silent on avoided emissions credits from feedstocks other than dairy, swine, and organics diverted from landfill. While we believe the current Tier 2 process is sufficient for a user to develop and CARB to approve avoided emissions credits for feedstocks such as poultry manure, project developers and users may benefit from further regulatory clarity. (Apr-087.3)

Comment: CARB should amend the LOP to add beef cattle manure as a type of livestock manure that can generate LCFS avoided emissions credits.

The LOP was created for California Cap-and-Trade ("C&T") and not LCFS. While CARB uses the methodology set forth in the LOP for purpose of calculating the carbon intensity of LCFS dairy and swine manure ("DSM") pathways, the LOP was not created for LCFS, but rather for
another one of CARB's regulations, California Cap-and-Trade ("C&T"). When C&T went into effect in 2012, it included as a mean of cost containment the ability for covered entities to offset their annual compliance obligations through a limited number of offset credits. CARB included the avoidance of methane emissions that occurs by installing anaerobic digestion in DSM management operations as a type of offset credits a covered entity could acquire. The quantification of such offset was based on forerunner of LOP, a livestock offset protocol created by Climate Action Reserve ("CAR"). Version 1.0 of CAR's protocol was entitled...(CAR LOP V1).

CAR LOP V1 expressly referred to beef cattle manure as a type of livestock manure that could produce offset credits, along with dairy and swine manure....on p 43 it contains the following table:

	US		California			
	# Farms	# Animals	# Farms	# Animals	% of US Farms	% of US Animals
Dairy	91,989	17,013,361	2,793	2,806,357	3.0%	16.5%
Beef	796,436	34,431,060	12,497	879,582	1.6%	2.6%
Hogs	78,895	60,405,103	1,521	163,465	1.9%	0.3%

Table C.1: Livestock Population Data for the U.S. and California, 2002

Source: U.S. Department of Agriculture National Agricultural Statistics Service (2004)

Section 10.4 contains all necessary values for dairy, swine and beef cattle manure.... CARB appreantly accepted CAR's work without making the determination itself even through CAR's FAQ answer does not make sense.... CARB is on track to compound that error by amending the LCFS again with C&T's 2014 LOP incorporated yet again.

...Therefore, the legislature almost certainly had beef cattle in mind when it passed SB 1383. Yet CARB has not taken any action with respect to beef cattle manure. A way to do so is to add beef cattle manure to the LOP.

When beef cattle are housed in barns, their manure does not decompose anaerobically when store, and will thus generate methane emission unless anaerobically digested. Therefore CARB should want to incentivize the installation of anaerobic digesters on beef cattle farms where the manure decomposes anaerobically....Since the values CARB needs to update the LOP already exist in Chapter 10.4 of the IPCC Guidelines, it would be simple to amend the LOP to include beef cattle manure in the second 15-day packages.(15d1-205.1)

Agency Response: No change was made in response to these comments. Beef manure is typically not managed in anaerobic lagoons and, therefore, is not eligible for avoided CH₄ credit. Poultry litter is not currently eligible for avoided CH₄ credits under the LCFS regulation nor the anaerobic lagoon baseline assumption under Cap-and-Trade Livestock Offset Protocol. Amending the livestock offset protocol is outside the scope of this rulemaking. Moreover, it is challenging to either directly measure N₂O emissions in various agricultural practices ("project" scenario) or establish a robust indirect quantification method ("baseline" scenario) because parameters such as soil type, temperature, organic carbon content, moisture, microbial activities and chemical forms of the nitrogen compounds can all significantly affect N₂O conversion.

California is not a leading state in poultry farming; determining nation-wide "common practice" for poultry litter management, which is used for establishing the "baseline" scenario and emissions for CH_4 and N_2O from poultry litter, is also a challenge due to the data limitation and high operational variability. Unlike CH_4 , N_2O is not a form of energy that can be upgraded to transportation fuels, so there is no direct correlation between CH_4 and N_2O during anaerobic digestion. Currently, none of the LCFS fuel pathways rely on direct metering of site-specific N_2O . However, beef and poultry manure can still be used to produce RNG (similar to wastewater sludge), which means the CI would most likely be positive.

WW-9 Multiple Comments: Stop potential double counting of factory farm gas projects

Comment: Stop the potential for "double counting" by allowing factory farm gas projects paid for and claimed by other programs to sell LCFS credits as well. (45d-027.5, 45d-030.4, 45d-184.5, 45d-339.4, 45d-381.4, 45d-398.4, 45d-8608-8727.5, 45d-8756-8763.5, Apr-077.7)

Comment: the LCFS does not prohibit participants in the program from double-counting the emissions reductions attributable to anaerobic digesters, with the same purported emissions reductions being counted toward multiple programs, inflating climate progress. (45d-208.5)

Comment: Even if methane capture is being achieved at promised levels, it is almost certainly overstated as a result of double- and even triple-counting. Recent reporting has shed light on how multiple state programs take credit for the same purported reductions achieved by these 50 digesters, meaning they are often improperly attributed to multiple programs. Awarding excessive credits for practices that have already been required or supported wastes scarce funding for no additional climate benefit. (45d-383.33)

Agency Response: No change was made in response to these comments. See CEQA RTC Master Responses 1 and 5. CARB does not double-count emission reductions attributable to dairy digesters in either the LCFS or the GHG inventory. The LCFS regulation includes provisions to prevent entities from issuing credits in both the LCFS and in other voluntary or mandatory programs except for the federal Renewable Fuel Standard (RFS). Subsection 95488.8 (i)(2)(E) of the Proposed Amendments requires entities to demonstrate that no entity has be issued credits based on the environmental attributes in any other voluntary or mandatory program with the exception of the federal RFS, and the market-based compliance mechanism set forth in title 17, California Code of Regulations Chapter 1, Subchapter 10, article 5 (commencing with section 95800). Entities must attest to CARB that the environmental attributes associated with renewable natural gas (RNG) reported in the LCFS were not sold, transferred, or retired in any program or jurisdiction other than the federal RFS program.

WW-10 Multiple Comments: Increases herd size due to LCFS

Comment: CARB's low score for biogas and ensuing credits incentivizes more manure production from large CAFOs. As farmers struggle through volatile and often belowcost markets, payments for waste production create a new income stream that can subsidize larger herd sizes to produce more manure and access more LCFS credits. The growth of CAFOs

mean additional direct cow-related emissions. Currently, CARB does not have an effective system to track operations seeking biogas credits that are expanding their herd size (with associated additional methane emissions), or whether the LCFS is helping to finance new CAFOs with additional emissions. (45d-042.1, Apr-010.4)

Comment: Increasing dairy herd size to generate additional LCFS credit is a reasonably foreseeable compliance response resulting in local air quality impacts that could be mitigated by capping avoided methane credit based on the historic herd size before initial LCFS certification. (45d-154.23)

Comment: There are uncertainties about the current LCFS policy's impacts on farming management practices, such as the risk of subsidies accelerating the rate of consolidation of livestock herds, driving an increase in herd size, and leading to changes in manure management practices. Furthermore, because LCFS subsidies benefit dairies outside of California, analysis of the impacts on farming management practices should also consider farms outside the state. (45d-206.1)

Comment: CARB should investigate the avoided methane crediting mechanisms, their potential to affect farm management practices, and the implications of resulting shifts in those practices. CARB should support research that uses data from the 2022 census (just released in mid-February 2024) to investigate whether LCFS policies are accelerating the rate of consolidation in dairies participating in the LCFS in California and outside the state. Further analysis should evaluate if there is a correlation between farmers' intention to expand (based on permitting asks to increase herd size) and participation in the LCFS program. Note that because the LCFS benefits farms outside California, a simple comparison between California versus other states may represent a study bias, and the study design should account for that. These analyses would address some of the concerns around the LCFS credits supporting the deployment of anaerobic digesters in livestock farms. This could be achieved by convening an external working group comprised of experts that meet to review new science and data regarding the impacts of LCFS policy on farm management practices. (45d-206.3)

Comment: Arguments that the LCFS will directly lead to larger dairy herd populations should be rejected. Allegations of incentives to increase herds solely due to the LCFS are unsupported. In fact, reductions in total herd size continue to occur. (45d-245.3)

Comment: For practices related to manure management, including anaerobic digesters, the LCFS calculation should evaluate not only the risks of increased ammonia emissions and water pollution from disposal of digestate, but also the potential that the contract will lead to an increase in the total number or density of livestock raised on the site. The potential for LCFS funding to lead to more animals being raised on an operation with a digester, and the increase in enteric emissions and carbon emissions from feed production related to the increase, should be incorporated into a new LCFS scoring system for manure-derived biogas. (45d-339.5)

Comment: Finally, the amendments will continue and intensify CARB's discrimination against rural, low-income, Latino/a/e communities in the San Joaquin Valley both by incentivizing herd consolidation and by increasing pollution associated with the production and use of factory farm gas.

As discussed throughout these comments, the proposed Amendments will continue to

contribute to herd expansion and the concentration of milk cows and manure in the San Joaquin Valley.

The LCFS and the proposed Amendments will encourage further concentration of dairy herds, dairy cows, and wet manure in the San Joaquin Valley. In doing so, it will disproportionately Impact Latino/a/e communities and people. Specifically, Latino/a/e communities and people will disproportionately suffer (a) increased discharge of nitrate to groundwater within the localized zone of contribution; (b) decreased groundwater levels within the localized cone of depression; (c) increased air pollution, including exposure to ammonia, ozone, and pm 2.5; and (d) increasing and exacerbating impacts to odor and flies. They will also experience higher rates of the associated health impacts, as stated above. (45d-368.6)

Comment: Evaluate not only the risks of increased ammonia emissions and water pollution from disposal of digestate, but also the potential that the contract will lead to an increase in the total number or density of livestock raised on the site. (Apr-077.5)

Comment: The Agricultural Census data also reveals that farms with 2,500 or more dairy cattle have increased 17% between 2017 and 2022 in California. Though it is difficult to distinguish causality here, one should also consider the potential risk of consolidation in the industry at the expense of small farms to take advantage of high LCFS credits for RNG. Installing digesters might provide methane reductions when administered properly yet the potential risks should be carefully considered. (15d1-219.33)

Comment: We previously submitted multiple sets of comments explaining that the Proposed Amendments greatly increase the incentivize that large dairies with liquid manure handling systems ("factory farms") have to expand their herd sizes and install anaerobic digesters. Both the original Draft Environmental Impact Analysis ("DEJA") and the Recirculated Draft Environmental Impact Analysis ("Recirculated DEJA") omitted an analysis of the environmental impacts of herd expansion and included an insufficient cursory analysis of the impacts associated with digesters.

Instead of supplementing its deficient environmental analysis, CARB issued a second set of modifications that provide an even greater incentive than the previous versions of the Proposed Amendments to expand herd sizes and install anaerobic digesters at factory farms. Most significantly, the second set of modifications provide that the rule limiting avoided methane crediting if there is a law, regulation, or mandate requiring methane reductions only applies to pathways that break ground after December 31, 2029. Additionally, the second set: (1) requires hydrogen dispensed as a vehicle fuel to be at least 80 percent "renewable" by 2030, which includes hydrogen produced using fossil gas as a feedstock if biomethane attributes are matched to the production; (2) reverts to CARB's original proposal to allow three, ten-year avoided methane crediting periods for pathways certified before the effective date of the regulation; and (3) allows book-and-claim for biomethane used to produce electricity for electric vehicle charging if the electricity is generated using a fuel cell. (15d2-169.1)

Agency Response: No change was made in response to these comments. Please refer to CEQA RTC Master Response 1 and CEQA RTC-R14-7.

WW-11 Multiple Comments: The potential risk from out-of-state farms taking advantage of LCFS over in-state farms

Comment: To assess the potential risk from out-of-state farms, we draw upon data from the Census of Agriculture to identify the number of large-scale centralized farms that could be eligible to participate in the LCFS program. In a previous assessment of cost-viable RNG production potential over a 10-year project crediting period, we performed a discounted cash flow analysis and estimated the size of dairy projects that would result in breakeven project cost. Accordingly, a farm should have at least 2,300 dairy cattle to be economically feasible. As the Census data only provides data on certain ranges, we use 2,500 dairy cattle as cut-off. Figure 4 displays the distribution of farms with corresponding dairy cattle numbers indicating the risk for potential out-of-state farms making use of the LCFS crediting system. While California is home to 255 of breakeven farms (31%), there are also a substantial pool of at least 579 out-of-state farms that could qualify for LCFS credits. (15d1-219.32)

Comment: The potential of out-of-state farms capturing biogas and taking advantage of the LCFS crediting is particularly remarkable for the swine industry, which is largely concentrated outside of California. We illustrate this in Figure 5, where we considered farms with greater than 5,000 heads as cut-off since manure per head is lower for swine, and this is the highest range of data available from the Census of Agriculture. Accordingly, there is a total of 3,540 swine farms of this size, and only 2 of them are in California. In this case, the lack of geographical deliverability requirements for biomethane derived hydrogen could lead to an abundance of out-of-state credits generated by an industry without a sizeable in-state counterpart. There are already a few certified pathways for swine manure-derived RNG from Missouri being used as an offset for carbon intensity reductions for hydrogen production in California. These also have similarly low CIs as the dairy farms at an average of -357.4 gCO2e/MJ of hydrogen.

Thus, there is a possibility that further, long-term loose book-and-claim requirements would largely facilitate deployment of digesters at out-of-state farms with little impact on California's own methane goals or its transport sector emissions. There are hundreds of out-of-state dairy and thousands of swine farms that could take advantage of these incentives. (15d1-219.33)

Agency Response: No change was made in response to these comments. Please refer to CEQA RTC Master Responses 1 and 3.

WW-12 Multiple Comments: Increased pollution as a result of LCFS

Comment: There is growing evidence that CAFOs with biogas digesters are still significant sources of methane emissions. Recent Food & Water Watch research found that 15 California dairies, with biogas digesters receiving credits through the LCFS, emitted enough methane to be tracked by satellite and imaging aircraft. Other researchers have found that digester systems often leak, leading to an underestimation of their emissions. Methane leaks from digesters could contribute to as much as a 15% loss rate — cutting into its emissions intensity score and making it impossible to be a net loss emitter. (45d-042.1, Apr-010.6)

Comment: While Digesters are an important tool for capturing methane, the leakage of methane and the resulting net methane emissions relative to the counterfactual must be considered....While methane's negative impact on climate is commonly discussed, methane

can also be dangerous to human health at the local level, as a precursor to ozone....One of the largest sources of methane leakage in digester biomethane production comes from improper digestate management. Residual methane emissions from the digestate are estimated to be between 0.2-5.9% of that captured in the digester. Covering digester effluent storage captures this residual methane, which can be flared or added to the digester biogas, enhancing the carbon market value when it is used for energy. An impermeable cover on the digestate can reduce residual methane emissions by 90%. Another large source of methane leakage is from the processing of biogas. Methane leakage from the processing of biogas is estimated to be in the 2- 4% range up to as much as 15%. Methane leakage in the transmission and distribution of natural gas has been estimated to be in the range of 0.4 - 0.9%. (45d-327.3)

Comment: CARB's treatment of factory farm gas under the LCFS has the perverse effect of incentivizing larger, more concentrated herds and methane producing manure management systems, the two most important factors that increase a dairy's climate emissions. This is so because under CARB's "avoided methane" crediting, large herd size equates to increased profits from the LCFS and without liquid manure lagoons that cause large methane emissions a dairy cannot claim the extremely negative CI values enjoyed by other factory farm gas projects.

Regarding herd sizes and concentration, operators are increasing the number of animals housed in large confinement operations using liquid manure systems as indicated by the most recent Ag Census data. More animals mean more manure which means more opportunity to generate methane pollution. Larger herds lead to more cost effective and profitable gas production. As the largest factory farms monetize their pollution and reap additional profits from the LCFS, this provides a competitive advantage in the related agricultural markets, thus further incentivizing competitors to expand, change their waste management practices, or otherwise seek to maximize their own methane emissions to profit off the LCFS and minimize their competitors' competitive advantage. As one researcher at UCLA recently wrote, "Investing in industrial dairies further bolsters the competitive edge of these mega-operations at the expense of more sustainable "dairying models."

Petitioners previously documented the strong correlation between the installation of digesters, the issuance of a LCFS pathway, and the concentration of dairy herds. We incorporate those findings here and note that herd expansions in association with factory farm gas development continue. For example, Borba Dairy in California is currently seeking a conditional use permit to expand its herd from 4,450 animals to 6,100 animals. This expansion is intertwined with the dairy's plans to also develop a digester that would collect and digest manure. The expansion includes construction of new lagoons to store liquified manure even though alternatives exist that would avoid producing more methane pollution from this dairy. Pressurized gas from the digester would be transported via truck or pipeline to the Hilmar Biogas Cluster Plant. Commonsense supports the expectation that an industry known for cutting costs and taking advantage of lax regulation will seek to maximize the very large source of profits presented by avoided methane crediting under the LCFS, especially when CARB staff have broadcast that they do not intend to mandate methane reductions at dairies in the foreseeable future. And while it may be true that a number of factors contribute to the concentration of dairy herds, CARB's choices to incentivize the production of manure and methane are, at a minimum, contributing factors to the consolidation and expansion of herds.

Regarding how dairies manage their manure, the perverse incentives put in place by avoided methane crediting leads factory farms to structure their operations to maximize methane pollution. There are many ways this happens. For example, operators maximize the quantity of volatile organics put into anaerobic environments to maximize gas production instead of lowering methane emissions by diverting solids into dry handling systems. This happens during new construction but also through modifications to exiting operations. Doing otherwise leaves money on the table under CARB's backward incentive structure.

Commenters recognize some large factory farms utilized liquid manure handling systems prior to participating in the LCFS, but CARB's incentives pressure new or modified infrastructure development to double down on the conditions and practices that produce the most methane pollution.

By lavishly monetizing GHG emissions at factory farms, avoided methane crediting encourages the very practices that generate manure methane emissions in the first place. The policy counterproductively distracts from and disincentivizes methane avoidance despite readily available tools and programs designed for that purpose. The result on the ground is an industry dependent on "capturing" the intentional and increased climate emissions at the largest factory farms to generate LCFS credits. CARB's experiment with avoided methane crediting shows that the policy is detrimental to the LCFS and California's commitments to climate equity and environmental justice, and it must be eliminated from the program. (45d-368.8)

Comment: Factory farm gas pathways fail to maximize additional environmental benefits and interfere with efforts to improve air quality. (45d-368.17)

Comment: CARB cannot ignore that avoided methane crediting results in the perverse incentives to create more methane at factory farms as described in the Factual Background, and in the process more co-pollutants that contaminate the local environment. The policy creates pressure to house more animals in larger and larger confinement facilities using the most climate polluting manure management practices. In the process, avoided methane crediting undermines climate progress, causes environmental injustice, and distorts agricultural markets. Avoided methane crediting has become a festering problem for the integrity of the LCFS and CARB's climate and environmental justice efforts. It is time for CARB to fix its mistake and remove this detrimental policy. (45d-368.40)

Comment: CARB is also vastly overestimating the effectiveness of factory farm digesters, calling into question fundamental assumptions built into how CARB assesses these fuels. For example, CARB uses a default methane capture efficiency of 95% for lagoon digesters and 98% for fully enclosed vessels, unless a pathway applicant discloses otherwise. Were these default values remotely close to real-world conditions, they would align with real-world monitoring of LCFS-supported dairy digesters. But they do not. Instead, the actual monitoring data are showing that LCFS supported digesters are relatively ineffective at total methane capture, with one peer-reviewed study finding no statistically significant difference between methane emissions at California dairies with and without covered lagoon digesters. And an analysis of Carbon Mapper data conducted by Food & Water Watch shows that fifteen LCFS-supported dairy digesters continue to have massive methane plumes despite installation of a digester and certification to generate LCFS credits. Therefore, real-world conditions appear to

disagree significantly with CARB's assumptions regarding methane capture and loss to the atmosphere from factory farm digester operations. (45d-368.42)

Comment: What is more, despite these significant drawbacks, there is little evidence that avoided methane crediting is even effective at the one thing its purport to do - reduce California's methane emissions. Over 80% of the biomethane in the LCFS program as of 2022 was from out of state, so while California drivers pay for this subsidy, it has no benefit in California's GHG inventory. In some instances, the subsidies go to out of state dairies that may actually be changing their practices from a more sustainable baseline where they were not producing methane purely to be able to capture California subsidies. For instance, one dairy farmer in New York interviewed for a recently published study shared, "[i]f I don't keep the digester between 90-100 degrees, we're not going to produce gas. So, we are being paid to create methane gas and destroy it. Now wrap your head around that one. If we just did what we normally did it would not produce methane...it makes no sense." Emissions from digesters within California appear to be no better. Although CARB does not monitor emissions from these digester systems on an ongoing basis, recently published studies of real-world methane measurements found CAFOs with digesters exhibited virtually the same level of methane emissions as those without. CARB's own data shows "mega-emitting" farms that have been equipped with digesters. (45d-383.32)

Comment: It has become the nation's largest and most lucrative pollution trading scheme for factory farm biogas, perpetuating harmful practices rather than serving its environmental objectives. It is driving the construction of more factory farms and factory farm biogas projects in states far from California, causing severe harm to air, water, public health, rural economies, and overall quality of life. (45d-8655.6)

Comment: Biogas is unsustainable and unnecessary--it does not reduce the dairy industry's environmental footprint. In fact, investing in biogas helps maintain and expand factory farms. Investing in biogas means investing in even more factory farm pollution. (45d-8660.6, 45d-8728.1)

Comment: Require monitoring of controlled and fugitive emissions for digesters and biomethane plants. A mature set of technologies exists to accomplish this. (Apr-030.6)

Comment: The proposed draft continues to provide credits for industrial dairy "biogas." This financial support continues to incentivize the expansion of large-scale factory dairy farms, causing serious harm to the health of surrounding communities, increasing the greenhouse gases and pollution generated by the production of feed for cows confined to barns; concentrated methane emitted by pools of waste; the inevitable leakage of methane during storage and transportation; and greenhouse gas emissions produced by combustion of the product. We urge CARB to phase out support for biomethane as rapidly as possible. (15d1-010.3)

Agency Response: No change was made in response to these comments. Please refer to CEQA RTC Master Responses 1, 4 and 5, CEQA RTC-R17-5 and CEQA RTC-R14-7. In addition, methane leakage from the digester and fugitive biomethane from the upgrading facility is counted in the CI calculations of the pathways.

