CALIFORNIA
AIR RESOURCES BOARD

March 24, 2023

The Honorable Michael S. Regan, Administrator
U.S. Environmental Protection Agency
Office of the Administrator
William Jefferson Clinton Building, EPA East Room 1309
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20004

Dear Administrator Regan:

The California Air Resources Board (CARB) congratulates the United States Environmental Protection Agency (U.S. EPA) on taking its most significant action in decades to reduce heavy-duty vehicle pollution in its recently published emissions standards for on-road trucks also known as the Clean Trucks Plan Oxides of Nitrogen (CTP-NOx) rule.[1] As you know, these trucks threaten air quality in California and throughout the country for the decades they are on the road, and particularly burden lower-income communities and communities of color. Cleaning up this pollution is required by the Clean Air Act and is the right thing to do. CARB commends U.S. EPA's consequential and important work here and remains eager to partner with U.S. EPA as CARB implements its own rigorous regulatory program.

Initially, we understand that U.S. EPA plans to take action very soon on at least some of CARB's waiver requests for California's medium- and heavy-duty vehicle regulations and thank you for your swift consideration of those requests. Those regulations are critical to protecting Californians, and take effect before U.S. EPA's recent rule. However, for model year 2027 and beyond, there may be opportunities to align the strongest parts of our programs, and we recognize that the possibility of more fully aligned programs is worth exploring in future. In particular, we hope to work together on further refining provisions of the U.S. EPA rule with which CARB will be unable to align as things stand, but which might be modified in positive ways through further collaboration. We are therefore petitioning you today to provide an administrative forum for that collaboration to further strengthen both our partnership and the CTP-NOx rule.

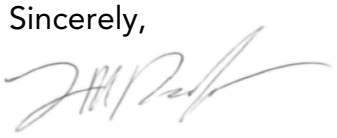
Specifically, the CTP-NOx rule (1) includes an "interim" compliance allowance that allows excess in-use emissions forever, despite its name, as it has no end date; and (2) a "temperature adjustment" that allows significant increases in pollution from trucks operating when the ambient temperature is below 25 °C.

[1] Volume 88 Federal Register (88 Fed. Reg.) p. 4296 (Jan. 24, 2023).

In their current forms, neither provision is necessary or well-supported. Because so many federal-certified trucks enter California to move the nation's freight, these provisions will harm Californians, as well as communities across the country. But we are confident that we could work together to address them, tackling any technical or industry needs while better protecting communities.

I am hopeful that you will direct your team to reconsider these two issues via a public and data-driven process and further advance pollution reductions consistent with U.S. EPA's commitments to public health and environmental justice.

Sincerely,



Liane M. Randolph, Chair
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Petition for Reconsideration and, in the Alternative, for Rulemaking

Seeking the Amendment of the Rulemaking Entitled "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards", EPA-HQ-OAR-2019-0055; FRL-7165-02-OAR

March 24, 2023

Petitioner[s]:

The California Air Resources Board (CARB) petitions the United States Environmental Protection Agency (U.S. EPA) to reconsider the above-referenced rulemaking and, in the alternative if U.S. EPA determines that the standard for reconsideration is not met, for a rulemaking to address the issues set forth in this petition.

CARB is the California state agency charged with promoting and protecting public health, welfare and ecological resources through the effective and efficient reduction of air pollutants, while recognizing and considering the effects on the economy of the State. CARB, in coordination with local air districts, is also responsible for attaining and maintaining the federal ambient air quality standards set by the U.S. EPA under the federal Clean Air Act (CAA),[2] and for preparing California's State Implementation Plan (SIP), which lays out California's proposed plan for attainment of the federal ambient air quality standards by identifying both the magnitude of emission reductions needed and the actions necessary to achieve those reductions by the required attainment deadline.[3] CARB also administers Assembly Bill (AB) 617[4], the California statute charging it with securing pollution reductions in communities across the state overburdened by air pollution,[5] among many other responsibilities. Each of these responsibilities bears directly on heavy-duty truck pollution reduction because these vehicles are dominant pollution sources statewide and within AB 617 communities. CARB's legal mandates therefore require it to seek continuing pollution reductions from these vehicles, both through its own authorities and through federal authorities for the portion of the vehicle fleet which CARB does not regulate directly.

I. Introduction: The Need to Reduce Deadly Truck Pollution and for Reconsideration or Rulemaking

The Clean Trucks Plan Oxides of Nitrogen (CTP-NOx) rule is central to CARB's and Californians' interests because it is the primary regulatory means of controlling new truck emissions throughout the country, and these emissions are dangerously high. CARB, for

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[2] 42 U.S.C. §§ 7401 et seq.
[3] California Health and Safety Code § 39602, 42 U.S.C. § 7410(a)(1).
[4] AB 617 (C. Garcia, Stats. 2017 Ch. 136). Health and Safety Code Sections 39607.1 and 40920.6.
[5] *See* California Health and Safety Code § 44391.2.

instance, cannot meet federal or state health standards, or protect communities, unless the emissions from federal-certified trucks are substantially reduced. The rule is a marked advance in national pollution control policy.

However, effectiveness of the final CTP-NOx rule is undermined by two provisions introduced after the close of the public comment period. The addition of these provisions makes it more difficult for CARB to meet its obligations or to explore further alignment. Because CARB did not have an opportunity to raise objections to these two provisions during the period for public comment, and because CARB's objections to these provisions are of central relevance to the rule, CARB petitions for reconsideration of these provisions under 42 U.S.C. § 7607(d)(7)(B). In the alternative, CARB petitions for general rulemaking under the CAA or Administrative Procedure Act, to explore and address both of these provisions and their effects. We first provide a brief background on CARB's needs and programs to contextualize the issue.

A. Truck Pollution in California and CARB's Need for Federal Action

California's most recent SIP to attain federal ambient air quality standards is clear.[6] As it explains, "it is critical to achieve emissions reductions from sources that are primarily regulated at the federal and international level" because CARB cannot achieve the CAA's air quality standards, or state air quality standards, without action on these sources.[7] As the SIP explains:

> While California has more stringent emission standards for heavy-duty vehicles than the federal government, this does not prevent trucks from outside of California traveling within the state. Close to half of the vehicle miles traveled from on-road heavy-duty vehicles in the State is contributed by vehicles originally sold outside of California, otherwise known as federal-certified vehicles. These federal-certified vehicles are only required to meet the less stringent federal emission standards and not California's emission standards.[8]

CARB has taken a series of actions on the portions of the vehicle fleet sold in California. For instance, its Advanced Clean Trucks Rule[9] requires a growing portion of these trucks to be zero-emission and, especially germane for this petition, its Heavy-Duty Engine and Vehicle Omnibus Regulation (Omnibus) establishes stringent emissions standards for these vehicles.[10] Moreover, CARB has dedicated hundreds of millions of dollars provided by the Legislature to incentive programs that reduce heavy-duty vehicle pollution.[11]

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[6] Attached as Exhibit X to this petition, and available at: 2022 State SIP Strategy (ca.gov)
[7] See id. at pp. 106-109.
[8] Id. at 108.
[9] See Advanced Clean Trucks | California Air Resources Board.
[10] See Omnibus Regulation | California Air Resources Board.
[11] See Low Carbon Transportation Investments and AQIP Funding Plans | California Air Resources Board.

Despite these actions, it is abundantly clear that additional reductions of mobile source emissions are necessary to attain compliance with ambient air quality air standards, and especially needed are reductions of emissions from heavy-duty trucks, since heavy-duty trucks are significant contributors to California's air pollution problems. They emit approximately one third of the total statewide emissions of NOx emissions and about a quarter of the total statewide emissions of diesel particulate matter (PM).[12] Furthermore, California continues to experience some of the worst air quality in the nation, with more than half of its 40 million residents living in regions that exceed the federal 8-hour standard for ozone of 70 parts per billion (ppb), and nineteen areas in California are nonattainment with that standard, including areas that encompass 99 percent of the State's disadvantaged communities.[13]

California's South Coast and San Joaquin Valley Air Basins, in particular, are classified as extreme nonattainment areas for the 2008 8-hour federal ozone standard,[14] and are the only extreme ozone nonattainment areas in the country.[15] These same air basins are also the only serious nonattainment areas in the country for the federal PM standards.[16] It is therefore apparent that California needs to achieve even more significant additional reductions of harmful pollutants from mobile sources in order to ensure that most regions of the state will attain compliance with the ozone and PM National Ambient Air Quality Standards (NAAQS). California must significantly reduce statewide emissions of NOx, because NOx leads to the formation of both ozone and fine particulate matter (PM2.5), and must also significantly reduce statewide emissions of diesel PM, because diesel PM contributes to ambient concentrations of PM2.5. California's need to obtain emission reductions is especially heightened for the South Coast Air basin, which needs NOx emissions to be reduced by 127 tons per day (tpd) in order to comply with the federal 70 ppb ozone NAAQS by 2037.[17] In light of California's urgent need to substantially reduce emissions from mobile sources, it is especially notable that a significant fraction of mobile sources that directly contribute to its poor air quality is comprised of trucks that are first sold and certified for use outside of California's borders.

