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March 15, 2023

Cheryl Laskowski
Chief, Transportation Fuels Branch
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Comments submitted electronically

RE: Comments Related to the February 22nd 2023 Low Carbon Fuel Standard Workshop

Dear Dr., Laskowski,

Air Products is pleased to provide comments in support of the California Air Resources Board (CARB) rulemaking for the Low Carbon Fuel Standard (LCFS). We support California's climate goals and believe that Air Products can help California with the energy transition needed to meet these challenges. We are glad that CARB recognized the substantial role that hydrogen must play in the energy transition in the final 2022 Scoping Plan Update, and we appreciate staff continuing this recognition in the LCFS rulemaking.

Air Products is the only U.S.-based global industrial gas company and the world's largest hydrogen producer and supplier for use in numerous markets, including transportation. Within California, the company safely operates nine hydrogen production facilities, about 30 miles of hydrogen pipeline and currently supplies and operates a network of light-duty and heavy-duty hydrogen fueling stations, facilitating the transition to zero-emission transportation. Air Products has also been selected to be part of the California ARCHES LLC Hydrogen Hub Project.

We are committed to rapidly scaling and decarbonizing global hydrogen supplies to support decarbonization efforts internationally. On July 25th, 2022, Air Products announced[1] that it will spend or commit at least $4 billion in additional new capital for the transition to clean energy over the next five years. In the two years proceeding this announcement, Air Products had announced approximately $11 billion in clean energy investments., bringing its total recent commitment to clean energy investments targeting hard-to-abate economic sectors to $15 billion.

Program Stringency

We urge CARB to be as aggressive as practical in setting the new carbon intensity reduction targets for 2030 and beyond and align targets with levels no less than what is needed to achieve California's greenhouse gas targets and outcomes in the Scoping Plan. CARB should be confident in setting strong standards, given the existing cost-containment provisions in the regulation which are robust and provide

[1] Air Products Announces Additional "Third by '30" CO2 Emissions Reduction Goal, Commitment to Net Zero by 2050, and Increase in New Capital for Energy Transition to $15 Billion

the necessary protections should low-carbon fuel supplies not develop as quickly as anticipated. As described below, the more stringent standard should include an immediate step down as well as a dynamic ratchet mechanism to reflect the opportunity to deliver additional reductions in greenhouse gas emissions due to substantial overcompliance of the program as reflected by the large cumulative bank of LCFS credits. As discussed in the workshop and in the scoping plan, a statewide carbon reduction target of 48% below 1990 levels by 2030 as well as carbon neutrality by 2045 creates an ambition that needs to be supported by the LCFS targets. The transportation sector and fuel production pathways are the largest component of statewide greenhouse gas emissions, accounting for about half of the state's climate footprint, so the LCFS needs to provide a substantial amount of the reductions toward the 48% reduction target and potentially mirror it.

Hydrogen Book-and-Claim Provisions

Air Products appreciates CARB's willingness to provide a 'book-and-claim' accounting approach, which is essential to capture the carbon intensity attribute of hydrogen that is transported in multi-source/multi-use distribution systems where lower carbon hydrogen is comingled with conventionally produced hydrogen. A book-and-claim system for hydrogen is essential to support near-term development of nascent low-carbon hydrogen projects to meet the state's ambition greenhouse gas reduction targets as underscored in the recently adopted 2022 Scoping Plan and by ARCHES. A robust book-and-claim system for hydrogen will ensure that the low-carbon attributes of the hydrogen are retained and applied to end-uses where the most environmental benefit can be derived which sends the necessary long-term signal for low-carbon hydrogen to play a meaningful role in decarbonizing transportation. CARB's design of such a system will serve as a model to other jurisdictions considering or implementing an LCFS program. It is important to get this right.

