The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021 – 2026 Passenger Cars and Light Trucks

Final Environmental Impact Statement

Summary

March 2020

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U.S. Department of Transportation
National Highway Traffic Safety Administration

NHTSA
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

SUMMARY

Foreword

The National Highway Traffic Safety Administration (NHTSA) prepared this environmental impact statement (EIS) to analyze and disclose the potential environmental impacts of the Corporate Average Fuel Economy (CAFE) standards for passenger cars and light trucks for model years (MYs) 2021 to 2026. NHTSA prepared this document pursuant to Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) implementing regulations, U.S. Department of Transportation (DOT) Order 5610.1C, and NHTSA regulations.

This Final EIS compares the potential environmental impacts of eight alternatives for setting fuel economy standards for MY 2022–2026 passenger cars and light trucks (seven action alternatives and the No Action Alternative). Additionally, some of the action alternatives would revise the currently existing CAFE standards for MY 2021. This EIS analyzes the direct, indirect, and cumulative impacts of each action alternative relative to the No Action Alternative.

Background

The Energy Policy and Conservation Act of 1975 (EPCA) mandated that NHTSA establish and implement a regulatory program for motor vehicle fuel economy, known as the CAFE program, to reduce national energy consumption. As codified in Chapter 329 of Title 49 of the U.S. Code (U.S.C.) and, as amended by the Energy Independence and Security Act of 2007 (EISA), EPCA sets forth specific requirements concerning the establishment of average fuel economy standards for passenger cars and light trucks, which are motor vehicles with a gross vehicle weight rating less than 8,500 pounds and medium-duty passenger vehicles with a gross vehicle weight rating less than 10,000 pounds. The Secretary of Transportation has delegated responsibility for implementing the CAFE program to NHTSA.

EISA, enacted by Congress in December 2007, amended the EPCA CAFE program requirements by providing DOT additional rulemaking authority and responsibilities. Consistent with its statutory authority, in a rulemaking to establish CAFE standards for MY 2017 and beyond passenger cars and light trucks, NHTSA developed two phases of standards. The first phase included final standards for MYs 2017–2021. The second phase, covering MYs 2022–2025, included standards that were not final, due to the statutory requirement that NHTSA set average fuel economy standards not more than five model years at a time. Rather, NHTSA wrote that those standards were *augural*, meaning that they represented its best estimate, based on the information available at that time, of what levels of stringency might be maximum feasible in those model years.

On July 26, 2017, NHTSA published a Notice of Intent to prepare an EIS for new CAFE standards, which stated that NHTSA intended to publish a Notice of Proposed Rulemaking (NPRM) for MY 2022–2025 passenger cars and light trucks. The NPRM was issued together with the Draft EIS on August 2, 2018.

To inform its development of the final CAFE standards, NHTSA prepared this EIS, which analyzes, discloses, and compares the potential environmental impacts of a reasonable range of alternatives, including a Preferred Alternative, and discusses impacts in proportion to their significance. NHTSA is issuing this Final EIS concurrently with the final rule (Record of Decision), pursuant to 49 U.S.C. 304a (Pub. L. 114-94, 129 Stat. 1312, Section 1311(a)) and U.S. Department of Transportation *Guidance on the*

Use of Combined Final Environmental Impact Statements/Records of Decision and Errata Sheets in National Environmental Policy Act Reviews.

Purpose and Need for the Action

In accordance with EPCA, as amended by EISA, the purpose of NHTSA's rulemaking is to set fuel economy standards for MY 2021–2026 passenger cars and light trucks at "the maximum feasible average fuel economy level that the Secretary of Transportation decides the manufacturers can achieve in that model year." Specifically, in addition to establishing new standards for MY 2022–2026 vehicles, NHTSA also considers whether the current MY 2021 CAFE standards are "maximum feasible" and, if not, how to amend them as appropriate. When determining the maximum feasible levels that manufacturers can achieve in each model year, EPCA requires that NHTSA consider the four statutory factors of technological feasibility, economic practicability, the effect of other motor vehicle standards of the government on fuel economy, and the need of the United States to conserve energy. In addition, when determining the maximum feasible levels, the agency considers relevant safety and environmental factors.

