October 28, 2021

California Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: Informal Public Comments on the Proposed Advanced Clean Fleets Rulemaking (acf-comments-ws)

Allison Transmission, Inc. ("Allison") is pleased to comment on the California Air Resources Board's ("CARB's") proposed regulatory language designed to implement the Advanced Clean Fleets ("ACF") program, specifically amendments related to high-priority and federal fleet requirements, drayage trucks, the 2040 100 Percent ZEV Sales Requirement and Public Fleets. Allison appreciates the public process that CARB has followed in the development of these proposed regulations, including the multiple public workshops that have been conducted, staff PowerPoint presentations containing information on the programmatic elements under consideration and the current ability to comment on draft regulatory language.

In general, Allison agrees that zero emission vehicles ("ZEVs") will serve many important roles in the commercial sector, particularly with respect to stop-and-go vocational vehicles provided that sufficient infrastructure exists to support the deployment of such vehicles. Allison also believes, however, that it will take additional time for both vehicle electrification technology and related infrastructure to be developed and deployed to meet commercial vehicle requirements. Despite the progress that has been made by Allison and other companies to develop electric propulsion technology, additional time is necessary to further validate ZEV technological readiness as well as to further identify "bridge technologies" that may be available to assist in the transition away from internal combustion engines and vehicles.

Headquartered in Indianapolis, Indiana with over 1,000 dealer and distributor locations in the United States, Allison is well-positioned to be part of this process. Our company is the world's largest manufacturer of fully automatic transmissions for medium- and heavy-duty commercial vehicles and is a leader in hybrid propulsion systems for city buses; in addition, Allison's emerging eGen Power™ electric e-Axles will offer bolt-in solutions compatible with current vehicle frames, suspensions, and wheel ends, compatible with full battery electric vehicles (BEV) and fuel cell electric vehicles (FCEV) as well as range extending hybrid applications. With a market presence in more than 80 countries, Allison's products are specified by over 250 of the world's leading vehicle manufacturers and are used in a variety of applications including refuse, construction, utilities, fire, pick-up and delivery, distribution, bus, motorhomes, defense, and energy.

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CARB's current effort provides an opportunity to align the efforts of manufacturers, regulators, and fleets to achieve substantial environmental results. However, to maximize the opportunities for success, Allison would recommend several changes to the proposed programs. Specifically, prior to finalization of regulatory language, CARB should consider the following actions:

- CARB should incorporate additional flexibility mechanisms within the proposed regulatory language to implement the ACF program. While CARB has allowed some ability to utilize near-zero electric vehicles ("NZEVs") for compliance with zero emission vehicle ("ZEV") standards and has provided other specific exclusions to ZEV mandates, CARB should additionally consider how alternatively-fueled vehicles can play a role in meeting the state's greenhouse gas emission targets. Alternatively-fueled vehicles offer potentially significant near-term gains in environmental performance and could be integrated into the ACF program to allow sufficient time to address remaining technological and operational issues concerning ZEVs and NZEVs as well as related ZEV infrastructure needs. Specifically, CARB should allow regulated entities to comply with ZEV purchase and fleet percentage requirements using low-carbon alternative fuels, including renewable natural gas. These fuels can offer "drop in" capability to lower carbon dioxide ("CO_2") emissions, particularly in vehicle categories where high utilization rates are needed and/or overnight recharging infrastructure may not exist.

- CARB should also broaden the definition of NZEV to include vehicles with other types of hybrid technology suitable to reducing emissions for the vehicle's typical duty cycle, such as electric power take-off ("ePTO") or hybrid with All Electric Range ("AER") operation. Even if these advanced technologies do not include a plug-in charging and therefore do not fit the strict regulatory definition of NZEV, these hybrid systems can result in significant reductions in CO_2 and criteria pollutants that benefit many local environments, including disadvantaged areas. Finally, CARB should consider crediting for post-production software that can be utilized to reduce existing fleet CO_2 and criteria air pollutant emissions.