As discussed in more detail below, we believe that there are key principles or attributes that underpin a good book-and-claim accounting framework for hydrogen:

- The longstanding technology-neutral approach embodied in the LCFS should apply to hydrogen in the book-and-claim framework. As such, eligibility requirements should not require a specific production methodology or renewable requirement.
- The book-and-claim framework should enable a robust tracking system for the carbon intensity of hydrogen across the entire value chain including various transport mechanisms – similar to feedstock and fuel pathway carbon intensity tracking for liquid alternative fuels like ethanol, biodiesel, and renewable diesel.
- Eligibility should recognize meaningful improvements in carbon intensity and should be matched in time on a monthly or quarterly basis such that shuffling of existing production of grey hydrogen does not occur.
- There should be no geographic limitations for where the book-and-claim mechanism applies provided the hydrogen or a finished fuel derived from the hydrogen is consumed in the California market.
- Hydrogen carriers, like ammonia, should be similarly eligible for book-and-claim accounting.

To support the greenhouse gas reductions and energy transition envisioned by the 2022 Scoping Plan Update, it will be important that the provisions allow the environmental attributes of hydrogen at varying

carbon intensities to be tracked and credited consistent with a variety of end uses including, but not limited to:

- Hydrogen dispensed to fuel cell vehicles.
- Feedstock to produce renewable fuels such as renewable diesel, gasoline, sustainable aviation fuel, including co-processed renewable fuels. In addition, renewable fuel facilities often produce biogenic gases that are captured and can be used as hydrogen feedstock to lower the carbon intensity of the hydrogen. It is important that these carbon intensity reductions be recognized in any hydrogen produced to the pipelines that feed this renewable fuel facilities.
- Feedstock to conventional fuel production via the refinery investment credit provisions.

Book-and-claim accounting for hydrogen would allow low-carbon hydrogen to be transported reliably and efficiently through existing hydrogen pipeline networks in the key fuel-producing regions of Southern California, the United States Gulf Coast, and Alberta. This is essential to support the investments and innovation necessary to spur the market in support of the volumes of low-carbon hydrogen needed to meet California's ambition. The current lack of a book-and-claim provision under CA LCFS necessitates that hydrogen producers build redundant and expensive parallel pipelines to provide the hydrogen required for the production of renewable diesel and sustainable aviation fuel. CARB's incorporation of book-and-claim accounting will reduce the financial and environmental costs associated with new facilities for the production of low carbon transportation fuels and is a lynchpin to delivering on the state's statutory greenhouse gas reduction targets.

A book-and-claim accounting framework for low carbon hydrogen produced from fossil fuels, including production that utilizes carbon capture and sequestration would also enable increased production of low carbon hydrogen by taking advantage of economy of scale. Without book-and-claim accounting, producers must either build redundant pipelines as mentioned above, or build smaller dedicated low carbon hydrogen facilities to supply an individual customer. This production model is higher cost compared to a model with fewer large- scale plants that might supply multiple renewable fuel manufactures though a distribution network.

We are in strong agreement on the need for robust mass balance accounting of the carbon intensity of the hydrogen used directly as a transportation fuel or used to produce other transportation fuels (described in more detail below). This is true for both the lower carbon intensity hydrogen and any conventional hydrogen used. Robust accounting protocols, similar to those used to successfully track biogas and renewable power for over a decade is the model that should be applied to hydrogen to ensure that the carbon intensity attributes are appropriately tracked and the integrity of the LCFS is maintained with no double counting of credits. We encourage CARB to advance rigorous and sustainable book-and-claim accounting.

However, we are very concerned that CARB's approach to limit hydrogen eligibility for book-and-claim to only hydrogen below set carbon intensity levels and hydrogen that is not derived from any fossil resources, will impede the nascent market for lower carbon hydrogen. This approach undermines efforts to drive down the carbon intensity in conventional hydrogen which is antithetical to the principles and much of the success of the LCFS (i.e., incentivize driving down the carbon intensity in all fuels with the greatest rewards going to fuels with the lowest lifecycle carbon footprint). In fact, much of reductions in greenhouse gases under the LCFS have resulted in investments that drive down the carbon intensity of conventional fuels while concurrently supporting the transition to even low carbon intensity renewables