Approximately 230,000 trucks that were first sold and certified outside of California regularly enter California each day, substantially because 40 percent of the nation's freight moves

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[12] CARB, 2020, Staff Report, Initial Statement of Reasons, Public Hearing to Consider the Proposed Heavy-Duty Engine and Vehicle Omnibus Regulation and Associated Amendments (Omnibus ISOR) ES-1,2. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/isor.pdf

[13] CARB, 2022 State Strategy for the State Implementation Plan, pp. 1, 2 (2022). Available at: https://ww2.arb.ca.gov/sites/default/files/2022-08/2022_State_SIP_Strategy.pdf

[14] U.S. EPA, 8-Hour Ozone (2015) Nonattainment Areas, https://www3.epa.gov/airquality/greenbook/jnc.html (last accessed Feb. 9, 2023).

[15] Ibid.

[16] See, e.g., U.S. EPA, PM-2.5 (2012) Nonattainment Areas https://www3.epa.gov/airquality/greenbook/knc.html (last accessed Feb. 9, 2023).

[17] CARB, 2022 State Strategy for the State Implementation Plan, p. 14. (2022).

through California ports.[18] These trucks emit about 102 tons of NOx per day in California, 56 percent of total heavy-duty diesel NOx emissions, and are projected to emit about 38 tons of NOx per day in 2031 (the next attainment date) and 38 tons of NOx per day in 2037 (the required attainment date following). For this reason, California's state SIP identified a federal rule securing at least 3.8 tons per day of NOx reduction in 2037 in the South Coast Air Basin from these trucks as necessary for California's attainment of the relevant standards[19,20] which would have been achieved by a federal rule aligned with the Omnibus. Indeed, for California to attain the following federal ambient air quality standards (see Tables 1 and 2), the state needs NOx and PM reductions from federal-regulated new vehicles:

Table 1. National Ambient Air Quality Standards for Ozone

Concentration	Averaging Time	Extreme Area Attainment Date
0.120 parts per million (ppm)	1-hour	2022
0.8 ppm	8-hour	2023
0.75 ppm	8-hour	2031
0.70 ppm	8-hour	2037

Table 2. National Ambient Air Quality Standards for PM2.5

Concentration	Averaging Time	Serious Area Attainment Date
35 ug/m3	24-hour	2024
12 ug/m3	Annual	2025

The problem extends beyond regional plans to specific communities near trucking routes and facilities. California's AB 617 communities, in particular, need steep reductions – indeed, steeper reductions than are required statewide, because truck pollution is often concentrated in these communities. The following "Community Emission Reduction Programs"[21] (CERP) approved under that statute identify truck emission reductions as a key strategy:

- West Oakland
- El Centro, Heber, Calexico
- Portside Environmental Justice Neighborhoods
- Shafter
- South Central Fresno

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[18] *Overview of California's Ports*. Legislative Analyst's Office. August 23, 2022 (last accessed 03/07/2023)
[19] See State SIP at pp. 122-123.
[20] Heavy-duty trucks emit approximately 32 percent of NOx emissions in the South Coast Air Basin. CARB, Measures for Reducing Emissions from On-Road Heavy-Duty Vehicles (June 3, 2021) available at http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/heavy-duty-trucks-presentations-06-03-21.pdf?sfvrsn=8 (last accessed Feb. 22. 2023).
[21] *https://ww2.arb.ca.gov/capp-communities*

- Stockton
- East Los Angeles, Boyle Heights, West Commerce
- Eastern Coachella Valley
- San Bernardino, Muscoy
- South-East Los Angeles; and
- Wilmington, Carson, West Long Beach

Although these CERPs are California state law plans, they ultimately reduce the burden of pollution in communities of color, consistent with both CARB's and U.S. EPA's environmental justice and civil rights obligations under the CAA and Civil Rights Act. Moreover, similarly situated communities nationwide would benefit from trucking pollution reduction, both at the community level and the attainment area level.

In sum, the emissions reductions which only U.S. EPA can secure from the national truck fleet are central to public health in California. We appreciate that U.S. EPA has acknowledged that federal-certified heavy-duty vehicles emit significant quantities of NOx and other air pollutants that contribute to the generation of ozone and PM2.5, which severely impair the health and welfare of our nation's residents,[22] and especially those residents that live and work in areas located near truck freight routes, such as warehouses and major roadways, that are more likely to be low-income and/or people of color.[23] We likewise appreciate the acknowledgement that "[r]educing NOx emissions is a critical part of many areas' strategies to attain and maintain the NAAQS for ozone and PM."[24]

B. The Final CTP-NOx Rule

As noted above, the final CTP-NOx rule represents the most significant action in decades to reduce heavy-duty vehicle pollution. To further strengthen the CTP-NOx rule, CARB requests reconsideration of, or, in the alternative, timely rulemaking to address, two specific provisions that appeared for the first time in the final rule. Modifications to these provisions would strengthen the federal program, thereby improving public health protections, and would also provide a clearer path for CARB to consider aligning its state rules with the federal program in the future. We discuss the provisions in detail below but outline briefly in this introduction.

The "Temperature Adjustment" Provision. After the comment period closed, U.S. EPA introduced a provision into the final off-cycle NOx standards in 40 CFR § 1036.104(a)(3) that allows NOx emissions to increase at ambient temperatures from 25 to 5 °C.[25] At 5 °C, this provision allows for emissions that are almost 60 percent greater than would be allowed without it. Accordingly, CARB projects that this provision will generate up to 6.4 tons per day

[22] 88 Fed. Reg. 4296, 4298 (January 24. 2023)
[23] "Relative to the rest of the population, people of color and those with lower incomes are more likely to live near truck routes." 88 Fed. Reg. 4298 (January 24. 2023)
[24] 88 Fed. Reg. 4298 (January 24. 2023)

excess NOx emissions statewide in 2037, increasing emissions up to 16 percent above what would be the baseline without the provision, much of which will be concentrated in our most vulnerable communities.

The "Interim Compliance Allowance" Provision. The final CTP-NOx rule also contains an in-use compliance allowance with no end date.[26] The proposed in-use compliance allowance included a MY 2033 sunset date and applied only to heavy-duty engines,[27] but the final rule's allowance is indefinite and applies to both heavy heavy-duty and medium heavy-duty engines. CARB's analysis suggests this new provision will allow approximately 1.4 tons per day excess NOx emissions in California through 2037.

In combination, these two provisions hamper the technologically feasible pollution reductions required by the Act, prevent the standards from being truly technologically forcing to secure necessary reductions,[28] and leave communities exposed to up to 8 tons more pollution per day (more than 20 percent) than would be the case without those provisions.

II. Reconsideration is warranted

Reconsideration is warranted because CARB's objections to these provisions could not practicably be raised during—and the grounds for them did not arise until after—the public comment period, and because CARB's objections are "of central relevance to the outcome of the rule." 42 U.S.C § 7607(d)(7)(B).

It was impracticable for CARB to raise its objections to these provisions during public comment because both the temperature adjustment to NOx off-cycle standards (40 CFR § 1036.104(a)(3)) and the extension and expansion of the in-use compliance allowance (40 CFR § 1036.150(y)) appeared only in the final rule.

The notice of proposed rulemaking (NPRM) expressly requested comment on proposed provisions excluding data when ambient temperatures were below a specified threshold, but presented no indication that U.S. EPA was additionally considering the distinct concept of adjusting or modifying non-excluded data based on ambient temperatures.[29] Similarly, the NPRM gave no indication that its in-use compliance allowance for heavy-duty engines would be replaced with an indefinite measure or one that applied to medium-duty engines as well.

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[26] 88 Fed. Reg. 4502, codified at 40 CFR § 1036.150(y)
[27] 87 Fed. Reg. 17414
[28] See 42 U.S.C. § 7521(a)(3)(A) and fn. 3 of the final truck rule at issue (discussing the importance of this technology-forcing provision).
[29] CARB's late comments on the temperature adjustment provision, filed immediately after CARB staff learned about the provision just prior to the issuance of the final rule, are not to the contrary, as they were made without the benefit of a full public proposal for CARB or the public to respond to, and without the benefit of a full comment period. See https://www.regulations.gov/comment/EPA-HQ-OAR-2019-0055-2884, https://downloads.regulations.gov/EPA-HQ-OAR-2022-0332-0059/attachment_6.pdf.