- The use of fleet percentage milestones for high priority and federal fleets should be reconsidered. This regulatory approach effectively results in near-100% ZEV mandates applying as soon as 2025 to 2030 in vehicle categories where electric options are limited or unavailable at the required scale. This regulatory approach could be especially problematic for specialized trucks that are custom-made and normally owned by one entity throughout their useful life. CARB should recognize that near-term ZEV options are not available for these vehicles and that this means a different regulatory approach is required to transition specialty vehicles to low or zero carbon options.

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- CARB should refine its cost analysis to include more granular information and better-supported estimates concerning the costs associated with the transition to ZEVs and NZEVs.

- CARB's limited examination of six vehicle types in its cost analysis should not be utilized as rationale to limit the availability of additional exemptions for alternative vehicles, particularly in cases where electrification options are not feasible given the achievable range and utilization of some vocations.

- Similarly, CARB's cost estimates for medium and heavy-duty batteries are based on an assumed time lag relative to the cost-experience for light-duty batteries. This approach is fundamentally flawed; the analysis does not consider the very real costs that are associated with battery disposal and recycling or the smaller volumes and packaging costs associated with medium- and heavy-duty batteries. The cost analysis also does not recognize that batteries for medium- and heavy-duty vehicles often require higher performance than those in the light-duty sector, as measured by kilowatt ("kW") which may not be equivalent when scaling cost for energy kilowatt hours ($/kWh). Different battery chemistries may be required, affecting end costs. Other assumptions made in the cost analysis, including the level of revenue projected to be obtained through the low carbon fuel standard need refinement. The prior experience in carbon credits points to a range of uncertainties that should be accounted for in making long-term cost estimates.

We thank you for your attention to our views regarding the proposed amendments. As CARB finalizes this proposal, we invite further discussion to clarify our suggestions as well as answer questions about this submission. We would be pleased to offer our perspective based on our relationship and experience supporting the commercial vehicle requirements of vocational end-customers. We are present in the marketplace every day, and so we speak from experience that customers are committed to the ZEV goal but challenged to make a full transition on the aggressive timeline that CARB targets. If Allison can offer value to CARB during this rulemaking process, please contact Kat Laker at 317-242-2754 or at Kat.laker@allisontransmission.com.

Sincerely,

Kat Laker
Allison Transmission, Inc.
Director, Regulatory Compliance

I. CARB Should Incorporate Additional Flexibility Mechanisms within Proposed Regulatory Language for Advanced Clean Fleets and Better Support its Regulatory Analysis

A. Additional Flexibility for ZEV and NZEV Mandates Can Lower Emissions and Costs

CARB has proposed that, starting in 2024 and 2027, public agencies must purchase 50% and 100% ZEVs.[1] The proposed regulatory language allows for public agencies in low population counties to avoid the 50% ZEV purchase requirement. And the regulatory text would further allow in any given year (until January 1, 2035) the purchase of a NZEV to be counted the same as the purchase of a ZEV vehicle if there are "no responsive bids" received for ZEVs.[2]

CARB has also proposed that high priority and federal fleets be subject to specific ZEV phase-in requirements that apply as a percentage of their fleet.[3] Box trucks, vans, two-axle uses, yard tractors, work trucks, day cab tractors, three-axle buses, sleeper cab tractors and specialty vehicles will be required to meet or exceed fleet percentage milestones applying in years 2025 through 2039,[4] unless specific exemptions are applicable.[5] Under the proposed regulatory text, an alternative compliance requirement is available, but only if each high priority or federal fleet vehicle is a ZEVs or NZEV (Model Year 2035 or newer) or a vehicle owned by the fleet prior to January 1, 2024 and still within the vehicle's minimum useful life.[6]

Allison appreciates that CARB has made efforts to avoid placing a "one size fits all" approach to fleet requirements and has provided exemptions for certain types of vehicles as well as the ability, in some cases, to purchase a NZEV in lieu of a ZEV. But the proposed regulations could be improved in several respects.

