To: **Liane M. Randolph**, Chair, California Air Resources Board
Honorable Board Members, California Air Resources Board

From: Steven S. Cliff, Ph.D., Executive Officer, California Air Resources Board

Date: September 25, 2024

Subject: California Truck Availability Analysis

I am writing to provide an update on the availability of medium- and heavy-duty vehicles in California for the 2024 model year (MY) and to respond to concerns raised at the May Board hearing. I am also including responses to ongoing questions regarding potential differences between zero-emission truck (ZET) pricing in the United States and in Europe.

On May 23, 2024, staff presented to the California Air Resources Board (CARB or Board) proposed amendments to the Advanced Clean Trucks (ACT) regulation. At the hearing, numerous upfitters and dealers spoke about their current inability to receive combustion products from manufacturers in California. They primarily attributed the issue of limited chassis availability to the ACT regulation. In response to these comments, the Board deferred its vote on the proposed ACT amendments to a future hearing and directed staff to work with industry to assess the situation further. This memo provides an update on the situation and staff's findings based on conversations with the affected parties.

Background

In California, the transportation sector alone accounts for 41% of total greenhouse gas emissions (50% when upstream emissions from fuel is included) and is a major contributor to oxides of nitrogen (NOx) and toxic diesel particulate matter (PM) emissions. Medium- and heavy-duty vehicles contribute a quarter of the transportation sector's greenhouse gas emissions and a third of the transportation sector's NOx emissions, a disproportionately high share considering these vehicles represent only about 1.8 million trucks of the 30 million registered vehicles in the state.

CARB has adopted several programs aimed at achieving California's criteria pollutant and greenhouse gas reduction goals, including regulating manufacturers under the ACT and HD Omnibus regulations and setting requirements for fleets in the Advanced Clean Fleets (ACF) and Clean Truck Check regulations. Actions toward reducing emissions have been taken at the federal level as well, most recently with the adoption of the Clean Trucks Plan and Phase 3 greenhouse gas emissions standards for heavy-duty (HD) vehicles.

The ACT regulation, adopted by CARB in June 2020, and approved by the Office of Administrative Law (OAL) in March 2021, reduces emissions beyond what can be achieved with internal combustion engines (ICE) and assists California in attaining the State's air quality and climate mitigation targets. The ACT regulation requires manufacturers of

Class 2b-8 vehicles to produce and deliver for sale an increasing percentage of zero-emission vehicles (ZEV) over time starting with the 2024 MY. The ACT regulation will ensure ZEVs are available for purchase and includes flexibility for manufacturers to strategically focus on vehicle models that are most suitable for electrification, but it does not require any specific fleets, dealers, or others to purchase these vehicles. The amendments proposed at the May hearing consist of generally minor, administrative changes that would address minor issues that have arisen through the rule's implementation, would ensure alignment with the original intent of the rule, and fulfill some of CARB's commitments in the Clean Truck Partnership (CTP) agreement.[1]

Announced in July 2023, the CTP is an agreement between CARB and the nation's leading truck manufacturers that advances the development of ZEVs for the trucking industry and provides flexibility for manufacturers to meet emissions requirements while reaching the state's climate and emission reduction goals. The agreement marks a commitment from the manufacturers to meet California's vehicle standards, including standards that will require manufacturers to only produce and sell ZEVs starting with the 2036 MY. As part of the CTP agreement, CARB agreed to initiate a rulemaking action in 2024 to include specific changes to the ACT regulation that are part of the amendments proposed to the Board in May.

The HD Omnibus regulation was adopted by CARB in September 2021 and approved by OAL in December 2021. The regulation primarily establishes more stringent exhaust emission standards for NOx and PM emissions for new on-road medium- and heavy-duty ICEs for sale in California starting with the 2024 MY. The regulation additionally revamped the HD in-use testing program, established powertrain certification test procedures for HD hybrid vehicles, implemented a new low-load test cycle, and increased the useful life and warranty periods for HD engines. The HD Omnibus regulation is expected to result in significant emission reductions from 2024 MY and newer engines sold in California.