CARB's objections to these two provisions also satisfy the "central relevance" prong of the reconsideration provision because they go to whether the rule is as stringent as the CAA requires and whether it satisfies the arbitrary-and-capricious standard. *See Chesapeake Climate Action Network v. EPA*, 952 F.3d 310, 322 (D.C. Cir. 2020) (objections are "of central relevance" if they directly challenge the "legality" of a final rule). Specifically, CARB's objections concern whether the two new provisions undermine the CTP-NOx rule's ability to address the danger to public health and welfare from heavy-duty NOx emissions, see CAA § 202(a)(1), and effectively relax the standards below the level achievable by heavy-duty engines and vehicles in the 2027 and subsequent MYs, through the application of technology EPA has determined will be available, see CAA §§ 202(a)(3).[30]

CARB thus respectfully requests that U.S. EPA "convene a proceeding for reconsideration of the CTP-NOx rule and provide the same procedural rights as would have been afforded had the information been available at the time the rule was proposed." 42 U.S.C § 7607(d)(7)(B). That would afford CARB and other commenters the

III. Technical Analysis of the Provisions

The following subsections provide detailed analysis of both provisions.

A. The Temperature Adjustment Provision is Inappropriate

U.S. EPA introduced the temperature adjustment to the off-cycle NOx standards (40 CFR §1036.104(a)(3)) based on results from a low ambient temperature test program[31] funded by the Truck and Engine Manufacturer Association (EMA) and conducted at the Southwest Research Institute (SwRI). During the test, the laboratory temperature was reduced from the room temperature of ~25 °C down to approximately 2-7 °C, and laboratory air was blown via a variable speed blower directly toward the aftertreatment package using the following assumption:

$$Air\ speed\ over\ aftertreatment = C\% \times vehicle\ speed \qquad Equation\ 1$$

The parameter C% is smaller than 100 percent and was based on a vehicle manufacturer's computational fluid dynamic simulation of a specific heavy-duty vehicle. The reduced wind speed relative to the vehicle speed was intended to account for some protection of the aftertreatment system from the full speed of wind under the driving conditions. SwRI data indicated that the exhaust gas temperatures (EGT) near the Selective Catalytic Reduction (SCR) brick decreased by 30-50 °C (both the upstream "light-off" SCR and downstream SCR). The lowered SCR catalyst activity under low ambient temperatures (AMT) contributed to the observed higher NOx emissions.

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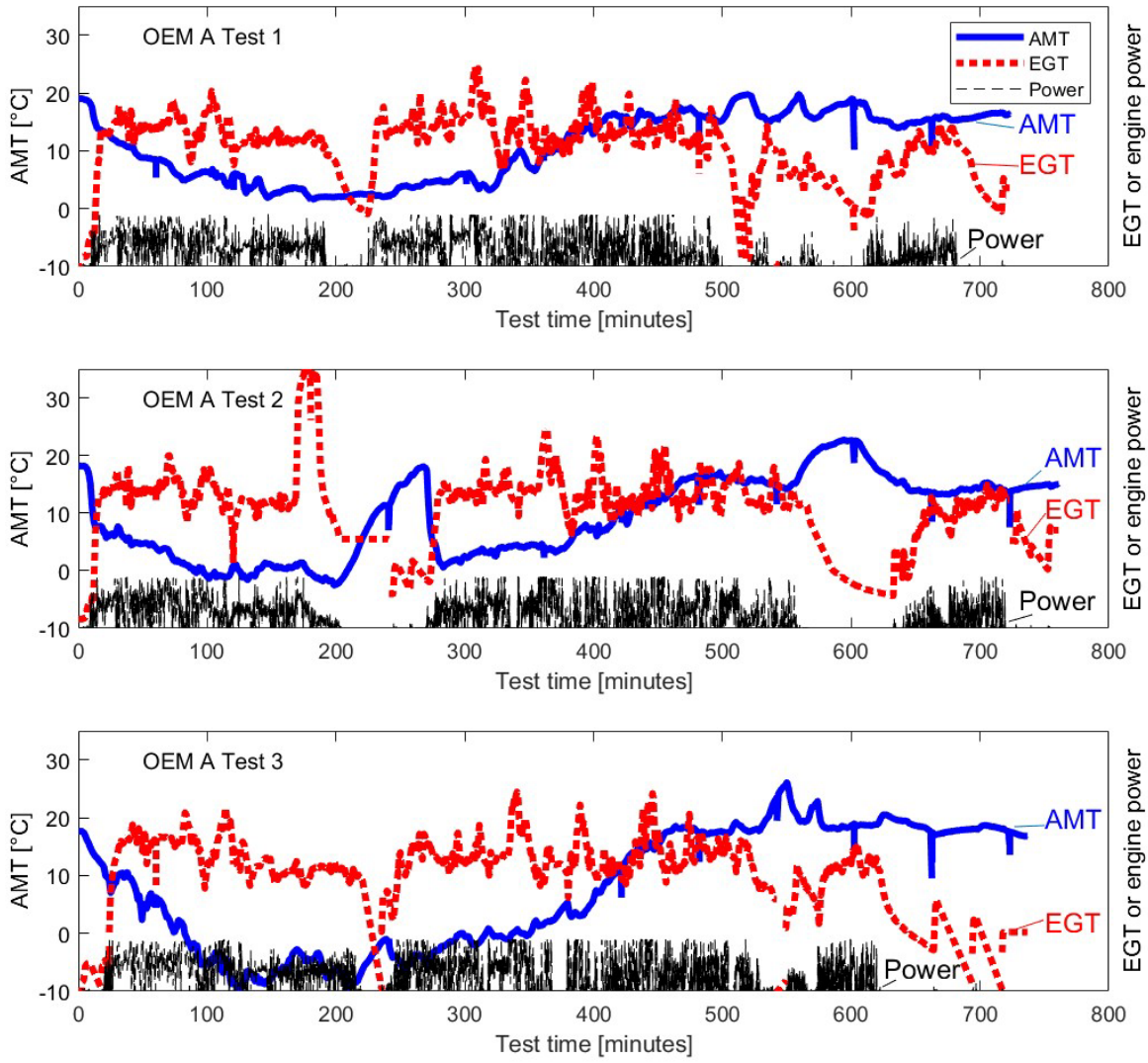
[30] 88 Fed. Reg. 4312 (January 24. 2023)

[31] Sharp, Christopher. 2022 Low NOx Update Progress and Challenges. COMVEC. September 20-22, 2022.

To double check the results from the low AMT test study, CARB staff conducted a review of the heavy-duty in-use testing (HDIUT) program dataset and performed analysis of the EGT, AMT, and the engine power within the HDIUT data. For 17 years, CARB has required HDIUT testing by manufacturers and evaluated the submitted in-use testing data from large numbers of real-world trucks. CARB staff has examined the data from that test program to see what happens to aftertreatment temperatures in conditions similar to the low AMT conditions U.S. EPA tried to address with their temperature adjustment function. As described below, the HDIUT data analysis did not support the findings of EMA's low AMT test.

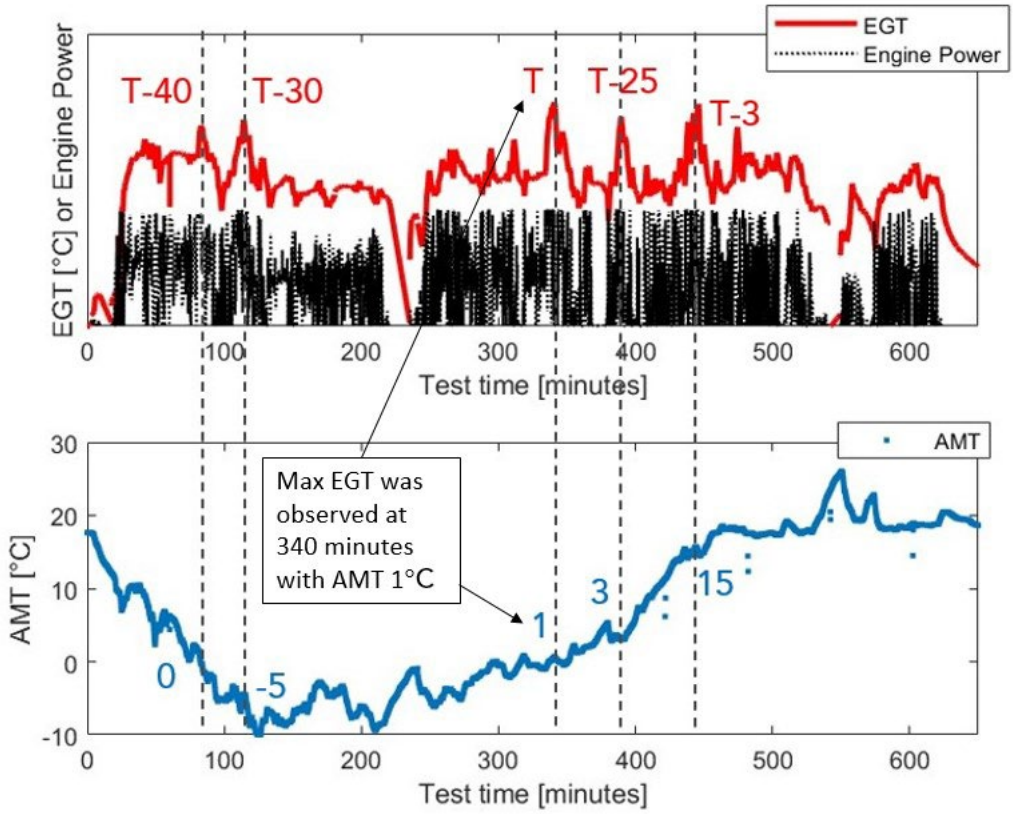
For the HDIUT data analysis, CARB staff examined data from two engine families produced by 2 different original engine manufacturers (OEM) that were tested at various AMTs for multiples days of testing. Figure 1 shows multiple test results for the same engine (A) certified by OEM "A". The time-series of AMT, EGT, and the engine power in Figure 1 show that EGT generally follows the trend of the instantaneous engine power and is not a function of AMT. For example, for Test 1, peak EGT at 310 minute (AMT around 5 °C) is higher than the peak EGT at 410 minutes (AMT around 15 °C).