consistent with the framing in the Scoping Plan[2]. While the scenario selected and analyzed by CARB in the 2022 Scoping Plan Update indicates that much of the new hydrogen is anticipated to have a renewable component (e.g., renewable power, biogas, of other bioenergy), it is unlikely that all of the production and process energy will be fossil free, particularly in the near-term. It is also important to note that all of this new renewable hydrogen growth in the Scoping Plan Update is expected to be "off-grid", but for reliability, these facilities will likely have grid connection. The concept that book-and-claim mass balancing can only be used when no grid (fossil) electricity is involved will be administratively burdensome and counterproductive to supporting the scale-up of low-carbon intensity hydrogen that is needed to deliver on ambition of the Scoping Plan and meet the state's greenhouse gas reduction targets. And, by relying on the LCFS's robust lifecycle carbon intensity construct, the cleanest fuels including their associated source of electricity, will be fully accounted for, and appropriately rewarded.

Two of the most important principles that underpin the LCFS are technological neutrality and performance based. The LCFS enables all fuels to compete on a carbon intensity basis and rewards reductions of carbon intensity with marketable credits. The LCFS does not specify how those fuels are produced but provides for a robust calculation and accounting system for determining the carbon intensity of each fuel pathway and assuring that credits are derived accordingly. This approach has fostered investments and innovation that have supported driving down the carbon intensity in a broad spectrum of traditional as well as renewable fuels contributing to substantial reductions in greenhouse gas emissions. Setting a particular carbon intensity target and dictating that the hydrogen production must be renewably derived to be eligible for carbon intensity tracking directly contradicts these critical LCFS principles and forecloses on opportunities to deliver additional reductions in greenhouse gases by severing the market signal to drive down the carbon intensity in hydrogen produced from feedstocks beyond those deemed renewable.

Moreover, in the workshop, CARB cited consistency with the Inflation Reduction Act (IRA) as a rationale for establishing the eligibility criteria. However, the IRA is technologically neutral and does not specify that the hydrogen be renewably derived. It simply sets specific limits or thresholds for clean hydrogen to qualify for specific tax credits.

While carbon intensity is used to derive these tax credit thresholds, it should not serve as a model for how the LCFS treats hydrogen under a book-and-claim scenario as the design and implementation of the LCFS is a national and international model that continues to be replicated by states and other jurisdiction (i.e., tax incentives complement the LCFS rather than the reverse). Because the LCFS is performance based, it naturally rewards even small incremental improvements in carbon intensity which is something that the IRA does not do. Instead, the IRA sets four specific carbon intensity thresholds that correspond to tax credit levels per kilogram of hydrogen produced. Improvements to carbon intensity between these levels are not rewarded with additional tax credits, but the LCFS instead provides a mechanism to incent continuous innovation to improve carbon intensity.

We also recommend that CARB provide a 'book-and-claim' accounting approach which could be applied consistently across a hydrogen supply network. This approach is consistent with the longstanding design of the LCFS and can properly account for the carbon intensity of hydrogen supplied and allocated across the network, regardless of the specifics of the technology used to produce the hydrogen.

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[2] *"There is a high degree of uncertainty around the availability of solar to support both electrification of existing sectors and the production of hydrogen through electrolysis. Producing hydrogen required under the Scoping Plan Scenario with electrolysis would require about 10 gigawatts (GW) of additional solar capacity. If steam methane reformation is paired with CCS, the hydrogen produced could potentially be low carbon. Additionally, the biomethane used to generate hydrogen could be sourced from gasification of forest or agricultural waste resulting from forest management and other NWL management practices, which could also lead to net negative carbon outcomes. Steam methane reformation paired with CCS can thus ensure a rapid transition to hydrogen and increase hydrogen availability until such time as electrolysis with renewables can meet the ongoing need, assuming there is also sufficient water supply" (p.88 2022 Scoping Plan Update)*

We understand and strongly support CARB's intention to ensure that low carbon hydrogen production credited under book-and-claim is additional or incremental to what is produced today and does not result in shuffling of existing conventional hydrogen production. Criteria to mitigate this concern may include a minimal carbon intensity reduction, initiated after a particular date, or a timeline for new, low carbon hydrogen to come online. We would like to work with CARB to develop robust criteria to ensure that any improvements to carbon intensity credited under the book-and-claim do not result in shuffling.