For MYs 2021–2030, NHTSA must establish separate average fuel economy standards for passenger cars and light trucks for each model year. Standards must be "based on one or more vehicle attributes related to fuel economy" and "express[ed]…in the form of a mathematical function." EISA includes another requirement, which mandates that NHTSA "prescribe annual fuel economy standard increases that increase the applicable average fuel economy standard ratably," for MYs 2011–2020. This requirement does not apply for MY 2021 and later model years.

Proposed Action and Alternatives

NHTSA's action is setting fuel economy standards for passenger cars and light trucks in accordance with EPCA, as amended by EISA. NHTSA has selected a reasonable range of alternatives within which to set CAFE standards and to evaluate the potential environmental impacts of the final CAFE standards and alternatives under NEPA. In any single rulemaking under EPCA, fuel economy standards may be established for not more than five model years. For this reason, NHTSA is establishing CAFE standards for MY 2022–2026 passenger cars and light trucks. In addition, some of the action alternatives would revise the current CAFE standards for MY 2021.

NHTSA has analyzed a range of action alternatives with fuel economy stringencies that increase annually, on average, 0.0 to 3.0 percent from the MY 2020 or MY 2021 standards for passenger cars and for light trucks (depending on alternative). This range of action alternatives, as well as the No Action Alternative, encompasses a spectrum of possible standards NHTSA could determine is maximum feasible based on the different ways the agency could weigh EPCA's four statutory factors.

The No Action Alternative (also referred to as Alternative 0 in tables and figures) assumes that NHTSA would not amend the CAFE standards for MY 2021 passenger cars and light trucks. In addition, the No Action Alternative assumes that NHTSA would finalize the MY 2022–2025 augural CAFE standards that were described in the 2012 joint final rule. Finally, for purposes of its analysis, NHTSA assumes that the MY 2025 CAFE standards would continue indefinitely. The No Action Alternative provides an analytical baseline against which to compare the environmental impacts of the other alternatives presented in the EIS. NHTSA also considers seven action alternatives, Alternatives 1 through 7, which would require average annual increases in fuel economy ranging from 0.0 percent for passenger cars and light trucks

(Alternative 1) to 2.0 percent (passenger cars) and 3.0 percent (light trucks) (Alternative 7) from year to year. These action alternatives are as follows:

- **Alternative 1.** Alternative 1 would require a 0.0 percent average annual fleet-wide increase in fuel economy for both passenger cars and light trucks for MYs 2021–2026. This alternative revises the MY 2021 standards to the MY 2020 levels and carries those numbers forward for MYs 2021–2026. Alternative 1 was identified as NHTSA's Preferred Alternative in the NPRM and Draft EIS; however, Alternative 3 is now NHTSA's Preferred Alternative.
- **Alternative 2**. Alternative 2 would require a 0.5 percent average annual fleet-wide increase in fuel economy for both passenger cars and light trucks for MYs 2021–2026.
- **Alternative 3 (Preferred Alternative/Proposed Action).** Alternative 3, which NHTSA has identified as the Preferred Alternative, would require a 1.5 percent average annual fleet-wide increase in fuel economy for both passenger cars and light trucks for MYs 2021–2026.
- **Alternative 4.** Alternative 4 would require a 1.0 percent average annual fleet-wide increase in fuel economy for passenger cars and a 2.0 percent average annual increase in fuel economy for light trucks for MYs 2021–2026.
- **Alternative 5.** Alternative 5 would require a 1.0 percent average annual fleet-wide increase in fuel economy for passenger cars and a 2.0 percent average annual increase in fuel economy for light trucks for MYs 2022–2026. Alternative 5 would make no changes to the current CAFE standards for MY 2021.
- **Alternative 6.** Alternative 6 would require a 2.0 percent average annual fleet-wide increase in fuel economy for passenger cars and a 3.0 percent average annual increase in fuel economy for light trucks for MYs 2021–2026.
- **Alternative 7.** Alternative 7 would require a 2.0 percent average annual fleet-wide increase in fuel economy for passenger cars and a 3.0 percent average annual increase in fuel economy for light trucks for MYs 2022–2026. Alternative 7 would make no changes to the current CAFE standards for MY 2021.