Figure 1. HDIUT Test Data from One Vehicle Using Engine from OEM "A". The Values on the Secondary Y-Axis are Removed to Protect OEM Confidentiality



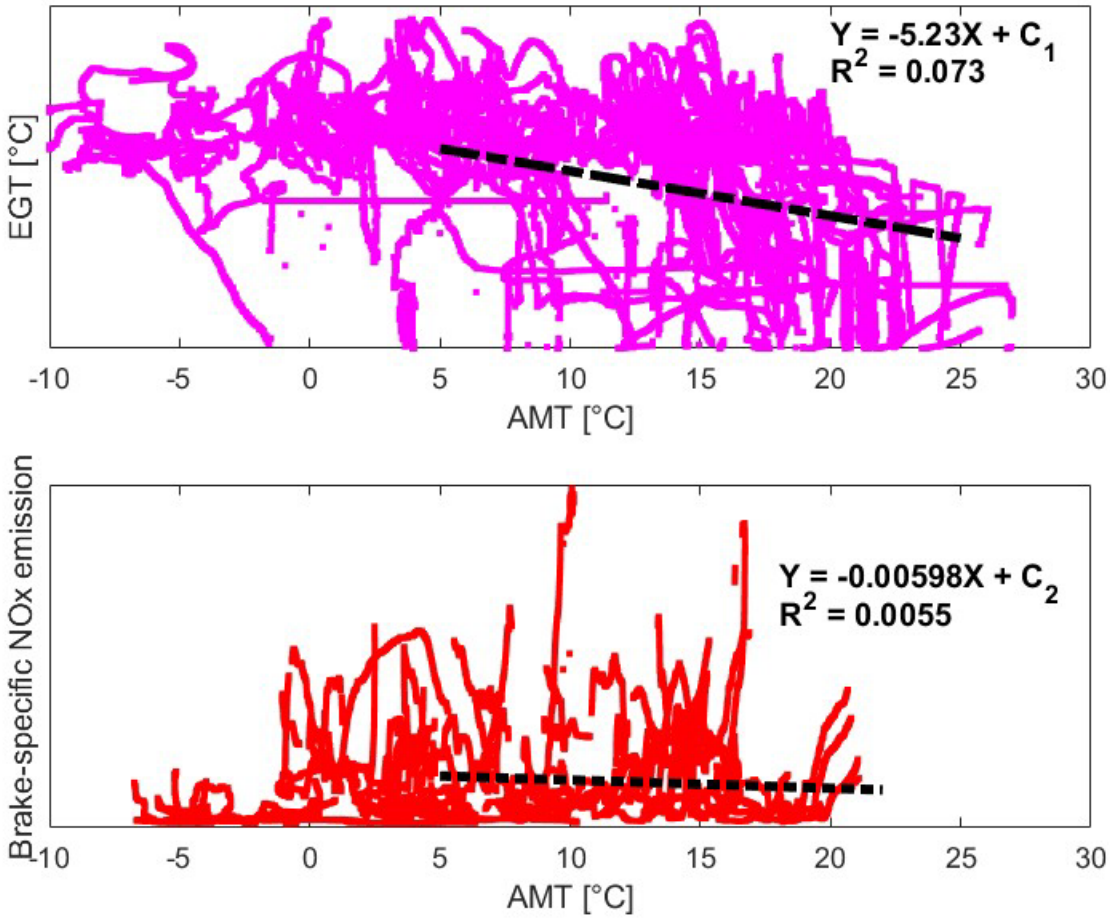
The peak EGT values and the corresponding AMT values of Test 3 are examined further in Figure 2. For Test 3, the AMT ranged from around -10 C to around 20 C. The maximum EGT (noted as "T") was observed at 340 minutes with AMT 1° C showing that low AMT did not result in low EGT. EGT for the time interval 250-300 minutes (AMT around 0 °C, maximum engine power) was similar to the EGT for the time interval 480-520 minutes (AMT around 20 °C, maximum engine power). So, a 20 °C reduction of AMT, from 20 °C to 0 °C, had no impact on EGT. The values of EGTs and engine power level on the vertical axis are redacted to ensure confidentiality of the data.

Figure 2. Peak EGT and Corresponding AMT in HDIUT Test 3 Data from OEM "A"



To further evaluate the relationship between EGT and AMT for the entire dataset for the same engine family, Figure 3 combines the temperature data from 5 different tests together after removing the active regeneration events. Also, Figure 3 includes the corresponding brake-specific NOx emissions. Linear regression lines between 5 and 25 °C were added to the figure with the corresponding R-squared values. R-squared values measure how well the independent variable (e.g., AMT) can predict the variation in the dependent variable (e.g., EGT). Since most of the variation in EGT can be explained by the engine power, as shown in Figure 1 and 2, the R-squared value is expected to be near zero. As discussed above, peak EGT did not track AMT in this dataset. Similarly, the brake-specific NOx emission did not track the AMT as expected from the apparent lack of dependence of EGT on AMT.

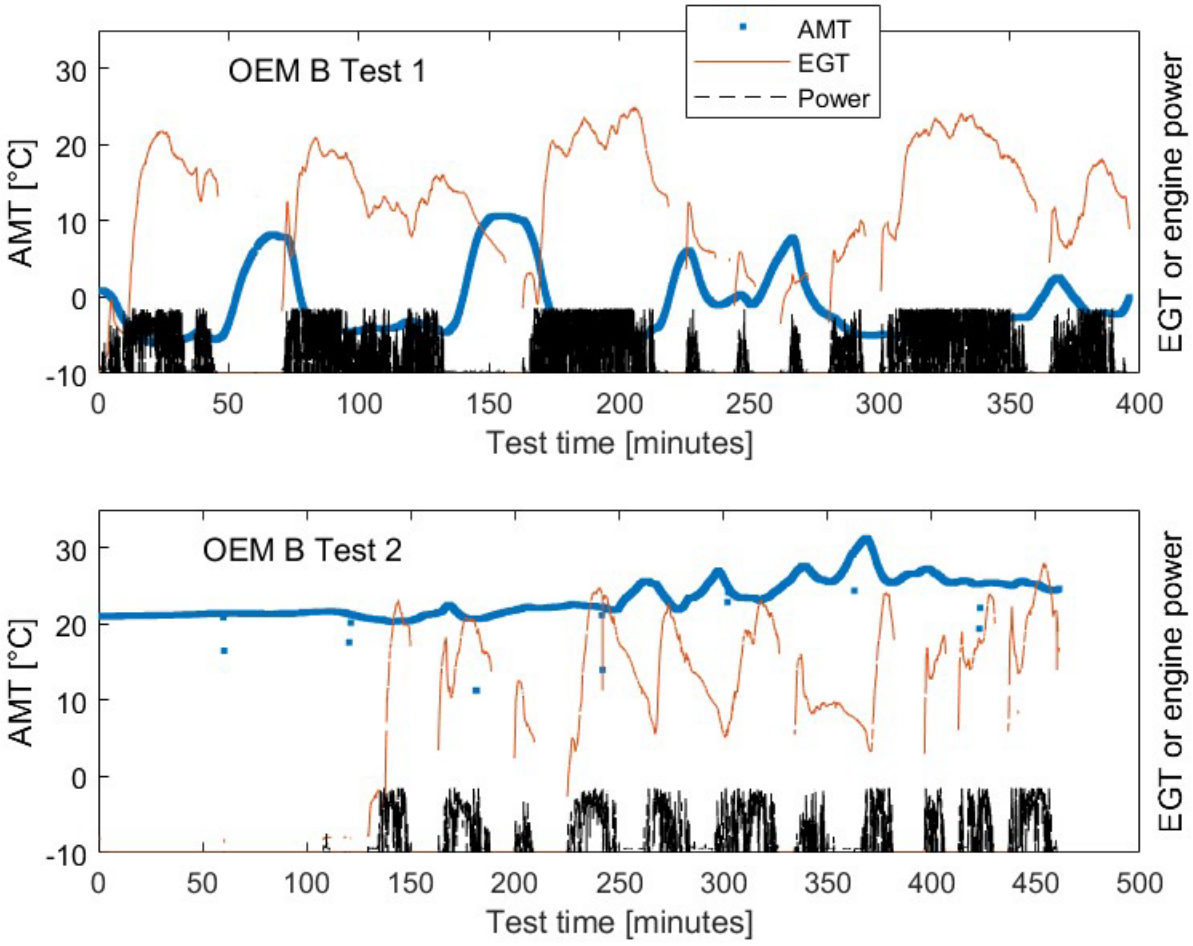
Figure 3. Relationship Between EGT, Brake-Specific NOx Emission, and AMT for Test Engine from OEM A. C1 and C2 are Constants



The validity of the temperature adjustment function can be evaluated by examining the slope of the EGT versus AMT. The temperature adjustment is based on the impact of decreasing the SCR temperatures by 30-50 °C when the laboratory AMT was decreased by ~20 °C. Therefore, U.S. EPA's temperature adjustment implicitly assumes a positive slope in the EGT versus AMT of between +1.5 and +2.5. While the HDIUT data contains wide variability, the observed slopes (-3.7 or -10.2) were not at all consistent with the observations from EMA's low ambient temperature test (+1.5 to +2.5).