One of the compliance flexibilities in the HD Omnibus regulation is the legacy engine provision that allows limited production of HD engines that meet the 2010 MY NOx and PM emissions standards, referred to as legacy engines. Legacy engine sales in California are only allowed if the manufacturer offsets any excess NOx and PM emissions deficits with HD combustion credits, performing emission reduction projects in disadvantaged communities in California, or with HD zero-emission (ZE) powertrain credits. The mechanism for generation and use of HD combustion credits and HD ZE powertrain credits is further described in the California Averaging, Banking and Trading provisions of the Omnibus regulation. Each manufacturer is limited on the number of legacy engines they can sell

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[1] California Air Resources Board, Clean Truck Partnership, 2023 (web link: *https://ww2.arb.ca.gov/sites/default/files/2023-07/Final%20Agreement%20between%20CARB%20and%20EMA%202023_06_27.pdf*, last accessed September 2024).

based on their total HD diesel engine production, also known as the legacy engine sales caps.

In February 2023, CARB staff became aware that while the technology for diesel-fueled HD Omnibus-compliant engines was available, some manufacturers did not intend to produce compliant engines for several categories of trucks for the 2024-2026 MY period. Given the impacts to fleets, additional flexibility was desired to enable a smoother transition to the HD Omnibus standards. Accordingly, in December 2023, CARB amended the legacy engine provisions in the HD Omnibus regulation to allow engine manufacturers to sell an increased number of legacy engines i.e., increased the legacy sales caps in the 2024 and 2025 MYs, as well as extend the provision to the 2026 MY so long as all excess emissions deficits are offset. This change to the legacy engine provisions was also part of the CTP agreement. The intent of the 2023 HD Omnibus amendments was to minimize HD product availability issues in California for the 2024-2026 MY transition period. The new legacy engine sales caps were developed in a collaborative manner with the Truck and Engine Manufacturers Association, its members, and the Ford Motor Company.

The ACF regulation, adopted by CARB in April 2022 and approved by OAL in October 2023, aims to accelerate the widespread adoption and usage of ZEVs in the medium- and heavy-duty truck sector, and light-duty vehicles used in mail and package delivery, to reduce harmful emissions generated from on-road mobile sources. The regulation requires drayage trucks, government fleets, and well capitalized businesses to phase-in increasing number of ZEVs and establishes a clear end date of new medium- and heavy-duty ICE vehicle sales in 2036 which creates a catalyst to accelerate development of a HD public infrastructure network.

Summary of Findings

Since the May hearing, staff met with representatives from all major HD truck and engine manufacturers, including Cummins, Daimler, Ford, GM, Hino, Isuzu, Navistar, Paccar, Stellantis, and Volvo/Mack. Each original equipment manufacturer (OEM) was presented with a consistent set of questions regarding the current availability status of the tractors and medium- and heavy-duty vehicles that they offer. Staff additionally met with several dealer, upfitter, and fleet representatives, some of which spoke at the May hearing, to hear their issues and insights from their perspectives.

This section compiles the information gathered from discussions with the affected parties regarding the current product shortage issues.

Which vehicles and engines are affected?

The shortage varies by vehicle type, but generally affects Class 4-8 diesel HD vehicles, with a prevalent impact on Class 6 and 7 vehicles (which typically use medium heavy-duty (MHD) engines). Each manufacturer is dealing with a unique situation, but the factors driving the

availability issues, outlined in the following sections, appear to be broadly consistent amongst the manufacturers.

What is the impact of the Advanced Clean Trucks regulation?

The OEMs indicated that the product availability issues for the 2024 MY are not driven by the ACT regulation, as evidenced by the excess of ZEV credits available based on the ACT credit summary through the 2023 MY.[2] All of the regulated OEMs have ZEV products available for the market in the 2024 MY, and many have already sold ZEVs in previous years to build up an early credit bank. Most manufacturers have also indicated that they are open to purchasing ACT credits from other OEMs if the economics make sense but would ultimately prefer to sell ZEVs themselves. In addition, the lower-than-expected overall sales of 2024 MY engines are effectively decreasing each manufacturer's ZEV sales requirement under the ACT regulation as ZEV sales requirements are based on a percentage of total sales volumes.