First, as proposed, it is unclear whether CARB regulations will result in consistent application of NZEV and other advanced technologies across the medium- and heavy-duty sector. As proposed, for public agencies, a ZEV purchase is essentially the default option for compliance; NZEVs may only be considered and purchased if there is a lack of "responsive bids" for ZEVs. For high-priority and federal fleet requirements, compliance can at least theoretically be achieved through a combination of ZEVs and NZEVs and other vehicles[7] at least until such time as the 100% ZEV Fleet Milestones apply for different types of vehicles in 2035 through 2042, but it may become more difficult to include NZEVs and other vehicles as percentage

[1] Proposed 17 CCR §95693.1.
[2] *Id*. §95693.1(a)(1)(B)-(C).
[3] Proposed 17 CCR §95692.1.
[4] *Id*. §95692.1(a).
[5] "Backup vehicles" may be excluded if they meet certain requirements. *Id*., §95692.2. In addition, a fleet owner may demonstrate that additional ZEVs cannot be placed in service and meet daily mileage needs. *Id.* §95692.2(b). Emergency vehicles are also excluded. *Id*. §95692.1(d)
[6] *Id.* §95692.1(c)
[7] Vehicles that are not ZEVs or NZEVs, however, must have been owned prior to January 1, 2024 and be within minimum useful life periods as defined in 17 CCR §95692(b)(30).

requirements increase in the interim years. In addition, as detailed below, the variable fleet composition for high priority and federal fleets is also limited and, in certain cases, dependent on the lack of "responsive bids."

The regulatory structure of the public fleet and high-priority and federal fleet requirements can therefore result in variable consideration of NZEVs and alternative vehicles for different fleets -- even while such vehicles could provide an efficient interim solution to serve as transitional vehicles until more efficient ZEV technology is available along with associated infrastructure to support the vehicles. Technological transitions rarely happen in a linear fashion, rather the medium- and heavy-duty commercial vehicle sector is largely purpose-built with different solutions developed at different times for different vehicle applications. By utilizing a criterion based on "responsive bids" for public fleets, given the nature of the bidding process, it will be difficult for vehicle manufacturers and suppliers to determine when such conditions exist that would allow for consideration of NZEVs, creating greater uncertainty to the market place for alternative technologies. And by strictly limiting the number of non-ZEVs and non-NZEVs, vehicles that could realistically offer substantial environmental benefits during the next 20 years (*e.g.*, until ZEV Fleet Milestones are fully implemented at the 100% level) are either excluded entirely or subject to strong disincentives for purchase (*e.g.*, due to the limited time they may be utilized).

With respect to high priority and federal fleets, the staggered percentage phase-in structure does allow for some additional flexibility versus a purchase mandate, but at the same time there is inherent arbitrariness in percentage step-downs which do not appear to be supported by adequate technical analysis that is specific to all the vehicle types that are covered by the proposed rule.[8] In addition, while NZEVs are available as a compliance option until Model Year 2035, reaching fleet percentage goals will realistically limit the number of NZEVs that can be integrated into a fleet (due to later issues with higher fleet percentage requirements). And there are no provisions which would allow for the crediting of alternatively-fueled vehicles versus ZEVs or NZEVs even while such vehicles may have very beneficial carbon footprints relative to ZEVs or NZEVs.

It may certainly be the case that a ZEV has considerable, concrete benefits in a specific vehicle application compared to an NZEV or alternative vehicle, but it may also be the case that incremental benefits of using a ZEV versus NZEV or alternative vehicles in specific applications is marginal (or perhaps non-existent) at certain points in time. In addition, it is quite possible that the incremental environmental benefits of the ZEV in a specific end use may not be worth the upfront costs, particularly when there is a low-carbon alternative solution and suitable ZEVs and associated infrastructure may become more readily available (and less costly) in the future.

[8] There does not appear to be a supporting technical document which examined the feasibility or reasonableness of staggered 10, 25, 50, 75 and 100% requirements for different vehicle types that are utilized in the commercial sector.