NHTSA eliminated from further consideration two alternatives that were considered in the Draft EIS and added a new alternative (Alternative 3) in this Final EIS. For purposes of its analysis, NHTSA assumes that the MY 2026 CAFE standards for each alternative would continue indefinitely. Table S-1 shows the estimated average required fleet-wide fuel economy forecasts by model year for each alternative.

Table S-1. Projected Average Required Fleet-Wide Fuel Economy (mpg) for Combined U.S. Passenger Cars and Light Trucks by Model Year and Alternative

Model Year	Alt. 0 No Action	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7
Projected required mpg								
MY 2021	38.8	36.8	37.0	37.3	37.4	38.8	37.7	38.8
MY 2022	40.6	36.8	37.2	37.9	37.9	39.4	38.7	39.8
MY 2023	42.5	36.8	37.4	38.5	38.6	40.0	39.7	40.8
MY 2024	44.5	36.9	37.6	39.1	39.2	40.7	40.8	41.9
MY 2025	46.6	36.9	37.8	39.8	39.8	41.3	41.9	43.0
MY 2026	46.6	36.9	38.0	40.4	40.5	42.0	43.0	44.2

Notes:
mpg = miles per gallon; MY = model year

The range under consideration in the alternatives encompass a spectrum of possible standards that NHTSA could select based on how the agency weighs EPCA's four statutory factors. By providing environmental analyses at discrete representative points, the decision-makers and the public can determine the projected environmental effects of points that fall between the individual alternatives. The alternatives evaluated in this EIS therefore provide decision-makers with the ability to select from a wide variety of other potential alternatives with stringencies that would increase annually at average percentage rates from 0.0 to 3.0 percent, or up to the No Action Alternative. This range includes, for example, alternatives with stringencies that would increase at different rates for passenger cars and for light trucks and stringencies that would increase at different rates in different years. These alternatives reflect differences in the degree of technology adoption across the fleet, in costs to manufacturers and consumers, and in conservation of oil and related reductions in greenhouse gas (GHG) emissions.

Environmental Consequences

This section describes how the Proposed Action and alternatives could affect energy use, air quality, and climate, as reported in Chapter 3, *Energy*, Chapter 4, *Air Quality*, and Chapter 5, *Greenhouse Gas Emissions and Climate Change*, of this EIS, respectively. Air quality and climate impacts are reported for the entire light-duty vehicle fleet (passenger cars and light trucks combined); results are reported separately for passenger cars and light trucks in an appendix. Chapter 6, *Life-Cycle Assessment of Vehicle Energy, Material, and Technology Impacts,* describes the life-cycle environmental implications of some of the fuels, materials, and technologies that NHTSA forecasts vehicle manufacturers might use to comply with the Proposed Action. Chapter 7, *Other Impacts,* qualitatively describes potential additional impacts on hazardous materials and regulated wastes, historic and cultural resources, safety impacts on human health, noise, and environmental justice.

The impacts on energy use, air quality, and climate include *direct*, *indirect*, and *cumulative impacts*. Direct impacts occur at the same time and place as the action. Indirect impacts occur later in time and/or are farther removed in distance. Cumulative impacts are the incremental direct and indirect impacts resulting from the action added to those of other past, present, and reasonably foreseeable future actions. The cumulative impacts associated with the Proposed Action and alternatives are discussed in Chapter 8, *Cumulative Impacts.*

To derive the direct and indirect impacts of the action alternatives, NHTSA compares each action alternative to a No Action Alternative, which reflects baseline trends that would be expected in the absence of any regulatory action as discussed above. The No Action Alternative for this EIS reflects fuel use and emission trends that would be expected if there were no change in the joint MY 2017–2025 National Program standards issued in the 2012 final rule, which include the MY 2017–2021 CAFE standards and the augural MY 2022–2025 CAFE standards. All alternatives assume the MY 2025 (No Action Alternative) or MY 2026 (action alternatives) standards would continue indefinitely. Because EPCA, as amended by EISA, requires NHTSA to set CAFE standards for each model year, environmental impacts would also depend on future standards established by NHTSA, but which cannot be quantified at this time.