Why are manufacturers requiring ZEV sales ratios?

Through discussions with manufacturers, dealers, and fleets, it appears numerous manufacturers have begun to inform their customers they will be applying future requirements to purchase ZEVs before they can acquire combustion vehicles to each of their dealer or upfitters regardless of the types of vehicles they sell as ZEVs. Some have expressed plans to begin implementing a rigid policy to require each dealer or upfitter to purchase a certain number of ZEVs from the manufacturer before they can get any ICEs whether or not the manufacturer offers ZEVs in the market segment the dealer specializes. For example, one dealer may focus on selling school buses which are already being electrified today while another may focus on specialized municipal equipment. In contrast to these manufacturer ratios, the ACT regulation includes flexibility for manufacturers to strategically focus on vehicle models that are most suitable for electrification, but it does not require any specific fleets, dealers, or others to purchase these vehicles.

The purpose for these ratios varies depends based on the manufacturer. Some are using these ratios in order to meet their percentage sales requirement under the ACT regulation and as a result are requiring a ratio of roughly 1 ZEV to 10 to 15 ICE vehicles, which essentially pushes the ACT regulation's requirement onto the dealership or fleet. In other cases, manufacturers are requiring ZEV sales in order to generate NOx credits as they did not plan to have an HD Omnibus-compliant engine and are instead setting ratios of 1 ZEV to 1 to 3 ICE vehicles in order to achieve compliance. These policies do not appear to be

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[2] California Air Resources Board, Advanced Clean Trucks Credit Summary Through the 2023 Model Year, 2024 (web link: *https://ww2.arb.ca.gov/resources/fact-sheets/ACT-Credits-Summary%202023*, last accessed September 2024).

causing acute product shortages today but will have an increasing impact in 2025 MY and beyond as more manufacturers implement ZEV ratios across their product portfolio.

Further, it appears that there is a discrepancy between what manufacturers are communicating as the main cause of the current product shortages to CARB staff versus to the dealers and fleets. Dealers and fleets conveyed that they recently heard from sales representatives from a number of manufacturers that the product shortage issues are primarily driven by the ACT regulation while referring to these ZEV ratios while other representatives from the same manufacturers have been specifically communicating to CARB staff that this is not the case for the 2024 MY. Staff believes that attributing the driving factor to the ACT regulation could be a sales strategy to continue ramping up ZEV sales and towards building a credit bank for the ACT requirements in the 2025 and 2026 MYs despite the current surplus of ACT credits. Nevertheless, the inconsistencies in communication have lead dealers and fleets to believe that the ACT regulation's requirements are leading to the product shortages in the medium- and heavy-duty space which, upon discussions with all affected parties, is not backed by the data available.

In summary, the manufacturers are well-situated to comply with the ACT regulation's requirements for the 2024 MY and there are more than enough available ACT credits that manufacturers could purchase, if necessary, to sell dealers what is needed. In anticipation of requirements in the upcoming MYs, some manufacturers are requiring dealers to sell ZEVs in order to receive combustion vehicles which affects the current acquisition issue to a small degree, but this is also a strategy that aligns with the ACT regulation’s requirements. Lastly, while OEMs are largely informing dealers and fleets that the ACT regulation is placing limits on the number of ICE vehicles which can be delivered, they have alternatively confirmed with CARB staff that this is not the case for the 2024 MY, which is consistent with the current ACT credit surplus. This apparent contradiction appears to be the result of manufacturers needing to ensure their sales representatives and customers are continuing to make progress on increasing ZEV uptake to meet their upcoming ACT requirements in future years even if their current requirement for 2024 MY has been met.