As currently drafted, neither the public fleet or high-priority and federal fleet regulations appear to recognize the benefits of additional regulatory flexibility or adequately account for differences in vehicle greenhouse gas performance in specific applications. Rather, they create a default ZEV mandate that can only be avoided through the lack of "responsive bids" in public fleets or specific exemptions in the high priority and federal fleet regulations. Even the availability of ZEV "off ramps" is questionable. For example, whether the daily mileage exemption for high-priority and federal fleets is available depends first on whether "all available ZEVs" cannot meet the daily mileage needs and whether any NZEVs are available (to be determined only after a public bidding process is conducted in which only one or no NZEV bids are received that are responsive to the request for bids) and whether CARB agrees with this assessment following submission of various documentation on the bid process.[9]

As indicated in our cover letter, Allison agrees that ZEVs will serve many "stop-and-go" vocations where there is sufficient infrastructure to supports the mission and specific end-uses of vehicles, but it will take considerable time for technology and infrastructure to meet requirements for all commercial vehicle applications. CARB should therefore include additional options for emission reductions to the largely binary ZEV/NZEV structure of the proposed regulations. Specifically:

- CARB should further consider additional measures to address existing fleet of vehicles and how improvements in the existing fleet's environmental performance could be integrated into its proposed ZEV mandates. Currently, within California, only 43% of existing heavy-duty vehicles meet 2010 federal regulations designed to substantially reduce particulate matter and nitrogen oxides and only 0.22% of commercial vehicles are fully electric.[10] Therefore, substantial environmental benefits could be obtained by accelerating fleet turn-over for "conventional" non-ZEVs along with other efforts to utilize alternative fuels in such vehicles. While we recognize that California has taken several steps in this area, including the CARB Truck & Bus Rule that will be fully implemented in 2023, additional emphasis could be placed on transitioning to cleaner conventional and alternatively-fueled vehicles while the necessary technology and infrastructure to support medium- and heavy duty ZEVs is developing. At minimum, CARB's proposed regulations should provide for additional flexibility to integrate such cleaner vehicles into the fleet requirements (*e.g.*, through allowing partial crediting) rather than focus primarily on ZEVs.

- Pursuant to the above, CARB should also include additional options for flexibility relative to NZEV requirements:

[9] 17 CCR §95692.2(b). It should be further noted that with regard to both the public agency and high-priority and federal fleet requirements, what constitutes a "responsive bid" is undefined leading to potentially variable results in what vehicles are or not able to be purchased.
[10] *See* dieselforum.org/California.

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- CARB should allow compliance with the proposed regulations on NZEVs to include utilization of alternative fuels, including commercially viable renewable natural gas and other emerging lower carbon fuels that perform well to reduce emissions and operate in duty cycles with difficult performance requirements such as refuse. In some cases, low carbon renewable fuels can offer the cleanest available technology for high-utilization applications, such as vehicles that are not able to be recharged in overnight depots, or vehicles that must maintain high-utilization rates due to work schedules or the nature of the vehicle's work demands

- CARB should broaden the definition of NZEV alternative compliance pathways to include non-PHEV hybrid systems. For example, electric power take-off ("ePTO") and other hybrid options that lack plug-in capability, can still significantly reduce CO_2 emissions. The current regulatory definition of NZEV reference only "on-road plug-in hybrid electric vehicles" and "an on-road hybrid electric vehicle that has the capability to charge the battery from an off-vehicle conductive or inductive electric source."[11] Another regulatory requirement of NZEV technology is that the vehicle must also be capable of operating like a ZEV for a minimum number of miles which increase in range over time. Allison has delivered 9,000 electric hybrid propulsion systems for coach and transit buses since its launch in 2003, preventing 3 million metric tons of CO_2 emissions. Unfortunately, this non-PHEV hybrid system does not follow the strict regulatory definition of NZEV therefore would not be viable for credit if expanded to truck, despite enabling vehicles to burn up to 25% less fuel and, in latest release, capability to drive in zero-emissions zones with All Electric Range to improve community air quality. CARB should consider how holding to a restrictive regulatory definition of NZEV will exclude some proven, trusted hybrid technologies that can reduce emissions to commercial vehicle applications, particularly those that operate with high PTO performance requirements while stationary. Excluding bridge technologies that can reduce CO_2 emissions, maintain productivity, and operate in areas with limited charging infrastructure will delay progress until ZEV technology and infrastructure is ready.