Energy

NHTSA's final standards would regulate fuel economy and, therefore, affect U.S. transportation fuel consumption. Transportation fuel accounts for a large portion of total U.S. energy consumption and energy imports and has a significant impact on the functioning of the energy sector as a whole. Although

U.S. energy efficiency has been increasing and the U.S. share of global energy consumption has been declining in recent decades, total U.S. energy consumption has been increasing over that same period. Until a decade ago, most of this increase came not from increased domestic energy production but from the increase in imports, largely for use in the transportation sector.

Petroleum is by far the largest source of energy used in the transportation sector. In 2018, petroleum supplied 91 percent of transportation energy demand, and in 2040, petroleum is expected to supply 85 percent of transportation energy demand. Transportation accounts for the largest share of total U.S. petroleum consumption. In 2018, the transportation sector accounted for 78 percent of total U.S. petroleum consumption. In 2040, transportation is expected to account for 72 percent of total U.S. petroleum consumption.[1]

With transportation expected to account for 72 percent of total petroleum consumption, U.S. net petroleum imports in 2040 are expected to result primarily from fuel consumption by light-duty and heavy-duty vehicles. The United States is poised to reverse the trend of the last four decades and achieve net energy exports starting in 2020 because of continuing increases in overall U.S. energy efficiency and recent developments in U.S. energy production.

In the future, the transportation sector will continue to be the largest consumer of U.S. petroleum and the second-largest consumer of total U.S. energy, after the industrial sector. NHTSA's analysis of fuel consumption in this EIS projects that fuel consumed by light-duty vehicles will consist predominantly of gasoline derived from petroleum for the foreseeable future.

Direct and Indirect Impacts

To calculate the impacts on fuel use for each action alternative, NHTSA subtracted projected fuel consumption under the No Action Alternative from the level under each action alternative. As the alternatives increase in stringency, total fuel consumption decreases. Table S-2 shows total 2020 to 2050 fuel consumption for each alternative and the direct and indirect fuel use impacts for each action alternative compared with the No Action Alternative through 2050. NHTSA used 2050 as the end year for its analysis as it is the year by which nearly the entire U.S. light duty vehicle fleet will be composed of MY 2021–2026 or later vehicles. This table reports total 2020 to 2050 fuel consumption in gasoline gallon equivalents (GGE) for diesel, gasoline, electricity, hydrogen, and biofuel for cars and light trucks. Gasoline accounts for approximately 99 percent of car and light truck fuel use.

Table S-2. Fuel Consumption and Increase in Fuel Use by Alternative (billion gasoline gallon equivalent total for calendar years 2020–2050)

	Alt. 0 No Action	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7
Fuel Consumption								
Cars	1,482	1,594	1,591	1,583	1,584	1,564	1,560	1,537
Light trucks	1,889	2,004	2,000	1,988	1,977	1,950	1,932	1,919
All light-duty vehicles	3,371	3,598	3,591	3,571	3,561	3,514	3,492	3,456

[1] This Summary references pertinent data from the analysis in the EIS. Sources of such data are appropriately cited and referenced in those chapters.

	Alt. 0 No Action	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7
Increase in Fuel Use Compared to the No Action Alternative								
Cars		112	108	101	101	82	78	55
Light trucks		115	111	98	88	61	43	29
All light-duty vehicles		226	220	200	189	142	120	85

Total light-duty vehicle fuel consumption from 2020 to 2050 under the No Action Alternative is projected to be 3,371 billion GGE. Light-duty vehicle fuel consumption from 2020 to 2050 under the Proposed Action and alternatives is projected to range from 3,598 billion GGE under Alternative 1 to 3,456 billion GGE under Alternative 7. All of the action alternatives would increase fuel consumption compared to the No Action Alternative, with fuel consumption increases that range from 226 billion GGE under Alternative 1 to 85 billion GGE under Alternative 7.

Air Quality

Air pollution and air quality can affect public health, public welfare, and the environment. The Proposed Action and alternatives would affect air pollutant emissions and air quality, which, in turn, would affect public health and welfare and the natural environment. The air quality analysis in Chapter 4, *Air Quality*, assesses the impacts of the alternatives on emissions of pollutants of concern from mobile sources, and the resulting impacts on human health. The reductions and increases in emissions would vary by pollutant, calendar year, and action alternative.