It is important that there be a temporal relationship to when the lower carbon hydrogen is produced and consumed as tracked through a material balance approach. We recommend that this be incorporated including monthly and quarterly tracking/reporting consistent with the established LCFS reporting cycle.

There shouldn't be a geographic limitation or requirement that eligible hydrogen be directed only to California as doing so will place a constraint on a nascent market that will stifle investments at a time when we need investments increase by orders of magnitude. To the extent that these hydrogen networks support renewable diesel or sustainable aviation fuel, a book-and-claim approach is a key provision, particularly in regions where these fuels are produced and support for book-and-claim in these regions would not impede development of pipeline networks within California. As mentioned above, these facilities are likely located in fuel producing regions across North America and connected to regional hydrogen hubs. For example, we believe that CARB would welcome projects where a direct-connected renewable electrolytic hydrogen facility produces hydrogen in the gulf coast that is ultimately consumed by a renewable fuel facility providing fuel to California. But a specific geographic limitation directing that hydrogen to California would make such a project ineligible. The lower carbon intensity of the hydrogen feedstock to renewable fuel facilities in these regions should be properly reflected in the carbon intensity of these low carbon liquid fuels provided that the fuels are consumed in California as doing so is consistent with science, the design of the LCFS, and delivers real reductions of greenhouse gas emissions.

In addition, we ask that CARB include a 'book-and-claim' approach to hydrogen that is transported in the form of important carriers such as ammonia (NH3) – essentially enabling the environmental attributes to be retained by the low-carbon hydrogen in the form of NH3 and comingled with other forms of NH3 in transportation systems (i.e., pipelines, vessels). NH3 is an established, globally traded commodity and is an efficient transport method for hydrogen over long distances. The NH3 can then be cracked to produce hydrogen at the location where it is needed as an energy source. In their Net Zero by 2050 roadmap, IEA[3] and others have documented these advantages and have even identified low-carbon NH3 as a promising way to decarbonize the global shipping industry when used as a fuel.

We also want to reiterate support for consideration of preferential allocation of low-carbon hydrogen to finished renewable or conventional fuels (governed by project-based crediting). Air Products views this as complementary to the expanded 'book-and-claim' provisions and believes that environmental attribute tracking and apportionment is important both within and without the hydrogen plant production process. The use of low-carbon electricity or feedstock, like renewable natural gas, should be apportioned to produce low-carbon hydrogen that can then be apportioned by volume through material balance to the most beneficial downstream uses – whether as a fuel or a feedstock. This apportionment should then continue, in the case when hydrogen is used as a feedstock, to the renewable or conventional fuel that is

[3] Net Zero by 2050 - A Roadmap for the Global Energy Sector (windows.net)

consumed in the state of California. The environmental attributes should not be 'diluted' through averaging if some portion of the produced fuel is exported from the state.

Lastly, while not specifically discussed in the workshop, we continue to urge CARB to expand the existing book-and-claim accounting approach for renewable natural gas and renewable electricity beyond use for production of hydrogen (feedstock) to use for process energy associated with other components of the hydrogen processing and distribution system to enable the carbon reduction ambition in California policies. Some examples of these components include the fuel and electricity needed for the production of the hydrogen in a steam methane reformer or other natural gas-based hydrogen production, and electricity demand for liquefaction. Extending book-and-claim provisions to process energy will not only incentivize bringing more renewable production on-line but will also enable hydrogen to further lower its carbon intensity helping California decarbonize cars, trucks, buses, and other equipment transition out of combustion everywhere possible.