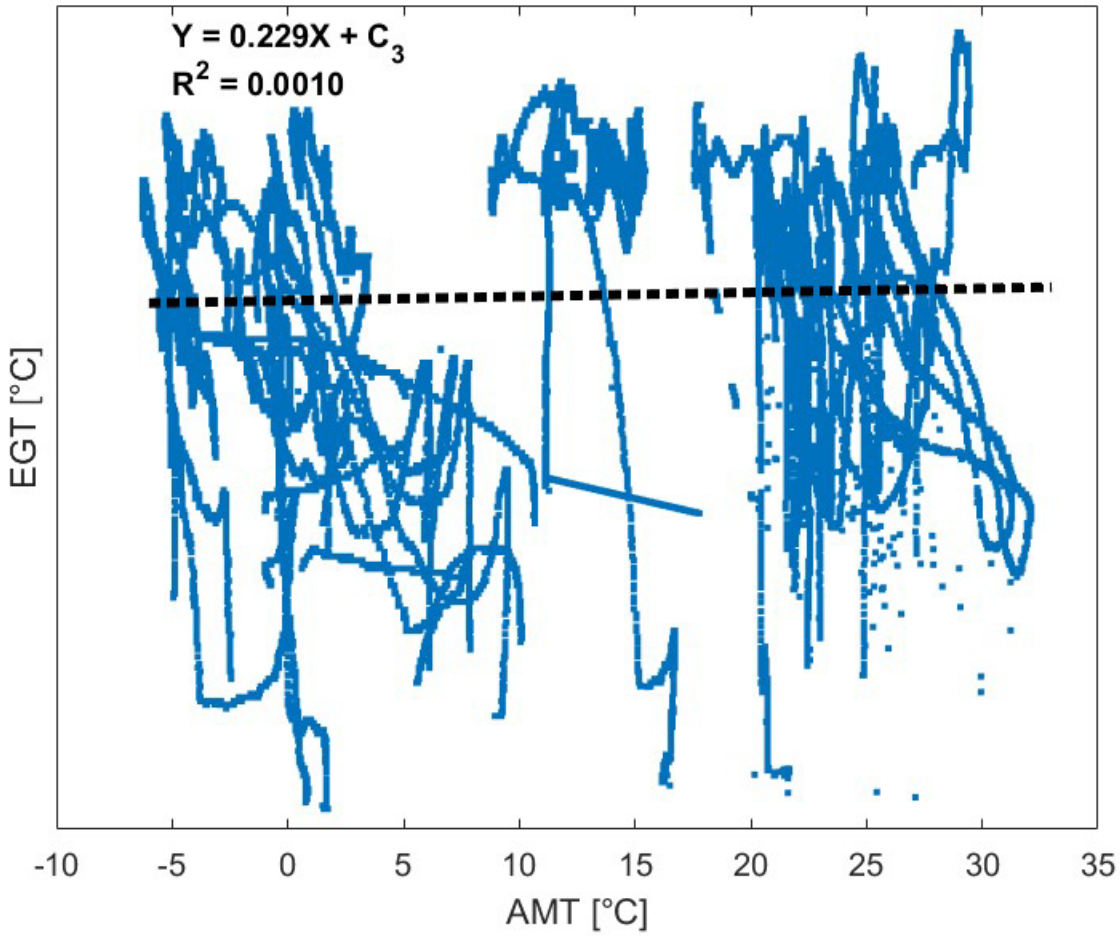
A similar analysis is conducted for another set of data from a different OEM (OEM "B"). Figure 4 shows two example data sets obtained at contrasting temperature ranges. Again, the trend of EGT followed the trend of engine power but not the AMT.

Figure 4. HDIUT Test Data from One Vehicle Using Engine from OEM "B". The Values on the Secondary Y-Axis are Removed to Protect OEM Confidentiality



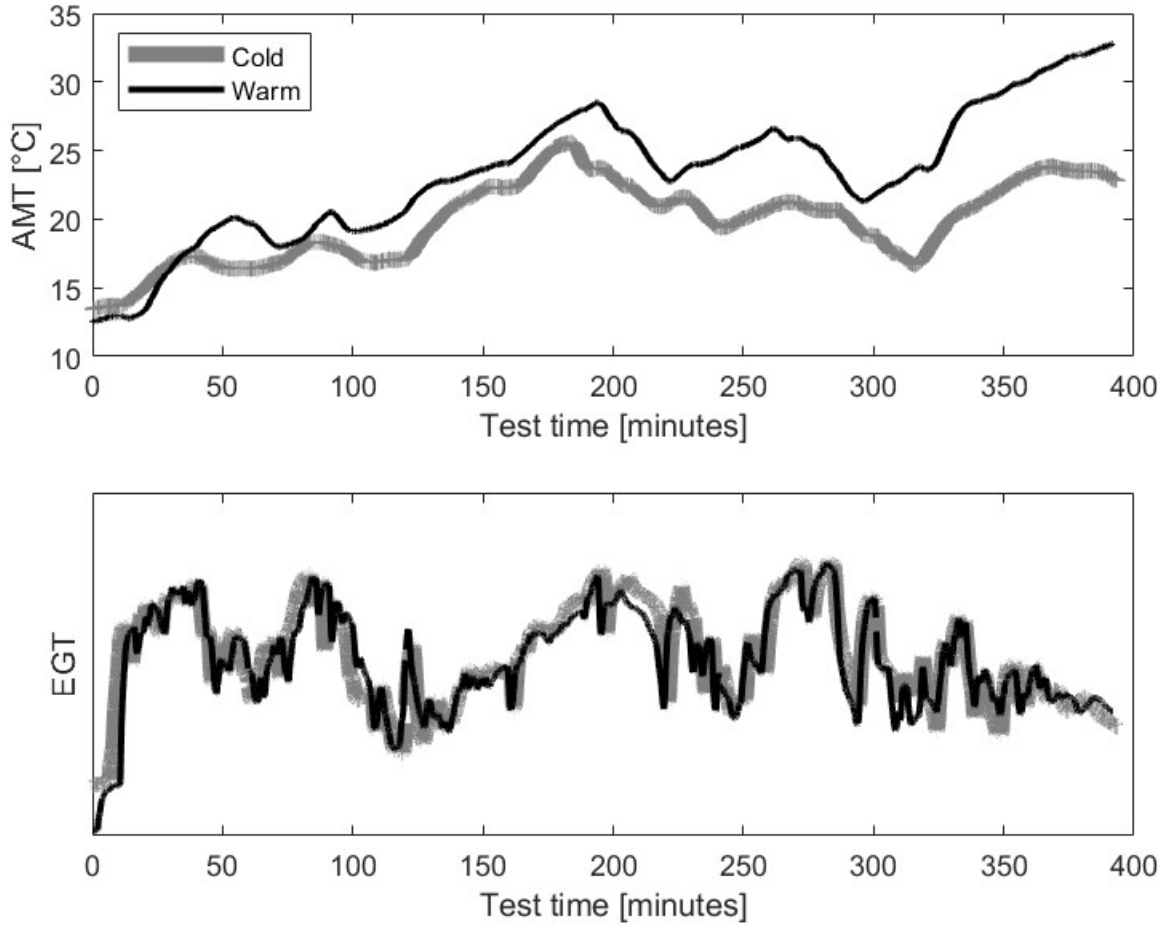
The relationship between EGT and AMT is further examined in Figure 5. Figure 5 combines the data obtained from four different in-use tests into one. The observed trends in Figure 5, along with Figure 3, show that the assumed dependence of the exhaust temperature on the ambient temperature in U.S. EPA's temperature adjustment (i.e., slope of +1.5 to +2.5) is not supported by the available in-use data.

Figure 5. Relationship Between EGT and AMT for Test Engine from OEM "B". C3 is a Constant



Next, to further evaluate the impact of AMT while minimizing the impact of variability of various factors other than temperature, CARB staff compared a pair of in-use compliance test datasets for another vehicle (engine from OEM "C") on the same route conducted at different AMTs in 2 separate days. As shown in Figure 6, although one test was conducted at lower temperature than the other (i.e., the temperature difference up to ~7 °C), the lower AMT experiment did not result in consistently lower EGTs. The lack of any correlation between AMT and EGT as shown in Figure 6 is not consistent with the observations in the low AMT testing conducted at SwRI.