WW-13 Multiple Comments: Lagoon cleanout

Comment: "Manure-to-Biogas (LOP Inputs)" Tab: L1.(1-6).14 Retention Time and Drainage – Required Annual Lagoon/Digester Cleanout: After production, many facilities remove excess water but do not fully cleanout the lagoon/digester to keep the microbes active. The requirement to cleanout the system annually in September per the calculator is inconsistent with many baseline scenarios. We request that the lagoon/digester cleanout be optional, and if one occurs, it should be modeled in the month when the cleanout takes place. (45d-144.4, 15d1-031.4)

Comment: Assuming one lagoon cleanout annually in the base case will reduce methane avoidance and thus increase the CI for these projects. This will, in turn, reduce the credits issued to many dairy and swine RNG projects-in some cases significantly. (45d-240.10)

Comment: CARB has proposed that all digester projects would be required to model one (1) lagoon cleanout a year in September even if this does not match the actual practice of the farm. Implementing this assumption would result in the Carbon Intensity scores of most biogas digester projects becoming more positive by a range of 40-70 CI points causing a significant adverse impact on the economics of such biogas digester to RNG projects and may either cause planned projects to be cancelled or cause current or soon to be commercial biogas digester RNG projects to divert supply to alternative markets. While we understand CARB is proposing this change primarily to improve administrative simplicity of evaluating baseline conditions, we strongly urge CARB to reevaluate this position as modeling lagoon cleanouts where they do not occur will lead to a gross underestimation of avoided methane emissions and cause investments in manure RNG projects to be greatly reduced. (45d-252.3)

Comment: As an alternative to annual clean-up modeling, Anew encourages CARB to consider allowing swine projects to submit their site-specific lagoon clean out frequencies as part of a Tier 2 fuel pathway registration. The annual loss in volatile solids results in a significant detrimental impact to the baseline methane emissions of swine projects and unfairly penalizes the project's CI score. Anew appreciates CARB's intention to simplify and streamline the project registration process, however, this should not be done at the expense of swine projects. To accurately reflect actual operating conditions of swine manure projects and minimize pathway registration processing time, we urge CARB to consider allowing applicants to enter actual cleanout frequencies by project in the Tier 1 Calculator. (45d-363.11, 15d1-220.20)

Comment: Gevo reasserts our concerns regarding the proposed changes to the "Retention Time and Drainage" instructions under the "Biomethane from Anaerobic Digestion of Dairy and Swine Manure" Tier 1 calculator. While Gevo appreciates what we perceive to be CARB's approach to standardize the Tier 1 Calculator's inputs for swift processing, we are concerned that by setting this specific "System Emptied" timeframe, this requirement can result in a forced increase in the CI of a project, causing a penalty to farms that retain a certain level of volatiles in their storage system throughout the year. Accordingly, we urge CARB to retain the current approach rather than adopting this amendment. In any event, although the proposal appears to seek to standardize, and only apply to, Tier 1 applications, to the extent CARB proceeds with the proposed change, we respectfully request that CARB continue to assess site-specific optionality in Tier 2 applications. This will ensure unnecessary penalties aren't assessed for

farm-specific circumstances in which the farm does not completely empty their storage systems in any year. (Apr-078.9)

Comment: Gevo reasserts our concerns regarding the proposed changes to the "Retention" Time and Drainage" instructions under the "Biomethane from Anaerobic Digestion of Dairy and Swine Manure" Tier 1 calculator. Currently, an applicant can select from the options that are applicable to their farms in the "Manure-to-Biogas (LOP Inputs)" tab without having to select a particular month where the system is completely emptied. CARB has now proposed a standardized requirement that: "If there is no regular storage/treatment system clean schedule, must select 'System Emptied in This Month' each September. The applicant only needs to select one 'System Emptied in This Month' for each year." While Gevo appreciates what we perceive to be CARB's approach to standardize the Tier 1 Calculator's inputs for swift processing, we are concerned that by setting this specific "System Emptied" timeframe, this requirement can result in a forced increase in the CI of a project, causing a penalty to farms that retain a certain level of volatiles in their storage system throughout the year. Accordingly, we urge CARB to retain the current approach rather than adopting this amendment. In any event, although the proposal appears to seek to standardize, and only apply to, Tier 1 applications, to the extent CARB proceeds with the proposed change, we respectfully request that CARB continue to assess site-specific optionality in Tier 2 applications. This will ensure unnecessary penalties aren't assessed for farm-specific circumstances in which the farm does not completely empty their storage systems in any year. (Apr-079.9)

Comment: We support improvements to the Tier 1 calculators to improve processing timelines and streamline verification currently requiring Tier 2 pathways. We would recommend the Tier 1 DSW model enable entering 0, 1, or more lagoon cleanouts per year based on verified inputs based on historical practices. This best reflects the actual avoided emissions. (Apr-158.7)

Comment: We further recommend using site specific data for dairy and swine manure lagoon cleanouts as is currently implemented, rather than the proposed transition to an inaccurate and overly optimistic default baseline that assumes lagoons are fully cleaned annually when in fact in most cases they are not. It is especially important to avoid stranding capital not to implement such a new default cleanout baseline, which our modelling shows misses 30-70 CI points versus actual cleanouts for projects that were already in construction prior to this change. (15d1-231.5b)

Agency Response: No change was made in response to these comments. All farm lagoons require periodic cleanouts to ensure continued operation; therefore, lagoon cleanout must be included in the modeling. However, verification of lagoon cleanout is challenging, as most of lagoons are not fully cleaned out, and the frequency of cleanouts varies based on factors such as livestock type, manure management practices, and the lagoon design. To streamline the staff review and verification process led by the third-party verification body, all dairy and swine RNG projects must model at least one cleanout annually in September, or in any other month that cleanout actually occurred.

WW-14 Multiple Comments: Streamlining the pathway approval process

Comment: We support the revised Tier 1 calculators and urge improving pathway processing times by utilizing the Tier 1 application as the norm for dairy RNG project applications, not the exception. The current initial review delay of over one year has put existing project capital repayment in jeopardy, and if this persists, will stymie future investment in RNG and other zero or below zero carbon projects. Today, each \$4 million completed project must endure an 18- to 24-month administrative review to fully certify the project's LCFS pathway. Given the urgent nature of climate change and the need for methane abatement, this delay is completely unacceptable. Certification should be performed in less than a six-month window, as is the norm with most Tier 1 applications. (45d-201.5)

Comment: We encourage CARB to move dairy and livestock sector projects from Tier 2 to Tier 1 pathways immediately so that all RNG projects are processed under a more time efficient process. Currently, a Tier 2 dairy pathway takes 18-21 months to receive approval of its Provisional CI pathway application. These capital intensive projects are left to generate credits based on a -150 CI Temporary Pathway (default) while waiting for approval, resulting in hundreds of thousands of dollars of revenue loss and lower project returns. Incrementally, the state is unable to recognize the true CI benefit of the project because it is being recognized at a default CI vs the actual project CI. As outlined in the LCFS regulation, this process is supposed to take approximately 6 months. (Apr-160.5)

Comment: Adopt administrative reforms that can help smooth out the process. For example, streamlining dairy pathway certification from a Tier 2 to a Tier 1 process and reducing long pathway review times by allocating more staff hours to the evaluation. (Apr-164.9)

Comment: The unwarranted attacks on dairy-RNG, which lack credible data, coupled with CARB's delay in implementing more aggressive targets and pathway approvals, have shaken the confidence of investors and markets. These are dangerous signals that could impact other sectors and slow or halt the progress of key components of the LCFS. (Apr-180.5)

Comment: CARB must address the unreasonable processing time that currently exists for RNG Pathway approvals. The current situation not only deprives the state from claiming the full benefit of methane abatement, but it also causes significant economic damage to the developers and investors who followed years of CARB's strong policy support and encouragement of dairy RNG projects. This again sends a very negative message to investors in RNG projects as well as investors considering other high priority LCFS programs like hydrogen, SAF, and CCUS. The current 14–24-month processing time for Pathway approvals, coupled with a grossly oversupplied credit market, have combined to create a situation where developers are unable to meet investment repayment schedules and has had a chilling effect on future investment. Moving quickly to a default Tier-1 regime (like other biofuels) would remove the unnecessary process of review that can be appropriately shifted to qualified verification bodies. Over 100 RNG Pathway approvals have been granted by CARB, and sufficient data has been established to ensure an accurate review of current and future RNG pathways. (Apr-180.9)

Agency Response: Changes were made in response to the comment. The primary reason for the relatively long processing time for Tier 2 dairy and swine manure

pathway applications is the higher volume of submissions. With limited staff resources, applications are reviewed in the order of their initial submission date. During the rulemaking process, staff updated the Tier 1 CI Calculator for Dairy and Swine Manure Biomethane based on lessons learned, accumulated experience, and stakeholder feedback. Additionally, several changes were implemented to streamline the application review and certification process, including aligning the deemed complete quarter for Tier 1 and Tier 2 applications and introducing credit true-up mechanisms. These enhancements are expected to significantly improve the efficiency of the pathway review and certification process and reduce or mitigate any delay in LCFS crediting benefits for fuel pathway holders that can arise from lengthy application certification timelines.

WW-15 Multiple Comments: Anaerobic digester alternate strategies to meet SLCP targets

Comment: Installing anaerobic digesters at livestock farms is one strategy to comply with the state's SLCP reduction strategy that sets a 40% methane emissions reduction target by 2030 alongside other organic waste diversion requirements. Compared to alternative manure management strategies digesters are costly to build and have higher methane production rates than practices that utilize solid treatment. We compare the average methane emissions per livestock head by management type in 2022 using data from the California GHG emissions inventory and U.S. Census in Figure 3. (15d2-237.9)

Comment: Rather than subsidizing anaerobic digesters via transportation fuel credit incentives, CARB and partner agencies can pursue methane reduction strategies that operate independent of the LCFS program to meet SLCP targets. These strategies include incentivizing farmers to implement alternative cattle diets to reduce enteric methane emissions, mandating methane flaring, and providing financial support to the California Department of Food and Agriculture's Alternative Manure Management Program (AAMP). Though alternative manure strategies such as solid storage and daily spread may not be feasible to implement at all farms, solid management emits the lowest quantity of methane per dairy cattle head. (15d2-237.10)

Agency Response: No changes were made in response to these comments. Please refer to CEQA RTC Master Response 1 and 5.

XX. Project-Based Crediting

XX-1 Multiple Comments: Phase out crediting of oil projects

Comment: California should be planning a transition away from fossil fuels, so allowing credits for oil projects provides a perverse incentive to perpetuate the very problem that the LCFS seeks to solve. These credits should be phased out sooner than the 2040 date proposed by the ISOR. (45d-101.8)

Comment: The innovative crude and refinery investment projects that have been approved to date are certainly not innovative and are excessively subsidized. These projects should not be credited through the LCFS. All projects certified under the innovative crude provision are for

solar electricity, which is cost effective without LCFS credit value. Likewise, the refinery investment credit project certified for the Chevron refinery in Richmond is providing approximately 60,000 credits annually for a hydrogen plant upgrade that Chevron was planning to do before the LCFS was even adopted. These are certainly not additional emission reductions. In effect, the LCFS is subsidizing oil companies to meet their Cap-and-Trade obligation. (45d-154.10)

Comment: Revisit regulations governing the Refinery Investment Credit program, title 17, CCR, section 95489(e), which currently fails to consider the range of risks necessary to protect refinery communities. (45d-200.16)

Comment: California should be planning a transition away from fossil fuels, so allowing credits for oil projects provides a perverse incentive to perpetuate the very problem that the LCFS seeks to solve. These credits should be phased out sooner than the 2040 date proposed by the ISOR. (Apr-39.08)

Agency Response: No change was made in response to these comments. Although LCFS aims to drive a transformative change in the market, moving away from traditional petroleum-based fuels toward low-carbon transportation fuels, it is crucial to acknowledge that, as of 2023, petroleum-based fuels still constitute the majority of California's total gasoline pool energy demand and California law requires the State to reduce GHG emissions by 40% from 1990 levels by 2030 and 85% by 2045. LCFS project-based crediting offers an incentive and opportunity for near-term GHG emissions reductions at existing facilities that will likely continue to supply ongoing consumer demand for petroleum fuels, which in turn will help the State achieve its statutorily-required GHG reductions.

XX-2 Multiple Comments: Oppose phasing out crediting of oil projects

Comment: Chevron opposes the phaseout of project-related credits proposed in this rulemaking. This is a counterproductive approach to targeting greenhouse gas reduction in transportation. While recognizing that reduced reliance on fossil fuels is a stated goal of the state, eliminating recognition of emission reductions in the production of those fuels while still part of the transportation fuel mix misses an opportunity to achieve real incremental change during the transition. Emission reductions today have a cumulative effect that should not be discouraged. Further, project-related crediting has not presented a threat to alternative fuel growth since its introduction but has incentivized several projects explicitly focused on emissions reduction. (45d-165.4)

Comment: We urge CARB to reconsider retaining the opportunity for renewable hydrogen to be eligible for project based crediting beyond 2040.

While CARB anticipates a substantial phase-down of petroleum refining, it will be important to preserve some emission reduction opportunities for the refining capacity that remains, as recognized in the 2022 Scoping Plan Update, and preserving the renewable hydrogen option recognizing the role that hydrogen can play to ensure that residual petroleum refining helps meet CARB's decarbonization goals for the transportation sector. We note the exemption from phase-out provided for Carbon Capture and Sequestration (CCS) and renewable hydrogen has a similarly important role to play. There is still refining capacity anticipated in 2045 so

enabling crediting to at least 2045 will continue to promote emission reductions at these facilities. (45d-214.33)

Comment: The Refinery Investment Credit Provision is critical to incentivize petroleum refineries to reduce emissions... The proposed amendments sunset the Refinery Investment Credit Protocol in 2040. MPC opposes setting a date for the provision to end as projects that qualify for crediting will continue to provide benefits to the state long past 2040. Additionally, MPC recommends CARB remove the requirement that applications for process improvement projects under §95489(e)(3)(H) be submitted on or before December 31, 2025, as it does little to incentivize innovation and reduce emissions within a petroleum refinery. (45d-217.10)

Comment: Rondo also suggests that for very large capital infrastructure projects, such as new renewable energy fields, that these credit generating opportunities should continue as long as they are reducing the carbon intensity of California fuels. This is the approach already proposed for Carbon Capture and Storage projects. (45d-378.2)

Comment: CIPA doesn't see the need to end LCFS crediting, as is proposed in the amendment package, of large capital projects that are built to meet the goals of the Program by continually reducing

GHG emissions year-after-year, thus reducing a key economic feedstock's carbon intensity. (45d-315.1)

Comment: In Section 95489(c)(5), GARB staff proposes to phase out crediting of innovative crude projects no later than December 31, 2040, excluding CCS projects. In Appendix E: Purpose and Rationale for Low Carbon Fuel Standards Amendments, the rationale for this phase out was the 2022 Scoping Plan, where the "State has identified the need to phase down fossil fuel production as fossil fuel demand drops, and the need for all viable tools such as CCS and direct air capture to address the existential threat that climate change presents."

While fossil fuel demand in California will decline over time, it is not expected to be eliminated in 2040. Given this need past 2040, as well as the goals of reducing GHG emissions, Aera is evaluating solar electricity and solar steam projects that would be some of the largest in the world, to achieve near-zero emissions crude oil production, including after 2040. This would allow fossil fuel production in California to be much less carbon intensive than fossil fuel imported from elsewhere. Given the size of these projects, they would require years of permitting and construction and hundreds of millions of dollars in investment, with long payouts. Eliminating LCFS credit generation "no later than December 31, 2040" would hurt the investment case for these projects, as well as send a signal to developers of all types of projects that LCFS credit generation could be prematurely eliminated in future rulemaking. Such a phase out, and uncertainty over future potential LCFS regulatory changes, would discourage investment, incentivizing higher emissions from the crude oil producers and imports in the coming years.

In Appendix E: Purpose and Rationale for Low Carbon Fuel Standards Amendments, GARB staff also recognize the need for tools such as CCS and direct air capture to address climate change, which is presumably the rationale for allowing these credit generation pathways to continue post 2040. Similar to CCS and DAC, other innovative crude projects such as solar electricity and solar steam are tools needed to address climate change long-term, with the

potential to provide zero-carbon energy long after the cessation of oil production. Aera recommends removing the post-2040 phase of innovative crude crediting, supporting investments that not only result in near-term emissions reductions, but also long-term low-carbon energy generation that would benefit the State for decades to come. (45d-268.2)

Agency Response: No change was made in response to these comments. The LCFS aims to drive a transformative change in the market, moving away from traditional petroleum-based fuels toward more low-carbon transportation fuels.

The proposed phasing out crediting of these projects by 2040 is consistent with the 2022 Scoping Plan Update's projected reductions in demand for petroleum fuels, while also recognizing there are benefits to achieving verifiable GHG reductions at existing traditional fuel production facilities while those facilities continue to operate to meet consumer fossil gasoline demand over the coming years.

XX-3 Multiple Comments: Innovative crude oil methodology - emission factor for calculating credits

Comment: In Section 95489(c)(1)(F), CARB staff propose updating the emission factor for producing crude oil with solar or wind electricity from 511 gCO2e/kWh (current emission factor) to 314 gCO2e/kWh (proposed emission factor), which would result in a 39% reduction in credits generated by these projects. In Appendix E: Purpose and Rationale for Low Carbon Fuel Standards Amendments, the rationale for this update is that the solar projects approved by CARB under this pathway to date have been supplemented by grid electricity. Therefore, the avoided emissions from solar projects should be based on the carbon intensity of grid electricity (the proposed emission factor) rather than the carbon intensity of electricity from a natural gas fired combined cycle plant (the current emission factor).

However, this change presumes that future innovative crude solar or wind project applications will all be supplemented by grid electricity, similar to previous project applications. In fact, Aera has contracted with a solar developer to install 37 MW DC (27 MW AC) of solar PV at its Belridge oilfield, with an estimated completion date of 2025. This would be one of the largest innovative crude solar projects to date, and unlike previous projects, the solar electricity would be supplemented with electricity from natural gas fired cogeneration units that currently supply almost all of the electricity to the Belridge oilfield. Therefore, the emissions avoided from this project would be similar to the emission factor in the current LCFS regulation, rather than the proposed reduced emission factor. Lowering the emission factor and credits generated by a project such as the one at Belridge would incorrectly calculate avoided emissions and discourage investment in oilfield solar electricity and energy storage, as companies such as Aera consider installation of much larger solar projects. Aera recommends that innovative crude solar or wind electricity projects that displace natural gas electricity generation utilize the current emission factor when calculating LCFS credits generated. (45d-268.1)

Comment: The Proposed Rules include a substantial reduction in the credits awarded to innovative crude oil produced or transported using solar or wind-based electricity... This reduction stems from a change in the coefficient (i.e., the displacement emission factor) in the equation listed above (replacing "511" with "314") which will reduce awarded credits by approximately 40%. CRC notes that this crediting pathway has resulted in at least seventeen

innovative crude oil projects to date across the state. Furthermore, our operating experience has shown that solar electricity production provides one of the best ways as an operator to directly reduce our Scope 2 GHG emissions. Despite these successful emission reductions, CARB's proposed changes to this crediting equation will impact funding investment decisions for projects currently in development. Worse still, operating projects that were financially justified based on the previous crediting equation risk becoming stranded assets if their LCFS credits are taken away. (45d-365.5, 45d-365.12)

Comment: The Proposed Rules include a substantial reduction in the credits awarded to innovative crude oil produced or transported using solar or wind based electricity. As highlighted in Figure 1, this reduction stems from a change in the coefficient (i.e., the displacement emission factor) in the equation listed above (replacing "511" with "314") which will reduce awarded credits by approximately 40%. CRC notes that this crediting pathway has resulted in at least seventeen innovative crude oil projects to date across the state. Furthermore, our operating experience has shown that solar electricity production provides one of the best ways as an operator to directly reduce Scope 2 GHG emissions. Despite these successful emission reductions, CARB's proposed changes to this crediting equation will impact funding investment decisions for projects currently in development. Worse still, operating projects that were financially justified based on the previous crediting equation risk becoming stranded assets if their LCFS credits are taken away.

We request CARB reverse this proposed change and keep the current displacement factor of 511. In the alternative, we request that the Proposed Rules be revised to more explicitly state that projects that have already been approved to generate LCFS credits in this manner be allowed to keep using the existing crediting equation with a potential grace period for projects currently under development. Absent these requested revisions, the arbitrary changes to the innovative crude pathway crediting scheme sets a precedent that LCFS credits cannot be relied upon when justifying long-term project investment decisions. In turn, this could impact other LCFS crediting programs—beyond just the innovative crude pathway—by creating hesitation among equity investors and lenders instead of incentivizing new projects and developments to reduce emissions. (Apr-181.5, Apr-181.20)

Agency Response: No change was made in response to these comments. Staff proposes to use the new emission factor for California grid electricity (as process energy) derived from the CA-GREET4.0 model in this equation to calculate the credits for crude oil produced or transported using solar or wind-based electricity.

The current displacement emission factor (511 gCO2e/kWh) used in the equation was derived based on the assumption that the displaced system is a natural gas-fired combined cycle plant. However, based on the innovative crude projects using solar electricity approved by CARB since 2016, Projects generally generate solar electricity to replace grid electricity rather than substituting electricity produced by a natural gas-fired combined cycle power plant. Therefore, adjusting the displacement factor to an electricity-based factor more accurately reflects the change in GHG emissions from these projects. Because the innovative crude must be delivered to California refineries for processing to be eligible for crediting under this provision, the proposed update will align the displacement emission factor with the more representative and accurate

California grid electricity emission factor, which is similar to the LCA approach applied to fuel pathways and other petroleum-based GHG reduction projects.

XX-4 Innovative crude oil methodology - threshold

Comment: §95489 (c)(1)(D) - On page 189 of Appendix 1 of the rulemaking package is a reference for which it is difficult to interpret which section of the proposed code it falls under. It states "The innovative method must achieve an emission reduction of at least 1,000 metric tons of CO2e per year". It appears that this is intended to be part of §95489 (c)(1)(D), but this should be clarified to prevent confusion. Moreover, we could ascertain no reason for reducing the threshold for crediting from the previous 5,000 metric tons to 1,000. (45d-391.62)

Agency Response: No change was made in response to these comments. The threshold included in subsection 95489 (c)(1)(E) is aligned with other requirements described in the same section. The Proposed Amendments update the criteria for approving an innovative crude project from multiple criteria to a single criterion to streamline the application preparation and approval process. The multiple threshold criteria currently implemented were developed solely based on the estimated future projects, as there were no commenced innovative crude projects to reference at that time. After evaluating and approving 15 innovative crude applications, staff has gained sufficient knowledge and confidence to use a single threshold criterion of at least 1,000 metric tons of CO_2 reduction per year, to reflect a representative threshold CO_2 reduction preparation and review process and will apply to all future innovative crude projects.

XX-5 Allow delivery of low-CI electricity via book-and-claim for electrolytic hydrogen production in the Renewable Hydrogen Refinery Credit Program

Comment: Requiring onsite renewable generation to decarbonize even a portion of a refinery's hydrogen production requires more land than refineries have available onsite. Allowing for the delivery of low-CI electricity via book-and-claim for electrolytic hydrogen production would allow refineries to utilize this program to lower emissions. Without this amendment, this program will likely continue to be underutilized. (45d-198.3)

Agency Response: No change was made in response to these comments. According to subsection 95488.8(i) of the LCFS Regulation, "Reporting entities may use indirect accounting mechanisms for low-CI electricity supplied as a transportation fuel or for hydrogen production through electrolysis for transportation purposes", if the applicable conditions mentioned in that subsection are met.