Step Down and Ratcheting Mechanism

We support including both an initial 2024/2025 accelerated stepdown and automatic stringency 'ratcheting' mechanism in the amended regulation. The LCFS program is most effective when the credit pricing is consistently at a level that incentivizes the necessary decarbonization of the transportation sector and enabling the program to make this adjustment automatically would be very powerful for accelerating deployment of low carbon fuels. We believe that such a mechanism will be needed even more in the future as many policies and funding streams outside of the LCFS will contribute to decarbonization of transportation and further depress LCFS credit values translating into reduced investments, less innovation in clean low-carbon intensity fuels, and lost opportunities for millions of tons of reductions of greenhouse gases. For example, there are substantial programs that support battery electric vehicles outside of the LCFS and provide significant incentive to the purchase and use of light duty battery electric vehicles[4]. In terms of ratchet mechanism design, we prefer that the trigger bring stability to the market without price volatility, and that the action taken be predictable to provide more certainty as market participants project credit balance outlook and value.

Scenario Input

Air Products supports CARB evaluating a range of scenarios and encourages CARB to explore further scenarios that would better align LCFS carbon intensity targets with California's 2030 climate targets. We understand that individual model parameters selected do not necessarily represent CARB's preferred approach, but we do want to comment on our preferred regulatory outcomes based on the model scenarios presented.

First, we support CARB's plan to continue to incent all biomethane use for hydrogen under book-and-claim scenarios. This includes both full avoided methane crediting as well as no directional flow requirements for the biomethane. This will not only continue to incent beneficial use of biomethane wherever it can be cost-effectively developed, but also help lower the carbon intensity of hydrogen to enable broad use of low carbon hydrogen across many sectors consistent with the 2022 Scoping Plan Update as well as the state's commitment to the key role hydrogen must play in the energy transition

[4] Volkswagen Environmental Mitigation Trust Fund, California Energy Commission EnergIIZE Infrastructure Funding Program and Clean Transportation Programs, and the National Electric Vehicle Infrastructure Program

reflected in ARCHES. In fact, the ability to utilize book-and-claim biomethane to produce hydrogen should be extended from solely what is needed as feedstock to include all demand for process energy in the production of low carbon hydrogen. The same holds true for any process energy needs derived from renewable electricity, including for compression and liquefaction. The LCFS has and will continue to be an important and successful decarbonization policy which spurs carbon reducing investments nationally – including recovery and productive use of RNG. These investments are catalyzing significant innovation that is delivering progressively more reductions in greenhouse gases at low costs benefitting California and the planet. Now is not the time to limit the program's ability to do this as the LCFS helps drive the low carbon hydrogen market, especially as the state implements a clear transition to zero emission vehicles in the light-duty and heavy-duty segments.

As discussed further below, we continue to support the proposed Medium and Heavy-Duty (MHD) Hydrogen Refueling Infrastructure (HRI) credit cap at 2.5% of the previous quarter deficits, and that this credit cap of 2.5% must be in addition to a LDV HRI cap of 2.5% and stations offering both should have a combined cap of 5%. Any deficit caps for electrical infrastructure should be in addition to our suggested 5% for HRI credits. We believe that alternative scenarios modeled should reflect our proposal.

Hydrogen Refueling Infrastructure (HRI) Credits

We are pleased that CARB is proposing the expansion of HRI credits to stations serving MHD vehicles. Air Products strongly supports this expansion. The current HRI program, in combination with other California incentives, has been very effective in promoting the infrastructure build-out of zero emission fuels and vehicles. It is important that CARB build on this success by expanding the program to the truck and bus markets. This expansion will complement CARB's ambitious goals under the Advanced Clean Truck (ACT) regulation, the proposed Advanced Clean Fleet (ACF) regulation and help advance the state's goals for zero-emission vehicles in line with Executive Order N-79-20.