Under the authority of the Clean Air Act and its amendments, EPA has established National Ambient Air Quality Standards (NAAQS) for six relatively common air pollutants known as *criteria pollutants*: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone, sulfur dioxide (SO_2), lead, and particulate matter (PM) with an aerodynamic diameter equal to or less than 10 microns (PM10) and 2.5 microns (PM2.5, or fine particles). Ozone is not emitted directly from vehicles but is formed in the atmosphere from emissions of ozone precursor pollutants such as nitrogen oxides (NO_X) and volatile organic compounds (VOCs).

Criteria pollutants have been shown to cause the following adverse health impacts at various concentrations and exposures: damage to lung tissue, reduced lung function, exacerbation of existing respiratory and cardiovascular diseases, difficulty breathing, irritation of the upper respiratory tract, bronchitis and pneumonia, reduced resistance to respiratory infections, alterations to the body's defense systems against foreign materials, reduced delivery of oxygen to the body's organs and tissues, impairment of the brain's ability to function properly, cancer, and premature death.

In addition to criteria pollutants, motor vehicles emit some substances defined by the 1990 Clean Air Act amendments as toxic air pollutants. Toxic air pollutants from vehicles are known as mobile-source air toxics (MSATs). The MSATs included in this analysis are acetaldehyde, acrolein, benzene, 1,3-butadiene, diesel particulate matter (DPM), and formaldehyde. DPM is a component of exhaust from diesel-fueled vehicles and falls almost entirely within the PM2.5 particle-size class. MSATs are also associated with adverse health impacts. For example, EPA classifies acetaldehyde, benzene, 1,3-butadiene, formaldehyde, and certain components of DPM as either known or probable human carcinogens. Many MSATs are also associated with noncancer health impacts, such as respiratory irritation.

Contribution of U.S. Transportation Sector to Air Pollutant Emissions

The U.S. transportation sector is a major source of emissions of certain criteria pollutants or their chemical precursors. Emissions of these pollutants from on-road mobile sources have declined dramatically since 1970 because of pollution controls on vehicles and regulation of the chemical content of fuels, despite continuing increases in vehicle travel and fuel consumption. Nevertheless, the U.S. transportation sector remains a major source of emissions of certain criteria pollutants or their chemical precursors. On-road mobile sources are responsible for 17.9 million tons per year of CO (30 percent of total U.S. emissions), 133,000 tons per year (2 percent) of PM2.5 emissions, and 287,000 tons per year (1 percent) of PM10 emissions. Passenger cars and light trucks contribute 93 percent of U.S. highway emissions of CO, 40 percent of highway emissions of PM2.5, and 56 percent of highway emissions of PM10. Almost all of the PM in motor vehicle exhaust is PM2.5; therefore, this analysis focuses on PM2.5 rather than PM10. All on-road mobile sources emit 1.8 million tons per year (11 percent of total nationwide emissions) of VOCs and 3.6 million tons per year (34 percent) of NO_X, which are chemical precursors of ozone. Passenger cars and light trucks account for 90 percent of U.S. highway emissions of VOCs and 51 percent of NO_X. In addition, NO_X is a PM2.5 precursor, and VOCs can be PM2.5 precursors. SO_2 and other oxides of sulfur (SO_X) are important because they contribute to the formation of PM2.5 in the atmosphere; however, on-road mobile sources account for less than 0.68 percent of U.S. SO_2 emissions. With the elimination of lead in automotive gasoline, lead is no longer emitted from motor vehicles in more than negligible quantities and is therefore not assessed in this analysis.

Methods

To analyze air quality and human health impacts, NHTSA calculated the emissions of criteria pollutants and MSATs from passenger cars and light trucks that would occur under each alternative. NHTSA then estimated the resulting changes in emissions by comparing emissions under each action alternative to those under the No Action Alternative. The resulting changes in air quality and impacts on human health were assumed proportional to the changes in emissions projected to occur under each action alternative.