XX-6 Multiple Comments: Eligibility for hydrogen plants that are not co-located with refineries

Comment: We appreciate and strongly support the clarification that hydrogen plants that are not co-located with refineries are eligible under the project-based crediting provisions. (Apr- 103.9)

Comment: Air Products appreciates CARB's amendments throughout §95489 to clarify that hydrogen production facilities not co-located with a petroleum refinery can generate credits under the refinery investment credit and renewable hydrogen provisions. This is an important clarification and provides equitable treatment between third-party hydrogen production and production and productions. (45d-214.32)

Agency Response: No change was made in response to these comments. To be eligible to participate in the Refinery Investment Credit Program and the Renewable Hydrogen Refinery Credit Program, a hydrogen production facility must physically provide hydrogen to a refinery. Hydrogen plants that are not co-located with refineries may still qualify, provided they can physically deliver hydrogen to the refineries.

XX-7 Multiple Comments: Additionality

Comment: Finally, as described above, are the exemptions to additionality considerations relating to policy support for alternative fuels from the U.S. Renewable Fuel Standard, California's cap and trade program, and proposed exemptions in the current amendments for support from the Inflation Reduction Act. In the past, when alternative fuel technologies were immature, stacking multiple streams of revenue was necessary to make alternatives to petroleum cost-competitive. Given advancements in technology and the implementation of alternative fuel policy at a variety of jurisdictional levels, stacking multiple streams of policy-driven revenue may not be required to bring these fuels to market. (45d-391.12)

Comment: Section 95489 Provisions for Petroleum-Based Fuels

§95489 (c) and (e) - Existing provisions to generate LCFS credits from the reduction of GHG emissions during crude production and transport or at petroleum refineries align with the intent of the LCFS, and support continued incremental decarbonization of California's transportation fuel portfolio, provided that the credited reductions actually match real-world GHG impacts. These provisions may be improved however, by stronger requirements to demonstrate the additionality of approved projects, such as a requirement that emission-reducing projects provide emissions benefits in excess of industry standards, or by requiring facility-level mass/energy flow assessment instead of the current requirement that system boundaries for these assessments include only direct and first-order indirect impacts. (45d-391.60)

Comment: §95489 (c)(1)(G) - As discussed in the section Reevaluating Previous Assumptions Around Additionality, above, a comprehensive review of existing considerations around additionality is warranted. The specified exemptions from the usual practice that prevents the use of environmental attributes credited under the cap and trade system from supporting claims of emissions reductions should be reevaluated as part of that review. (45d-391.63)

Comment: 95489 (e)(1)(D)1. - Proposed language specifies capturing anthropogenic sources for the purposes of LCFS crediting. Similar to 95489 (c)(1)(A)2. above, this may allow sources created for the purpose to gain LCFS credits in a way that would render the claimed emissions benefits non-additional. (45d-391.64)

Comment: 95489 (e)(1)(K) - As with 95489 (c)(1)(G) and other sections, the exclusion of environmental attributes credited under the cap and trade or other climate programs may

represent an opportunity to improve the treatment of additionality in the LCFS and should be reviewed as part of a comprehensive reevaluation of additionality provisions. (45d-391.68)

Comment: 95489 (f)(1)(E) - As with 95489 (c)(1)(G) and other sections, the exclusion of environmental attributes credited under the cap and trade or other climate programs should be part of a comprehensive review of additionality provisions. (45d-391.70)

Agency Response: No changes were made in response to these comments. The baseline for these projects is established on a case-by-case basis following specified regulatory criteria for demonstrations that the project is a change that is reducing emissions. Staff's experience evaluating these projects supports the idea that eligibility thresholds that are more achievable, easier to estimate, and equitable to all applicants will send a stronger signal to encourage the development of eligible emission reduction projects.

The LCFS does not include a general financial additionality requirement. Instead, the LCFS is designed to leverage other available incentive sources to increase the deployment of low-carbon fuels while also preventing any emissions reductions double-counting and supporting accurate accounting of GHG emission reductions towards State GHG reduction goals. Allowing the combination of incentives helps to create a stronger signal for producers of the fuels and leads to increased investment in production of low-CI fuels in excess of Federal support alone. See also CEQA RTC Master Response 5 and CEQA RTC 163-19 for more discussion on how the LCFS works to facilitate combining incentives to amplify benefits in some contexts, while retaining environmental accounting rigor.

YY. Crude Oil CI and OPGEE

YY-1 CARB should streamline crude CI determinations by eliminating the annual update requirement

Comment: Under the current program, CARB updates the Oil Production Greenhouse Gas Emission Estimator (OPGEE) Model and determines the average crude CI on an annual basis, which requires reporting entities to expend significant time and resources generating MCON reports and having the MCON reports verified by third parties. Compared to this significant effort, annual adjustments to the CARBOB and ULSD CI score have been very minor. Instead, reducing benchmarks has a comparatively outsized impact on deficit generation. WSPA recommends that CARB address any significant impacts on the crude CI to CARBOB and ULSD during the LCFS rulemaking process instead of requiring annual updates. (45d-241.20)

Agency Response: No change was made in response to these comments. Staff updates the crude CI each year based on the latest crude slate available, in order to reflect the latest data. Updated versions of OPGEE are only adopted through formal rulemaking processes, because the model is incorporated by reference into the LCFS Regulation.

YY-2 MCON (Crude Oil) reporting

Comment: CARB should eliminate the requirement for refineries to report California crudes by field name in the MCON report. This reporting requirement is unnecessary, because CARB is using data from the California Department of Conservation instead. CARB should also eliminate verification requirements for California crudes. (45d-241.21)

Agency Response: No change was made in response to these comments. Data from the California Department of Conservation is not broken down by individual refinery. CARB staff relies on verified data submitted by refineries to compare with publicly available information from the California Department of Conservation when calculating the annual crude average CI. Therefore, reporting of verified annual MCON data plays a critical role.

YY-3 Provisions for petroleum-based fuels

Comment: In section (a), incremental deficit calculation for crude oil, WSPA notes that the equations for the baseline crude averages appear to be incorrect. Appendix E of the ISOR states that the equations for the three-year California Crude Average CI and California Baseline Crude Average CI contained in this section are being revised "to be consistent with the updated Oil Production Greenhouse Gas Emission Estimator (OPGEE) model version, the updated Carbon Intensity Lookup Table for Crude Oil Production and Transport, and the implementation timeline of the amended regulation." However, it appears that the existing CI factors continued to be used in the CI Baseline Crude Ave calculations. These CI factors should be updated to reflect the revised factors derived using OPGEE 3.0b (which are assumed to be the updated factors listed in the updated Table 9). (45d-241.60)

Agency Response: Changes were made in response to these comments. Staff has corrected the California Baseline Crude Average and the Three-year California Crude Average carbon intensity values in the final amendments' language.

YY-4 OPGEE and Table 9 updates

Comment: The OPGEE scores for California produced crude have moved higher on average, even though CARB has claimed success for reducing industry emissions on several fronts, including implementation of the Oil/Gas Methane rule. This is incongruent, especially given that foreign CI scores have proportionally decreased compared to in-state production even though it can't be shown that new or additional emission controls have been enacted. (45d-315.2)

Agency Response: No change was made in response to these comments. The last annual crude average CI for the past years is lower than the past four years because more crude was procured from overseas low-CI crude sources, and crude production from Alaska and California decreased compared to previous years. However, the three-year weighted average is similar to the crude CI value from before the COVID-19 pandemic. The total crude volume reported in CA has started to reduce since 2019.

YY-5 OPGEE

Comment:

- 1. CARB should accelerate the adoption of the more robust Version 3.0b of the OPGEE model released Feb. 21, 2023.
- 2. CARB should implement a rapid review/update process to update CARB reporting from OPGEE data/modeling to reflect field specific contemporary peer review literature as it becomes available.
 - a) "Climate justice delayed is climate justice denied." Accurate and current data of thee missions is critical to understanding the nature and extent of the climate challenge. In 1954 oil companies knew that what they were doing had an adverse impact on the climate. Their failure to disclose the nature and extent of their knowledge of those impacts is an indictment of their self-interest in preserving profits despite horrific impacts on people and the environment. CARB has a responsibility to use timely, accurate data.
 - b) CARB should strive to "level the playing field" among oil producers and accelerate the reporting of field-specific clean energy resources to encourage energy developers to strive for lower life cycle emissions.
- 3. CARB should support OPGEE model data updates to reflect the unique challenges of Arctic oil and gas development highlighted in the peer review literature, including:
- a. Exploration & Development (§6.1 to §6.2.2.3)
 - i. CARB should allocate the GHG emissions estimates associated with unsuccessful exploration activities at the field level. If the emissions estimate from unsuccessful exploration activities cannot be directly assigned to a producing field, the CARB should assign those emissions to regional ornational oil producing provinces. For example, Shell conducted and abandoned exploration activities in Alaska's Chukchi Sea. The emissions associated with those activities could be assigned to Alaska's North Slope, Alaska as a whole, or the U.S.
 - ii. CARB should task the OPGEE team with conducting a peer review literature for Alaska North Slope land use impacts related to tundra disturbances and acceleration of melting permafrost and associated methane/biogenic carbon emissions.
 - iii. CARB should task the OPGEE team to review field drilling and development data for Alaska's North Slope field data in OPGEE data tables to verify:
 - 1. that the drilling energy consumption estimates reflect the high level of energy consumption required to drill through typically thick permafrost strata.
 - 2. that the well completion activities associated with working in thick permafrost are reflected in the emissions estimates.
 - 3. that the field development emissions data adequately include the risk of gas leakage around inadequately completed and monitored wells [CD-1 Pad, Alpine Field, Alaska North Slope, March 4, 2022]
 - 4. that the hydraulic fracturing energy consumption and associated emissions estimates reflect the higher level of energy consumption required in the typically lower temperature North Slope oil producing strata near thick permafrost strata, especially for viscous and heavy oil prospects that are being developed at shallower depths.
 - 5. that the energy expenditures and GHG emissions that arise from the extraordinary surface use activities necessary to protect the fragile tundra

ecosystem, e.g., snow/ice roads, are adequately reflected in emissions estimates.

- 6. that the GHG emissions associated with surface disturbances of highly thermally sensitive tundra which leave trails in the tundra which accumulate surface water which in turn absorb heat during the increasingly warming climate and accelerate the thermal degradation of permafrost which in turn releases high concentrations of methane are adequately reflected.
- b. Production (§6.4 through §6.53)
 - i. CARB should task the OPGEE team with reviewing the data associated with the use of miscible injectant (CH4, CO2 mixture) for enhanced oil recovery on Alaska's North Slope to verify that the data adequately accounts for CH4 and CO2 leakages.
 - ii. CARB should task the OPGEE team with reviewing the data associated with the use of polymer flooding for enhanced oil recovery of viscous and heavy oils on Alaska's North Slope to verify that the data adequately accounts for the life cycle emissions of those activities to produce viscous and heavy oils.
- c. Fuel Cycle & Embodied Emissions (§7)
 - i. CARB should task the OPGEE team with reviewing and verifying the assumptions underlying the co-production credit for prospective LNG exports from Alaska, i.e., the "natural gas displaces coal" vs. "natural gas could be substantially displaced by renewables." Verify the estimates for the magnitude and direction of the savings/cost of natural gas vs. coal supply chains, especially considering the energy intensive LNG supply chain associated with Alaska's North Slope natural gas, either an 800-mile pipeline+LNG or arctic ice breaking LNG tankers. We note that commentary research on coal v. natural gas supply chains suggests that any LNG advantage evaporates with more rigorous analysis.2 Adding an 800-mile pipeline clearly disadvantages that supply chain compared to a local coal supply.
 - ii. CARB should task the OPGEE team with reviewing and verifying the OPGEEmodel and field specific data to ascertain the extent to which GHG emissions associated with the long energy intensive supply chain for mobilization, transport and storage of equipment and materials associated with Alaska'sNorth Slope are taken into account. In addition, subsequent GHG emissions associated with landfilling and recycling materials from Alaska's North Slope–including the emissions associated with dismantlement, removal and restoration fossil fuel lease obligations – should be included in the embodied emissions accounting or a separate category.
- d. Venting, Global Warming Potential & Fugitive Emissions (§8, §9.1, §10.2.3.1)
 - CARB should task the OPGEE team with reviewing and incorporating contemporary flaring emissions data by field instead of country to more accurately reflect highly variable CH4 emissions. See for example the date within OCI+ (Oil Climate Index + Gas)3.
 - ii. CARB should adopt the 20-year Global Warming Potential (GWP) for CH4 as the default and require OPGEE to adopt the 20-year GWP for CH4.
- 4. CARB should require the OPGEE team to divest itself of funding sources that create the appearance of conflict of interest, e.g., Aramco and Chevron.

- 5. CARB should avoid the trap of only updating the data in the OPGEE model when ALL fields have ALL data input fields updated with field-specific data as this will create a perverse incentive for dirty oil producers to refrain from reporting fieldspecific data while cleaner oils fail to get credit for cleaner field-specific data – skewing comparisons between fields as well as underestimating aggregate emissions.
- 6. CARB should independently audit and verify data provided by the field operators to ensure reliable reporting of the data that drives emissions estimates. (15d1-202.3, 15d1-202.7)

Agency Response: No change was made in response to these comments. Staff has been transparent about the limitations of the Oil Production Greenhouse Gas Emissions Estimator (OPGEE) model and the data sources used to estimate CI values for individual crudes (e.g., see comment "LCFS 37-3", CARB's response in the Final Statement of Reasons for the 2018 (section K-2.1)¹³, and CARB's response in the Final Statement of Reasons for the 2015¹⁴ LCFS rulemaking, and comments "CIPA1 and CIPA2" from the Final Statement of Reasons for the 2015¹⁴ LCFS rulemaking, and comments). As stated in past CARB responses, while extensive data is available for California, Alaska, western U.S., Alberta oil sands, and some foreign crudes, CARB staff agrees that the data limitations on production parameters for many imported crudes do exist. These data limitations take two forms: lack of field production data and lack of data that maps field production to marketable crude blends.

The GHG Inventory uses 100-year GWP values for consistency with UNFCCC guidance for national parties. CARB is not required to use the same GWPs for programs as for GHG Inventory, but using common metrics across programs and inventory is helpful for interpreting and using data. Also see response KK-13.

Staff has explored options for obtaining this data from several data collection sources and have asked refiners and oil producers to supply this data with little success. Oil producers are also encouraged to supply data to CARB in order to help maintain a robust database. If crude-specific data cannot be obtained and are not provided by producers, the OPGEE model assigns default parameters when estimating the carbon intensity for these crudes. OPGEE defaults are based on available information for a parameter and within the range observed worldwide. Detailed documentation of the

¹³ State of California AIR RESOURCES BOARD Amendments to the Low Carbon Fuel Standard Regulation and to the Regulation on Commercialization of Alternative Diesel Fuels Final Statement of Reasons, November 2018,

https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/lcfs18/fsorlcfs.pdf?_ga=2.146931895.1665352487.1735600823-1195029355.1635956385

¹⁴ State of California AIR RESOURCES BOARD Final Statement of Reasons for Rulemaking, Including Summary of Comments and Agency Response PUBLIC HEARING TO CONSIDER THE PROPOSED RE-ADOPTION OF THE LOW CARBON FUEL STANDARD Public Hearing Dates: February 19, 2015, September 24-25, 2015, ww2.arb.ca.gov/sites/default/files/barcu/regact/2015/lcfs2015/fsorlcfs.pdf

¹⁵ State of California Environmental Protection Agency AIR RESOURCES BOARD Final Statement of Reasons Amendments to the Low Carbon Fuel Standard Regulation, October 2012, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2011/lcfs2011/lcfsfsor.pdf

OPGEE model and the default values used in the model have been provided to stakeholders for review with every update to the model. Moreover, for some input parameters, OPGEE makes use of "smart defaults." Smart defaults are used by OPGEE for those parameters that can be correlated to other parameters that are often known. For instance, the produced water-to-oil ratio is often unknown, but this parameter can be correlated to field age which is almost always known. CARB staff believes that these default parameters generally result in conservatively high CI estimates for crudes that are lacking in quality data. Producers who do not believe that these defaults accurately represent their crude production are encouraged to provide CARB with more complete data.

OPGEE version 3.0b (May 14, 2022) is incorporated in these LCFS amendments. CARB published the OPGEE model version used for the calculations through the workshopping process. The OPGEE modeling output is incorporated directly into the LCFS regulation, therefore, any modifications must be made through the formal rulemaking process, which does not accommodate rapid reviews or updates. CARB agrees that accurate and current data is critical to a successful, science-based program, and believes that the current process of updating to the latest OPGEE model with major rulemakings and requiring annual reporting of crude oil CI data maintains data integrity.

For this rulemaking, staff used the available set of potential input parameter options within OPGEE to model carbon intensity of all oilfields. The type of analysis and updates suggested by the commenter for Alaska North Slope goes beyond the capabilities of the current OPGEE model based on available data input parameters. The level of research and development suggested by the commenters specifically for one field would go far beyond the level of detail used across the entire set of global fields and beyond the process of general updates to the OPGEE model and OPGEE modeling inputs and was not included in the scope of this rulemaking.

Regarding fuel cycle and embodied emissions, it should be noted that pipeline and tanker travel distances are accounted for OPGEE on a field-specific basis and appropriate crude oil pipeline and tanker distances were used. Additionally, the potential for LNG exports to occur in the future would be accounted for during future regulatory updates since crude oil carbon intensity values are only updated during each regulatory process. Staff appreciates the commenter raising this item for future consideration.

Regarding flaring modeling, staff believes that the country-level flaring data used for most global oilfields is the most appropriate level of data resolution for this regulatory program based on currently available data sources. Although the OPGEE model includes field-level flaring-to-oil ratio estimates, there is relatively high uncertainty regarding field boundaries and naming conventions underlying those estimates. The country-level data is better defined both spatially and temporally. Alaska North Slope is a special case where reported flaring data is available in an official state database, so the reported flaring data was paired with reported oil production data to derive an Alaska North Slope-specific flaring-to-oil ratio.

The comment regarding funding sources for the OPGEE team does not recommend any change to the Proposed Amendments, but instead recommends that CARB act to

minimize potential appearances of conflict of interest for the contractors that developed updates to the OPGEE model for CARB. CARB's contract for the OPGEE update work contains standard requirements for the contractor to ensure that no conflicts of interest exist in the performance of the agreement. The contract also requires that the contractor comply with formal policies and procedures to identify and mitigate conflicts of interest, and ensure that the contractor's organization, management, and employees avoid financial interests and activities that potentially create conflicts of interest.

CARB staff has engaged with stakeholders on the OPGEE model and inputs used to estimate CI values for individual crudes using the model for thirteen years. This engagement has included several workshops before which updated versions of the model, model documentation, and crude parameter inputs were posted publicly.

YY-6 OPGEE 3.0b values for California Crude do not agree with reported emissions and production

Comment: CARB proposes to amend the LCFS to update well-to-refinery gate carbon intensity (CI) for oil based on revised Oil Production Greenhouse Gas Emissions Estimator ("OPGEE"). However, OPGEE continues to use inaccurate assumptions and data for calculating the well-to refinery gate CI of California crudes. This inaccuracy likely extends to imported crudes as well.

Oil producers in California have been measuring, reporting and auditing direct green house gas emissions for over a decade. While there may be some uncertainty over methane emissions, the vast majority of greenhouse gas emissions from California producers is carbon dioxide from combustion sources, nearly all of which are measured with calibrated flow meters, sample results and applied combustion chemistry. These California scope 1 emission estimates for oil production are the most accurate in the world due to the financial impact of cap and trade and third-party verification requirements.

Likewise, electricity use is metered, third-party transacted and reported. Electricity purchases combined with the carbon intensity of the grid (which itself is comprised of measured and verified scope 1 emissions from generators and importers), defines the scope 2 input to the production carbon intensity.

Combining the scope 1 and scope 2 emissions with measured production provides a field's carbon intensity (CI). California producers know the carbon intensities of the fields they operate, CRC calculates the carbon intensity of production each year and reports that value in its sustainability report. The measured and calculated carbon intensity of CRC's production is approximately 30% lower than the barrel weighted average calculated using the OPGEE lookup table.

The reasons for the discrepancy between the OPGEE 3.0b model and reported emissions are likely multiple but include:

- Using 2018 data from CalGEM which was aggregated during a system transition, not verified and is now six years out of date;
- Using emission estimates from operators in other states (many without LDAR requirements or tank vapor recovery) to estimate leak rates

• Using estimated field equipment counts instead of actual inventories reported under CARB's Methane Rule

The input data for OPGEE for California fields is the most complete set used in the world, compiled by agencies under the direction of California EPA with decades of oversight of the industry. Even with the most accurate and complete inputs, the model does not accurately predict the carbon intensity of California production.

CRC requests that the model output be ground-truthed and converged to the verified GHG emissions from California's oil fields before adopting any revisions to this important policy tool.

Against this backdrop, companies in the US and Europe are being held to increasingly detailed and auditable data requirements when they report Greenhouse Gas results publicly to inform the public and investors, similar to what CARB requires under MRR for Cap and Trade. Given the costs borne by California residents for LCFS compliance which ripples through the economy, a greater level of assurance is needed than OPGEE as implemented can provide, at present. It is incumbent on CARB to assure that the model used to determine deficits is valid and the data inputs are accurate. As such, while CARB staff has reportedly completed some level of comparison between reported greenhouse gas emissions, field production and OPGEE results, the results and veracity of that work has not been made available to public disclosure.

CRC requests that a study comparing OPGEE field CIs against reported emissions and production is made available to the public for review and comment.

Even more troubling is the duplication of model outputs for fields outside California. We note that many fields have the exact same CI down to the hundredth of a gram per megajoule.

- 4 fields in New Mexico all have the same CI 10.03 g/MJ
- 10 Canadian fields have same CI 10.37 g/MJ
- 30 other Canadian fields have same CI 10.68 g/MJ
- 4 Fields in Utah, Saudi Arabia and Mexico all have the same CI 10.50 g/MJ
- 15 Nigerian fields are exactly the same 11.71 g/MJ
- 8 Fields in Texas and Oklahoma share the same CI 12.53 g/MJ
- 3 fields in ND model to exactly the same CI 12.62 g/MJ

The above represents 74 fields out of 383 or about 20% that have duplicate bins of exact values. This compares with 3 CI pairs (6 fields) within California's 155 fields. Fields that share a CI value down to the hundredth of a gram per megajoule are either missing large numbers of data values forcing the model is using a default value (which is based on US production practices) or values are being averaged across whole countries and input. Either result is unscientific.

Looking into the data file used to model field carbon intensities worldwide (MCON Inputs Spreadsheet) provides further reason to question the model output. The input data for the majority of world fields is limited to unverified information from technical journals, which is itself reported by companies developing the fields. For most non-California fields, OPGEE model output is being calculated based *only* on the following inputs:

- Field age (sometimes estimated based on discovery date)
- Average field depth (as reported in an Oil and Gas Journal)
- Production per well (as reported in an Oil and Gas Journal)
- Number of wells (as reported in an Oil and Gas Journal)
- API Gravity (company website/Oil and Gas Journal)
- Ocean transportation distance lookup assuming all shipping via Very Large Crude Carriers (VLCC).