- CARB should also offer the ability to credit aftermarket software that can improve existing fleet CO_2 and criteria pollutant emissions as an alternative compliance pathway. Such "retrofitting" of existing vehicles to improve overall efficiency can result in immediate reductions in emissions using conventional technology and infrastructure. By focusing solely on vehicles that must be purchased and maintained as part of a fleet, *e.g.*, by utilizing fleet milestones whereby compliance is calculated on the basis of an annual ZEV target expressed

[11] 17 CCR §95692(b)(30)

as a percentage of the number of vehicles in the entire fleet,[12] CARB would miss opportunities to incentivize and obtain near-term and cost-effective emission reductions. Today OEMs leverage Allison FuelSense2.0 software package, including Neutral at Stop feature, advanced shifting software algorithms and Acceleration Rate Management to achieve reductions in fleet CO_2 emissions. Allison has offered software/controls options to reduce fuel costs for end users for over a decade without requiring additional hardware, so this option can apply to conventional fleets in California once the Truck and Bus rule has fully phased in. Aftermarket emissions reduction for existing fleets may be an alternative compliance pathway to achieve percentage milestones in the ACF program while fleets build confidence in 1:1 ZEV solutions.

Allison realizes that CARB is focused on meeting the state's goal of achieving a zero-emission truck and bus fleet by 2045, including earlier transition to ZEVs in certain market segments, such as drayage and public fleets. But while CARB asserts that a "wide range of ZE trucks [are] commercially available today"[13] the administrative docket for the rulemakings does not appear to include any detailed analysis of the feasibility of various market segments.

B. CARB's Cost Analysis is Insufficient to Support Regulatory Alternatives; CARB Should Incorporate Approaches Utilized in Innovative Clean Transit Rule

In general, CARB's cost analysis for the proposed rules relies heavily on the "expectation" that costs of batteries and fuel cell components are "expected to decline substantially over the next decade."[14] CARB indicates that "[battery-electric and fuel cell electric vehicles are projected to be cost competitive with combustion-powered vehicles . . . in many categories beginning in 2025."[15] But the total cost of ownership comparison used to estimate the costs associated with this rulemaking effort references only six vehicle types,[16] compared with the much wider range of vehicles that will be affected by purchase mandates, particularly specially-designed vehicles.

Thus, CARB's analysis, while helpful in terms of structuring the overall goals of the program and their general feasibility, does not provide sufficient granularity to support restricting the number and type of exemptions that should be available from the overall fleet mandates imposed. The final rule should allow for either further categorical exemptions with regard to vehicle types that are expected to face technological and cost barriers to electrification or allow for a petition or other process to exempt various vehicle types (and associated fleet purchase

[12] *Id*. §95692.1(b).
[13] Advanced Clean Fleets Workshop, Sept. 18, 2020 a 19.
[14] Draft Advanced Clean Fleets Total Cost of Ownership Discussion Document, Sept. 9, 2021 at 68.
[15] *Id*.
[16] *Id*. at 5-6, 33-67.

requirements). In providing for the latter alternative, CARB should consider the following exemptions drawn from the Innovative Clean Transit Rule ("ICT"):

- CARB should make an exemption available if the vocation minimum required range exceeds 80% of ZEV range capability.[17] This would allow a vehicle to meet its intended use in the near term while accounting for the fact that battery State-of-Health (SOH) fades over lifetime of the battery.

- CARB should also parallel ICT exemptions that are allowed for adequate gradeability,[18] financial hardship,[19] and infrastructure setbacks outside of a fleet's control.[20]

- CARB should allow for a provisional exemption to apply for vehicle types that do not have a ZEPCert qualified powertrain available. In the alternative, CARB should allow a fleet to select the best technology option available which accounts for overall emissions, reliability, durability, and productivity until ZEV technology addresses the requirements of the intended vehicle segment.

