

Attachment A

EMFAC Off-Model Adjustment Factors to Remove Emissions Benefits of Advanced Clean Trucks, Zero-Emission Airport Shuttle, Warranty Phase 1, and Heavy-Duty Omnibus Regulations

I. Summary

On June 12, 2025, three Congressional Resolutions purported to disapprove U.S. EPA's decisions to grant California waivers for several regulations in the EMISSION FACTORS (EMFAC) 2021 v1.0.2 baseline, including Advanced Clean Trucks (ACT), Zero-Emission Airport Shuttle, Heavy-Duty Vehicle and Engine Emission Warranty and Maintenance Provisions (Warranty Phase 1), and Heavy-Duty Omnibus (Omnibus) regulations.¹ While those illegal actions are being contested, CARB staff are providing factors to remove these regulations from EMFAC2021 v1.0.2 solely for the purposes of State Implementation Plan (SIP) development and conformity determinations, including regional emissions analysis for transportation plan and transportation improvement program conformity determinations, as well as as hot-spot analysis for project-level conformity determinations. The off-model adjustment factors are listed in the attached Appendix A to remove ACT, Zero-Emission Airport Shuttle, Warranty Phase 1, and Omnibus emissions reductions from the EMFAC2021 v1.0.2 baseline.

II. Background on EMFAC

EMFAC is California's federally approved on-road mobile source emissions inventory model that reflects California-specific driving and environmental conditions, fleet mix, and vehicle emissions, including those resulting from California's mobile source regulations. The EMFAC model supports CARB's regulatory and air quality planning efforts and fulfills the federal Clean Air Act and the Federal Highway Administration's transportation planning requirements. On November 15, 2022, U.S. EPA approved EMFAC2021 v1.0.2 for use in SIP development and conformity analyses, with EPA noting that it would not be able to approve SIPs based on EMFAC2021 until the adopted regulations in the EMFAC2021 v1.0.2 baseline had received waivers from EPA and been approved in the California SIP. This model accounts for the effects of regulations that were approved by the Board as of the release of EMFAC2021 v1.0.2 on January 15, 2021.

¹ Other affected regulations include Zero-Emission Powertrain Certification and Advanced Clean Cars II. Zero-Emission Powertrain Certification does not affect pollutant emissions, and Advance Clean Cars II was adopted after the release of EMFAC2021.

III. Descriptions of ACT, Zero-Emission Airport Shuttle, Warranty Phase 1, and Omnibus

The EMFAC2021 v1.0.2 baseline includes the effects of a number of regulations, including ACT, Zero-Emission Airport Shuttle, Warranty Phase 1, and Omnibus. Descriptions of all regulations are provided below.

ACT:² ACT was approved by CARB's Board in June 2020. The California Office of Administrative Law (OAL) then approved ACT with an effective date of March 15, 2021. This regulation requires manufacturers of Class 2b-8 chassis or complete vehicles with combustion engines to sell an increasing percentage of zero-emission trucks in their annual California sales starting in 2024. By 2035, zero-emission truck or chassis sales would need to be 55 percent of Class 2b-3 truck sales, 75 percent of Class 4-8 vocational truck sales, and 40 percent of Class 7-8 tractor truck sales. This regulation reduces emissions from trucks model year 2024 and newer.

Zero-Emission Airport Shuttle:³ Zero-Emission Airport Shuttle was approved by CARB's Board in June 2019. OAL then approved the regulation in January 2020. This regulation requires airport shuttle fleets to fully transition to zero emission by 2035. No additional reductions were credited beyond ACT.

Warranty Phase 1:⁴ CARB adopted amendments to the heavy-duty engine (Gross Vehicle Weight Rating, or GVWR, above 14,000 lbs.) warranty regulation in 2018. The California OAL then approved this regulation on June 12, 2019. This regulation reduces NOx and particulate matter (PM) emissions from heavy-duty engines model year 2022 and newer.