Figure 6. HDIUT Test Data for Vehicle (Engine from OEM "C") Running on the Same Route at Different AMTs. The EGT Values are Removed to Protect OEM Confidentiality



It should also be noted that the results from EMA's low AMT test, which was the rationale for introducing the temperature adjustment function, also indicate that countermeasures can be used to ensure that tailpipe NOx emissions do not change as a function of the AMT. Such countermeasures could include recalibration of the stage three engine, or using "insulation material" to protect the exhaust piping and aftertreatment system from wind and low AMT. The use of insulation would be simple, inexpensive, and would not have any impacts on the CO_2 emissions.

In conclusion, CARB staff's analysis of the available HDIUT data from three different OEMs (currently there are only seven different OEMS that certify on-road heavy-duty diesel engines) suggests that for current production engines, EGT is not a function of AMT. Our analysis contradicts the assumed dependence of exhaust temperature on ambient temperature. Furthermore, consideration of EMA sponsored testing data should have also included a thorough investigation of possible countermeasures to fully examine the impacts of such measures on compliance with future NOx and CO_2 emissions standards. Opening a

reconsideration proceeding would be an opportunity to address these issues and design a more appropriate approach to temperature.

B. The Interim In-Use Compliance Allowance is Inappropriate

The primary objective of the HDIUT program is to ensure that on-the-road heavy-duty truck emissions are controlled as well as they are at the time of certification in the laboratory. As described in the NPRM[32], U.S. EPA generally establishes in-use emissions standards that are a function of the certification standards. However, U.S. EPA has occasionally established an interim allowance for in-use standards for a transitional period when it believes that manufacturers would need more time to fine tune their products and gain experience with new emissions control technologies[33] when establishing a new emissions standard.

Based on historical precedent, the NPRM proposed and requested comments on providing manufacturers a temporary in-use testing allowance (i.e., "interim NOx compliance allowance for in-use testing") to be applied to heavy heavy-duty engines in-use emissions standards for the period covering MYs 2027 through 2033[34]. However, in the final CTP-NOx rule, U.S. EPA adopted an "interim" compliance allowance of 15 milligrams per horsepower-hour (mg/hp-hr) NOx for both medium- and heavy heavy-duty engines and made it permanent with no sunset date.[35] While CARB staff understands that implementing new, stricter standards—especially national standards—may call for additional flexibility for a limited period of time, such interim allowances should have a specified sunset date in the final CTP-NOx rule, as has been done in the past.

i. Applicability of interim compliance allowance to medium heavy-duty engines

Months after the closure of the comment period, a stakeholder that manufactures medium heavy-duty engines submitted confidential information to U.S. EPA indicating that medium heavy-duty engines experience more deterioration in the field since they encounter a more severe duty cycle compared to heavy heavy-duty engines.[36,37] Based on this comment, U.S. EPA justified the use of emissions data test point at 650,000 miles when establishing the in-use emissions standards for medium heavy-duty engines. It should be noted that the amended useful life for a medium heavy-duty engine is 350,000 miles, so using the emissions data point at 650,000 miles can be considered as a hidden and permanent compliance allowance for medium heavy-duty engines.

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[32] 87 Fed. Reg. 17414 (March 28, 2022)
[33] *Id.* p. 17563
[34] *Id.* p. 17564
[35] 88 Fed. Reg. 4296 (January 24, 2023)
[36] Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards. Regulatory Impact Analysis (RIA) EPA-420-R-22-035. December 2022. p.115-116
[37] *https://www.regulations.gov/comment/EPA-HQ-OAR-2019-0055-2891*

Given the use of the 650,000-mile emissions data test point for medium heavy-duty engines, CARB staff believes that a compliance allowance has already been provided to medium heavy-duty engines. Therefore, adding another 15 mg/hp-hr by applying the interim compliance allowance for medium heavy-duty engines is unnecessary and constitutes double counting.

ii. Sunset date of the interim compliance allowance

As indicated earlier, the NPRM had proposed a 2033 MY[38] sunset date for the interim compliance allowance for heavy heavy-duty engines. However, in the final CTP-NOx rule, U.S. EPA finalized an interim compliance allowance for both medium heavy-duty and heavy heavy-duty diesel engines and despite being referred as "interim" and codified in the Interim Provisions section (40 CFR 1036.150), is indefinite without a sunset date. [39] U.S. EPA did not provide any rationale for removing the sunset date. Furthermore, U.S. EPA states that "...consistent with past practice (for example, see 66 FR 5114, January 18, 2001), the interim, in-use compliance margin is included as an interim provision that U.S. EPA may reassess in the future through rulemaking based on the performance of emissions controls over the final useful life periods for medium and heavy heavy-duty engines." [40] However, in the 2007/2010 heavy-duty engine standards (66 FR 5114, January 18, 2001), which U.S. EPA refers it as a past practice, the interim compliance margin lasted only four years with a sunset date of MY 2011. Therefore, to be fully consistent with past practice and also with the NPRM, CARB staff believes U.S. EPA should establish a sunset date for the interim compliance allowance.

iii. Technical flaws in calculating the interim compliance allowance

In addition, several flaws exist in the methodology that was used to establish the numerical value of the interim compliance allowance as it applies to in-use testing. As discussed in the U.S. EPA's Regulatory Impact Analysis (RIA) for the final CTP NOx rule, the compliance allowance is intended to account for the emission variance associated with sulfation, fuels, sensors, production variability, and field aging.[41] CARB staff believes that engine manufacturers and parts suppliers will continue to further develop, refine and improve the reliability of their products and, therefore, sensor and production variability variances will be reduced over time.

Also, some of the sources of variability used in calculating the field aging component are already accounted for in the way vehicles are screened and tested for the HDIUT program.[42]

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[38] 87 Fed. Reg. 17564 (March 28, 2022)
[39] 88 Fed. Reg. 4302, 4305,-4307, 4329; footnotes to Tables III-3, III-6, and III-17 respectively pp. 4334, 4337, and 4348 (January 24, 2023)
[40] 88 Fed. Reg. 4302
[41] Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards. RIA EPA-420-R-22-035. December 2022. pp. 124-126
[42] 88 Fed. Reg. 4514 (40 CFR § 1036.410), (January 24, 2023)

In the RIA, the field aging component is described as "the degree to which in-field aging might be more or less severe than that observed in the Diesel Aftertreatment Accelerated Aging Cycle (DAAAC) aging protocol used for the U.S. EPA Stage 3 program."[43] This could include the long-term impact of a more severe duty cycle, impact of fuel impurities, or the impact of other engine related issues that are too small to detect or prior to fault detection. Given that engine manufacturers have the flexibility to screen out vehicles that have been mis-fueled or mal-maintained, adding a compliance allowance to account for the same mechanisms should be considered as double counting the compliance allowance.

In the HDIUT program, test engines are carefully screened to ensure that they are properly maintained and used, have not been tampered with, rebuilt, or undergone major repair that could be expected to affect emissions, and have not been mis-fueled.[44] Additionally, an engine manufacturer may disqualify an engine/vehicle for an illuminated malfunction indicator light or stored On-Board Diagnostic trouble codes, or for any other reasons, with advanced notice to the Administrator.[45] The example given in the regulatory text for "any other reasons" may be the "vehicle's usage is atypical for the particular application." Given the broad range of discretionary authority to reject or disqualify an engine/vehicle, an engine manufacturer may minimize any variability related to field aging since engines are carefully screened during the selection and testing process.

It should also be noted that at the time of certification, manufacturers attest that all emission-related components are durable to the engine's full useful life subject to the appropriate maintenance schedule, thereby, eliminating the potential for component failure due to poor design or bad components. In the RIA[46], the field aging component of the compliance allowance include scenarios such as "… the impact of other engine related issues (such as an [exhaust gas recirculation] EGR cooler leak that was too small to detect, or the impact of a short-term high temperature excursion results from a turbocharger failure prior to fault detection, etc.) …" It should be noted that a compliance allowance should not be provided for cases where such an HDIUT failure has been caused by either a bad part or a poor design. If an engine fails to meet the emissions standards during HDIUT because of poor design and bad parts, that should be considered as a legitimate failed test, and a compliance allowance under such a scenario is not warranted.

