EMFAC Off-Model Adjustment Factors for Carbon Dioxide (CO_2) Emissions to Account for the SAFE Vehicles Rule Part One and the Final SAFE Rule

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Summary

Federal actions in the past year to undermine motor vehicle greenhouse gas emission (GHG) standards and California's requirements for zero-emission vehicles have necessitated changes to California's modeling tools for estimating on-road vehicle emissions. In September 2019, the U.S. Environmental Protection Agency (U.S. EPA) and the National Highway Traffic Safety Administration (NHTSA) issued the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program (SAFE Part One) that revoked California's authority to set its own greenhouse gas emissions standards and zero-emission vehicle (ZEV) mandates in California.[1] In April 2020, the federal agencies issued the SAFE Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks (Final SAFE Rule) that relaxed federal greenhouse gas emissions and fuel economy standards.[2]

On November 20, 2019, California Air Resources Board (CARB) released the EMFAC off-model adjustment factors to account for SAFE Part One.[3] These adjustment factors were only for criteria pollutants, and U.S. EPA considered them to be acceptable for use in transportation conformity determinations in California.[4]

The Final SAFE Rule then relaxed federal greenhouse gas emissions and Corporate Average Fuel Economy (CAFE) standards to increase in stringency at only about 1.5 percent (%) per year from model year (MY) 2020 levels over MYs 2021–2026. The previously established emission standards and related "augural" fuel economy standards would have achieved about 4% per year improvements through MY 2025. The Final SAFE Rule affects both upstream (production and delivery) and downstream (tailpipe exhaust) carbon dioxide (CO_2) emissions.

CARB has evaluated the Final SAFE Rule and determined that the criteria adjustment factors to EMFAC that were issued on November 20, 2019, and subsequently approved by U.S. EPA continue to be valid and should be used for purposes of transportation conformity. Although the Final SAFE Rule will increase upstream criteria pollutant emissions, and this is a serious problem, these upstream emissions do not directly implicate transportation conformity, and EPA has stated that EMFAC 2017 and

[1] 84 Fed. Reg. 51,310 (Sept. 27, 2019).
[2] 85 Fed. Reg. 24,174 (Apr. 30, 2020).
[3] https://ww3.arb.ca.gov/msei/emfac_off_model_adjustment_factors_final_draft.pdf
[4] https://ww3.arb.ca.gov/msei/epa_emfac_adj_factors_response_031220_ada.pdf?_ga=2.257366732.635401472.1592431665-1276291156.1556055779

2014 remain approved.[5] Accordingly, at this time, additional adjustment factors for criteria pollutants are not needed beyond those already released for purposes of transportation conformity.

This document specifically provides the off-model adjustment factors that can be used to adjust tailpipe CO_2 emissions output from the EMFAC model (EMFAC2014 and EMFAC2017) to account for the impacts of both SAFE Part One and the Final SAFE Rule.

The adjustment factors do not account for commitments from various forward-thinking manufacturers to exceed the relaxed federal standards. These commitments are not reflected in EMFAC because no agreements are finalized at this time.

How Does SAFE Part One and the Final SAFE Rule Impact CO_2 Emissions?

As a result of SAFE Part One and the Final SAFE Rule, additional gasoline will be needed to meet the travel demands of the on-road vehicle fleet in California. This will increase tailpipe emissions and emissions associated with production and delivery of gasoline and diesel throughout the state. Moreover, because of the loss of California's ZEV sales requirements, there may be fewer ZEVs sold and thus additional gasoline-fueled vehicles sold in future years.

As mentioned above, the Final SAFE Rule will not impact tailpipe criteria (from both fuel system evaporation and engine exhaust) emissions. Therefore, the criteria pollutant emissions adjustment factors originally released by CARB in November 2019 remain in effect.

How Did CARB Analyze SAFE Part One and the Final SAFE Rule's impacts on CO_2 emissions?