For model variables that are not known, the data input reverts to a "default" value which is derived from known data from other producers. Because of the availability of data in the United States from government sources (e.g., EPA, State Agencies), US production practices act as the default for production around the world. Production practices in the U.S. are not a valid proxy for operations around the world.

For example, a common assumption is that gas which is not flared, vented or used is reinjected. Compounding the reinjection assumption (which is likely not correct due to the expense) are the following which are US default values: 1) the gas to oil ratio (GOR) of the field, 2) flaring ratio, and 3) venting fraction. As currently modeled by OPGEE, the CI of the vast majority of fields around the world was set at discovery. Further, there may be some motivation to inflate initial production values reported in an industry journal or on a company website which is the source of inputs for OPGEE.

As a matter of disclosure CRC requests that CARB evaluate the uncertainty of OPGEE field crude CI introduced by the lack of field specific data used by the model and take steps to independently verify whether using default values increases that uncertainty above levels required for program integrity. As a start, we would suggest that a maximum uncertainty of 0.10 g/MJ is appropriate, based on the level which triggers incremental deficits under the rule. (Apr-181.8, Apr-181.9, Apr-181.21)

Agency Response: No change was made in response to these comments. For the response to this comment, please refer to the first and third paragraphs of the response to YY-5.

Determining the carbon intensity of crude oil under the LCFS requires conducting a life cycle analysis to calculate the GHG emissions associated with producing and transporting the crude oils. CARB's verified data submitted under the MRR is not designed to support the life cycle analysis needed by the LCFS – this data set does not include emissions from land use change, transport, or upstream production of process fuels such as natural gas and electricity and is not specific to individual crude production pathways.

Many of the key values were derived from the Annual Report of the California State Oil and Gas Supervisor,¹⁶ because the data in those reports is static and has been through CalGEM's full vetting process. Publication of those reports are typically years behind the data year, and the typical delay has widened in recent years. CalGEM data from 2019

¹⁶ Annual Report of the State Oil and Gas Supervisor, May 31, 2024, Access at https://www.conservation.ca.gov/calgem/pubs_stats/annual_reports/Pages/annual_reports.aspx

was generally used in this OPGEE modeling, as shown in Column FF of the "CalGEM Data 2019" sheet in the MCON inputs spreadsheet. CARB did not use the 2020 report due to concerns that early pandemic data would not reflect standard operating conditions. CARB's goal was to use a consistent data year for all global oil fields and updating all data to 2021 in the middle of the rulemaking process (when the 2021 Report of the California State Oil and Gas Supervisor was published) would not be feasible due to the extensive time requirements for collecting and processing input data.

CARB used California-specific average activity factors (ratio of equipment count to well count) for key pieces of equipment (separators, tanks, and pneumatic controllers by type), including some from 2007 survey data and some from 2019 regulatory reporting data. This is also outlined in the OPGEE inputs spreadsheets.

Rutherford et al.¹⁷ (2021) extensively compared the underlying modeling that formed the basis of OPGEE's venting and fugitives model against field measurements from North America. This comparison depicted the level of alignment between the model results and the measurement studies. Stanford University discussed the results of this study in an August 10, 2021, public workshop hosted by CARB, including slides showing figures from the paper.

The commenter also identified sets of marketable crude oil names (MCON) sharing the same CI values. Those cases generally represent fields where one set of inputs were developed that are designed to be representative of all the MCONs that are assigned that CI value. This approach is typically used where CARB does not have MCON-level data and thus used data at a higher level of aggregation, which allows the use of more user input data (rather than OPGEE default data). The current regulation uses the same approach for many of these cases (i.e., New Mexico, Canada, Texas & Oklahoma, North Dakota, and Utah). In a few cases, MCONs had the same CI to two decimal places, but had different inputs and different CIs in the third decimal place.

The baseline and lookup table CI values are both calculated with the same version of OPGEE. The main changes between the modeling are updating inputs where available to reflect data for a more recent year (2019 when possible), using 2019 selections for secondary inputs (e.g., flaring-to-oil ratio lookup and California electricity grid mix), and updating the crude volumes received from each MCON (i.e., the weighting of MCONs). Because both the baseline and lookup table values are calculated using the same tool with similar levels of data inputs available, staff expects that the overall uncertainty of the tool has a smaller influence on the change from baseline to lookup table than it does on the absolute magnitude of any individual CI.

CARB staff has engaged with stakeholders on the OPGEE model and inputs used to estimate CI values for individual crudes using the model for thirteen years. This

¹⁷ Rutherford, J.S., Sherwin, E.D., Ravikumar, A.P., Heat, G.A., Englander, J., Cooley, D., Lyon, D., Omara, M., Langfitt, Q., and Brandt, A.R. "Closing the methane gap in US oil and natural gas production emissions inventories", *Nature Communications Journal, Article Number 4715, 2021*, Access at https://doi.org/10.1038/s41467-021-25017-4.

engagement has included several workshops before which updated versions of the model, model documentation, and crude parameter inputs were posted publicly.

ZZ. Carbon Capture and Sequestration (CCS)

ZZ-1 Multiple Comments: Support fuel pathways with CCS

Comment Summary: Commenters support the crediting mechanism for fuel pathway applications involving CCS. (45d-177.1, Apr-035.2)

Agency Response: Staff appreciates the support for the CCS and direct air capture (DAC) crediting mechanisms in the LCFS.

ZZ-2 Plant based, pH neutral and biodegradable surfactant as innovative crude method

Comment: We kindly request consideration of adding to CCR Section 95489(c)(1)(A), Chemistry Replace Steam, as an innovative production method. (45d-020.1)

Agency Response: No change was made in response to the comment. CARB appreciates the commenter submitting a background document on the natural surfactant which can replace steam in the TEOR process thereby reducing extraction GHG emissions. Because there is limited information about the GHG reduction efficacy of this approach, staff did not propose to include it as an eligible project under the innovative crude provision during this rulemaking.

ZZ-3 Carbon sequestration in turfgrass-soil systems

Comment: Please consider a review of carbon sequestration and according the National Instories Heqlth research (see below link) "plants are crucial players involved in carbon sequestration". Specifically, turfgrass which captures and stores atmospheric CO2 in its plant biomass (root system). Significant and detrimental air quality effects are occurring unchecked by the false claims of water savings through mass turf reduction programs. The heat sinks and carbon emissions released are simply profound!

I urge CARB to act in a regulatory fashion to protect the mass carbon release going on today. Please see the NIH article to better understand this issue. (15d2-018.1)

Agency Response: No change was made in response to this comment. The comment is outside the scope of the present rulemaking because staff has not proposed revisions to the existing CCS Protocol.

ZZ-4 Multiple Comments: Support CCS

Comment: Support for CCS. Proteum encourages Staff to provide clear support for CCS in the production of renewable transportation fuels. The process of reforming ethanol and other Biomass feedstocks benefit greatly from the use of CCS, which enables Proteum to produce carbon-negative transportation fuels. Due to the expense and required economies of scale, the Amendments should not restrict CCS to facilities co-located with fuel production. The Amendments can incentivize CCS in renewable transportation fuel production separate and apart from questions about utilizing CCS solely when producing fossil-based fuels. (15d1-126.4)

Agency Response: No change was made in response to these comments. CARB appreciates the support for CCS crediting in the LCFS. The regulation requires the capture facility to be co-located with a fuel production facility or that captured CO₂ from an eligible entity be directly transported from CO₂ source to an eligible geologic sequestration site so that GHG reductions from CCS are directly attributable to the fuel pathway.

ZZ-5 Multiple Comments: CO2 capture from existing sources

Comment: §95489 (c)(1)(A)2. - Capturing anthropogenic carbon for sequestration or reuse aligns with the intent of the LCFS, however the proposed language may allow producers to create a new stream of CO2 in order to subsequently capture it for credit generation. Limiting the eligible sources to those that existed at the time these provisions were adopted would help ensure that captured CO2 provides additional GHG benefits. (45d-391.62)

Comment: §95490 (c)(2)(A) - Proposed amendments require that if a CCS project uses CO2 that was previously being captured for industrial use, any replacement for that lost gas comes from new or expanded capture of anthropogenic CO2 sources. Given that CO2 is regularly captured for industrial use (e.g. soda carbonation or dry ice production) it is appropriate that CCS projects the deploy new CO2 capture capacity receive more credit for the additional reduction of net GHG emissions than a project that simply redirects existing captured CO2 and overlooks measures taken by industrial entities to replace the lost supply. This is especially true given that the intent of the CCS Protocol in the LCFS was to support the deployment of novel technology. (45d-391.73)

Agency Response: No change was made in response to these comments. The proposed language adequately ensures that a CCS project will deliver GHG benefits in cases where CO2 is being captured from existing sources.

ZZ-6 Multiple Comments: Oppose fossil fuel projects with CCS

Comment Summary: Commenters oppose granting LCFS credits to fossil fuel projects involving CCS. (45d-373.1)

Comment: CARB must not encourage continued and/or prolonged use of fossil fuels through its petroleum-plus-CCS phase-out loophole. (45d-210.5)

Comment: Oppose proposed LCFS amendment loophole to allow petroleum projects with carbon capture & storage past the 2040 phase-out. (45d-272.2)

Agency Response: No change was made in response to the comment. The Boardapproved 2022 Scoping Plan Update demonstrated that liquid fuels and some petroleum fuels will likely still be needed to meet the energy demand in various sectors even as California makes progress towards achieving the carbon neutrality goal by 2045. One of the feasible near-term solutions to reduce GHG emissions from liquid fuels and petroleum fuels is to incent the deployment of carbon capture and sequestration in crude oil extraction and petroleum refineries while this infrastructure is still in operation. This does not detract from the broader transition away from fossil fuel demand in California as combustion vehicles transition out of the economy.

ZZ-7 Multiple Comments: Support DAC projects

Comment: ...we strongly support the inclusion of carbon removal via direct air capture (DAC) as a credit-generating pathway under the LCFS." (45d-050.1)

Comment: Additionally, the Coalition supports the proposal in § 95490 (a)(2)(A) of the proposed regulation that direct air capture projects must be physically located in the United States to be eligible under the CCS Protocol.2 This proposal will effectively align the LCFS with national efforts currently underway, including major federal incentive funds, to capture the climate, economic and jobs benefits that these projects can deliver. (45d-350.2)

Agency Response: No change was made in response to the comment. CARB appreciates the support for DAC and the LCFS provision that limits crediting eligibility to US DAC projects.

ZZ-8 Multiple Comments: Oppose DAC projects

Comment Summary: The undersigned groups express their strong opposition to direct air capture (DAC) crediting provisions under the LCFS for the following reasons.

- DAC projects do not produce transportation fuels.
- Over emphasis on DAC creates a moral hazard by delaying reductions of direct GHG emissions.
- DAC is energy intensive, costly and has not been proven commercially. DAC projects that rely on fossil fuels or grid electricity for operation generates more GHG emissions.
- The proposed provisions on DAC do not prevent multiple claiming of credits under various programs/jurisdictions.
- CARB may not be able to provide better oversight of DAC projects nationwide. (45d-239.1)

Comment: Eliminate double counting of emission reductions from direct air capture (DAC): In several provisions of the LCFS regulation amendments (e.g., book-and-claim electricity, book-and-claim RNG, book-and-claim hydrogen, renewable or low-CI process energy), the regulation text prohibits generating LCFS credits if the RECs or environmental attributes are "being claimed in any other voluntary or mandatory program with the exception of (insert list of programs where stacking is allowed)".

However, such language is conspicuously absent from section 95490 for DAC or other CCS projects. It is public knowledge that Oxy 1PointFive is already preselling future emission reductions in the voluntary carbon market for its first DAC project and intends to bundle DAC emission reductions with crude oil being marketed as "carbon neutral crude" or "net zero oil". See:

- PointFive announces agreement with Airbus for purchase of 400,000 tonnes of carbon removal credits.
- Amazon makes first investment in direct air capture climate technology | Reuters
- Oxy teams with Macquarie to deliver the world's first carbon-neutral oil from Permian basin to India

While I agree that the LCFS value for CCS and DAC should stack with Federal 45Q tax credit, generating LCFS credit for emission reductions that are also sold to other entities in the voluntary carbon market and/or bundled with crude as "net zero oil" is a clear instance of double or maybe even triple counting of emission reductions. If your intention is to allow double or triple accounting, then that should be transparently stated and discussed in a public forum. (45d-154.7)

Comment Summary: Earthjustice urges CARB to prohibit the use of DAC since it constitutes an offset for in-state fossil fuel use in the future. Earthjustice expresses displeasure over CARB's failure to disclose the extent of the program reliance on DAC credits to achieve the desired CI reduction target by 2045. (15d1-222.10, 15d1-222.36)

Agency Response: No change was made in response to these comments. DAC is an emerging technology that has the potential to remove large amounts of CO₂ from the atmosphere. Direct air capture and sequestration could aide in achieving California's long-term climate goals and was included in the Board-approved 2022 Scoping Plan Update. The deployment of this technology will help advance carbon dioxide removal technology and accelerate the deployment of carbon dioxide removal in general, which is necessary to achieve California's carbon neutrality targets identified by Assembly Bill 1279 (Muratsuchi, Chapter 337, Statutes of 2022) with legislative policy support from companion bill Senate Bill 905 (Caballero, Chapter 359, Statutes of 2022).

CARB staff expects DAC projects will achieve the most greenhouse gas emissions reductions through use of renewable electricity. To encourage this practice, the proposed amendments offer book-and-claim of low-CI electricity for DAC.

Because DAC and CCS in general are in the early stages of technology scaling and significant quantities of carbon dioxide removal are likely necessary to achieve carbon neutrality within California and globally, access to incentives/financing is crucial.^{18,19} The ability to claim CCS credits under multiple programs such as IRA and 45Q supports scaling this emerging sector and is essential and therefore is not explicitly prohibited under the proposed DAC provisions. As far as emission reduction claims go, CARB does not, and will not, support double-counting of emissions reductions in California's emissions inventory and in assessing progress towards California's climate mandates and will follow IPCC methods and other best practices to ensure emission benefits are not double-counted. See also CEQA RTC R22-37.

ZZ-9 Multiple Comments: Cap on out-of-state DAC projects

Comment: Place a cap on out-of-state DAC projects: Based on press releases, DAC projects are expected to be massive, resulting in credit generation of up to one million MT annually for each project. At a credit value of \$200, a single out-of-state project may result in approximately \$200 million leaving the California economy annually, while providing no jobs for Californians,

¹⁸ CARB, 2022 Scoping Plan Update, 2022. Pages 216-222. https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf

¹⁹ IPCC. Climate Change 2022: Mitigation of Climate Change, 2022. Chapter 6, page 643. https://www.ipcc.ch/report/ar6/wg3/chapter/chapter-6/

displacing no fossil fuels in California, resulting in no air pollution benefits to California communities, and not even counting toward California's AB32 emission reduction goals. Therefore, not only will Californians be paying for a large out-of-state project that provides no immediate benefit to the state, but they will also have to pay again for separate emission reductions that do count toward the State's goals. In effect, these DAC projects would act as "LCFS offsets", allowing oil companies to comply with the LCFS without affecting their fossil fuel sales. Credit generation for out of-state DAC projects should either be quickly phased out through a grandfather date or tightly capped as is done in the Cap-and-Trade program for offsets. If left uncapped, a projects1 proliferation of DAC could result in repeated triggering of the Auto-Acceleration Mechanism leading quickly to excessive pass-through costs to California consumers. (45d-154.9)

Comment: Eliminating credits for Direct Air Capture (DAC). The LCFS is a program to reduce the carbon intensity of transportation fuels in California. A DAC facility in Louisiana has no apparent bearing on the carbon intensity of California's fuels, yet the CARB staff proposal would allow such projects to generate credits. Further, any project that aims to reduce atmospheric carbon by capturing carbon in the ambient air will fail to achieve net emissions reductions if those reductions are offset by further pollution from fossil fuels in California, the effective impact of including such projects in the LCFS. (45d-379.16)

Comment: Direct air capture projects in Texas that will likely result in hundreds of millions (and potentially billions) of dollars leaving the State annually for emission reductions that will not count toward California's statutory GHG reduction targets. (15d1-183.9)

Agency Response: No change was made in response to these comments. Greenhouse gases are a global pollutant and reductions in greenhouse gases anywhere are a benefit everywhere. As stated in response **Error! Reference source not found.**, DAC is an emerging technology that has the potential to remove large amounts of CO₂ from the atmosphere. Direct air capture and sequestration could aide in achieving California's long-term climate goals and was included in the Board-approved 2022 Scoping Plan Update. The deployment of this technology will help advance the carbon dioxide removal technology and accelerate the deployment of carbon dioxide removal in general, which is necessary to achieve carbon neutrality. Capping or otherwise limiting DAC project credits at this time could stall progress on scaling and deployment of this necessary climate solution at a time when immediate and significant scaling of all climate solutions is necessary to avoid the worst impacts of climate change.²⁰

ZZ-10 Multiple Comments: Oppose CCS projects that use CO2-enhanced oil recovery

Comment: Prohibit enhanced oil recovery as an eligible sequestration method. (45d-001.6)

Comment: CARB must immediately cease crediting CCS projects that use captured carbon for enhanced oil recovery in harmony with the statewide prohibitions in SB 1314 (Limón 2022) and SB 905 (Caballero 2022).

²⁰ https://www.ipcc.ch/2022/04/04/ipcc-ar6-wgiii-pressrelease/

In 2022, California prohibited the use of captured carbon for enhanced oil recovery in recognition of the local and climate harms of the practice, and it is incoherent for CARB to continue subsidizing the practice in other states. Apart from the hypocrisy of subsidizing outside of our state what is illegal inside it, the same reasons that we outlawed enhanced oil recovery in California demand that we immediately stop issuing LCFS credits for EOR using captured carbon outside the state for projects that use captured carbon for enhanced oil recovery (EOR).

Funded largely by taxpayers and—through the LCFS—car drivers, that is not a climate solution but rather a fossil fuel subsidy. We should not use the LCFS as a fossil fuel subsidy, so we should discontinue this crediting practice immediately.

Given the clear climate and local harms and utter lack of benefits beyond oil industry profits, as well as the illegality of the practice within the state, CARB must not delay in ending LCFS credits for enhanced oil recovery. While we recognize that the SB 905 rulemaking is gearing up and could also address this problem, that rulemaking is moving slowly at CARB, with little visible activity in the year and half since SB 905 was passed. Further, we see other changes to CCS crediting in the proposed amendments, and CARB would advance no public benefit by continuing crediting and subsidizing EOR while that rulemaking progresses, even as CARB makes other changes to the LCFS CCS protocol. Thus, CARB must end its fossil fuel subsidy for EOR under the LCFS in the current rulemaking. (45d-239.2)

Comment: End the crediting of Carbon Capture and Storage projects that use captured carbon for enhanced oil recovery, as this conflicts with statewide prohibitions in SB 1314 (Limón 2022) and SB 905 (Caballero 2022). (45d-148.4)

Comment: Remove Enhanced Oil Recovery (EOR) as an Eligible Sequestration Method: California SB 1314 prohibits the use of EOR as a sequestration method for CCS projects in California. Section 1 of SB 1314 reads "The Legislature finds and declares that the purpose of carbon capture technologies, and carbon capture and sequestration is to facilitate the transition to a carbon-neutral society and not to facilitate continued dependence upon fossil fuel production." CO2 EOR is a tertiary oil production method that is only used when oil field production has declined to the point that it is no longer profitable to continue producing using secondary production methods such as waterflood. As such, use of EOR results in the recovery of oil that otherwise would not be produced. The LCFS program should not be providing incentive to squeeze additional oil from these fields. Let's leave this oil in the ground! Out of consistency with California requirements, I strongly encourage the Board to remove EOR as an eligible sequestration method under the LCFS. This can be done by setting a grandfather date (e.g., 2028) after which projects using EOR cannot be certified. (45d-154.8)

Comment: Prohibiting credits for Carbon Capture and Storage or Direct Air Capture projects that utilize enhanced oil recovery. The Legislature and Governor have made clear with the passage of SB 1314 that enhanced oil recovery has no role to play in meeting California's carbon neutrality goals. Accordingly, such projects should not generate LCFS credits. (45d-379.15)

Comment: As we called for in our February 2024 comments, and as urged by the Environmental Justice Advisory Committee (EJAC), CARB must end credits to projects outside of California that produce oil using captured carbon dioxide (CO2).

The EJAC specifically directed CARB staff to "Prohibit enhanced oil recovery as an eligible sequestration method."1 Crediting CO2-based enhanced oil recovery (EOR) is also at odds with California law. SB 905 (2022) prohibits operators in California from utilizing CO2 from carbon capture and storage (CCS) in EOR.2 Yet while the State decidedly took a stand against CCS-associated EOR within California, the LCFS door remains open to incentivizing this same harmful practice outside the State's borders.

Under the LCFS CCS Protocol, applicable CCS projects are those "that capture carbon dioxide (CO2) and sequester it onshore, in either saline or depleted oil and gas reservoirs, or oil and gas reservoirs used for CO2-enhanced oil recovery (CO2- EOR).3 Thus, non-California regulated entities conducting EOR will be compensated by CARB for causing environmental and community health damage elsewhere. This asymmetry is simply wrong and must be corrected by removal of CCS-related EOR from the LCFS. It is not too late to close the out-of-state LCFS EOR loophole. Below are possible changes to accomplish this:

A. Remove the underlined language below from the LCFS CCS Protocol:

The CCS Protocol applies to projects "that capture carbon dioxide (CO2) and sequester it onshore, in either saline or depleted oil and gas reservoirs, or oil and gas reservoirs used for CO2-enhanced oil recovery (CO2- EOR)."

B. Update the following regulations:

In 17 Cal. Code Regs. section 95490(a)(1) (stating that eligible entities include "Alternative fuel producers, refineries, and oil and gas producers that capture CO2 onsite and geologically sequester CO2 either on-site or off-site"), make clear that, to be eligible, capture and sequestration of CO2 does not include EOR. In 17 Cal. Code Regs. section 95490(a)(2) (stating that "If CO2 derived from direct air capture is converted to fuels, it is not eligible for project-based CCS credits. However, applicants may apply for fuel pathway certification using the Tier 2 pathway application process as described in section 95488.7"), make clear that CO2 derived from direct air capture may not be used for EOR. (15d1-038.1)

Comment: Enhanced oil recovery (EOR): Last, the Board should eliminate LCFS credits for captured carbon that is utilized for EOR, in alignment with new the state law SB 13 I 4 that bans this practice. (BH-034.7)

Comment: First, we are very concerned that the current regulations allow out-of-state projects to receive subsidies for enhanced oil recovery. This is out of alignment with the intent of CARB to reduce and phaseout fossil fuel usage and as well as the intent to SB 905. (BHT-30)

Comment: Second, allowing enhanced oil recovery as an eligible sequestration methane perpetrates fossil fuels and puts communities like those in Kern County at further risk for exposure to additional contaminants. (BHT-35)

Agency Response: No change was made in response to the comment. The eligibility of CO2-enhanced recovery (CO2-EOR) as a reservoir for the purpose of CO2 sequestration and credit generation is established in the Carbon Capture and Sequestration (CCS) Protocol. Changes to the CCS protocol itself are outside of the scope of this rulemaking but may be considered as part of rulemaking activities conducted under SB 905 if appropriate.