Another point that minimizes the field aging input relates to the required extended laboratory durability demonstration to 750,000 miles for the heavy heavy-duty engines during the certification process. The purpose of the durability demonstration is to determine

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[43] Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards. Regulatory Impact Analysis (RIA) EPA-420-R-22-035. December 2022. pp. 125-126. *https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1016A9N.pdf*

[44] 88 Fed. Reg. 4514 (40 CFR § 1036.410(b)), (January 24, 2023)

[45] 88 Fed. Reg. 4514 (40 CFR § 1036.410(c)), (January 24, 2023)

[46] Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards. Regulatory Impact Analysis (RIA) EPA-420-R-22-035. December 2022. pp. 125-126. *https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1016A9N.pdf*

deterioration factors to show whether the engine will meet emission standards for the full useful life. While the heavy heavy-duty engine regulatory useful life is 650,000 miles, the laboratory durability demonstration requires the accumulation of an additional 15 percent aging beyond full useful life of mileage accumulation for a heavy heavy-duty engine, or about another 100,00 miles for an equivalent of 750,000 miles.[47] The justification provided in the preamble is that it would provide "greater assurance that an engine will maintain its certified emission levels in real world operation where conditions are more variable throughout the regulatory useful life. This greater assurance would be achieved while minimizing the compliance uncertainties identified by manufacturers in comments for the highest proposed useful life mileages."[48] Thus, the potential for more severe aging beyond the DAAAC aging protocol used for the U.S. EPA Stage 3 program is already accounted for in the certification durability testing requirement, and the contribution for this in the field aging input is unnecessary for heavy heavy-duty engines.

Similarly, as previously mentioned for medium heavy-duty engines, the final emission standards were determined using emission data that were measured at a deterioration equivalence of 650,000 miles even though medium heavy-duty engines have a regulatory useful life of 350,000 miles.[49] The RIA notes "While the final useful life for Medium heavy-duty engine is fewer miles than this test point, U.S. EPA considered comments with supporting data that showed, due to the real-world operation of these engines, that Medium heavy-duty engine experience more hydrothermal aging than a Heavy heavy-duty engine at the final useful life values of 350,000 miles for Medium heavy-duty engine…"[50] As indicated, any potentially more severe aging beyond DAAAC aging protocol, would already be considered in the justification for the medium heavy-duty engine emission standards and does not require an additional compliance allowance.

Therefore, the field aging input should be eliminated from the compliance allowance calculation methodology due to a robust engine screening and disqualification process, and to factors already accounted for in the determination of the medium heavy-duty engine certification standard and for extended durability testing of heavy heavy-duty engines. The inclusion of the field aging input amounts to double counting this variability in the compliance allowance methodology.

Furthermore, the statistical analysis for calculating the compliance allowance[51] does not account for the decreased variance associated with the arithmetic mean of emissions for ten engines tested to determine in-use compliance. U.S. EPA incorrectly quantified the analysis

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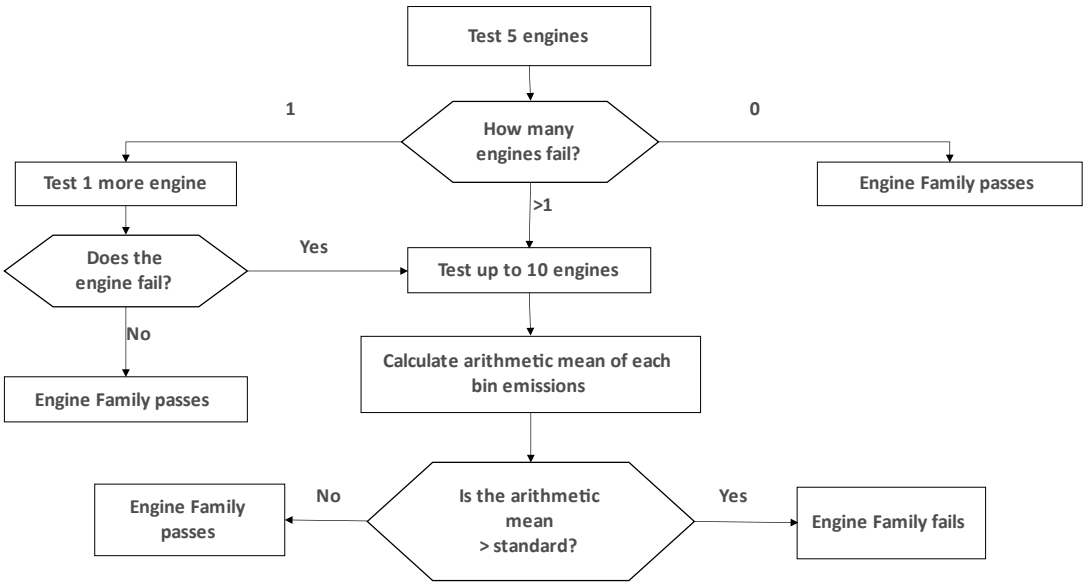
[47] 88 Fed. Reg. 4510 (40 CFR § 1036.245), (January 24, 2023)
[48] 88 Fed. Reg. 4361 (January 24, 2023)
[49] Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards. RIA EPA-420-R-22-035. December 2022. pp. 115-116
[50] *Id.* pp. 115-116
[51] Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards. RIA EPA-420-R-22-035. December 2022. pp. 124-126

of the inputs used to calculate the compliance allowance based only on the variance for one engine.

For the CTP-NOx HDIUT programs, five engines are initially tested for a given engine family, and each engine is individually evaluated to determine compliance with emission standards (plus any allowable margins and allowances).[52] If only one engine does not comply with the emission thresholds, another engine is selected and tested. If this later engine complies with the emission threshold, then the engine family passes, and testing stops. However, if this additional engine fails or if two or more of the initial five engines tested fail, then additional engines are tested until ten engines are reached. At this final step of testing, the arithmetic mean of the emissions from the ten engines is used to determine whether the engine family is in compliance.[53] If the arithmetic mean of the emissions from the ten engines is at or below the applicable emission thresholds, the engine family passes. However, if the arithmetic mean of the ten-engine emissions exceeds the applicable emission thresholds, the engine family fails and is not in compliance. See Figure 7 for a flowchart of the engine family pass and fail criteria to determine in-use compliance.

Figure 7. HDIUT Engine Family Pass/Fail Criteria*



***Applies to 2027 and subsequent MY engines. Additional flexibility to pass/fail is provided for MYs 2027 and 2028 in 40 CFR § 1036.150(z).**

[52] For MYs 2027 and 2028 engines only, alternative pass/fail criteria are allowed as described in 88 Fed. Reg 4351-4352.
[53] 88 Fed. Reg. 4515 (40 CFR § 1036.425(c)), (January 24, 2023)

U.S. EPA utilized the understanding of less variance associated with an increased sample size in an interim HDIUT provision that was finalized for MY 2027 and 2028.[54] This interim provision allows up to 15 engines from a given engine family to be tested in HDIUT, and the arithmetic mean of the engines' emissions is compared to the applicable emission thresholds to determine in-use compliance. This interim provision gives additional flexibility during the first two years of the implementation of the CTP-NOx rule, since averaging the emissions over a larger number (15) of engines provides additional margin than that of a lesser number (10) of engines.

Based on this analysis, CARB staff believes that there is no regulatory precedent for including a permanent "interim" compliance allowance nor a technical justification for the numeric value of a 15 mg/hp-hr compliance allowance for in-use standards in the CTP-NOx rule. CARB staff appreciates the need for additional flexibilities when new emission control technologies are introduced; therefore, CARB staff recommends that U.S. EPA implement a sunset date of 2030 MY for the 15 mg/hp-hr compliance allowance. On the other hand, if U.S. EPA is interested in pursuing a permanent compliance allowance, then the numerical value of the allowance must consider the technical issues with respect to the calculation methodology.

C. Emissions Impacts from the Provisions

CARB staff has conducted an analysis of the provisions and their impacts on the California emission inventory using the EMAFAC[55] model. The results from the analysis are shown on Figure 8. As shown, if U.S. EPA does not close the provisions discussed herein and CARB aligns with U.S. EPA's CTP-NOx rule, California could lose NOx emissions benefits of approximately 1 to 8 tons per day in 2037. Figure 8 shows the potential emission increases for one individual truck and also shows total potential loss in benefits for all California and federal-certified trucks operating in California.[56]

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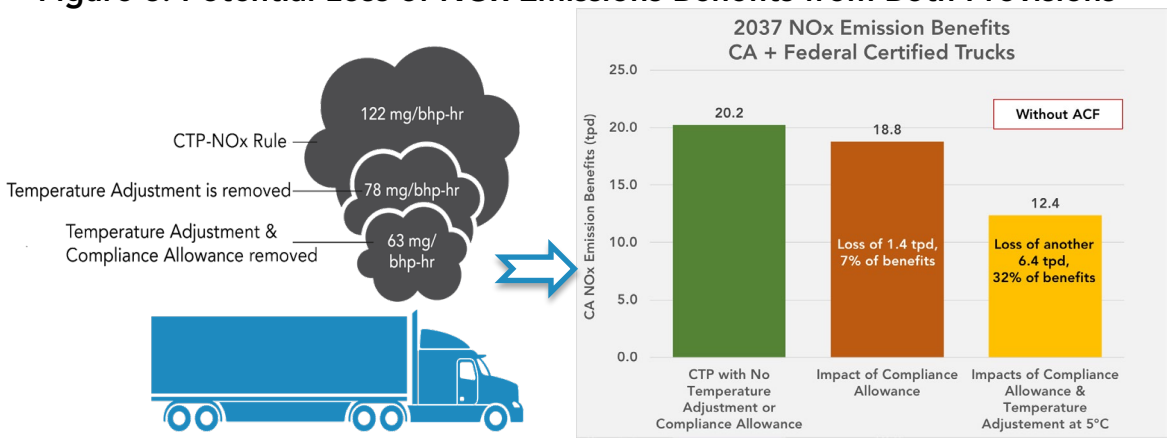
[54] 88 Fed. Reg. 4503 (40 CFR § 1036.150(z)), (January 24, 2023)

[55] *https://arb.ca.gov/emfac/*

[56] The column chart shows 2037 NOx emission benefits and the loses resulting from the two provisions without the Advanced Clean Fleets (ACF) rule from both California and federal-certified trucks, if California aligns with the CTP-NOx standards. If ACF had been considered as initially proposed, 2037 statewide NOx emission benefits from both California and federal-certified trucks would be 12.6, 11.7, and 7.7 tpd respectively for the green, orange, and yellow columns. In addition, the yellow bar in the column chart assumes operation at 5 °C and so is a worst-case estimate of benefit losses due to the temperature adjustment. The actual losses of benefits in CA will be somewhere between the brown and yellow bars.