II. CARB Should Reconsider Fleet Percentage Milestones and/or Utilize a Different Compliance Mechanism

The proposed high priority and federal fleets rule is based on fleet percentage milestones. These regulatory requirements incorporate a ZEV Target Calculation based on counting the number of vehicles in each of the three groups of vehicles created under the regulation. Percentage standards are then applied for each group, resulting in a total numeric fleet target, expressed as the number of vehicles in the fleet that must meet by adding ZEVs and NZEVs. Because the ZEV fleet milestones apply as soon as 2025-2030 and escalate over the following 6 years, the regulatory structure of this requirement could result in the early retirement of some conventional powertrains to stay within the required percentages. This is in contrast with other rules that CARB has either proposed or promulgated, including the proposed rules for drayage and public fleets, as well as the ICT zero-emission bus requirements that are based on percentages that apply to the total number of newly purchased vehicles each calendar year instead of a percentage requirement that applies to the entire existing fleet.

[17] The ICT allows for an exemption where a zero-emission bus cannot meet the transit agency's daily mileage needs. *See* 13 CCR §2023.4(c)(2)
[18] *Id*. §2023.4(c)(3).
[19] *Id*. §2023.4(c)(5).
[20] *Id*. §2023.4(c)(1).

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It seems clear that CARB adopted this percentage of total fleet requirement as a mechanism to ensure that ZEVs and NZEVs will be incorporated into California fleets by a certain time. As opposed to other vehicle programs which are based on either the "natural" transition to new models when vehicles reach the end of their useful lives, the percentage requirement does not allow for implicit grandfathering of existing vehicles or the ability of fleet owners to stretch out their purchases of ZEVs and NZEVs according to their own constraints or objectives. But this regulatory structure comes at a variable cost to different existing fleets -- which may include vehicles of many different model years and which may include specialized vehicles for which there are no available or feasible ZEV or NZEV alternatives. Moreover, in some cases, the fleet percentage requirement may translate into a de facto 100% ZEV or NZEV purchase requirement in the relatively near future, given normal useful life periods that apply to commercial vehicles. For example, in order to meet the 100% mandate for a Group 1 fleet to consist of only ZEVs and NZEVs by 2035, some fleets will be required to purchase 100% or nearly 100% ZEVs and NZEVs as early as 2023-2025.

Again, Allison recognizes that CARB intends to take aggressive action to meet the state's greenhouse gas emission goals and thus may favor regulatory mechanisms that provide a large degree of certainty that the broad emission goals will be reached. But as opposed to the static fleet percentage requirements (with limited exclusions cited earlier[21]) CARB should further refine its proposed regulation to: (1) provide recognition and crediting for technologies other than ZEV and NZEV that can produce verifiable emission reductions; and (2) further refine the proposed regulatory text to provide additional exclusions or a reduction in percentage standards based on work truck applications that do not tolerate overnight charging and/or are specialized equipment/vehicles with unique performance requirements.

Specifically, specialized trucks are normally built-to-order at Body Builders with accessories and equipment (such as power take-off) which are designed to allow the truck to be used as a tool to create or maintain infrastructure. These specialized equipment functions based on unique vocation requirements make this equipment more likely to have a single owner, differentiating specialized equipment from freight vehicles which can more easily be assigned fair commodity-like value through resale used truck markets. For example, a sewer vacuum truck will have high-performance pumping requirements while stationary, making it a fundamentally different type of asset in cost, mileage, and function compared to a truck built for freight requirements. Vehicle owners that source their equipment at Body Builders and maintain their equipment cradle-to-grave will have increased burden from forced retirement at minimum useful life. CARB should therefore consider additional flexible compliance pathways for these specialty trucks and other trucks that create or maintain infrastructure, such as construction and waste management vehicles. As noted in other submitted comments from utilities and municipalities, some of these fleets have already taken early action to invest in hybrid and ZEV where it is feasible for their operations or have achieved significant carbon reductions through investment in alternatively-fueled equipment and low carbon fuel infrastructure such as biofuel and

[21] Backup vehicle exclusion, daily mileage exemptions and emergency response exemptions.

renewable natural gas, and so mechanisms CARB could take to give fleets credit for early action or alternative fuel use could provide needed flexibility for owners of specialized equipment.