ZZ-11 Multiple Comments: Low- CI electricity matching period for DAC

Comment: 1PointFive has carefully examined low-CI electricity sourcing and has determined that a book-and-claim accounting period shorter than 12 months is currently infeasible and will severely constrain the deployment of this important climate mitigation technology. Such a requirement should wait until such time when robust long-duration storage capacity is available, the necessary market and regulatory frameworks are in place, and sufficient dispatchable low-CI electricity is available, which we anticipate will not occur in this decade. (45d-249.2)

Comment: ...we recommend that CARB revise its proposed amendments to permit book and claim accounting for low-CI electricity on no less than an annual basis. (45d-249.7)

Comment: Instead of prescribing a temporal matching framework that is not fit for purpose and does not reflect the current state of low-CI electricity supply or temporal attribute markets, we encourage CARB to convene a dialogue with key stakeholders to consider matching requirements appropriate for DAC as the technology and markets for temporal matching mature alongside DAC deployment. Such a dialogue would provide a venue for collecting valuable input to ensure that LCFS requirements mitigate resource shuffling and maximize long-term climate benefits. Prescribing an outcome without a robust conversation risks undercutting the growth of an industry that is likely to be vital to meet the State's 2045 net zero goal. undersigned groups write to express their strong opposition to the California Air Resources Board (CARB) staff proposal regarding the Low Carbon Fuel Standard (LCFS), specifically provisions regarding nationwide direct air capture (DAC) crediting. (45d-385.1)

Comment: Section 95488.8(i)(1)(C) of the Proposed Amendments includes criteria required for low-CI electricity supplying DAC projects. Criterion 1 requires that low-CI electricity be supplied to the grid within the local balancing authority where the electricity is consumed (local supply). Criterion 3 requires low-CI electricity to be supplied from new or expanded production within three years of the start of the direct air capture project (additionality). We strongly support these criteria for local supply and additionality as key pillars to mitigate against resource shuffling where existing low-CI electricity is redirected and backfilled with higher-CI electricity. (45d-385.2)

Comment: At this nascent stage of both DAC technology deployment and availability of continuous 24/7 low-CI electricity, an annual book-and-claim matching period for DAC under LCFS is appropriate. This would account for the full annual seasonal cycle for intermittent renewables. Matching periods shorter than 12 months will significantly impact the financeability of early DAC projects and impede deployment of this critical climate technology.
We request that CARB revise Section 95488.8(i)(1)(C) Criterion 4 of the Proposed Amendments to require annual book-and-claim matching for low-CI electricity for DAC projects in order to help facilitate early DAC project deployment. (45d-385.3)

Comment: "The latest proposed amendments to the LCFS Regulation Section 95488.8(i)(1)(C) issued on Monday, August 12th move in the right direction in allowing a longer temporal period in book-and-claim accounting for low-carbon intensity (CI) electricity for DAC (three quarters) as compared to the previous proposed amendments of January 2, 2024 (quarterly). However, book-and-claim accounting spanning three quarters cannot accommodate DAC's continuous 24-7/365 operations given the seasonal fluctuations in wind and solar power production, and is therefore not fit for purpose nor achievable for DAC at this stage of the industry's development. Instead, annual book-and-claim accounting for DAC is necessary, appropriate, and consistent with the leading global standards today.

Moreover, there is a lack of analytical evidence that emissions accounting accuracy or resource shuffling prevention would be enhanced by three-quarter accounting compared with annual.

The need for annual book-and-claim matching for DAC is driven by underlying physical and technological constraints, as well as market realities. DAC is more nascent in technological development and deployment than other technologies relevant to LCFS. For example, the first commercial DAC plus storage facility commenced operation in 2021, while advancements in hydrogen electrolysis are building on over 100 years of commercial operational experience. DAC technologies need to operate constantly with limited ability to ramp up and download because they often contain equipment components and chemical and physical processes that cannot be rapidly fluctuated or turned on and off. Currently, the vast majority of low-Cl electricity generation capacity being added to the US grid is intermittent renewable electricity sources like solar and wind. Book-and-claim accounting to match intermittent renewable supply with a constant DAC load over an annual period within the same grid is a challenge that requires detailed modeling and risk management to account for annual variability in renewable output.

Limiting the accounting period to three quarters significantly exacerbates the challenge, since the electricity production from these intermittent renewable resources is seasonal and a quarter of the annual cycle would be missed.

Any temporal matching period spanning less than a full year would present a severe barrier for DAC deployment given the current state of technology's needs for continuous, additional and local low-emissions electricity supply, and the lack of market and technological systems to support more granular temporal matching. For example, one commercial DAC project currently under development in the United States estimated that three quarter book-and-claim matching could require the procurement an additional 10-15% low-CI power under a three quarter book-and-claim accounting period compared with an annual period, increase electricity price risk and the risk of power matching shortfalls, and could make economics infeasible.

Recognizing these constraints, leading global standards bodies and registries provide for annual book-and-claim for DAC, with an eye to re-evaluate in the future as DAC and electricity sector technologies, markets, and policies evolve. These standards include Verra, Puro.earth, and Isometric1. Our DAC facilities under development will sell credits to voluntary market customers using the carbon registries' methodologies with annual matching. Importantly, we cannot generate credits with different matching periods from the same facility, since we cannot effectively operate under two different sets of energy procurement and operating patterns at the same facility. The LCFS market can help accelerate DAC facilities and add to demand to justify new facilities, but only if generating LCFS credits is compatible with the global DAC standards and market.

Over time as DAC matures with technology advancements, economies of scale, market chain development, and as firm dispatchable low-carbon electricity becomes more available, increasingly granular book-and-claim accounting may become more achievable and could be considered under LCFS. We would like to highlight our suggestion for CARB to convene a dialogue with key stakeholders to consider how electricity book-and-claim accounting for DAC should evolve alongside DAC industry maturation. Such a dialogue would provide a venue for collecting valuable input to ensure that LCFS requirements mitigate resource shuffling and maximize long-term climate benefits. (15d1-084.1)

Comment: The requirement that book-and-claim accounting for low-CI electricity may span only three quarters also presents a significant barrier to DAC deployment today. We propose that CARB revise this proposed language to allow DAC projects to book-and-claim claim credits on an annual basis. We believe that this is necessary for climate relevant scale DAC projects given the current constraints in low-CI electricity supply and temporal attribute market systems.

The first challenge is technological: Intermittent seasonal renewable electricity is the lowest cost and most available low-CI electricity source for DAC projects today that can be developed on timelines compatible with DAC project development. The technology for supplying continuous 24/7 low-CI electricity at the scale and duration needed for DAC is not yet readily available, and the market systems for tracking and trading the necessary low-CI power attributes at sub-annual time resolution do not currently exist. Pairing seasonal and intermittent renewable electricity with long term energy storage technology is simply not achievable today at the scale needed to support DAC projects with electricity supply balancing over threequarterly periods. The majority of the existing battery energy storage systems that have been deployed in the US only have a 1-4 hour duration, and only represent a small portion of the available capacity of the grids where they are installed, making it infeasible to firm-up intermittent resources for prolonged periods. Furthermore, in order to maximize the amount of carbon removed, DAC technologies should not be cycled in response to the seasonality of renewable resources, and instead should operate at maximum capacity year-round to optimize efficiencies and maximize climate benefits. Annual matching, in conjunction with the locational and additionality requirements, accomplishes CARB's goal of ensuring that enough new low-CI generation is installed in the grid where the project will operate, while allowing DACs to operate at full capacity year-round without the burden of having to over-build or over-procure, which negatively impacts project economics, decreases efficiency for the overall market, and ultimately hinders the ability to rapidly deploy this necessary technology.

• The second challenge is market systems availability: the tracking, trading, and usage systems supporting energy attributes (e.g., RECs) currently only allow for annual granularity;

systems capable of handling higher granularity are projected to take years to put into place (with a few very limited exceptions like PJM and M-RETS). Moreover, the mere availability of tracking systems to handle higher granularity is not sufficient; robust liquid markets for more granular energy attributes will be needed to achieve acceptable supply and pricing risk for project finance. In the interim, there is no ability for a project to be able to cover this risk other than significantly over contracting/installing new renewable electricity generation.

The third challenge is economics and financeability: The additional economic burden and financial risk required to comply with the first two challenges is significant and risks stifling this nascent industry. The three-quarterly book-and-claim matching period is not aligned with the full annual seasonal cycle of output from intermittent renewable electricity sources. Each subsequent three-quarterly period will cover a different part of the seasonal cycle to the previous and subsequent three-quarterly periods, making it very difficult to commit to long-term power procurement contracts with confidence that supply will be sufficient in each subsequent three-quarter period. However, signing long-term power procurement contracts is necessary in order to bring new additional power sources online that meet the additionality requirement. The only way a DAC project can cover the low-CI electricity supply risk is by significantly overcontracting for new renewable electricity capacity, which will introduce substantial additional cost and untenable financial risks associated with selling excess contracted generation to the market at times of high renewable output that are likely correlated with low prices. The additional cost and financial risk created by sub-annual matching requirements would be a severe barrier for DAC deployment, particularly given the context that DAC technologies are nascent, these will be first-of-a-kind commercial projects with inherent technology and market risk, and many DAC developers are early-stage companies without deep financial resources. This combination of factors creates extreme project financial risk that will limit investment in DAC deployment.

We strongly recommend that CARB revise § 95488.8.(i)(1)(C)4 as follows:

"Such book-and-claim accounting for low-CI electricity may span only three four quarters. If a low-CI electricity quantity (and all associated environmental attributes, including a beneficial CI) is supplied to the grid in the first calendar quarter, the quantity must be claimed for LCFS reporting no later than the end of the third fourth calendar quarter. After that period is over, any unmatched low-CI electricity quantities expire for the purposes of LCFS reporting."

We believe that at this nascent stage of both DAC technology deployment and availability of continuous 24/7 low-CI electricity, an annual book-and-claim matching period for DAC under LCFS is appropriate. This would account for the full annual seasonal cycle for intermittent renewables. Matching periods shorter than 12 months will significantly impact the financeability of early DAC projects and impede deployment of this critical climate technology that is likely to be vital to meet the State's 2045 net-zero goal. (15d2-272.4)

Comment: We would like CARB to confirm our understanding of the proposed book-and-claim balancing provisions as applying on a rolling quarterly basis, i.e., that if a low-CI electricity quantity is supplied to the grid in a calendar quarter, the quantity must be claimed for LCFS purposes no later than the end of the third calendar quarter following the beginning of such quarter. This is the only logical reading because it would permit low-CI electricity supplied to the grid when solar or wind generation peaks to be balanced sometime during the following

three quarters on a rolling basis. We strongly recommend that CARB confirm this understanding in its response to comments and also commit to issuing guidance for the use of book-and-claim accounting by DAC projects that confirm this understanding (the current Low Carbon Fuel Standard (LCFS) Guidance 19-01 Book-and-Claim Accounting for Low-Cl Electricity is not as clear as it could be).

We do expect that the analytical understanding of the emissions and financial implications of different book-and-claim matching periods, as well as the ability to achieve shorter matching periods, will improve as energy storage technology and the market systems needed to support temporal matching are advanced. Imposition of sub-annual temporal matching criteria can be contemplated at such time when it is practically and technologically feasible if there is strong justification that such requirements are necessary. (15d2-272.5)

Agency Response: Changes were made in response to these comments. Staff appreciates the support for clarifying eligibility criteria for supplying low-CI electricity to DAC projects. Staff has revised the book-and-claim period from one quarter to three quarters in the final regulatory proposal. Staff proposed to clarify that the book-and-claim matching period be three quarters for low-CI electricity used in DAC projects to align it with the matching period offered for book-and-claim of low-CI electricity used in EV charging and low-CI electricity used for hydrogen production. The alignment will simplify administration and will also ensure that DAC producers are able to procure sufficient low-CI electricity given seasonal variability of renewable electricity generation.

Regarding the interpretation of the three-quarter span for book-and claim of electricity, the proposed regulation text states that "If a low-CI electricity quantity (and all associated environmental attributes, including a beneficial CI) is supplied to the grid in the first calendar quarter, the quantity claimed for LCFS reporting must be matched to grid electricity used as a transportation fuel no later than the end of the third calendar quarter". The commenter interpretation appears to match the regulatory text. Staff may consider updating the current Low Carbon Fuel Standard (LCFS) Guidance 19-01 Book-and-Claim Accounting for Low-CI Electricity in the future if such implementation support might be helpful.

ZZ-12 Multiple Comments: Effects of relaxing criteria used to attribute low-CI electricity to direct air capture (DAC) via book-and-claim

Comment: The proposed changes to the 15-day package loosen the criteria used to attribute low-CI electricity production to direct air capture (DAC) via indirect accounting. Indirect attribution of electricity for producing e-fuels, hydrogen or capturing CO2 can have unintended emissions consequences, as modeled by Ricks et al. (2023) and highlighted by the U.S. Treasury department in its proposed guidance for the GHG accounting for electrolytic hydrogen. While the exact indirect emissions effects of hourly vs. book-and- claim electricity matching are a source of uncertainty and academic debate for hydrogen production, they are also significant for DAC projects.

Due to the intermittency of renewable electricity generation, there is a risk that industrial projects that create demand for electricity outside of the times when intermittent renewables

generate electricity will create additional demand for fossil electricity, thus increasing the de facto life cycle emissions of those projects. Furthermore, California in particular is at risk of large seasonal variation in renewable electricity supply, with a large discrepancy between the total solar generation during the summer months and that generated during winter; this may pose a particular challenge to the integrity of three-quarter book-and-claim attribution given the seasonal renewable electricity imbalance. Thus, annual matching or three quarter matching of environmental attribute certificates (EAC's) from renewable generation from other regions and other times of day to the electricity consumed by those projects may thus systematically underestimate the actual emissions attributable to them.

Because DAC is intended to be a direct source of CO2 reduction (and is credited as such) in the LCFS, any effects that could affect its net CO2 balance warrant close scrutiny. Casaban and Tsalaporta (2023) estimate that the energy consumption for a near-term DAC facility under development in Europe requires approximately 500 kWh of electricity and 1500 kWh of waste heat per tonne of CO2 captured based on industry data, with the potential for efficiency improvements such that the energy needs decline to 444 kWh and 1,333 kWh. While the contribution of electricity generated from zero-CI sources under the LCFS would therefore be 0 kgCO2e per tonne CO2 captured, this could increase significantly depending on the degree to which three-quarter EAC matching diverges from hourly electricity consumption. If we assume that the supplied electricity is the CA grid average of 80.55 gCO2e/MJ in 2024, the upstream emissions impact of electricity to provide DAC increases to approximately 145 kgCO2e/tonne CO2 captured. If marginal generating resources are used during off-peak times, as suggested in the electricity sector modeling conducted by Ricks et al. (2023), the natural gas power plant emission factor of 149 gCO2e/MJ estimated in GREET 2023 may be more appropriate, generating emissions of approximately 268 kgCO2e/tonne CO2 captured. While many DAC LCA's assume that zero-CI waste heat is used to supply heat, the use of electricity to generate heat (for example, in a region where waste heat is unavailable or inaccessible) may push the indirect GHG emissions even higher. Taking for example a hypothetical all-electric DAC configuration using heat pumps to supply heat, the facility would consume approximately 3.1 times as much electricity for heat & power as electricity alone; this could increase emissions to approximately 450 to 831 kgCO2e/tonne CO2 captured using the emission factors above, substantially reducing the net climate benefit for DAC.

Given that relaxing the electricity attribution for DAC can make a substantial impact on the net CO2 balance for DAC, we recommend restoring the requirement for book-and-claim electricity accounting to quarterly rather than the proposed three-quarter match. (15d1-219.35)

Comment: Longer-term, in order to mitigate potential unintended emissions, we recommend that CARB implement an hourly matching system for DAC projects, consistent with the approach proposed by Treasury for the 45V hydrogen production tax credit. (15d1-219.36)

Agency Response: No change was made in response to these comments. See response ZZ-11.

Comment: 1PointFive respectfully requests that CARB confirms that a full repower of a renewable resource will qualify as a new low-CI source so long as it meets the criteria established by the Internal Revenue Service's "80/20" rule. (45d-249.6)

Agency Response: No change was made in response to this comment. To the extent repowering results in new or expanded production of low-CI electricity as specified in §95488.8(i)(1)(C), the additional supply will meet the definition of expanded low-CI electricity.

ZZ-13 Multiple Comments: Book-and-claim of low-CI electricity for DAC projects

Comment: 1PointFive supports CARB's recommendation that the low-CI electricity must be supplied to the grid within the local balancing authority where the DAC project is consuming the electricity. (45d-249.3)

Comment: 1PointFive proposes that if the new low-CI electricity source from which the DAC project procures its electricity is not located in the same balancing authority as the DAC project, the DAC project must demonstrate that it can contractually and physically be able to supply the electricity to the grid within the local balancing authority where the DAC project is located. This will help mitigate the risk of resource shuffling or the double-counting of benefits. (45d-249.4)

Agency Response: No change was made in response to these comments. Staff appreciates the support for the proposed low-CI electricity requirements for DAC projects.

Comment: §95490 (b)(8)(B) - As with §95488.8 (i)(1)(C), above, aligning requirements for low-carbon electricity with the "three pillars" approach reflects global best practices and minimizes the risk on unwanted GHG emissions. (45d-391.72)

Agency Response: No change was made in response to this comment. The proposed regulation text for book-and-claim of low-CI electricity in DAC projects helps to ensure that low-CI electricity is expanded to meet growing demand from DAC facilities and provides opportunities for DAC deployment within jurisdictions that already have ambitious renewable electricity requirements, like California.

Comment: 1PointFive supports CARB's efforts to ensure that the low-CI electricity and associated environmental attributes are accurately tracked and accounted to mitigate the risk of double counting renewable energy certificate (RECs) or other environmental attributes. We understand that CARB's proposal that "The pathway holder must be the first contracted entity for procuring the low-CI power" is designed to mitigate this risk. However, 1PointFive recommends that rather than requiring DAC projects to be the first contracted entity, CARB should focus on requiring the pathway holder or project operator to prove that it can and has tracked the RECs and, in accordance with CARB's proposed amendments, that credits are retired and not claimed under any other program, other than those expressly listed.

In addition, CARB's proposed requirement is inconsistent with certain practical commercial approaches taken by companies to execute and manage power procurement contracts. In many cases, parent companies will establish an affiliate to manage their power purchase

agreements, track, account and retire RECs and ensure electricity usage is managed on a daily basis across multiple decarbonization projects or business units. 1PointFive understands that CARB may be intending to prevent the double-counting of low-CI power procured and, if so, we recommend that the criteria be changed to require the pathway holder (not necessarily the contracting entity) to be the only entity that can claim the electricity and associated environmental attributes from the low-CI project, and such claim must be auditable and verifiable by CARB. In the alternative,

CARB could revise this criterion to recognize commercial realities as follows: "The pathway holder, or the project operator or any of its affiliates must be the first contracted entity for procuring the low-CI electricity." (45d-245.5)

Comment: CarbonCapture Inc., Climeworks Corporation, Heirloom Carbon Technologies and 1PointFive express support for the availability of book and claim of low-CI electricity for DAC projects. The group stress that requirements imposed for book and claim of low-CI electricity help avoid the risk of resource shuffling or double counting of benefits. (15d2-272.1, 15d2-272.2)

Comment: However, we must again highlight the barriers presented by the following proposed criteria: \S 95488.8.(i)(1)(C)2. The pathway holder or the project operator must be the first contracted entity for procuring the low-CI electricity.

The requirement that the pathway holder or project operator be the first contracted entity for procuring low-CI electricity could present serious problems for this nascent industry which, due to the entrepreneurial nature and limited resources of the project companies, may necessitate the use of their parent companies or affiliates to execute power procurement contracts or other supply arrangements. We do understand that CARB may be intending to prevent the doublecounting of low-CI power procured and, if so, we respectfully recommend that the criteria be changed to require the pathway holder (not necessarily the contracting entity) to be the only entity that can claim the electricity and associated environmental attributes from the low-CI project, and such claim must be auditable and verifiable by CARB. It may be that this is already CARB's intent, i.e., CARB is already familiar with and understands that project such as DAC projects may involve several affiliated entities. Consequently, as interpreted by CARB and as applied in practice, CARB will recognize that the parent company or affiliates of a pathway holder or project operator could be the first contracting entity for procuring low-CI electricity as demonstrated by any number of corporate instruments or captive agreements. If this is the case, we respectfully request that CARB clarify this in its response to comments and in later guidance. (15d2-272.3)

Agency Response: No change was made in response to these comments. Staff appreciates the support for book-and-claim of low-CI electricity for DAC projects. The proposed language to include "first contracted entity" is written to establish clear traceability of renewable electricity attributes between the pathway holder or project operator and the low-CI electricity provider. This ensures that CARB staff and third-party verifiers are able to confirm the low-CI electricity meets the regulatory requirements and that the low-CI electricity attributes are not held by another entity that is unrelated to the DAC project. CARB aims to implement and enforce the LCFS regulation in ways that minimize administrative burden on fuel pathway holders, CARB staff, and third-party verifiers. Allowing parent companies or affiliates to the project operators to be the first contracting entity and to hold the low-CI electricity attributes would likely create additional administrative and enforcement complexity in tension with this objective.