Air Products supports the extension of light-duty (LD) HRI credit generation beyond 2025 with the requirement that such hydrogen refueling stations (HRS) be located in designated disadvantaged communities. It is important to continue incentivizing the needed build out of LD HRS throughout the state beyond core market areas to bring hydrogen FCEV accessibility to a larger share of the state's population.

However, we believe that LD HRI still warrants a higher level of support than the 0.5% proposed. Air Products believes that the 2.5% deficit cap for HRI should remain in effect until the California Energy Commission targeted 200-station build-out is met.

We understand that CARB is concerned about allowing too many capacity credits to enter the market and have proposed to limit them to 6% of the total deficit cap – equally split between electric vehicle charging and HRI credits. However, we believe that you can eliminate entirely the 2.5% deficit cap allocated for light-duty battery electric vehicle charging. Electricity-based credits significantly out pace hydrogen-derived credits in the program despite only 1 % of them being from EV charging credits. Based on the level of support that non-capacity-based crediting affords electricity in the regulation, along with many other policy supports and incentives for charging infrastructure in California, providing charging credits for the established light-duty battery-electric market is not needed in the LCFS. For example, the Volkswagen Environmental Mitigation Trust Fund, California Energy Commission EnergIIZE Infrastructure Funding Program and Clean Transportation Programs, and the National Electric Vehicle Infrastructure Program all

heavily subsidize electric charging infrastructure exclusively or relative to their funding of HRI. If this crediting is eliminated for light-duty vehicles, this would reduce the cap for both EV charging and HRI credits to 7.5% (5% combined for HRI of all vehicle classes, and 2.5% for MHD vehicle charging infrastructure). We recommend that CARB run the model of the selected scenario with a sensitivity analysis at both a 6% and 7.5% deficit cap to determine if there is a substantive impact on the credit pricing.

To ensure that the MHD HRI crediting approach is effective in promoting the advancement of this infrastructure, we offer feedback below on the concepts proposed to date.

- We support the proposal to require an eligible MHD station to be within one mile of a federal highway administration alternative fuel corridor. By the end of this year, the California Transportation Commission will release a report specifying optimal MHD refueling locations and corridors required by SB-671. We suggest that this eligibility requirement be linked to a location based on either the SB-671 report or the federal highway administration alternative fuel corridor.

- We believe that private fleet MHD vehicle stations (behind the fence) should also be able to earn HRI credits and that crediting should not be limited to only stations serving more than one fleet. This is an important complement to the anticipated Advanced Clean Fleet regulation adoption and will help facilitate fleet transitions for mass transit and ports where public access is unlikely. This is particularly important for rural and small transit and municipal fleets. Offering MHD HRI credits to these fleets operating their own HRI infrastructure will help these fleets overcome the high initial capital costs and transition sooner to zero-emission vehicles – many of which operate in disadvantage communities.

- Air Products believes that fuel-cell electric vehicles (FCEVs) will prevail over battery electric vehicles (BEVs) by replacing diesel fuel across major heavy-duty transportation markets. We recognize the impact of Economic Efficiency Ratio's (EERs) may have in the relative assessment of fuel-cells in comparison to diesel fuel and especially fuel-cells in comparison to battery electric vehicles.

  The relative EER value between FCEV and BEVs is particularly important in the evaluation of comparative emission reduction and resulting LCFS credits between the two zero-emission tailpipe vehicle options. Currently LCFS policy expect BEVs to achieve 263% higher efficiency for heavy-duty BEVs in comparison to heavy-duty FCEVs as reflected in LCFS §95486.1 Table 5 EER values of 5.0 and 1.9 assigned to BEVs (including plug-in electric vehicles) and FCEVs, respectively.