In addition, the total cost of ownership ("TCO") comparison for this rulemaking should be expanded to analyze the costs involved for specialized equipment as well as any resulting impact on productivity by moving to ZEVs or NZEVs. CARB is already in receipt of comments pointing out the difficulty in applying such technology to vehicles that require regular daily use of additional equipment (such as aerial booms), or derricks, dump trucks and crew trucks.[22] And, perhaps partially as a result, CARB has proposed to exempt emergency vehicles as defined in California Vehicle Code section 615[23] as well as snow removal vehicles, heavy cranes and other specialty vehicles.[24] But it is not clear from the administrative record that CARB has examined the full range of vehicles where ZEV and NZEV technology application may prove difficult or infeasible in the near-term. Body builders that customize equipment onto OEM vehicles may also face production constraints and backlogs that can challenge a fleet's compliance timeline, and specialized vehicle owners will need to coordinate timing of meeting phased goals with a more complex supply chain than other end-users. Without understanding specialty equipment requirements and Body Builders readiness to supply this equipment, CARB cannot assure that its calculation of percentage standards is reasonably achievable and/or within the bounds of costs and cost-savings that Board projects will result from this rulemaking.

III. CARB Should Reconsider and Adjust Draft Projections Concerning Cost

To support the policy assumptions and regulatory deadlines for this rulemaking, CARB estimated the costs (*i.e.*, the impact on purchase price of ZEV) in comparison to the cost projections of medium- and heavy duty vehicles in the low-NOx Omnibus rulemaking.[25] Specifically, "[s]taff estimated the cost of medium- and heavy-duty ZEVs for battery-electric and fuel cell powered vehicles by adding electric component costs, fuel cell component costs, and energy storage costs to a conventional glider vehicle."[26] The final retail price of a ZEV was calculated as a sum of the component costs plus an additional 10% for other costs attributable to research, development, retooling and overhead.

As noted in this analysis, the cost of battery storage is the largest cost involved in making projections of end vehicle cost. Thus, an estimate of this cost is a crucial component in CARB's analysis and relatively small shifts in assumptions on costs can have large effects in the final "real world" costs experienced by fleets and consumers. In this regard, CARB staff assumed

[22] Comments from Association of California Water Agencies, et al., November 10, 2020.
[23] 17 CCR §95692(c). "An authorized emergency vehicle" includes publicly owned vehicles for peace officers, forestry and fire departments, emergency fire and rescue and the California Highway Patrol among other vehicles. Cal. Veh. Code §165.
[24] *Id.*
[25] Advanced Clean Fleets – Cost Workgroup Cost Data and Methodology Discussion Draft at 2.
[26] *Id*. at 4.

that Class 2b-3 vehicle battery costs would follow the price trend of light-duty vehicle battery costs with a two-year delay and class 4-8 vehicles would follow the cost projections for light-duty battery costs with a five-year delay.[27]

Allison would recommend that CARB change its approach for estimating costs by means of using as a "proxy" the costs estimated for the light-duty sector by a single private company (Bloomberg). As opposed to using a commercial estimate and assumed correlation between light- and medium- and heavy-duty battery costs, CARB should survey original equipment manufacturers as well as solicit real quotes for commercial vehicle batteries. Several factors argue for such a "ground-up" cost estimate rather than the "top-down" approach CARB adopted:

- The light duty vehicle battery costs that CARB utilized in its analysis do not include costs associated with responsible battery disposal and recycling. Such actions were considered during the environmental analysis for ZEPCert[28] and they represent real costs imposed by the ZEV and NZEV purchase requirements that would result from implementation of the proposed regulations. But CARB excluded such costs based on the theory that "this cost could be offset by the residual value of the battery at the end of its useful life in a truck or bus."[29] CARB, however, fails to support this assumption with any detailed analysis, relying on one report for a second life application.[30]

- While CARB noted that costs could be higher for the medium- and heavy-duty vehicle sector due to smaller volumes and packaging costs, it is unclear how these costs are factored into the resulting analysis. CARB's methodology concerning battery costs appears to rely solely on an extrapolation of costs per kilowatt-hour ("kWh") experienced in the light duty sector.