CARB estimated the change in vehicle tailpipe emissions of the California light-duty vehicle fleet using its EMission FACtor 2017 (EMFAC2017) model and EMission FACtor 2014 (EMFAC2014) models. EMFAC2014 and EMFAC2017[6] is California's federally-approved on-road mobile source emission inventory model. It reflects California-specific driving and environmental conditions, fleet mix, and most importantly the impact of California's unique mobile source regulations. These include the Low-Emission Vehicle (LEV) program, the LEV II and LEV III standards, California inspection and maintenance programs, and in-use diesel fleet rules. 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.

[5] See p. 24859 of https://www.federalregister.gov/documents/2020/04/30/2020-06967/the-safer-affordable-fuel-efficient-safe-vehicles-rule-for-model-years-2021-2026-passenger-cars-and

[6] *See* https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-modeling-tools

The EMFAC default model, with an "annual average" setting, was run to estimate statewide vehicle emissions by calendar year, vehicle category, fuel type, and model year projected to occur under the existing Federal and CARB GHG standards and CARB ZEV requirements that were in place at the time of the analysis. These default results were then adjusted in a post-processing step to reflect SAFE Part One and the Final SAFE Rule's effects on California's on-road fleet.

1. As part of the SAFE Part One analysis, staff froze (flat-lined) new ZEV sales at model year 2020 levels. The projected fleet for model year 2021 and beyond was modified to reflect a lower number of future ZEVs and a corresponding greater number of future gasoline internal combustion engine vehicles (and thus, a higher portion of vehicle miles traveled (VMT) by gasoline vehicles) to meet consumer demand, all else being equal. Also, the increased number of gasoline vehicles were put into appropriate criteria pollutant certification categories under CARB's Low Emission Vehicle (LEV) III criteria pollutant standards to maintain compliance with the required fleet average.

2. The Final SAFE Rule analysis by staff of the relaxed federal greenhouse gas emissions and fuel economy standards incorporated the following assumptions. The Final 2020 SAFE Rule modified the tailpipe CO_2 emission targets for passenger cars (PC) and light trucks (LT) for the 2021 to 2026 model years. Actual fleet CO_2 targets are based on current fleet average footprints (FP) of 46.2 ft^2 for PC and 53.8 ft^2 for LT vehicles. These targets were subsequently used to derive year-over-year (YoY) percent reductions in CO_2 targets for model years 2021-2026 in the PC and LT fleets. Under the Final SAFE Rule, a 1.5% YoY improvement in fuel economy in the CAFE standards was finalized. But there is a different YoY reduction in CO_2 (i.e., grams of CO_2 emitted/mile versus the inverse expression of fuel economy in miles/gallon). Derived from the finalized CO_2 standards rather than the finalized CAFE standards, a 1.84% YoY reduction from 2020 to 2026 for the CO_2 emission factor (EF) values of gasoline passenger cars was applied. For light trucks, a 1.75% YoY reduction was applied. Moreover, in the current analysis, the CO_2 emission factors were further adjusted for differences in car/truck definitions in EMFAC versus those defined by the Federal GHG and CAFE regulations. The passenger car (PC), light duty truck 1 (LDT1), light duty truck 2 (LDT2), and medium duty vehicles (MDV) in EMFAC are defined based on criteria pollutant standards which are not necessarily the same as those defined under the GHG standards. For example, while a 2016 Cadillac SRX is defined as a light truck under the criteria pollutant certification,[7] it is considered a passenger car under the CAFE regulations. Due to this inconsistency, the passenger cars and light duty trucks 1 (i.e., PC & LDT1) in EMFAC are assumed to be comprised of 97% cars and 3% trucks, where the car and truck definition is as per the CAFE regulation. Similarly, for light duty

[7] https://ww3.arb.ca.gov/msprog/onroad/cert/pcldtmdv/2016/gm_pc-ldt_a0061975r1_3d6_b4u2.pdf

trucks 2 and medium duty vehicles (i.e., LDT2 & MDV), staff assumed that they are comprised of 24% cars and 76% trucks.