What is the impact of the Heavy-Duty Engine and Vehicle Omnibus regulation?

Heavy-duty engine manufacturers are currently offering a mix of Omnibus-compliant and legacy engines for sale in California. CARB staff anticipates that the engine manufacturers would continue the same sales strategy for 2024-2026 MY period while they gradually phase-out their legacy engine sales due to Omnibus legacy engine sales caps. Several manufacturers have recently announced the introduction of new Omnibus-compliant

engines. These include new HD engines by Volvo[3], Paccar[4] and Cummins[5] which can be used in class 8 vocational and tractor vehicles. CARB staff believes that manufacturers will continue to introduce additional Omnibus-compliant engines for various truck configurations in 2025 and 2026 MYs, thereby helping alleviate future product availability issues.

Based on conversations with the stakeholders, CARB staff believes that product availability issues in 2024 may be caused by limited supply of MHD engines made by a specific engine manufacturer, which is the dominant manufacturer in the MHD sector. The shortage concerns have been voiced primarily by the tow truck and municipal vehicle industries.

CARB staff has also discovered that while some engine manufacturers have limited their MHD legacy engine sales because of the legacy engine sales caps, there are at least two other engine manufacturers who have surplus legacy engines and have the capacity to sell additional MHD engines in California dealerships. At this stage, it is unclear if upfitters and secondary manufacturers have fully explored whether they can quickly switch to other engine platforms to produce tow trucks and municipal vehicles.

As indicated above, the 2023 HD Omnibus amendments were specifically designed last year to address product availability issues for the 2024-2026 MY period. It should also be emphasized that the CTP agreement explicitly specifies the legacy engine sales caps for various HD engine service classes for the 2024-2026 MY period. These sales caps were developed in a collaborative fashion between CARB and the CTP signatories. At the time, OEMs informed CARB that, to the best of their knowledge, the legacy engine sales caps would alleviate product availability issues for MHD engines.

Based on the information collected by CARB staff, the following factors appear to be contributing to the current product availability issues:

- The sales projections used by some OEMs at the time of CTP signing were inaccurate, underestimating the number of compliant engines they would sell. This has led to significantly fewer legacy engines being available.
- Several California-based companies have historically procured vehicles from out-of-state dealerships. Given the new California emissions requirements under the HD Omnibus regulation, out-of-state dealers have very limited or no allocations of

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[3] Volvo Trucks, Volvo Trucks North America Announces Availability of CARB 2024 Omnibus Compliant Heavy-Duty Engine, 2024 (web link: *https://www.volvotrucks.us/news-and-stories/press-releases/2024/july/volvo-trucks-north-america-announces-availability-of-carb-2024-omnibus-compliant-heavy-duty-engine/* , last accessed September 2024)

[4] PACCAR, CARB MX 13, 2024 (web link: *https://paccarpowertrain.com/products/carb-mx-13/*, last accessed September 2024)

[5] Cummins, X15 N (2024), 2024 (web link: *https://www.cummins.com/engines/x15n-2024*, last accessed September 2024)

HD Omnibus-compliant engines. These California-based companies are now reaching out to California dealerships for Omnibus-compliant engines. However, California dealers may be prioritizing their existing and well-established customers and are only providing a limited number of engines to their new customers. Dealers ultimately determine how to distribute their allocation, which further affects the ability for some fleets to obtain HD engines

- Product offering by OEMs are based on internal business decisions. Given the legacy engine sales caps, companies have focused production efforts on platforms with the highest profit margins while eliminating low-margin products. It should be noted that even if additional MHD engines become available, they may or may not end up being used for tow truck or municipal applications

Given that CARB is a signatory to the CTP agreement, there is no mechanism for CARB to unilaterally change the legacy engine sales caps without breaching the partnership agreement. A collaborative solution between CARB and the CTP signatories would be needed to address any adjustments to legacy engine sales caps.

What is the impact of the Advanced Clean Fleets regulation?