- Batteries that are suitable for more demanding use patterns in the medium- and heavy-duty sectors (such as commercial patterns of transient operation, operation on vehicles on grades, and the need for faster charging) require higher power measured by kW. Such batteries will generally cost more if measured on a $/kWh or $/energy scale as compared with a typical light-duty battery. In addition, different battery chemistries may be required for certain vocational duty cycle requirements that are inherently more costly, for example LTO vs. LFP.

[27] *Id.* at 5, Figure 1.
[28] Final Environmental Analysis for the Proposed Zero-Emission Airport Shuttle Regulation and Zero-Emission Powertrain Regulation, June 24, 2019 at 25.
[29] Advanced Clean Fleets – Cost Workgroup at 23.
[30] We would note that whether or not a battery may be able to repurposed for another use, eventually it is likely that disposal and recycling costs would be experienced.

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- Battery midlife replacement costs may be underestimated. CARB's draft report notes that current ZEV warranties for batteries are up to eight years and 300,000 miles.[31] Yet CARB does not define what warranty periods are being offered for various uses, nor represent the availability of batteries with longer warranty periods. In addition, CARB appears to assume that battery replacement in the future for all vehicles in this sector will occur at 500,000 miles rather than 300,000 miles. This is another major cost assumption for which little or no supporting data is provided in the administrative record.

- CARB should recognize that even if battery costs decline as projected, there may be additional costs involved in the retrofit of newer, lower cost batteries into a vehicle if space claim is different than current battery that is installed. Right battery sizing (energy kWh & power kW) against duty cycle analysis is a better measure of battery degradation than the 300-500K mile estimate utilized by CARB.

- CARB also assumes that hydrogen costs will undergo a very steep decrease by 2030.[32] Allison would recommend that CARB not solely rely on a study performed by interested stakeholders, but rather take additional steps to verify the reports methodology and assumptions.

- Finally, CARB's cost analysis includes assumed revenue generated through the Low Carbon Fuel Standard (LCFS). This revenue would be realized through the sale of credits by fleets who would generate credits through the use of electricity and hydrogen for transportation.[33] CARB staff projects an LCFS credit value of $200 that declines in a linear fashion from 2030 to 2045. But long-term projections on credit prices are difficult to make with any precision. As CARB well knows, the price of credits can vary according to many complex factors, including market behavior which is inherently unpredictable.[34] We would caution against complete reliance on such credit calculations or suggest that CARB condition its projections by using range estimates, rather than a fixed price estimate of credit value.

[31] Draft Advanced Clean Fleets Total Cost of Ownership Document, Sept. 9, 2021 at 26.
[32] CARB utilized a report by a "coalition of major hydrogen stakeholders." *Id*. at 20. This report indicates that prices will decline by over 50% by 2030.
[33] *Id*. at 23.
[34] Although not involving transportation fuels, the Regional Greenhouse Gas Initiative auction prices have fluctuated over the 13 years of its existence from a clearing price of $3.07 to $3.51 in the first few years to the "reserve" price for several years, followed by more recent increases to its last September 2021 price of $9.30. *See* https://www.rggi.org/auctions/auction-results/prices-volumes.

Allison Transmission Inc. | One Allison Way | Indianapolis, IN 46222-3271

IV. Conclusion

Allison appreciates the opportunity to provide comment on CARB's pending ACF regulations. Allison supports the continued evolution of vehicle propulsion technology and the broad goal of reducing emissions of CO_2 from the transportation sector. In several respects, however, Allison believes that the proposed regulations could be improved – and achieve better near-term results – by allowing for additional flexibility in the imposition of ZEV and NZEV requirements. Allison also believes that the final regulatory product could be improved by additional, detailed analysis of different commercial vehicle sectors, including specialty vehicles where ZEV and NZEV options may not currently be available. This analysis would help CARB better tailor its ZEV regulatory requirements to unique demands of the medium- and heavy-duty vehicle sector. Finally, we believe that CARB could benefit from further examination of the overall costs of the program, particularly with regard to the vast number of batteries that will be needed to meet required purchase and fleet percentage standards. As with other comments that Allison has filed with CARB, we remain available to provide any more detailed input that CARB may require on this pending matter.

Allison Transmission Inc. | One Allison Way | Indianapolis, IN 46222-3271