How are EMFAC CO_2 emissions impacted by SAFE Part One and the Final SAFE Rule?

Generally, after the Final SAFE Rule becomes effective on June 29, 2020, EMFAC2014 and EMFAC2017 must be updated with new assumptions reflecting SAFE Part One and the SAFE Final Rule as off-model adjustment factors to accurately estimate future tailpipe CO_2 emissions.

What are Off-Model Adjustment Factors and how should they be applied?

CARB has prepared off-model adjustment factors for both the EMFAC2014 and EMFAC2017 models to account for the impact of SAFE Part One and the Final SAFE Rule. These adjustments are provided in the form of multipliers applied to emissions outputs from EMFAC model to account for the impact of these rules and actions. The adjustment factors are provided in Table 1 for EMFAC2014 and EMFAC2017. Note these factors do not include upstream emissions associated with fuel demand, as EMFAC only estimates tailpipe and evaporative emissions. For more details on how to apply the off-model adjustment factors, please refer to CARB's previous memorandum titled "EMFAC Off-Model Adjustment Factors to Account for the SAFE Vehicle Rule Part One" released on November 20, 2019.[8] Please note that the adjustment factors generated for CO_2 can also be applied to assess impacts on fuel consumption. Additionally, these adjustment factors are calculated for fleet CO_2 emissions and cannot be applied to specific model years.

How should these CO_2 Off-Model Adjustment Factors be used in the context of SB 375 Analysis?

Currently, Metropolitan Planning Organizations (MPOs) use EMFAC2014 or EMFAC2017 to estimate regional passenger vehicle CO_2 emissions when developing Sustainable Communities Strategies under SB 375 (Steinberg, ch. 728, stats. 2008). When used for SB 375 GHG emission reduction target demonstration (SB 375 analysis by MPO's through "SB 375 mode" in EMFAC model), EMFAC does not account for the impact of light duty ZEV and GHG emissions standards. As such, SAFE Part One and the Final Rule do not impact EMFAC "SB 375 mode" and the CO_2 off-model adjustment factors provided in Table 1 should not be used for the SB 375 program.

[8] https://ww3.arb.ca.gov/msei/emfac_off_model_adjustment_factors_final_draft.pdf

Table 1. Off-Model Adjustment Factors for Gasoline Light Duty Vehicle[9] CO_2 Emissions in **EMFAC2014** and **EMFAC2017**

CO2 Adjustment Factors for **EMFAC** Gasoline Light Duty Vehicles[9]		
Calendar Year	**EMFAC2014**	**EMFAC2017**
2021	1.0041	1.0023
2022	1.0110	1.0065
2023	1.0202	1.0126
2024	1.0315	1.0207
2025	1.0452	1.0309
2026	1.0566	1.0394
2027	1.0674	1.0475
2028	1.0779	1.0554
2029	1.0879	1.0629
2030	1.0974	1.0702
2031	1.1064	1.0770
2032	1.1147	1.0834
2033	1.1223	1.0893
2034	1.1293	1.0947
2035	1.1355	1.0997
2036	1.1410	1.1041
2037	1.1457	1.1080
2038	1.1497	1.1114
2039	1.1531	1.1143
2040	1.1559	1.1168
2041	1.1582	1.1189
2042	1.1601	1.1207
2043	1.1616	1.1221
2044	1.1629	1.1233
2045	1.1639	1.1243
2046	1.1647	1.1251
2047	1.1655	1.1258
2048	1.1661	1.1263
2049	1.1666	1.1268
2050	1.1670	1.1272

Contact

For questions regarding the EMFAC off-model adjustment factors, please contact us at: EMFAC@arb.ca.gov

[9] LDA, LDT1, LDT2 and MDV vehicle categories in EMFAC