Omnibus:⁵ Omnibus was approved by CARB's Board in August 2020. The California OAL then approved Omnibus with an effective date of December 22, 2021. This regulation comprehensively updates heavy-duty engine NOx emissions standards and provides additional requirements for engines to remain clean throughout their lifetime. This regulation primarily reduces NOx emissions from trucks with engines that are model year

² CARB. (2021). Advanced Clean Trucks Regulation,
<https://ww2.arb.ca.gov/rulemaking/2019/advancedcleantrucks>.

³ CARB. (2020). Zero-Emission Airport Shuttle Regulation,
<https://ww2.arb.ca.gov/rulemaking/2019/asb19>.

⁴ CARB. (2019). Heavy-Duty Warranty Amendments,
<https://ww2.arb.ca.gov/rulemaking/2018/hd-warranty-2018>.

⁵ CARB. (2021). Heavy-Duty Omnibus Regulation,
<https://ww2.arb.ca.gov/rulemaking/2020/hdomnibuslownox>.

2024 and newer. Additionally, this regulation further lengthens the warranty requirement beyond Warranty Phase 1 for engine model years 2027 and newer.

IV. Methods for Removing Emissions Reductions of ACT, Zero-Emission Airport Shuttle, Warranty Phase 1, and Omnibus from EMFAC2021

To remove the impact of ACT, Zero-Emission Airport Shuttle, Warranty Phase 1, and Omnibus regulations on criteria pollutant emissions, CARB staff used the methodology implemented in the latest U.S. EPA-approved version of the EMFAC model, EMFAC2021 v1.0.2. Using the "Annual" setting, the model was run for calendar years 2022 through 2050 to estimate emissions under two scenarios:

1. **Remove Regulations** scenario where emissions are estimated without accounting for the benefits of the ACT, Zero-Emission Airport Shuttle, Warranty Phase 1, and Omnibus regulations. This scenario was developed using a custom internal version of the model with targeted adjustments. Changes to estimation methods and results for each are listed below.
 - ACT and Zero-Emission Airport Shuttle:
 - ACT zero-emission sales for medium- and heavy-duty (Class 2b-8) model year 2024 and newer vehicle population and vehicle miles traveled forecasts, which includes airport shuttles required as part of the Zero-Emission Airport Shuttle regulation, are removed; no zero-emission vehicles in these weight classes assumed, maintaining the model's 2019 base year.⁶
 - Outputs show increased tailpipe (all pollutants) and brake wear PM emissions.
 - Warranty Phase 1
 - Heavy-duty (Class 4-8) California-certified heavy-duty model year 2022 and newer engines are assumed to have baseline warranty requirement of 100,000 miles.
 - Removed adjustments for Phase 1 lengthened warranty, and, therefore, emission deterioration rates are based on in-use emissions test data of 0.2 g/bhp-hr NOx certified engines that are not affected by this regulation.
 - Outputs show increased tailpipe NOx and PM emissions.

⁶ The adjustment factors for heavy-duty ZEVs are 0, except for the UBUS (transit bus) category, where adjustment factors are equal to 1.0, reflecting the 2019 base year where it is assumed there are no heavy-duty ZEVs other than UBUS. Because vehicle population forecasts stay constant, the brake and tire wear emissions from ZEVs shift to combustion vehicles when ACT is removed and are therefore appropriately accounted for.

- Omnibus:
 - Heavy-duty (Class 4-8) California-certified heavy-duty model year 2024 and newer engines are assumed to meet prior California engine emissions standards (*i.e.*, 0.2 g/bhp-hr NO_x standard).
 - Removed reduction factors reflecting Omnibus requirements⁷ that are applied to baseline emission rates. Baseline emission rates default to in-use test data from 0.2 g/bhp-hr NO_x certified engines.
 - Outputs show increased tailpipe NO_x and PM emissions.
- 2. **Include Regulations** scenario where the benefits of ACT, Zero-Emission Airport Shuttle, Warranty Phase 1, and Omnibus regulations, in addition to all other adopted regulations when the model was finalized, are reflected when estimating emissions. This is the same scenario as presented in the public version of the EMFAC2021 v.10.2 model. More details on how these regulations were incorporated into the model can be found in the EMFAC2021 Technical Documentation.⁸