ZZ-14 Multiple Comments: Consider emerging carbon capture, removal, utilization, and storage (CCRUS) technologies

Comment: As the Governor rightly recognized in his July 22, 2022, letter to CARB Chair Randolph on the 2022 Climate Change Scoping Plan Update, innovative carbon capture and sequestration technologies will be necessary for California to reach its climate goals, including carbon neutrality by 2045. Additionally, SB 905 (Caballero & Skinner, 2022) further underscores the role that carbon capture technologies will need to play as part of these efforts. Solutions that can significantly reduce—and even fully eliminate—greenhouse gas emissions from California's transportation sector will be key. CARB should ensure that, as new carbon capture and removal technologies emerge, they can be quickly incorporated into the LCFS to decarbonize the transportation sector. (45d-270.1)

Comment: §95490 (a)(1) - This section proposed changes to the LCFS provisions on carbon capture and sequestration (CCS), however it retains previous language which limits the definition of CCS to applications in which CO2 is geologically sequestered. Emerging options for carbon removal may exist that do not sequester CO2 geologically, such as being converted into non-consumable products including concrete or building materials, or absorbed into carbonaceous minerals via enhanced weathering. The present provision may overly limit the scope of sequestration options; defining sequestration to include conversion to a solid form stable over geologic time scales could resolve this oversight and support innovative approaches to CO2 sequestration. (45d-391.71)

Comment: LCFS amendments should allow mineralization or other potential new carbon removal or DAC protocols to be used if they are adopted separately. (Apr-058.3)

Comment: We encourage CARB to allow additional carbon capture, removal, utilization and sequestration ("CCRUS") protocols to be utilized as they are developed. (Apr-101.9)

Comment: Supporting the widest array of CCRUS protocols possible, to support continued innovation and decarbonization of existing or new fuel pathways. (Apr-101.18)

Comment: CARB Should Ensure that Additional Technologies are Rapidly Incorporated into the Existing Regulatory Framework for Carbon Removal within the LCFS. (Apr-115.2)

Comment: GREET Model Treatment of CO2 Storage

With the emergence of various forms of above ground permanent CO2 storage, such as manufacturing products (including concrete, plastics, etc.) from captured CO2, we encourage CARB to broaden the definition of permanent CO2 storage beyond the limited "underground" storage definition currently used. This will incentivize more projects to capture and sequester

CO2, thus achieving even lower carbon intensities and furthering CARB's goals of aggressive decarbonization of the transportation sector. (15d1-062.6)

Comment: CAFB supports the use of CCSU to drive down carbon intensities and generate carbon negative emissions where possible. The proposed amendments, however, limit sequestration to geologic storage and limit the use of captured carbon to fuels production. These restrictions exclude the use of biochar, which can be a co-product of hydrogen, electricity or biofuels production from waste biomass. Biochar can be used or carbon sequestration in soil or to reduce emissions from cows, livestock manure and compost. Biochar can also be used in the production of concrete, pavement, tires, ink and other products. And biochar can replace charcoal for water filtration and purification. These are all beneficial uses that either sequester carbon or displace fossil fuel and higher emitting alternatives. Excluding the use of biochar will harm the economics and viability of forest waste and agricultural waste to fuel projects and contradicts the recommendations in the 2022 Climate Change Scoping Plan to increase the use of bioenergy with CCS (BECCS).

CAFB urges CARB to revise the definition of CCS in section 95490(a) as follows:

(a)(1) Alternative fuel producers, petroleum refineries, and oil producers that capture CO2 on-site, including at the location of the production of hydrogen used as an intermediate input, and geologically sequester CO2 geologically or in the form of biochar, either on-site or off-site.

CAFB urges CARB to revise the definition of CCS on page 8 as follows:

"Carbon capture and sequestration (CCS) project" means either 1) a project that captures CO2 by an eligible entity specified in section 95490(a) of this sub article, transports the captured CO2 to an injection site, and injects and permanently sequesters the captured CO2 pursuant to the Carbon Capture and Sequestration Protocol and as specified by section 95490 of this sub article, or 2) a project that captures carbon in the form of biochar during the conversion of waste biomass to fuels and that biochar is used in a manner that sequesters the carbon. (15d1-075.5)

Comment: Stronger benefits from the LCFS program could be realized if CARB swiftly establishes pathways within the current regulatory framework for additional carbon removal technologies. Charm can help support the success of an ambitious LCFS program through its proven carbon dioxide removal technology as one part of a suite of innovative technologies that California will need to meet its climate goals. The kinds of solutions that Charm has developed can also play a key role in supporting California's biomass and forest waste management goals, wildfire and forest resilience actions, and air quality goals. As a California-based company, we are invested in helping the state continue to be a climate leader by putting in place policies that pave the way for innovative technologies and solutions to support climate action. Policies that support emerging carbon-negative technologies will ensure continued investment, job creation, and economic growth for California.

Consistent with the necessary and ambitious goals for carbon removal technology detailed in the 2022 Scoping Plan, CARB can strengthen the LCFS by, as expeditiously as possible, ensuring that as new carbon dioxide removal and sequestration technologies emerge, they can be quickly incorporated into the existing regulatory framework. (15d1-119.1)

Comment Summary: Commenters raise a concern that that the proposed regulation excludes biochar as an eligible CO2 sequestration mechanism and therefore ignores its carbon sequestration potential in soil and other environmental/economic benefits. BAC proposes revisions to the regulation text which are similar to the CAFB proposed revisions above (see comment 15d1-075.5). (15d1-136.2, 15d1-158.2)

Comment: CCRUS protocols should be utilized as they are developed, pursuant to SB 905 or if the CCS Protocol is updated otherwise. (15d1-212.22)

Comment: In respect to solid carbon, we also believe it should be included in conversations around CCS. (BH-010.3)

Comment: In section § 95490. Provisions for Fuels Produced Using Carbon Capture and Sequestration, we suggest adding the eligibility requirement below:

(3) "Hydrogen producers from methane pyrolysis that capture precombustion carbon in solid form and permanently store it or provide proof of permanent storage. 1kg of solid carbon is equivalent to 3.67kg of avoided carbon dioxide". (BH-010.6)

Agency Response: No change was made in response to these comments. Currently the following CCUS projects are eligible for LCFS crediting:

- Direct air capture (DAC) and sequestration in eligible reservoirs (depleted oil and reservoirs, or oil and gas reservoirs used for CO₂-enhanced oil recovery or saline formations);
- CO2 capture at eligible fuel production or crude production facilities followed by subsequent sequestration in eligible reservoirs mentioned above; and
- Utilization of captured CO2 and its conversion to hydrocarbon fuels.

Staff recognizes that there are other emerging CCUS technologies that may offer direct carbon removal benefits. Given that these technologies are in the early stages of demonstration and commercial deployment, consideration of additional CCUS technologies and associated protocols are outside the scope of the current rulemaking. Additional carbon dioxide removal protocols may be considered as part of the SB 905 program development process and may be considered for inclusion of LCFS crediting in the future.

ZZ-15 Book-and-claim of low-CI electricity for CO2 capture

Comment: We would like to highlight that adding the process of carbon capture from controlled, high CO2 concentration sources (e.g. fermentation vessels at an ethanol plant) also require a higher electricity demand and may also need additional electricity load, which makes it financially challenging. Therefore, we request CARB treat all CO2 capture and sequestration activities similarly and allow the book-and-claim accounting for low-CI electricity or the expanded use of PPAs for carbon capture facilities with fuel pathways claiming CCS credits by producers of alternate transportation fuels. (45d-177.2)

Agency Response: No change was made in response to this comment. Staff proposed to offer book-and-claim of low-CI electricity to DAC projects given the high energy requirement to capture CO2 from the atmosphere where CO2 concentration is

extremely low (about 0.04%). On the other hand, capturing CO2 from combustion sources, biogas production, fermentation, and hydrogen purification is relatively less energy intensive due to higher concentration of CO2 (3% to about 95%) in the gas stream. Therefore, staff did not extend the book-and-claim of low-CI electricity to other types of carbon capture processes. These types of carbon capture processes can reduce the carbon intensity of their process energy via behind-the-meter installation of low-CI electricity generation such as solar and wind power.

ZZ-16 Apply lessons learned from CCS projects

Comment: ...amend the regulations to reflect initial assessments and findings from the first examples of CCS projects on fossil fuel infrastructure across the globe. (45d-200.17)

Agency Response: No change was made in response to this comment. The proposed CCS provisions draw upon the lessons learned from CCS projects involving fossil fuel infrastructure across the globe as well as feedback from stakeholders.

ZZ-17 CO2 transport as joint applicant

Comment: ...adding the entity responsible for transporting captured CO2, as proposed by § 95490(c)(1), may obstruct development of CCS projects because parties providing transport, are reluctant if not entirely opposed to taking on the responsibility of understanding subsurface geology and geophysics. (45d-249.8)

Agency Response: No change was made in response to this comment. This provision was added to ensure that the CCS application will have complete information on CO2 transport required to model GHG emissions associated with the CO2 transport. The primary responsibility for subsurface geology and geophysics lies with the applicant and sequestration site operator.

ZZ-18 Multiple Comments: Mobile Carbon Capture and Storage (MCCS) technologies

Comment: Remora urges CARB to ensure that it optimally positions California to reap the benefits that innovative and proven technologies like MCCS can provide.

Incorporating additional technologies into the existing CCS Protocol within the LCFS Regulation, which recognizes the role CCS can play in decarbonizing the production of transportation fuels, will be key.

By incorporating MCCS into the LCFS, California can work towards even more ambitious transportation decarbonization targets, which will provide climate, air quality, and public health benefits to Californians. (45d-326.4)

Comment: LCFS should be positioned to incorporate Mobile Carbon Capture Technologies

Given the scale and scope of the challenge to meet California's GHG reduction targets, the State cannot afford to limit any approaches that can contribute to this effort. As CARB works to refine LCFS, Remora urges CARB to ensure that it optimally positions California to reap the benefits that innovative and proven technologies like MCCS can provide.

Incorporating additional technologies into the existing CCS Protocol within the LCFS Regulation, which recognizes the role CCS can play in decarbonizing the production of transportation fuels, will be key.

By incorporating MCCS into the LCFS, California can work towards even more ambitious transportation decarbonization targets, which will provide climate, air quality, and public health benefits to Californians. (Apr-114.2)

Agency Response: No change was made in response to these comments. Staff appreciate commenter bringing to CARB's attention MCCS technologies and its potential to deliver GHG reductions from the heavy-duty truck sector by capturing CO2 from tailpipe combustions. The existing regulation allows for captured CO2 from mobile sources to be utilized for alternate fuel production such as synthetic gasoline and diesel and generate credits under the LCFS as a Tier 2 fuel pathway. The option for generating CCS credits for geologic sequestration without fuel production is currently limited to DAC projects only. Additional carbon dioxide removal protocols may be considered as part of the SB 905 program development process and may be considered for inclusion of LCFS crediting in the future.

ZZ-19 Inconsistency of CCS provisions with 2022 Scoping Plan

Comment: CARB's LCFS Proposed Rules, then, are entirely inconsistent with the state's 2022 Scoping Plan, completely disregarding prior acknowledgement of the absolute necessity of CCS. CARB must return to embracing CCS as an integral part of its strategy to achieve the state's targets. (45d-365.8)

Agency Response: No change was made in response to this comment. The LCFS regulation and revised CCS provisions are designed to support CCS and DAC technology deployment and their associated GHG benefits, consistent with the Board-approved 2022 Scoping Plan Update.

ZZ-20 System boundary for CCS projects at alternative fuel production

Comment: In view of the proposed revisions to section 95490, CARB should revisit the system boundary for carbon capture and sequestration (CCS) projects when the carbon dioxide (CO2) is captured at an alternative fuel production facility. (45d-215.6)

Agency Response: No change was made in response to this comment. When CO_2 is captured at fuel production facilities, it can be either a Tier 2 application or projectbased crediting application such as the Refinery Investment Credit Program. In either case, the applicant is required to submit their own proposal for a system boundary around the CO_2 capture for CARB review and approval. Because CO_2 capture technologies and processes may vary from project to project, it may not be practical to offer a generalized system boundary for CO_2 capture in the regulation.

ZZ-21 CCS Requirements

Comment: Include actual carbon capture rates: CARB must require actual, verified carbon capture rates. "Nameplate" capacities can be erroneous as CCS technology often captures carbon dioxide at lower rates, facilities may not run CCS continuously or fully control their

emissions from all processes, and infrastructure for carbon transport and storage can have unplanned outages. Producers must also verify claims by demonstrating permanent sequestration, detailing each ton of carbon stored while following best practices. This data also must be reported, verified, and publicly available. (15d2-289.1)

Agency Response: No change was made in response to this comment. Applicants requesting approval of CCS projects for LCFS credit generation are required to meet all the applicable CCS provisions including reporting and verifying the actual CO₂ capture rate using measured/metered data, as well as reporting and verifying GHG emissions associated with capture, transport and storage emissions. In addition to reporting and verifying GHG emissions and sequestration from the project, applicants must also complete demonstration of permanent sequestration pursuant to the Carbon Capture and Sequestration Protocol and meet all other applicable CCS-related provisions in the LCFS regulation.

AAA. Market Functioning

AAA-1 Remove U.S. Commodity Futures Trading Commission registration

Comment: <u>Remove the U.S. Commodity Futures Trading Commission registration</u> <u>requirement for Clearing Service Providers operating spot exchanges.</u> SRECTrade supports CARB's efforts to enable a robust cleared spot market for LCFS credits. Exchange-traded spot markets create transparent marketplaces with better price discovery and confidence with secured clearing and settlement. The current requirement that a Clearing Service Provider (CSP) maintain a derivative clearing organization license is prohibitive for operators of spot exchanges where no such licenses are required or relevant. The requirement should be removed or clarified so that it only applies to futures exchange operators. (45d-189.5)

Agency Response: No changes were made in response to this comment. Staff appreciates the commenters' insights on the potential benefits of exchange-based spot trading of LCFS credits. Historically, all the regulated entities have been able to participate in a spot market through over-the-counter bilateral or broker-facilitated transactions. The LRT-CBTS also allows entities using brokers to conduct blind transactions. The current regulation facilitates a futures credit market, should the market desire one, potentially providing stakeholders with a forward credit price curve and an option to enter into long-term offtake contracts backed by the security of a clearing service provider. Staff believes this allows project developers and compliance entities to hedge their investment and compliance risks, potentially unlocking more financing in low carbon fuels.

All the clearing service providers opting into LCFS must be registered with the Commodities Futures Trading Commission (CFTC) as a derivatives clearing organization (DCO). Not requiring the same for clearing service providers operating spot-only exchanges would require creating a separate category of clearing service providers. Staff did not propose creating that separate category as it would result in administrative complexity in the program which staff does not believe is necessary to further promote spot trading at this point.

AAA-2 Reporting deadlines

Comment: CARB should change the third quarter reporting deadline from December 31st to January 15th, to allow flexibility over the winter holidays. (45d-241.24)

Agency Response: No change was made in response to this comment. Under California law, any action due to be completed upon a holiday may be performed upon the next business day with the same effect as if it had been performed upon the day appointed. Staff believes the reporting timelines and this flexibility are well understood and accepted in the industry and several stakeholders have designed their reporting systems around the current reporting schedules. Therefore, staff did not propose changes to the quarterly reporting timelines.

AAA-3 Cost containment mechanism/advanced crediting

Comment: In subsection (c)(3)(c) Advanced Credits, WSPA appreciates that CARB is proposing to increase the limit of Advanced Credits from 10 to 30 million. However, as described in our other comments regarding benchmarks, it would be more effective if CARB "froze" the benchmarks instead of advancing credits from the future as described in this section. (45d-241.53)

Agency Response: No change was made in response to this comment. Freezing the benchmarks would compromise the environmental integrity of the program, may further destabilize the LCFS credit market by creating additional uncertainty, and fails to support future investments in low-carbon fuels. Advanced crediting gives deficit generating entities access to additional credits to meet compliance obligations that are later repaid. If after the 6-year borrowed credit window, deficit-generating entities are still unable to obtain sufficient credits to offset deficits under the program, entities are allowed to further bank deficits with interest for up to 5-years. Staff believes that the 6year credit borrowing window alongside the 5-year deficit banking period provides a sufficient time period for deficit-generating entities to make the necessary investments in low-carbon fuel projects to fully offset any outstanding deficits they otherwise may have accrued. These provisions help to maintain the environmental integrity of the program, while providing compliance flexibility for addressing short-term credit shortages. The staff proposal will help maintain a predictable framework for supporting low-carbon fuel investment and is therefore better aligned with long-term cost containment

BBB. Carbon Isotopic (C-14) Analysis

BBB-1 Include requirements for carbon isotopic analysis

Comment: This comment is intended to recommend the use of the carbon-14 testing method to determine the share of biogenic carbon content of feedstocks, fuels and emissions under California's Low Carbon Fuel Standard (LCFS). Biogenic content measurements following methods such as ASTM D6866 Method B currently provide critical value to prominent clean fuel standard programs including California's LCFS.

Our recommendation is that California's Low Carbon Fuel Standard (LCFS) should include direct biogenic content testing requirements following the ASTM D6866 Method B standard for any fuels or feedstocks seeking recognition of renewable (biogenic) content. Routine direct biogenic testing requirements are the only reliable method of incentivizing the use of biomass derived content and guaranteeing compliance. Routine biogenic testing requirements currently play a critical role in California's LCFS and prominent similar programs.

California's LCFS currently requires testing following ASTM D6866 for any fuels produced from co-processing and recommends testing for fuels produced from municipal solid waste (MSW). Several of the updates being considered by the program could benefit from the introduction of similar testing requirements and offer opportunities to strengthen the existing requirements.

Beta's first recommendation for this update to this LCFS is to introduce routine biogenic testing requirements for fuels produced from MSW in line with the program's requirements for coprocessing. Given the heterogeneous nature of MSW, it is critical that routine testing requirements be maintained to make sure the program only rewards the renewable portion of those fuels.

Implementing routine testing for these fuels would be in line with the requirements of the US Renewable Fuel Standard (RFS), Canada's Clean Fuel Regulations (CFR), Oregon's Clean Fuels Program (CFP) and As CARB updates the program, other leading programs. As CARB updates the program, it is important to improve this policy from a recommendation to a requirement. (Apr-125.1, 15d1-022.1)

Comment: Beta also recommends that CARB introduce routine biogenic testing requirements for fuels produced from biogas, biomethane and RNG. As CARB considers the best way to move forward with biogas, biomethane and RNG in the program, we recommend reviewing the Biogas Regulatory Reform Rule (BRRR), which the EPA included in the RFS Set Rule, the EU's updated methodology for biogas under the Renewable Energy Directive (RED), and Canada's Clean Fuel Regulations (CFR) Quantification Method (QM) for Co-Processing. These recent policies reflect the leading best practices for regulating this sector under clean fuel programs. (Apr-125.2, 15d1-022.3)

Comment Summary: Beta urges CARB to implement the requirement for carbon-14 isotopic analysis (e.g., ASTM D6866 Method B) to routinely analyze renewable fuels and feedstocks in the supply chains such as biogas and renewable diesel and fossil jet fuel. Beta recommends that CARB should not rely on mass balance or book-and-claim to quantify renewable fuel volumes and points to mass balance fraud challenges by the European Renewable Energy Directive. Beta mentions that EU implemented biogenic (renewable) carbon testing requirements for fuels produced from biogas in 2023, primarily in response to the discovered mass balance frauds and recommends that CARB utilize certification systems that rely on carbon-14 isotopic testing. Beta requests CARB to consider the EPA Biogas Regulatory Reform Rule, the EU's updated methodology for biogas under the Renewable Energy Directive (RED), and Canada's Clean Fuel Regulations (CFR) Quantification Method (QM) for Co-Processing in developing the requirements for carbon-14 isotopic analysis for renewable fuels.

(Apr-125.3, Apr-125.4, Apr-125.5, Apr-125.6, Apr-125.7, 15d1-022.1, 15d1-022.2, 15d1-022.3, 15d1-22.4, 15d1-22.5, 15d1-022.6, 15d1-022.7)

Agency Response: No change was made in response to these comments. The fuel pathway holders of co-processing fuel pathways are required to perform C-14 analysis to determine the renewable fuels volumes in co-processed fuels. In addition, as part of monitoring, audit and enforcement, CARB may use C-14 analysis or require the applicable entities to perform C-14 analysis using D6866 Method (B or C) or other CARB approved carbon isotope testing methods to quantify renewable content in fuels or feedstock including MSW, if the situation warrants.

CCC. Miscellaneous

CCC-1 Multiple Comments: *Municipal solid waste (MSW)*

Comment: § 95488.8(g). Specified Source Feedstocks

- 1. MSW diverted from landfills will be added under specified feedstock sources.
- 2. Robust chain of custody documentation that traces MSW to the point of origin is required.

It is recommended that the definition of MSW diverted from landfill to include non-biogenic components/ non-recyclable components such as plastic. Considering 48% of landfill waste is non-biogenic (by mass, ref 2023 R&D GREET model), landfill diverted MSW represents a valuable untapped, sustainable, and renewable clean energy resource when carbon capture is Implemented. (45d-360.8)

Agency Response: No change was made in response to the comment. Carbon intensity values for MSW diverted waste pathways are primarily derived from the conversion of organic feedstocks to energy because the organic fraction readily degrades in the landfill to create greenhouse gases, any waste product of petroleum origin such as plastics does not degrade in landfills for centuries to millennia and is considered to be a fossil feedstock that increases the carbon intensity of the finished fuel and is generally not subject to the specified source feedstock provisions of the regulation. Under the existing LCFS regulation, when reviewing individual fuel pathway applications, the Executive Officer may designate individual feedstocks as specified-source feedstocks if necessary.

Comment: California Air Resource Body (CARB) to refer following precedence available under Renewable Fuel Standard Program (RFS) to produce renewable fuel from Separated MSW. As per US-EPA's decision on petition filed by Fiberight Blairstown Operating, LLC, MSW that has undergone separation and recycling of "recyclable paper, cardboard, plastics, rubber, textiles, metals, and glassto the extent reasonably practicable, and according to a plan submitted to and approved by U.S. EPA under the registration procedures specified in § 80.1450(b)(1)(viii)" is categorized as Separated MSW and has been approved as feedstock for production of renewable fuel under RFS program.

Thus, we urge CARB to approve feedstock 'Separated MSW' which has been derived from MSW and processed with the most advanced technology available for separation of recyclables and to the extent reasonably practicable, as per the procedures approved by EPA in § 80.1450(b)(1)(viii) to produce renewable fuels under LCFS. (15d1-213.5)

Agency Response. No change was made in response to this comment. Alternative fuels produced from separated MSW is eligible to participate in the LCFS provided that applicable requirements are met. Whether the separated MSW will be credited with avoided methane depends on many factors including the demonstration of diversion of organics from a landfill.

Comment: Municipal solid waste to fuel pathways: There are strong concerns from communities and NGOs regarding hazardous air pollutants and other toxic impacts from facilities that process municipal solid waste (MSW), which includes waste plastic, into fuel - particularly pyrolysis and gasification which are regulated as incinerators. Given the increasing interest in building highly polluting pyrolysis and gasification incinerators for MSW in California and beyond, it would be highly concerning if the LCFS program were to essentially subsidize this effort. (BH-034.4)

Agency Response: See comment response 15d1-83.2 under OO-5. The proposed regulation is not incentivizing pyrolysis and gasification of plastics in California or elsewhere. Staff adjusted the specified source feedstocks in section 95488.8(g)(1)(A) to incentivize fuel production from the organic portion of municipal solid waste and not plastics. Pyrolysis and gasification are not currently being utilized for certified fuel pathways in California, but could potentially be a useful technology for producing low-carbon fuels that displace fossil fuels, and which reduce methane emissions by diverting organic waste from landfills.

Comment: MSW: "BE IT FURTHER RESOLVED that the Board directs the Executive Officer to remove the pathway for Municipal Solid Waste (MSW) to fuel as an eligible source to receive LCFS credits." (BH-034.10)

Comment: Page 118: Delete the words "and municipal solid waste" from§ 95488.1(b)(2)(A) (BH-034.13)

Comment: Page 148: Delete§ 95488.8 (g)(1)(A)(4) (BH-034.14)

Comment: Page 166: Delete § 95488.9 (f)(2). (BH-034.15)

Agency Response: No change was made in response to these comments since MSW can provide low-CI fuels such as RNG, electricity, and hydrogen while contributing to the State's methane reduction and organic waste diversion goals under SB 1383.