Figure 8. Potential Loss of NOx Emissions Benefits from Both Provisions



D. Temperature Adjustment and Ozone Formation

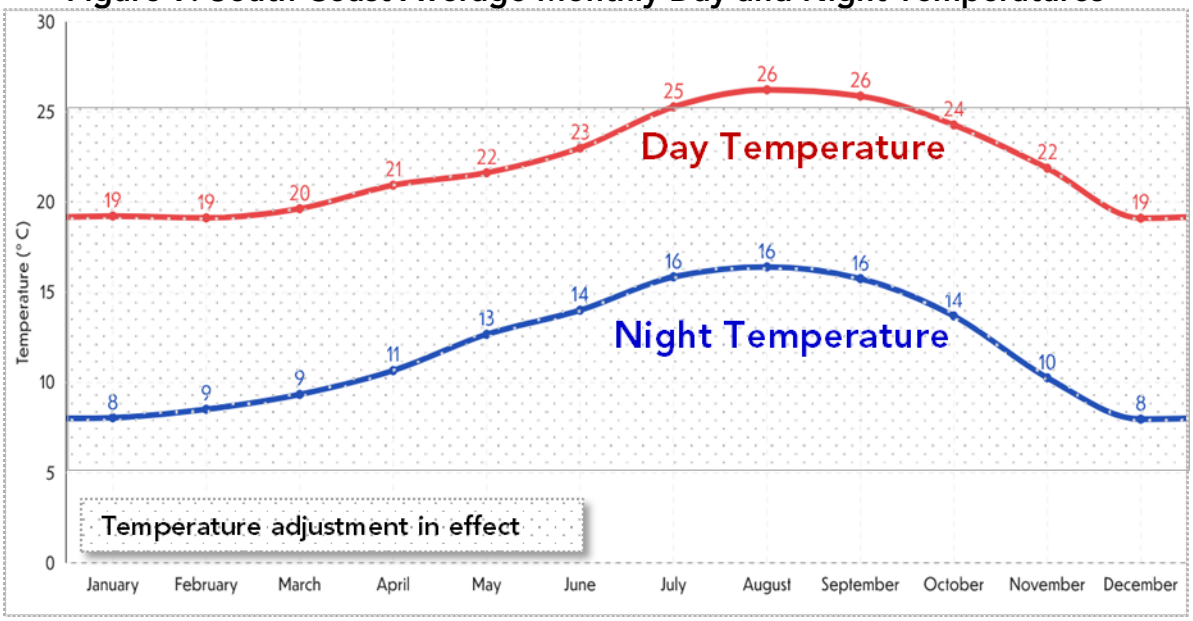
Some stakeholders have recently indicated that ozone formation in Southern California is only a problem in hot summer months and therefore, CARB staff should not be concerned with the temperature adjustment function.

It is worth noting that NOx is not just a precursor to ozone whose formation depends on the presence of sunlight but also a precursor to PM2.5 whose formation is independent of the presence of sunlight. Therefore, irrespective of the time of the day or the month of the year, NOx will contribute to the formation of PM2.5.

With regards to the formation of ozone in hot summer months, CARB staff performed a preliminary investigation of the South Coast climate throughout the year to examine this further. As shown in Figure 9, even during the July to September period, average evening temperatures in the South Coast fall well below the 25 °C limit where the temperature adjustment function becomes active. Furthermore, analysis of the EMFAC model indicates that 37 percent of the heavy-duty truck vehicle miles traveled (VMT) in Southern California occur between the hours of 8 P.M. to 8 A.M. Therefore, even during the hot summer months in Southern California, the temperature adjustment would permit additional NOx emissions of heavy-duty trucks at nighttime.

The overall impacts of these excess NOx emissions would have to be modeled in future versions of the EMFAC model, but nevertheless, the rationale for rejecting any NOx impacts from the temperature adjustment function in California during summertime is flawed because it does not consider the impacts of heavy-duty truck VMT at nighttime.

Figure 9. South Coast Average Monthly Day and Night Temperatures[57]



IV. Conclusion

It has been 22 years since U.S. EPA last updated its heavy-duty truck standards for criteria pollutants. The new final CTP-NOx rule is a major step forward, but because it is so monumental and so needed, it is also important to ensure it is as strong as it can be and satisfies the CAA's requirement to achieve the greatest degree of emission reductions. The improvements to the provisions discussed in this petition would achieve that end and also provide opportunities to explore deeper state/federal alignment in the future. In light of the pressing attainment deadlines in California, the need for industry certainty, and the importance of this pollution problem, CARB requests an initial response to this petition as soon as possible and no later than June 1, 2023.[58] Thank you for your attention to these critical matters.

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[57] Temperature data from: *California - South coast climate | Sunheron* (*https://www.sunheron.com/north-america/united-states-of-america/california-south-coast-weather-climate/* - last accessed 3/5/2023)

[58] We anticipate that U.S. EPA may express reservations in timely accommodating our concerns, on the grounds that incorporating modifications to the final CTP-NOx rule would necessarily delay the implementation of the rule under CAA section 202(a)(3)(C). We are certainly not requesting that U.S. EPA immediately address our concerns at the expense of delaying the timely implementation of the final CTP-NOx rule, because we certainly prefer having a flawed final rule to the alternative of no rule at all, and we also anticipate that U.S. EPA can accommodate our concerns in a manner that is consistent with its obligations under CAA section 202(a)(3)(C), such as implementing the requirements beginning with the 2031 or later model years.

V. Appendix

Comparison of Omnibus 2031 and Later MY vs Clean Trucks Plan 2027 and Later MY Heavy-Duty Engine Standards

Table 3. NOx Certification and In-Use Duty Cycle Standards on Engine Dynamometer

Cycle	Omnibus Regulation	Clean Trucks Plan
FTP[1]/RMC[2] (mg/hp-hr)[3]	LHDD[4]/MHDD[4]: 20 HHDD[4]: 40	LHDD: 35 MHDD/HHDD: 35 for new engines, 50 for in-use engines[5]
LLC[6] (mg/hp-hr)	LHDD/MHDD: 50 HHDD: 100	LHDD: 50 MHDD/HHDD: 50 for new engines, 65 for in-use engines[5]
Idle (g/hr)[7]	All Classes: 5	All Classes: 10 optional

Table 4. In-use Off-Cycle NOx Standards[8] with Portable Emissions Monitoring Systems

	Omnibus Regulation	Clan Trucks Plan
Bin 1 (g/hr)	All Classes: 7.5	All Classes: @77 °F (25 °C):10.4 @41 °F (5 °C): 15.4
Bin 2[9,10] (mg/hp-hr)	LHDD / MHDD: 75 HHDD: 150	LHDD: @77 °F (25 °C): 63) @41 °F (5 °C): 107) MHDD/HHDD: @ 77 °F (25 °C): 78 @ 41 °F (5 °C): 122)
Bin 3[11] (mg/hp-hr)	LHDD / MHDD: 30 HHDD: 60	N/A

[1] FTP – Federal Test Procedure
[2] RMC – Ramped Modal Cycle
[3] mg/hp-hr – milligram per horsepower-hour
[4] LHDD: Light Heavy-Duty Diesel
MHDD: Medium-Heavy-Duty Diesel
HHDD: Heavy-Heavy-Duty Diesel

[5] Clean Trucks Plan has separate standards for new and in-use engines when tested on engine dynamometer with certification duty cycles
[6] LLC – Low load cycle
[7] g/hr – grams per hour
[8] CTP NOx Off-cycle standards include the accuracy margins for in-use testing in 40 CFR § 1036.420(a)
[9] Under Omnibus Regulation, Bin 2 represents low load operations
[10] Under Clean Trucks Plan, Bin 2 represents low-to-medium-to-high load operations
[11] Under Omnibus Regulation, Bin 3 represents medium-to-high load operations.