The emissions results from these two scenarios were used to assess the increase in emissions from removing ACT, Zero-Emission Airport Shuttle, Warranty Phase 1, and Omnibus and derive the adjustment factors presented in Appendix A. The adjustment factors for each calendar year, vehicle category, fuel type and pollutant (described further below) were calculated based on the following equation:

$$\text{Adjustment factors} = \text{Remove Regulations emissions} / \text{Include Regulations emissions}$$

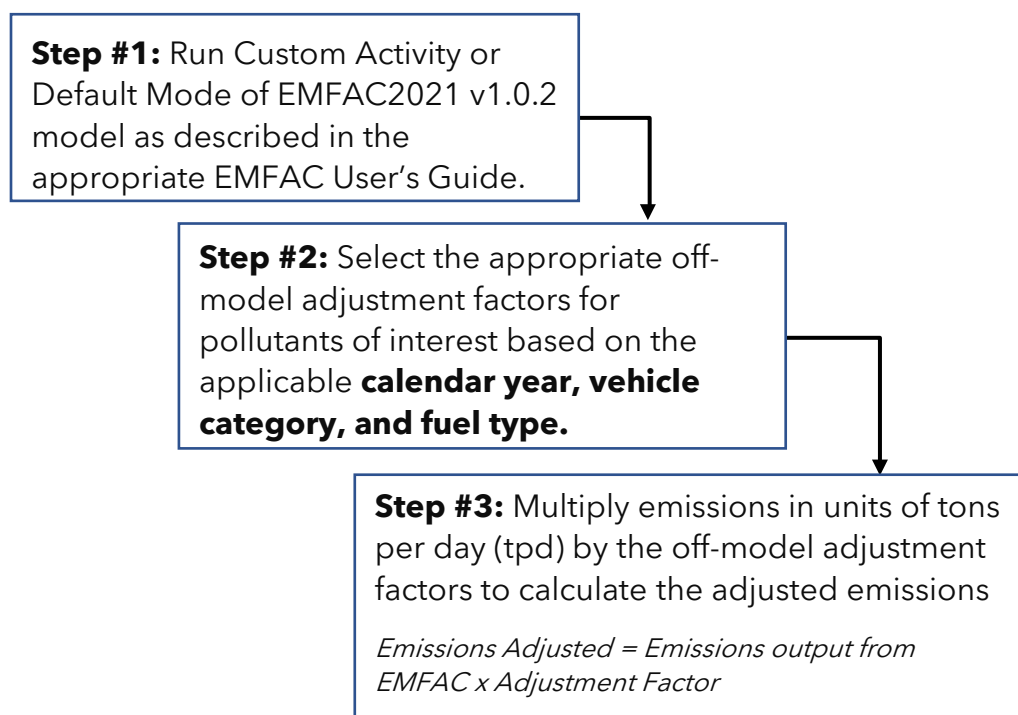
⁷ Includes tightened Federal Test Procedure (FTP), new load certification cycle (LLC), tightend idling standards, improvements to the existing heavy-duty in-use testing program (HDIUT), improvements to the durability demonstration program (CCP), lengthened warranty and useful life (UL) mileages, and amendments to the emissions warranty information reporting (EWIR) program and corrective action procedures.

⁸ CARB. (2021). EMFAC2021 Technical Documentation. EMFAC2021 Volume III Technical Document, https://ww2.arb.ca.gov/sites/default/files/2021-03/emfac2021_volume_3_technical_document.pdf.

V. Application of Off-Model Adjustment Factors

The off-model adjustment factors for EMFAC2021 v1.0.2, prepared using the methods described above, are tabulated in Appendix A. These factors apply to NO_x, ROG, PM_{2.5}, and PM₁₀ emissions for each calendar year, vehicle category, and fuel type in EMFAC2021 v1.0.2. The flowchart illustrated in Figure 1 details the methodology to apply these adjustment factors.

Figure 1. Process to apply EMFAC2021 v1.0.2 off-model adjustment factors⁹



Contact

For questions regarding the EMFAC off-model adjustment factors, please contact us at:
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⁹ Custom Activity (SG) mode is available using the EMFAC2021 v1.0.2 desktop application, or the EMFAC2021 v1.0.2 web database: <https://arb.ca.gov/emfac/scenario-analysis/>.