CCC-2 Carbon intensity of palm oil-derived fuel

Comment: §95482 (f) - Depending on characteristics related to the method of palm oil production and conversion, transportation fuel derived from palm oil or palm derivatives may have a higher carbon intensity than fossil ULSD. Assigning it the CI score of ULSD may therefore underestimate its actual impacts. (45d-391.29).

Agency Response: No change was made in response to the comment. Given the significantly higher palm oil yield per hectare compared to soybean or canola, farming emissions of palm oil may actually be significantly lower. Therefore, assigning the CI of ULSD to palm–derived fuels is a reasonable approach and will not understate the actual impact of palm-oil derived fuels.

CCC-3 Multiple Comments: Support for other stakeholders' comments

Comment: We endorse the comments from Amp Americas, the RNG Coalition, and the American Biogas Council on CARB's proposals regarding RNG. (45d-140.5)

Comment: As an active member of the American Biogas Council (ABC) we are in support of and agreement with ABC's positions on all matters pertaining to State of California Low Carbon Fuel Standard policies and practices. (45d-152.12)

Comment: GM contributed to the development of comments through the Alliance for Automotive Innovation and provides its support for the positions established therein. (45d-180.4)

Comment: Also, in addition to providing our own comments, Gevo is a member of and supports and incorporates by reference the comments of the Coalition for Renewable Natural Gas (RNG Coalition) and the Low Carbon Fuels Coalition (LCFC). (45d-187.7)

Comment: Beyond these comments, SMUD also supports comments submitted by the California Municipal Utilities Association (CMUA) and the California Electric Transportation Coalition (CalETC), both filed on February 20. (45d-291.6)

Comment: We echo parallel comments submitted by a broad coalition of sustainable aviation fuel (SAF) producers, including LanzaJet, in strongly supporting CARB's proposal to eliminate the exemption for intrastate fossil jet fuel under the LCFS.¹

¹ See SAF group comments on LCFS Rulemaking 2024.docx *submitted* February 20, 2024

(45d-346.1)

Comment: We fully support the comments submitted by the Coalition for Renewable Natural Gas, which has provided a detailed and authoritative response to the full set of issues raised in this process. (45d-351.1)

Comment: The comment letter from CalETC, of which PG&E is a member, includes an appendix with suggested regulation language on how to accomplish these recommendations. (45d-388.7)

Comment: Prologis echoes the broader comments submitted today by the Joint MHD EV Infrastructure Parties,... (Apr-076.1)

Comment: PACT agrees with comments provided by multiple stakeholders, including the Joint MHD EV Infrastructure Parties and others as referenced throughout our comments, and offers additional suggestions with respect to public and private infrastructure crediting. Specifically, PACT aligns with parties in the following areas:

- Support for the creation of an MHD-FCI program;
- Support for an increase in the overall MHD-FCI program size;
- Support for the holdback credit investments in M/HD;
- Eliminate geographical restrictions for crediting eligibility;
- Eliminate the FSE cap; and
- Adjust the minimum nameplate power rating. (Apr-092.2)

Comment: Bunge supports the comments submitted by the National Oilseed Processors Association ("NOPA"); NOPA is the leading industry group for the oilseed processing sector, and Bunge supports the positions NOPA has expressed to CARB in its submission to CARB. (Apr-148.1)

Comment: Kia supports comments submitted by the Alliance for Automotive Innovation (AFAI). Kia supports AFAI's request for CARB to provide additional clarity on the definition of an "eligible OEM." Kia also supports more clarity on how this rule will impact the Clean Fuels Rewards program and the metrics that determine the allocation of "up to 45 percent" of base credits for residential EV charging. (15d1-054.1)

Comment: As a founding member of the California Hydrogen Coalition (CHC), Air Liquide supports the comments made in the CHC's letter to CARB regarding the proposed amendments. In particular, the CHC letter has extensive comments on the potential effects of the proposed changes on the LCFS credit value and on changes in the light-duty HRI credits and the expansion of HRI to the heavy-duty vehicle market. (15d1-081.6)

Comment: The CA Utilities are also members of the California Electric Transportation Coalition ("CalETC") and support the positions taken in the CalETC Board Letter that was submitted on August 27, 2024. The CA Utilities urge CARB to adopt all the recommendations outlined in the CalETC Board Letter. (15d1-108.1)

Comment: As a member of the Alliance for Automotive Innovation (Auto Innovators), BMWNA concurs with the comments submitted by the Auto Innovators. (15d1-131.2)

Comment: Audi supports the comments submitted by the Alliance for Automotive Innovation (AFAI) that detail further areas for program refinement, context for the proposed changes, and how to best support a successful future implementation of consumer-facing EV investments, and light-duty EV rebates, in particular. (15d1-162.3)

Comment: We also support the comments submitted by the California Forestry Association (Calforests), et al. (15d1-175.1)

Comment: Amp supports the Coalition for Renewable Natural Gas's comment letter. (15d1-212.24)

Comment: In addition to these comments, SABR supports the comments submitted by the American Soybean Association (ASA) and the National Association of Truck Stop Operators (NATSO). (15d1-218.7)

Comment: Please refer to the California Joint Utilities letter being submitted concurrently for further details and proposed redlines to effectuate these important regulatory clarifications.⁷ California Joint Utilities Comment Letter on LCFS 15-Day Changes, August 27, 2024. Available at https://www.arb.ca.gov/lists/com-attach/7439-lcfs2024-BWRVJgFnACZVIAB0.pdf

(15d1-224.24)

Comment: Neste also supports comments from the Low Carbon Fuels Coalition (LCFC) and ICF on this rulemaking. (15d1-228.1)

Comment: In addition, we support the detailed analysis submitted by the Coalition for Renewable Natural Gas (RNGC) and the comments offered by the American Biofuels Council (ABC). (15d1-252.2)

Comment: As noted above, SABR Coalition supports the comments of the American Soybean Association, particularly with respect to the sustainability and certification requirements in the proposal. (15d2-194.15)

Comment Summary: As CARB finalizes its update to the LCFS, members of the soybean association align themselves with the American Soybean Association (ASA) and other industry recommendations that will prevent an increase in fossil diesel use, improve carbon intensity calculations, and maintain market access for sustainable agricultural feedstock providers. (15d2-184.18, 15d2-197.21, 15d2-208.21, 15d2-214.21, 15d2-239.21, 15d2-240.21, 15d2-268.21, 15d2-285.21)

Comment: We echo the concern of the American Soybean Association that the new requirement appears to contradict the cost-minimizing statutory guidance laid out in AB-32. (15d2-255.9)

Comment: SMUD also supports the comments submitted by the California Electric Transportation Coalition (CalETC) submitted on October 16. (15d2-276.2)

Comment: In closing, Hyundai is aligned with the comments submitted by the Alliance for Automotive Innovation... (15d2-280.3)

Comment: SABR Coalition also supports the comments submitted by the American Soybean Association. (15d2-286.1)

Comment: As noted above, SABR Coalition supports the comments of the American Soybean Association, particularly with respect to the sustainability and certification requirements in the proposal. (15d2-286.8)

Comment: As CARB finalizes its update to the LCFS, NDSGA aligns itself with ASA recommendations that will likely prevent an increase in fossil diesel use, improve carbon intensity calculations, and improve market access for sustainable agricultural feedstock providers. (15d2-293.21)

Comment: Beyond these comments, we associate ourselves with those submitted by Growth Energy, Clean Fuels Alliance America, National Oilseed Processors Association, and California Advanced Biofuels Association – all organizations that represent the interests of our sector, which has achieved much in clean fuels policy. (15d2-307.6)

Comment: CMUA supports the comments submitted by the Sacramento Municipal Utility District and the comments submitted by the California Electric Transportation Coalition, both submitted on October 16, 2024. (BH-018.2)

Comment: The EJAC submitted a letter on October 22, 2024, raising significant concerns about the current LCFS Proposal.³ The undersigned organizations agree with and underscore the points raised in that letter.

³ EJAC, Letter to CARB re Second 15-Day Change Proposal (Oct. 22, 2024), https://ww2.arb.ca.gov/sites/default/files/2024-

10/EJAC%20Letter%20to%20CARB%20board%20re_%20Low%20Carbon%20Fuel%20Standard%20recom mendations_Oct%202024.pdf.

(BH-030.2)

Comment: I want to echo many of the comments that you just heard from Mr. Wade. I also want to echo the comments of Mr. Randolph from earlier about the importance of this Program in light of what took place earlier this week in terms of the national electorate. (BHT-3)

Agency Response: No changes were made in response to these comments. Staff acknowledges these stakeholder comments in support of comments provided by other organizations. All comments submitted by the referenced organizations have been responded to elsewhere in the FSOR.

CCC-4 Multiple Comments: Adopt a technology-neutral approach

Comment: On behalf of the hundreds of thousands of farmers, ranchers, producers, and workers here in Nebraska who help feed and fuel the world — and for the sake of our shared goal of reducing greenhouse gas emissions — we respectfully request for you to adopt a more technology-neutral, market-based approach that ensures that biofuels can contribute on a level-playing field to a cleaner, more efficient energy future in California and across the country. (45d-174.1)

Comment: The LCFS must remain fuel-neutral, driven by CARB's science-based analysis, capable of incentivizing real-world investment, and focused on performance-based GHG outcomes. Remaining true to these core concepts will ensure California leads the world in rapid transportation sector decarbonization. (45d-328.8)

Comment: I find the moves to limit crediting to particular decarbonization technologies as concerning for the integrity of the program going forward. To preserve an efficient market, the rules must be clearly established and enforced. The developments needed to decarbonize transportation (or any industry) require long periods of time to fund, deploy, and operate to be financially viable. Inconsistent rules add economic and regulatory risk to that process, and will make investment more expensive and more short-term focused. I do not believe this is the intention of the CARB, but it is a likely consequence of proposed changes to RNG, biomass-based fuels, and electric forklifts.

LCFS and the CA-GREET model have effective and scientifically rigorous means for evaluating technology, and in many ways already address the criticism of various technologies. Adapting these methodologies to new science and evidence is entirely appropriate, but disregarding them or creating parallel, inconsistent methodologies is not.

I urge ARB to eliminate its unscientific changes to its rules meant to favor some technologies over others, and instead strongly reaffirm its science-driven rules-based technological neutrality. To the extent that existing pathways do not properly reflect compliance with the LCFS CI targets, corrections for this should be made primarily through the established program mechanisms – updating CA-GREET and adjusting the annual CI reduction targets. (45d-352.3)

Comment: In addition, we urge CARB to maintain the technology neutrality that has enabled the success of the LCFS program. (45d-354.6, 45d-370.5)

Comment: 3Degrees urges CARB to maintain the technology-neutral principles of the program by providing an agnostic methodology for phasing-out any credit generation opportunities. Implementing artificial and arbitrary cuts to specific technologies and fuel types threatens the integrity of the entire program. (Apr-128.4)

Comment: While PG&E encourages serious consideration of stakeholder comments, sufficient analysis of the pros and cons of large-scale modifications such as removal or limitations on different fuel sources must also be weighed against several other factors. This includes taking a technology agnostic approach, and the urgency of adopting amendments related to increasing the stringency of the program, stabilizing the market, and further enabling LCFS revenue to accelerate transportation electrification in the near-term. PG&E notes that this is not the final opportunity CARB and stakeholders will have to reevaluate and amend the LCSF program. As new data and information comes forward, PG&E encourages continuous evaluation of potentially needed programmatic modifications, including those raised in this rulemaking process. (Apr-151.2)

Comment: We also collectively urge CARB to avoid selectively limiting or disadvantaging technologies or pathways that can reduce GHG reductions within the LCFS program. The principle of technology neutrality has allowed the LCFS program to achieve GHG reductions more quickly and cost-effectively than anticipated, as reflected in the greater ambition proposed in this rulemaking. CARB's analysis presented at the workshop also reflects the risks of selective limitations, with a more selective approach resulting in fewer GHG reductions, more petroleum use, higher health costs due to pollution, and higher LCFS program costs overall.³

³ CARB Staff Presentation from April 10, 2024 workshop

(Apr-193.3)

Comment: The LCFS modifications proposed by CARB staff are comprehensive and represent significant efforts that are appreciated. It is our belief that California should continue to be fuel neutral through the LCFS, using national standards and the Argonne GREET model to determine the best LCFS credit generators.

. . .

The LCFS modifications proposed by CARB staff are comprehensive and represent significant efforts that are appreciated. TTP supports most changes with some caveats as detailed in the paragraphs on the second page. It is our belief that California should continue to be fuel neutral through the LCFS, using national standards and the Argonne GREET model to determine the best LCFS credit generators. (15d1-066.1)

Comment: Staff should consider an adjustment of the LCFS to re-focus the regulation on reducing the CI of liquid fuels supplied in California and remove ZEV from credit creation once an established penetration threshold is achieved. As ZEV use expands, the credits available in the compliance market will remove the signal for ongoing and increasing decarbonization in gasoline and diesel fuels. Staff should consider whether the LCFS is best utilized to ensure that remaining Internal Combustion Engines have the highest use of low carbon liquid fuels possible. (15d1-113.5)

Comment: For considerations for improvement, we raise a concern with the cost implications of the various proposals that affect renewable diesel (RD) and SAF. These cost implications may lead to avoidable higher costs for consumers and renewable fuel supply instabilities without delivering significant environmental improvements as compared to CARB's proposals in the 45-day regulatory package. Neste recommends that CARB reprioritize technology neutrality to ensure that California consumers receive renewable energy at the lowest cost possible. Focusing on the renewable energy needs of nearby jurisdictions is counterproductive because climate change is a global phenomenon and any GHG emissions reductions will result in global benefits. (15d2-300.5)

Comment: I have invested hundreds of millions of dollars into LCFS-linked projects. And my ability to continue to do that relies on trust with CARB to be a steward of this Program. And, for example, to take corrective action the price of credits drops 80 percent over two years, that is exactly what this proposed rule would do.

Further, there will always be a temptation to put our thumbs on the scale and to pick winners and losers. And my advise, don't. If you champion one technology at the expense of others, it undermines the faith and credit that I have in this Board as a steward of the program

I can't then believe that the current rules are reliable and I just won't invest in new projects. I don't have to do that. I won't invest in LCFS -- in EV charging and EV deployment things that we currently do, because we do believe in this Board to be a steward of the Program. This package is good as it is necessary. (BHT-61)

Agency Response: No changes were made in response to these comments. In general, technology neutrality has been and will continue to be an important consideration within the LCFS. The LCFS is designed to decrease the carbon intensity of California's transportation fuel pool and provide an increasing range of low-carbon and renewable alternatives, which reduce petroleum dependency and achieve air quality benefits. The LCFS is based on the principle that each fuel has life cycle GHG emissions. This life cycle assessment (LCA) examines the GHG emissions associated with production, transportation, and use of a given fuel. The LCA includes direct emissions from the energy and material inputs for the production, transport, and use of the fuels, as well as significant GHG emissions from market-driven changes, such as changes in land use for some crop-derived biofuels, and emissions that may result from market displacement effects. The system of declining benchmarks that is used to calculate credits and deficits and the obligation of deficit-generating fuels to be canceled out by credits, result in a decrease in the total life cycle GHG emissions from the transportation fuel pool in California.

The 2022 Scoping Plan Update,²¹ approved by the Board in December 2022, lays out a cost-effective and technologically feasible path to achieve California's GHG reduction targets and achieve carbon neutrality by 2045. One of the objectives of this rulemaking is to align with the 2022 Scoping Plan Update that identifies fuel and technology pathways for achieving carbon neutrality. Importantly, the LCFS is being amended to provide clean fuels to support ZEV regulations already adopted by the Board. In aggregate, there are legislative and regulatory signals that are reflected in the LCFS program update.

CCC-5 Livestock Offset Protocol

Comment: The Livestock Offset Protocol (LOP) uses methane conversion factors taken from Chapter 10 of the 2006 Intergovernmental Panel on Climate Change ("IPCC") entitled *Emissions from Livestock and Manure Management* ("Chapter 10"). Section 10.4 of Chapter 10 (pp. 35 – 52) provides these factors for many types of livestock in addition to dairy and swine, including poultry (both layers and broilers) and beef cattle. CARB may amend the LOP or create a separate LOP for the LCFS to add user clarity for other feedstocks. (45d-094.4)

Agency Response: No changes were made in response to these comments. Staff appreciates the commenter's insights but notes that the recommendation is beyond the scope of this regulatory proposal. Any amendment made to the Livestock Offset Protocol would require a separate rulemaking proceeding.

CCC-6 Multiple Comments: Supporting the Scoping Plan

Comment Summary: Stakeholders ask that CARB begin to think about the framework and guardrails needed to achieve the 80% goal set forth in the Scoping Plan and leverage all of the tools available to the vehicle market, such as book-and-claim and avoided emissions accounting, to make this goal a reality. (45d-152.11, 45d-168.17)

Comment: These seven requests largely stem from regulatory inconsistencies and counterproductive consequences associated with the Proposed Rules, including 1) conflicts between the amendments and CARB's 2022 Scoping Plan, 2) negative impacts to California's climate goals, and 3) harmful financial effects, including risk of stranding assets. (Apr-181.10)

Agency Response: No changes were made in response to these comments. The 2022 Scoping Plan Update signals the need for an aggressive reduction of greenhouse gas emissions and fossil fuel use, building on and accelerating greenhouse gas reduction programs that have been in place for a decade and a half, including the LCFS program. The 2022 Scoping Plan Update directly identifies that the stringency of the LCFS CI benchmarks should be increased, both pre- and post-2030, which is the key change staff is proposing for this rulemaking. The objective is to send clear, long-term market signals to support investment in low-carbon fuel production and technologies that are needed to achieve deep emissions reductions in the transportation sector while

²¹ California Air Resources Board, 2022 Scoping Plan for Achieving Carbon Neutrality. November 16, 2022. https://ww2.arb.ca.gov/sites/default/files/2022-12/2022-sp_1.pdf

supporting the broader portfolio of zero-emission vehicle regulations and climate statutes. Another goal is to align the crediting opportunities in the LCFS with the fuel and technology pathways identified in the 2022 Scoping Plan Update. Any phasing down of crediting options is balanced with the need to avoid stranded assets.

CCC-7 Multiple Comments: New markets

Comment: CARB could and should expand the LCFS program outside of transportation or use the LCFS program as an example to develop and adopt a broader Clean Fuels Standard that would complement the LCFS. Such a standard could impose a decreasing, rate-based target on regulated entities, allowing these sectors to achieve emission reductions in a technology neutral manner by choosing between electrification, procuring low- and zero-carbon and carbon-negative fuels, and/or improving energy efficiency. Such a standard would achieve significant reductions at least cost by enabling compliance flexibilities and harnessing technological innovation. The current LCFS program is providing critical support to the RNG market. Because a significant amount of RNG usage today is occurring in the transportation sector, the LCFS program holds continued importance as the State explores opportunities to incentivize RNG use in other sectors. Competitive pricing and availability of supply will be critical when looking to expand RNG usage to other hard-to-abate sectors. For these reasons, Bloom Energy continues to recommend that discussions about the potential expansion of LCFS or the potential development of a broader standard should happen in parallel with ongoing support provided to the RNG market through the current LCFS. (45d-181.7)

Comment: As the technology in the transportation sector continues to evolve and advance towards lower carbon alternatives, Prairie Farms members and the rest of the dairy industry and are ready to serve these new markets, such as alternative jet fuel (AJF), low-CI hydrogen, as well as exploring opportunities where biomethane can be utilized outside of transportation. As these markets continue to grow, Prairie Farms asks CARB to remain mindful of the success of the historical framework of the program and to continue to apply it to these newer pathways and technologies, including the use of avoided emissions and book-and-claim. (45d-219.5)

Comment: While we appreciate this may be beyond the scope of this rulemaking, we encourage CARB to consider expanding the LCFS to other transportation end uses and sectors. For biogas, in particular, expanding the LCFS to cover all gas end uses (e.g., industry, buildings, power, etc..) would provide the most equitable program and market signal transition biogas from the transportation sector to stationary sources. (Apr-101-20)

Comment: Over the past two years, CARB staff have held numerous public workshops to gather feedback on potential changes to the program, where ABC participated, and we are happy to see that the rulemaking is nearing completion. As the technology in the transportation sector continues to evolve and advance towards lower carbon alternatives, ABC members are following suit and are ready to serve these new markets, such as alternative jet fuel (AJF), low-CI hydrogen, as well as exploring opportunities where biomethane can be utilized outside of transportation. As these markets continue to grow, the ABC asks CARB to remain mindful of the success of the historical framework of the program and to continue to apply it to newer pathways and technologies, including the use of avoided emissions and book-and-claim. (15d2-256.8)

Comment: As these markets continue to grow, Newtrient asks CARB to remain mindful of the success of the historical framework of the existing LCFS program and to continue to apply it to newer pathways and technologies, including the use of avoided emissions and book-and-claim. (15d2-260.7)

Comment: Oberon encourages CARB to ensure there continues to be a market for low-Cl liquid and gaseous fuels as they are a critical decarbonization tool, especially in sectors that are hard to decarbonize. Oberon recommends that CARB send a clear policy signal that biofuels (e.g., biomethane, renewable propane, renewable DME) are necessary and effective decarbonization strategies in these sectors (e.g., residential, commercial, industrial, and agricultural stationary applications) and are fundamental to the state meeting its ambitious GHG reduction targets.

As the state transitions out of combustion in the transportation space, gaseous and liquid fuels will continue to support the substantial volumes of fuels required by industrial, commercial, residential, and agricultural sectors with escalating pressure to drive down GHG emissions. One approach for doing so is stronger signals and incentives for the production and use of low-CI fuels in these sectors to support meeting the State's substantial and necessary climate targets.

Expanding the LCFS or creating a LCFS-like structure to facilitate the decarbonization of other gasoline-, diesel-, fossil natural gas-, propane-fueled applications in such markets is an opportunity that merits attention. Doing so would reward investments and use of cleaner fuels by these legacy sectors that are not anticipated to be electrified for many decades. In the last year new domestic and international policies have been established to apply the LCFS approach beyond transportation fuels such as Vermont's Clean Heat Standard, the Canadian Clean Fuel Regulation, and the EU ETS II which cover both transportation and non-transportation fuel. Policy expansion, as signaled in the Initial Statement of Reasons for the proposed LCFS amendments, will support the vast opportunity for reductions in greenhouse gas emissions in these sectors and drive the continued market development of low carbon fuels such as renewable DME in sectors where their GHG reducing benefits are needed. (15d2-278.9)

Agency Response: No changes were made in response to these comments. Staff acknowledges the commenters support for the LCFS framework and its potential for use in other new markets. These recommendations are outside the scope of this regulatory proposal. The adoption of a regulation would require a new, separate rulemaking proceeding outside of the LCFS program.