At the May hearing, several representatives of tow truck fleets expressed concerns over the current infeasibility in acquiring and deploying ZEVs pursuant to the ACF regulation in their respective industry due to high costs and operational restrictions. However, the ACF regulation does not require tow trucks to be purchased as ZEVs until 2027 in addition to providing numerous safeguards if a ZEV is not available or does not meet a fleet's needs.

Larger tow truck fleets may be affected by the ACF regulation if they have either $50 million or more in gross annual revenue, or that own, operate, or direct the operation of a total of 50 or more vehicles. Based on conversations with industry, only a handful of tow truck fleets are large enough to meet these thresholds, so the remainder of these smaller tow truck fleets are exempt from the ACF regulation. Under this regulation, larger fleets following the ZEV Milestones pathway have no requirement to purchase ZE tow trucks until 2027. This puts work trucks, including tow trucks, on a later schedule; however, some advanced ZEV purchases in this category would be appropriate as fleets progress towards the 2027 requirement. The ACF regulation also offers several exemptions and flexibilities to assist in the challenges that come with ZEV acquisition, including cases in which available ZEVs do not meet a fleet's daily operational needs, and delays in infrastructure construction.

In summary, only a portion of tow truck fleets are affected by the ACF regulation, and the requirements on these vehicles acknowledge and reflect the challenges that could be applicable with electrifying tow trucks. In light of these facts, staff determined the ACF regulation is not having an impact on the availability of tow trucks currently.

What other factors are impacting the California market?

With the upcoming implementation of U.S. Environmental Protection Agency's HD emissions standards in the 2027 MY, almost all existing HD engine families will be phased out within the next two years at the national level. Given that California is ahead of the nation in terms of HD emissions requirements, we are seeing this phase-out happen sooner in California than elsewhere. Customers will eventually have to reevaluate their options for HD engines and choose new replacement products.

Other factors contributing to the overall product shortage situation, per the OEMs, include a nationwide downturn in the market, supply chain issues carrying over from previous years not caused by CARB regulations that are limiting the OEMs' ability to produce trucks, and manufacturers not being sufficiently prepared to comply with the HD Omnibus regulation. Additionally, some vehicle upfitters producing specialty vehicles, including tow trucks, have reached maximum production capacity thresholds nationwide and cannot increase production levels, which affects the manufacturers' ability to accept new orders. Finally, with the introduction of the federal Clean Trucks Plan,[6] the phase-out of all legacy engine productions will be implemented nationwide within the next two MYs. These additional factors have significant cumulative impacts on the current unavailability issues, and all vary by manufacturer.

Truck Price Comparison between California and Europe

At the May Board hearing, questions were raised regarding the growing differences between ZET pricing in the U.S. and in Europe as well as the reasons for it. To better understand the situation, Clean Truck and Bus Voucher Incentive Project (HVIP) staff undertook a preliminary assessment of pricing levels for a key category: ZE Class 8 tractors in the U.S./California and for the equivalent models (Class 5 Long Haul (LH)) in Europe.

Broadly, the same manufacturers operate in both the U.S. and Europe under a variety of brands:

- Daimler Truck is the parent company of Mercedes-Benz Trucks in Europe and Freightliner among other brands in the U.S.
- Traton is the parent company of MAN and Scania trucks in Europe and Navistar in the U.S.
- PACCAR is the parent company of DAF in Europe and Peterbilt and Kenworth in the U.S.
- Volvo Trucks operates in both Europe and the U.S., and owns Mack Trucks in the U.S.