  Air Products recognizes the difficulty in estimating EER performance of entirely new vehicle technologies, and we expect EERs assigned to LCFS policy and crediting should reflect empirical vehicle performance over time. Through early market demonstration programs fuel-cell bus providers and transit agencies have progressed from testing to early commercial bus deployments and the bus demonstrations are showing very

encouraging results. The latest report[5] from Orange County Transportation show FCEBs achieving an EER of 2.3 on a diesel gallon equivalent basis. Similarly, Alameda-Contra Costa Transit District (AC Transit) 5x5 Study has provided real-time testing of bus propulsion systems in the same service environment. AC Transit is reporting higher EERs for FCEBs and more favorable relative EER of fuel-cell buses to battery electric buses in AC Transit's latest Zero Emission Transit Analysis report[6].

The higher EER performance of FCEBs in comparison to diesel buses and improved relative efficiency of fuel-cell buses in comparison to battery buses suggests CARB consider an EER value higher than 1.9 for fuel-cell buses and lower EERs for battery electric buses.

- Consistent with past crediting windows, we believe that for the MHD trucks, a full 15-year crediting period should be allowed. This will help ensure continued station support through 2045 when there is finally a 100% ZEV sales mandate for heavy-duty vehicles pursuant to Executive Order N-79-20.

- As the eligible nameplate refueling capacity of a HRS is determined by the HySCapE model, Air Products suggests that CARB provide an allowance in the model for multi-modal stations that are designed and built to support both LD and MHD refueling. We believe that the deficit and credit caps should be additive for these stations based on the final caps adopted in the regulation. For example, stations credits should be capped based on the combined maximum of 1,200 kg/day (LD) and 6,000 kg/day (MHD) for a total of 7,200 kg/day.

- We support CARB's proposal for a Maximum Station Capacity of up to 6000 kg/day and not determine it on a case-by-case basis. Stipulating a MHD HRS maximum station capacity provides private HRS developers more market certainty that can be factored into HRS business and network planning.

- We support CARB's intention to update and use this HySCapE model for the MHD HRI credit program. We also support CARB's reference to the latest version of the model in the regulation but want to make sure that it delineates credits appropriately for multi-modal hydrogen stations, i.e., those serving both LD and MHD FCEVs.

    - We continue to believe that CARB should provide flexibility in the MHD vehicle HRI language to include new fueling methods that may not be included in HDV HySCapE model. For example, MHD vehicle fueling may include liquid hydrogen fueling in the future.

- § 95486.3.a(4)(G) indicates that "the HRI crediting cancels after 24 months if FSE is not operating and if estimated potential HRI credits from all approved FSEs exceed X percent of deficit." Please clarify that if the potential HRI credits are below the deficit limit, that

[5] Orange County Transportation Authority "Zero-emission Bus Pilot Update. Summary Report" (2022).
[6] AC Transit Zero Emission Program "Zero Emission Transit Bus Technology Analysis – Volume 4 (published December 14, 2022).

the approved HRI station will get a time extension beyond 24 months.

- We see that future stations might have an increased renewable content requirement pursuant to §95486.3 (a)(4)(F). Currently, the 40% renewable requirement applies to all stations receiving credit statewide. If there is a future higher renewable requirement, will it only apply to newly 'applied-for' stations receiving HRI credits statewide or will it retroactively apply to both new stations and existing stations complying with the existing 40% requirement. We suggest that existing stations receiving credits prior to any increase in renewable requirement be allowed to stay at the 40% requirement for the remainder of their crediting period and that the increase renewable requirement apply only to stations granted HRI credits after a certain date.

- Section 95486.3.a(4)(H) Caps HD HRI credits to initial eligible capital expenditure reported and cumulative value of MHD-HRI credits earned.

    - Does this include hydrogen production and distribution costs upstream of the stations? If not, CARB should ensure sure that on-site hydrogen production costs are not included in the capital calculation which would create an unlevel playing field. §95486.3 (a)(6)(B)(1) would create a situation that favors on-site hydrogen generation vs. the more efficient centralized hydrogen production and distribution approach. We also suggest that operations and maintenance costs be included in the MHD HRI payback metric as these are differential to the costs associated with electric vehicle charging.

    - Please clarify if it is CARB's intention to reduce the MHD HRI crediting to less than 10 years based on this payback metric?