CCC-8 Multiple Comments: Modernize the LCFS

Comment: The Union of Concerned Scientists (UCS) is a long-standing supporter of the Low Carbon Fuel Standard (LCFS) and has been actively involved in its implementation for more than 15 years. We urge the California Air Resources Board (CARB) to modernize the LCFS to ensure it equitably meets the needs of Californians and supports the attainment of air quality standards. Beyond California's borders, the LCFS is an important policy model for other states and the federal government, which could help address the many deficiencies of the Renewable Fuel Standard. (Apr-086.1)

Comment: For the foregoing reasons, and in the foregoing ways, CARB must update the proposed Modifications to comply with its legal obligations and reform the LCFS. To do otherwise would be arbitrary, capricious, and an environmental injustice. (15d1-211.13)

Agency Response: No changes were made in response to these comments. The LCFS program's primary objective is to reduce the average carbon intensity of transportation fuel and reduce greenhouse gas emissions from the transportation sector by incentivizing the development of low carbon fuels and their deployment in California, while understanding what consumer demand looks like in the near- and longer-terms. Staff will continue collaborating with stakeholders, industry, and community members to improve the program and further support California's climate goals that represent a pragmatic and cost-effective approach that reflects energy demand trends.

CCC-9 Amount of methane leaking from landfills

Comment: I'd like to have access to the amount of methane leaking from landfills in our communities. We have a closed landfill in our county that still leaks and receives violations and fines. (45d-297.5)

Agency Response: No change was made in response to this comment. The quantity of methane leakage from an individual landfill depends on a wide range of site-specific factors, including but not limited to the amount and age of biodegradable waste, and many other environmental and operational conditions. Tools and strategies to directly measure emissions from large area sources such as landfills are under development and CARB has conducted and funded significant research efforts to advance these capabilities. Estimation methods, such as the IPCC First-Order Decay method, are most typically used to assess emissions from landfills, including in CARB's AB 32 GHG Inventory and in the LCFS Tier 1 Calculator for Biomethane from Anaerobic Digestion of Organic Waste.

CCC-10 Multiple Comments: Not within scope of rulemaking

Comment: Low carbon fuel standards should apply to all industries. We can't pick and choose to whom standards apply as we attempt to save our planet. (45d-058.1)

Comment: Time to turn this unjust, LCSF policy around. What was the reason for ever making such a decision in the first place? Whatever it was, allowing big corps to defile Californias environment looks to be a deal which never should have even been considered.

The people of this state stand behind you in any and all your efforts to get rid of the LCSF legacy. The time is now. (45d-132.1)

Comment: What we need to stop is pollution, whether it be from private jets, yachts, McMansions, golf courses, the military, industry and factory farming. The predatory class, industry and the military cause the vast majority of the pollution that poisons us and our environment, yet they are all exempt from the ridiculous "carbon" standards foisted on the rest of us, and yet our tax dollars subsidize what little mitigation is actually done toward cleanup. There is no reason why Air Force One should run 24-7, which creates gawd-knows how much pollution.

If anyone in government or our regulatory agencies (mostly staffed by a revolving door of executives and lobbyists), actually cared about us (they don't), our tax dollars would subsidize regenerative, humane, organic, biodynamic, local, small-scale farming and ranching, which would go a long way to restoring the soil and cleaning up the environment. And, we would severely punish industrial polluters, where the executives would be criminally prosecuted and spend time with rank and file criminals in prison, and not some Club Fed where they play golf all day. (45d-192.1)

Comment: Respectfully therefore, having in mind especially §38561.2(b)(6) and Title XVII, we repeat our request for an LCFS rule-innovation that favors SB596 industrial low-energy *electrification*. We fully accept any new rule must be open equally to others also delivering those same benefits in an SB596 setting. To such ends, we believe the innovations we have suggested could be easily implemented and require minimal change to California's existing code, while being linked expressly to the aims of SB596. Further, the suggestions we have made are designed also to concord with Title XVII, moreover so that only innovative *electrification* technologies may qualify under the LCFS (with the credits generated tied to verified carbon mitigation). Nevertheless, if it is demonstrated objectively that the LCFS cannot be innovated no matter the reasons as suggested by us here, then we would welcome any alternate rule-change given §38561.2(b)(7)'s express requirements, per lines 76–86 above which includes energy-efficiency improvements and *"Measures to facilitate fuel switching"*. (45d-193.1)

Comment: It may be worth considering whether there is a role for the LCFS in facilitating the shutdown of older, less efficient refineries, or those in or near disadvantaged communities to help California achieve its climate and equity goals. This would entail leveraging the LCFS in a novel way with a wide variety of tradeoffs that would require diligent consideration prior to action, however using the LCFS to help manage the wind-down of California's refining sector may offer significant long-term efficiency advantages. Exploration of this concept is outside the scope of the present rulemaking, however and would require a new rulemaking to fully implement, at which point the provisions in this section could be modified to accommodate the new application of the LCFS. (45d-391.67)

Comment: Please promote the more efficient generation of electricity by funding solar at the site of use. (45d-1712.3)

Comment: Biofuels are NOT a climate solution. Instead, the state should be subsidizing residential and business rooftop solar, and installing it above irrigation canals and parking lots, as well as restoring net metering. (45d-3400-6399.5)

Comment: We need to make sure we have meaningful community engagement, but also we have to have zoning for the digesters. We need to keep them at least 10 miles away from the communities and towns. We also need to address the cleanup of the drinking water. These long-term subsidies should stop, only be used for a startup, not multi-millionaires continuing to get subsidies off the backs of the poor of these communities that are being impact. Also, address the quality of the digesters in our local areas, what impacts are they doing with contamination of the air and water and the quality of life, including those big flies, okay.

• • •

In closing, what's so important for us is that we have been here for generations in our healthy communities, but now the friends we're losing are due to illnesses related to these digesters, long-term illnesses. No more credits. They could stand on their own. They're a private business. But more importantly, vote no. Vote no. Protect our lives, our communities, that's what we expect for you. Why do we continue to give the rich money? (BHT-41)

Agency Response: No changes were made in response to these comments. Staff appreciates the commenters' insights but notes that these recommendations are not within the scope of this rulemaking.

CCC-11 Multiple Comments: Not specific to LCFS

Comment: FOIE GRAS PRODUCTION

Please stop! (45d-056.1)

Comment: Pure air

YOU said – you PROMISED – to GET SOMETHING POSITIVE DONE!

Start LIVING UP TO IT!!! (45d-057.1)

Comment: Gas is cruel! (45d-062.1)

Comment: Protect Mother Earth!

There is no Planet B! (45d-063.1)

Comment: Destruction of all living things

Stop killing our planet and our children (45d-076.1)

Comment: Constantly beholden to money and industry

It's sad to see the state of affairs of politicians and government officials of today. Constantly beholden to corporate and industry, bribery, corruption, and lobbying. Always looking the other way. Always doing their bidding.

How have you all reached this point in your lives? How much is enough for you all to actually finally have a conscience and do the right thing? I assume you all have children, family, pets, etc...does it not register with any of you regarding what you are leaving behind?

Sad. Do the right thing for once in your lives. Just once. (45d-086.1)

Comment: The Democratic Party platform should support: Animal Rights, Defending the Affordable Care Act, Ending Citizens United, Ending Marijuana Prohibition, Giving Greater Visibility to Pro-Life Democrats, Gun Control, Net Neutrality, Raising the Minimum Wage to \$15 an Hour, Responding to the Scientific Consensus on Global Warming, and a Sustainable Energy Policy. Democrats for Life of America, 10521 Judicial Drive, #200c, Fairfax, VA 22930, (703) 424-6663 (45d-091.2)

Comment: Animal Abuse

Just stop it. All of it. Go vegan! (45d-098.1)

Comment: Stop the gas (45d-106.1)

Comment: Stop using valuable resources

We cannot continue to pay for farmers to abuse our water systems. (45d-110.1)

Comment: I support the humane treatment of animals and a cleaner environment. (45d-131.1)

Comment: Focus on real air pollution solutions, not greenwashing. (45d-917.3)

Comment: Reward the folks who are cleaning up our air not polluters! (45d-917.4)

Comment: I object to that wasteful spending to support the Fossil Fuel industry and Big Ag. (45d-2998.3)

Comment: Keep our air clean@ Stop poluters (15d1-002.1)

Comment: Look up we have a huge clean energy source 24-7 work on capture and storage SUN & Done! I've been flying and have a Birds Eye view on what we humans are doing to our planet and environment and am personally disturbed. (15d1-004.1)

Comment: Keep putting small business out of business with your regulations then wonder why owners and consumers who don't want to pay for the associated additional costs are leaving California. Idiot Democrats and their socialist climate agenda raising costs for Californians and all Americans. (15d1-039.1)

Comment: Large Carbon emitters should be buying non-carbon energy credits rather Biofuel which carbon polluting fuel. It should help low income people to electrify the homes, add solar on their homes and purchase EVs. (15d1-044.1)

Comment: Abolish the CARB

You are all worthless cucks and should all lose your jobs for even thinking of taxes us even more than you already do. And I'm sure I speak for the majority of Californians when I say, GO FUCK YOURSELVES! (15d2-099.1)

Comment: Stop funding highway expansion projects, even those with toll lanes like I-405 in Orange County and US 101 in the Bay Area. (BH-021.4)

Comment: How come wildfires are not included in the carbons studies?

Sadly, the longer this comment section went on, the more I/we heard this comments section the more I/we heard this large LCBA Industrial Complex. Look, I've said myself and many others want good air. But what really needs to be done is working together on many of these matters without burdening the working Californian and bringing in another wave of massive inflation. (BH-071.7)

Agency Response: No changes were made in response to these comments. Staff acknowledges the comments but note that these comments are not specific to the LCFS and this rulemaking, and most of these comments, including the request to "Abolish CARB" are outside the scope of this rulemaking. CARB values the input it receives on its regulations. The best input is constructive and supported by underlying data. We also

believe we should engage in respectful debates on the issues and not devolve into personal attacks on career staff. Staff responded to the specific recommendations elsewhere in this FSOR and is available to meet with members of the public to provide factual data about the agency's programs.

CCC-12 Multiple Comments: General concerns

Comment: We encourage ARB to continue to pursue aggressive policies that support California's climate goals. As the transportation sector is the largest sector contributing to greenhouse gas emissions, reducing those emissions is critical to achieving carbon neutrality. The LCFS has been an important and effective tool, but it will only continue to perform if ARB makes changes like those described above. (45d-256.29)

Comment: Capturing carbon and reducing the release of carbon into our atmosphere is incredibly urgent and important for the survival of life on earth and for the air quality for all of us, but especially for those most at risk of developing lung cancers, such as infants, children and those with compromised immunity. The toxins released by climate-caused wildfires and loose carbon regulations pose a constant threat to the health of the public, our food and water sources. The new carbon regulations should place public health before private profits. (15d1-003.1)

Comment: reduce all pollution levels in California (15d1-008.1)

Comment: SCE supports the LCFS regulation, but requests edits to the Proposed 15-day changes to improve clarity, address operational challenges, and provide certainty to the market and utilities. (15d1-092.1)

Comment: CBE is extremely concerned with the direction of these changes and the status of the rulemaking process and urgently requests that further changes and corrections are made to better align the program with the suggestions and concerns raised in this letter and throughout the rulemaking process. (15d1-240.6)

Comment: We must remain respectfully opposed the second proposed amendments to the Low Carbon Fuel Standard (LCFS) program. Our analysis of the proposed changes reveals significant concerns about their potential impacts on fuel supply, consumer prices, and the overall effectiveness of the state's energy transition strategy. (15d2-001.1)

Comment: Would like more information as this sounds ludicrous. (15d2-035.1)

Comment: Speaking for myself and household, we strongly OPPOSE the amendment. (15d2-097.1)

Comment Summary: CARB's Second 15-Day Changes to revise the LCFS did not address our major concerns with provisions included in the August 15-day notice... (15d2-184.1, 15d2-197.1, 15d2-208.1, 15d2-214.1, 15d2-214.27, 15d2-239.1, 15d2-240.1, 15d2-243.1, 15d2-255.1, 15d2-268.1, 15d2-285.1, 15d2-293.1, 15d2-293.27)

Comment Summary: CARB's Second 15-Day Changes did not address any of the fundamental issues raised by soybean farmers in the first 15-Day Changes... (15d2-184.23,

15d2-197.27, 15d2-208.27, 15d2-239.27, 15d2-240.27, 15d2-243.27, 15d2-268.27, 15d2-285.27)

Comment: However, we urge CARB to reconsider certain RNG-specific provisions during the implementation phase and future LCFS rulemakings. (15d2-212.1)

Comment: We find that these changes will do little to address CARB's current aim to stabilize the credit market and, in some cases, may be counterproductive. Timely fixes are required to address upstream environmental risks associated with crop-based fuel production and inflated carbon intensity values for livestock manure derived biomethane that are compounded by book-and-claim crediting. (15d2-237.1)

Comment: As Californians continue to purchase, own and operate millions of vehicles that consume liquid transportation fuel, we look forward to future opportunities to work collaboratively to lower emissions from these vehicles. Unfortunately, the agency's proposed rule, as expressed in the Second Revised Proposed Amendments is not a step forward in that direction. (15d2-253.11)

Comment: As noted in previous letters from health organizations and others in the advocacy community, the initial proposal included many concepts that we believe would have strengthened the health and equity outcomes of the program going forward and we expressed our concerns that subsequent proposals weakened the potential for health improvements.

With the latest proposals, we are increasingly concerned that the amendments have moved further from the initial proposal and offer our comments to inform future actions beyond the potential adoption or rejection of the latest staff proposal. (15d2-275.1)

Comment: It is deeply discouraging that the opportunity to update the LCFS program has been resolved with insubstantial amendments. It is similarly disappointing that there is no clear path forward for the legitimate concerns raised by impacted community members, which we believe could have been acted on during this rulemaking. (15d2-292.5)

Comment: As we have noted in past comments, in our direct engagement with the CARB staff and Board, and through our industry associations, ADM believes the changes proposed in August 2024 were ill-advised – for California consumers, the clean fuels market, and ultimately, the program's role in advancing sustainable practices. The latest proposal only serves to deepen our concerns. (15d2-307.1)

Comment: Members of the board, please consider the following carefully: 1. You can forget about meeting United Nations goals. The great state of California is simply too big. It is impossible. The harder you try to "catch up" to the timetables, the more you will be resisted by families and businesses across the Golden State.

2. The United Nations' International Panel on Climate Change (IPCC) has been exposed, repeatedly, for using fraudulent figures. This fraud is then perpetrated on millions of taxpayers. Do not get caught up in this fraud, stand for your state, the people of California need you to do the right thing. (BH-008.1)

Comment: I feel that the standards that CARB are putting into please are limiting consumers options for purchase of car and limiting jobs. My Gardener will now be unable to keep his

company going due to your limits placed or carbon emissions. We can not purchase low carbon emission DEF diesel engine vehicle, like the rest of the world can. Imagine using a low carbon engine diesel engine with state of the art now fuel injectors running a generator charging fuel cells to run a vehicle. LA traffic is the worst thing of Carbon emissions. Diesel run at a lower RPM and can put out super low Carbon with next gen fuel injectors. Rather taking opportunities away and need to use these funds for R&D on making Diesel the fuel of the future. (BH-019.1)

Comment: In addition to making these urgent changes before finalizing this rulemaking package, there is additional work that must proceed in the months and years to come. More details on why these changes are necessary and on the work that must continue next year is below. (BH-025.5)

Comment: Further, on September 10, 2024, many of us submitted a letter urging the Board to oppose the proposed amendments unless key changes were made.⁴ Despite explicit EJAC recommendations, clear direction from Board Members, and our science-based critiques and reform proposals, staff's Second 15-Day Change Proposal doubles down on entrenching polluting practices and delaying critical reforms.

⁴ FixLCFS Coalition, Proposed Changes to the Low Carbon Fuel Standard Regulation (15-Day Change Proposal) (Sept. 10, 2024)

https://static1.squarespace.com/static/65f1d93992b6d17681a4754e/t/6717f67fd001cd6bee65a4a5/17296236 90124/FixLCFS+Coalition+-15+Day+Changes+Comment+Letter++Sept.+2024+%281%29.pdf.

(BH-030.3)

Comment: We underscore that these recommended actions are moderate and grounded in science and equity. By limiting fuels that are problematic or over-subsidized, CARB would shore up the credit price without imposing high regressive costs on Californians, and CARB would send a signal nationally and globally that the LCFS is based on scientific advances and environmental justice. Unless the Board directs staff to implement these critical fixes, the LCFS will remain a regressive, outdated, and combustion-focused program, prioritizing the demands of powerful fossil fuel and agribusiness industries over public health and environmental justice committee. (BH-030.10)

Comment: The LCFS – now in its fifteen year of implementation – has been one of the mainstays of SB32 and California's climate policies. But it is in desperate need of reform and modernization to reflect the sustainability, environmental justice, and climate targets of today.

While staff has tried to address some of the concerns the past year, unfortunately today's amendments are a far cry from what is necessary to resolve them. We ask the Board to provide staff with clear and strong direction to fix the following issues over 2025. (BH-034.1)

Comment: We need the Board to push for a gold standard LCFS. If it doesn't, the LCFS may eventually collapse under the weight of the problems and issues it is currently exacerbating. We urge you to direct ARB to fix these issues in the LCFS by the end of 2025, in a manner that genuinely protect communities and continues progress on climate. (BH-034.8)

Comment: ARB should listen more to these experts and less to the renewable fuel providers that are profiting financially from the LCFS. (BH-051.16)

Comment: I want to be clear that we are not opposed to the greenhouse gas emissions goals of the state, but the choice today is not one of endorsing a zero-emissions, electrification of the state, it's one of subsidizing bio-fuels. (BH-053.1)

Comment: What you are doing is Criminal to the people of California. (BH-068.1)

Comment: Time we spoke of destruction caused by the industrialists, whom seem to screw up everything they get their hands on. Let's make good healthy food, good for us, the environment, birds, insects and all living creatures.

Do we want cheap, environmentally destructive, water polluting, cheap food. Or do we want clean water, clean air, diversity, more trees and common sense intelligence; then, get industrial agribusiness out of agriculture and return the farm to the farmer. Otherwise we just pour more dollars into fake solutions based on wrong decisions.

Promote clean water by composting that returns 70% or more carbon to the soil than the digester. Stop this nonsense solution modeling developed by industrial agribusiness. Wrong decisions along time ago.

The digester burning carbon to the atmosphere, using the energy from manure that was intended to make healthy soils to grow clean nutrient rich foods that didn't require all the chemicals and poisons of today's industrialist.

Farmers work the land, are connected to nature and make common sense solutions to promote the interaction of humans with nature for energy to support life. That energy needs to be returned to the soil as carbon resulting from growth of aerobic organisms that consume and capture the energy and nutrients to grow new life that we consume. Should we add more chemicals or the alternative composting, to apply the common sense of a real farmer who loves and cares for his land.

Agriculture is the solution to climate change, not the problem. A farm could and should be operated entirely by solar and wind, in addition to generating energy for others. We have many alternative good solutions of agriculture for a family farm.

Just imagine solar on wheels planting, harvesting, and maintaining the soil while sitting at the coffee table! Makes me want to be a farmer again.

I have memory of our grandfather speaking to others at our century farm, I was about 3 or 4 yrs then, but his face and expression are locked in my memory. He spoke of the industrialist coming for our land, his conviction and vision he shows me still today. (BH-075.1)

Comment: I am here today to emphasize those challenges and the impending precipice where continuing to reliably provide transportation fuels to our neighbors, local businesses and communities is jeopardized. Kern is a privately held company but you can see from recent public comments from leadership of major refiners that the industry, particularly in California, is experiencing a prolonged period of negative margins. Layering on the significant additional costs that Kern will incur with these amendments, combined with the certain additional costs from the Cap & Trade amendments, will be very difficult to bear for a small, CA only, refiner like Kern. Even as our state evolves electrification and zero-emission alternatives , we cannot ignore the established reality that Californians, particularly in the Central Valley, will be relying

on conventional transportation fuels for decades. Continuing to drive out small refineries that provide those fuels will only increase costs for consumers and increase the burden on those who can afford it least.

I implore you to consider, when voting today or when implementing the LCFS, the impacts on a small California business that has for 90 years provided reliable transportation fuels, including renewable fuels, to California. As the Governor, Legislature and CEC have recently put increasing emphasis on retail gasoline prices, now is not the time to jeopardize the continued operation of current, local, fuel providers. (BH-090.1)

Comment: We can't take another tax!!! (BH-102.1)

Comment: Ethanol biomass, all these alternatives quote/unquote fools -- fuels pollute, generate emissions. They generate emissions such as particulate matter 2.5 and 10, carbon dioxide, nitrogen oxide, and all of those have proven to damage the health of the communities, creating cancer, asthma, and other respiratory diseases. We are right now in the Inland Empire one of the most polluted areas in the U.S. And if CARB approves this, companies will keep polluting without any accountability. (BHT-17)

Comment: I'm looking here at a graph that you published on site on CARB, and it shows that the amount of credits have increased, but the amount of production of biofuel, biodiesel, ethanol has not decreased at all. So the credits are not really working.

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I call you to instead focus all the funds on electric vehicles, which are the only proven zero emissions right now, both for health, not for profits. (BHT-18)

Comment: Now, what will I tell them when I go back, that you changed your mind, that they met your price? I feel deceived. I feel abused. I feel disappointed knowing that now you're proposing amending that law. That's not possible. It's not possible. And it's -- you can't play with people's lives. We're worth something. Our lives are worth something and we love you. We respect you, but we demand that you keep your word. (BHT-19)

Comment: First, CARB's focus on biogas would worsen public -- the public health crisis in the valley. Air pollution from biogas processing exceeds those from fossil fuel processing. Research has shown higher emissions on carbon monoxide, sulfur dioxide, nitrogen oxides, and ammonia. These pollutants are issues on their own, but combined also contribute to the PM2.5 in the valley, a pollutant that is so dangerous, that 1,200 residents in the valley prematurely die each year. (BHT-34)

Comment: We are committed to continue to work with our environmental justice allies and raising issues that haven't been effectively addressed by these LCFS changes, including the impact of factory dairy farms and oil refineries in the surrounding communities. (BHT-51)

Comment: If we settle for less, the program will result in continued poor air quality and water quality, and exacerbate inequities in the environmental justice communities by over-incentivizing livestock biomethane and other problematic combustion fuels. We acknowledge CARB staff efforts to improve the Program including the adoption of several of

our EV provision recommendations, but these changes don't go far enough to sustain our progress on climate. (BHT-154)

Comment: We need to go above and beyond call here in California and go faster, farther to electrification and not pander to biofuels and the dairy industry the way that we are. (BHT-217)

Comment: Finally, we believe that crop-based biofuels and avoided emission credits will both lead to more rather than fewer emissions and more injustice. (BHT-243)

Agency Response: No changes were made in response to these comments. Staff acknowledges the commenters' general concerns and responded to any and all specific recommendations elsewhere in this FSOR.