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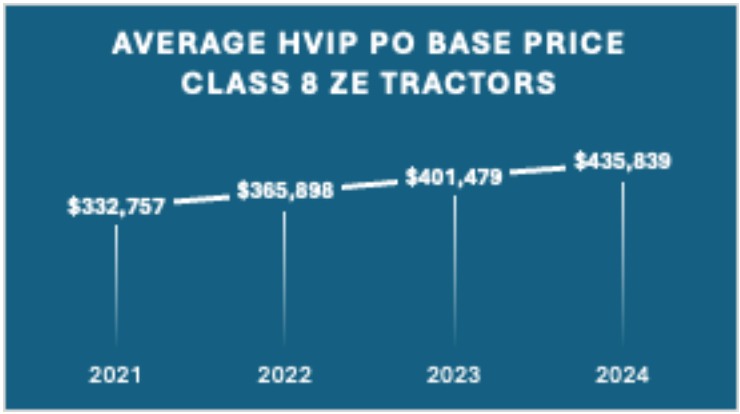
[6] U.S. EPA, Clean Trucks Plan, 2022 (web link: *https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-and-related-materials-control-air-pollution*, last accessed September 2024)

Pricing data in California have been pulled directly from purchase orders submitted as part of the HVIP voucher request process. Pricing in Europe has come from industry sources in the European Union (EU) and was compared for the period from 2021-22 against pricing seen in 2024.

Europe Zero-Emission Trucks have Lower Whole Vehicle Prices Compared to Equivalent California Zero-Emission Trucks

The preliminary findings from this research are revealing and are summarized as follows:

- The average California ZE Class 8 tractor in 2024 was priced at $435,839.
- The average European ZE tractor of similar capability to California. tractors (Class 5 LH in Europe) in 2024 were priced at $347,001.
- U.S. ZE tractors averaged $88,828 more to purchase than in Europe.



Europe Zero-Emission Trucks Have Lower Zero-Emission Powertrain Incremental Pricing Than in United States/California

There are differences between European and American tractor designs. To separate any price offset of the base tractor (known as a "glider") price from the powertrain (including batteries) price, HVIP examined the incremental pricing: the difference between the base diesel price in each region and the ZET price. While the equivalent trucks have detailed base tractor differences, the powertrains for ZETs are essentially the same in both regions and allow a direct "apples-to-apples" comparison. The findings were stark, as follows:

The incremental ZE powertrain price for California Class 8 ZETs in 2024 averages $279,937.

The incremental ZE powertrain price for European Class 5 LH ZETs averages $228,153.

EU incremental ZE powertrain price averages $51,784 lower than equivalent California incremental price even when accounting for lower base truck pricing in the EU. (European diesel trucks costing less than U.S. diesel trucks).

European Zero-Emission Truck Pricing is Going Down; U.S. Zero-Emission Truck Pricing is Going Up

- California zero-emission trucks (ZET) have increased in price by an average of $86,512 since 2021-22.
- European ZETs have decreased in price by an average of $12,641 in that same period.

There appear to be no clear reasons for this disparity between regions. Total ZET sales volumes are comparable between each region. Some European industry observers have noted that as battery prices are edging lower, generally vehicle makers in Europe have increased capability (increased battery size, range) while holding prices steady or lower. This is not the observed trend in California. There also appears to be some OEM price competition in Europe in advance of the Vehicle Energy Consumption Calculation Tool CO_2 model reporting deadline in 2025.

Next Steps

Staff intends to return to the Board at the upcoming October hearing to present their findings in addition to providing a final recommendation on the proposed amendments to the Advanced Clean Truck (ACT) regulation. While the proposed amendments are relatively minor and predominantly apply to compliance in the upcoming years, the changes are expected to provide manufacturers with more flexibility in complying with the ACT regulation as the market adjusts and potentially mitigate pressure on truck purchasers in future years, as explicitly expressed by many of the manufacturers.

The adoption of the ACT and Heavy-Duty Engine and Vehicle regulations are two of the largest actions taken by the Board in the pursuit of reducing criteria pollutant and greenhouse gas emissions in California and are critical in achieving the State's air quality and climate change goals. Subsequently, these regulations are significantly changing the current dynamics of the truck market in California and increasing the penetration of the first wave of ZE HD technology is expected to be difficult. However, measures have been taken through the Heavy-Duty Engine and Vehicle amendments, the proposed amendments to the ACT regulation, and other future actions to remedy unanticipated challenges that come with the changing market.