Hydrogen Tier 1 Simplified Calculator

Air Products greatly appreciates CARB's issuance of a Tier 1 Simplified Calculator for hydrogen. Air Products has begun its review of the calculator and will offer comments separately in that docket.

ZEV forklift placeholder

Air Products is not opposed to phasing down electric forklift crediting based on existing fleets that effectively transitioned to electrification where credits under the LCFS are understood to have little to know impact on the rate or magnitude of the transition (i.e., electrification is the baseline for new purchases/replacements and no longer should be considered an opt-in source eligible to generate LCFS credits). This is a durable principle that can be applied to other sectors when the transition is sustainable. However, we do not believe that adjusting the Energy Economy Ratio (EER) is a valid way to do this and are concerned about the precedent this will set for other vehicle classes. The carbon intensity targets in the LCFS regulation are anchored on the carbon intensity of the base fuels – gasoline and diesel. The EERs that are used in the credit generation calculation should likewise always be calculated relative to conventional fuel vehicles that are being replaced. This helps ensure proper crediting for the vehicle turnover that is needed to comply with various ZEV regulations and mandates.

Air Products supports CARB's rulemaking and an update to credit calculation to target electrification of the remaining internal combustion forklifts. Air Products recommends the forecast include the expected market potential for hydrogen powered fork-trucks in the forecasted conversion to electrification. The scope of CARB's updated study should include the inventory of large-spark ignition diesel equipment that is not subject to Large Spark Ignition Regulation requirements.

Intrastate Jet Inclusion as Deficit-Generating Fuel

Air Products is supportive of actions to further the state's decarbonization goals and stimulate additional credit demand in the LCFS program. To this end, we are supportive of including intrastate jet fuel as an obligation-generating fuel. This will spur demand for cleaner jet fuel and possibly hydrogen for aviation in the future consistent with Governor's Newsom's target of 20% sustainable aviation fuels by 2030 and the 2045 scenario action in the 2022 Scoping Plan Update.

Project-Based Crediting

At the workshop, CARB presented the concept of phasing-out project-based crediting for refineries, including the ability to use renewable hydrogen in refinery processes. We urge CARB to reconsider keeping this particular project -based crediting component. 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 recognizes the role that hydrogen can play to ensure that residual petroleum refining helps meet CARB's decarbonization goals for the transportation sector. This proposal also appears to correspond to a credit price spike around 2040 in the scenario modeling that was presented. Allowing this crediting to continue may help mitigate this credit price spike.

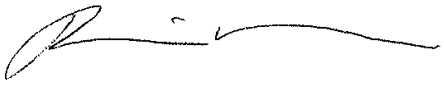
CARB's proposal to clarify that hydrogen production facilities not co-located with a refinery can generate credits under the refinery investment credit and renewable hydrogen provisions is an important clarification and provides equitable treatment between third-party hydrogen production and production embedded in refinery operations. Air Products is very supportive of this change and any other additional proposals to expand crediting for projects that reduce emission for hydrogen used in conventional refineries.

Model and Factor updates

Air Products supports CARB updating the CA-GREET model to the latest version (GREET 2022) from Argonne National Labs and the U.S. Environmental Protection Agency eGRID 2022 values. There have been important updates to factors in both models and it is important that the LCFS recognizes the latest and most accurate factors. Moreover, an accurate and current accounting of electricity carbon intensity should be applied not only to electrolytically-produced hydrogen and balance of plant operations, but also extended to all aspects of hydrogen production and processing (i.e., liquefaction). Providing for annual updates as the grid mixes improve for all parts of the hydrogen supply chain will ensure that lower carbon hydrogen will be incented and promoted for use in California.

Air Products appreciates the opportunity to provide this feedback and we would like to meet with CARB to discuss any of these topics further. Please feel free to contact me by phone (916-860-9378) or email hellermt@airproducts.com.

Respectfully,



Miles Heller
Director, Greenhouse Gas Government Policy