Key Findings for Air Quality

The EIS provides findings for air quality impacts for 2025, 2035, and 2050. In general, emissions of criteria air pollutants increase across all alternatives, with some exceptions. The changes in emissions reflect the complex interactions among the tailpipe emissions rates of the various vehicle types, the technologies assumed to be incorporated by manufacturers in response to the CAFE standards, upstream emissions rates, the relative proportions of gasoline and diesel in total fuel consumption reductions, and changes in vehicle miles traveled (VMT) from the rebound effect. In addition, the action alternatives would result in increased incidence of PM2.5-related adverse health impacts due to the emissions increases. Increases in adverse health outcomes include increased incidences of premature mortality, acute bronchitis, respiratory emergency room visits, and work-loss days.

Direct and Indirect Impacts

<u>Criteria Pollutants</u>

The air quality analysis identified the following impacts on criteria air pollutants:

- In 2025, emissions of CO, NO_X, and SO_2 decrease under the action alternatives compared to the No Action Alternative (except for SO_2 under Alternative 7, which has emissions slightly greater than under the No Action Alternative). For CO, the more stringent alternatives have the smallest decreases, while for NO_X the decreases vary across the action alternatives, and for SO_2 the more stringent alternatives generally have the largest decreases (except for Alternative 7). Emissions of PM2.5 and VOCs increase under the action alternatives compared to the No Action Alternative, with the more stringent alternatives generally having the smallest increases.

- In 2025, across all criteria pollutants and action alternatives, the smallest decrease in emissions is less than 0.1 percent and occurs for NO_X under Alternative 7; the largest decrease is 0.5 percent and occurs for SO_2 under Alternative 6. The smallest increase in emissions is 0.1 percent and occurs for SO_2 under Alternative 7; the largest increase is 0.7 percent and occurs for PM2.5 under Alternative 1.
- In 2035 and 2050, emissions of CO, NO_X, PM2.5, and VOCs increase under the action alternatives compared to the No Action Alternative, with the more stringent alternatives having the smallest increases. SO_2 emissions decrease under the action alternatives compared to the No Action Alternative, with the more stringent alternatives having the smallest decreases.
- In 2035 and 2050, across all criteria pollutants and action alternatives, the smallest decrease in emissions is 0.9 percent and occurs for SO_2 under Alternative 7; the largest decrease is 12 percent and occurs for SO_2 under Alternative 2. The smallest increase in emissions is 0.2 percent and occurs for CO under Alternative 7; the largest increase is 12 percent and occurs for VOCs under Alternative 1.

Toxic Air Pollutants

The air quality analysis identified the following impacts on toxic air pollutants:

- Under each action alternative in 2025 compared to the No Action Alternative, decreases in emissions would occur for all toxic air pollutants except for DPM, for which emissions would increase by as much as 2 percent. For 2025, the largest relative decreases in emissions would occur for 1,3-butadiene, for which emissions would decrease by as much as 0.5 percent. Percentage reductions in emissions of acetaldehyde, acrolein, benzene, and formaldehyde would be less.
- Under each action alternative in 2035 and 2050 compared to the No Action Alternative, increases in emissions would occur for all toxic air pollutants. The largest relative increases in emissions would occur for DPM, for which emissions would increase by as much as 9 percent. Percentage increases in emissions of acetaldehyde, acrolein, benzene, 1,3-butadiene, and formaldehyde would be less.

Changes in criteria pollutant emissions in 2035 are shown by alternative in Figure S-1. Changes in toxic air pollutant emissions in 2035 are shown by alternative in Figure S-2.

Health Impacts

The air quality analysis identified the following health impacts:

- In 2025 and 2035, all action alternatives except for Alternative 6 would result in increased adverse health impacts (mortality, acute bronchitis, respiratory emergency room visits, and other health effects) nationwide compared to the No Action Alternative as a result of increases in emissions of NO_X, PM2.5, and DPM. The increases in adverse health impacts are largest for the least stringent alternative (Alternative 1). With some exceptions, the increases get smaller as stringency increases, while Alternative 6 would result in decreased adverse health impacts.
- In 2050, all action alternatives would result in decreased adverse health impacts nationwide compared to the No Action Alternative as a result of decreases in emissions of SO_X. The decreases in adverse health impacts get smaller from Alternative 1 to Alternative 7.

Figure S-1. Nationwide Criteria Pollutant Emissions (tons/year) from U.S. Passenger Cars and Light Trucks for 2035 by Alternative

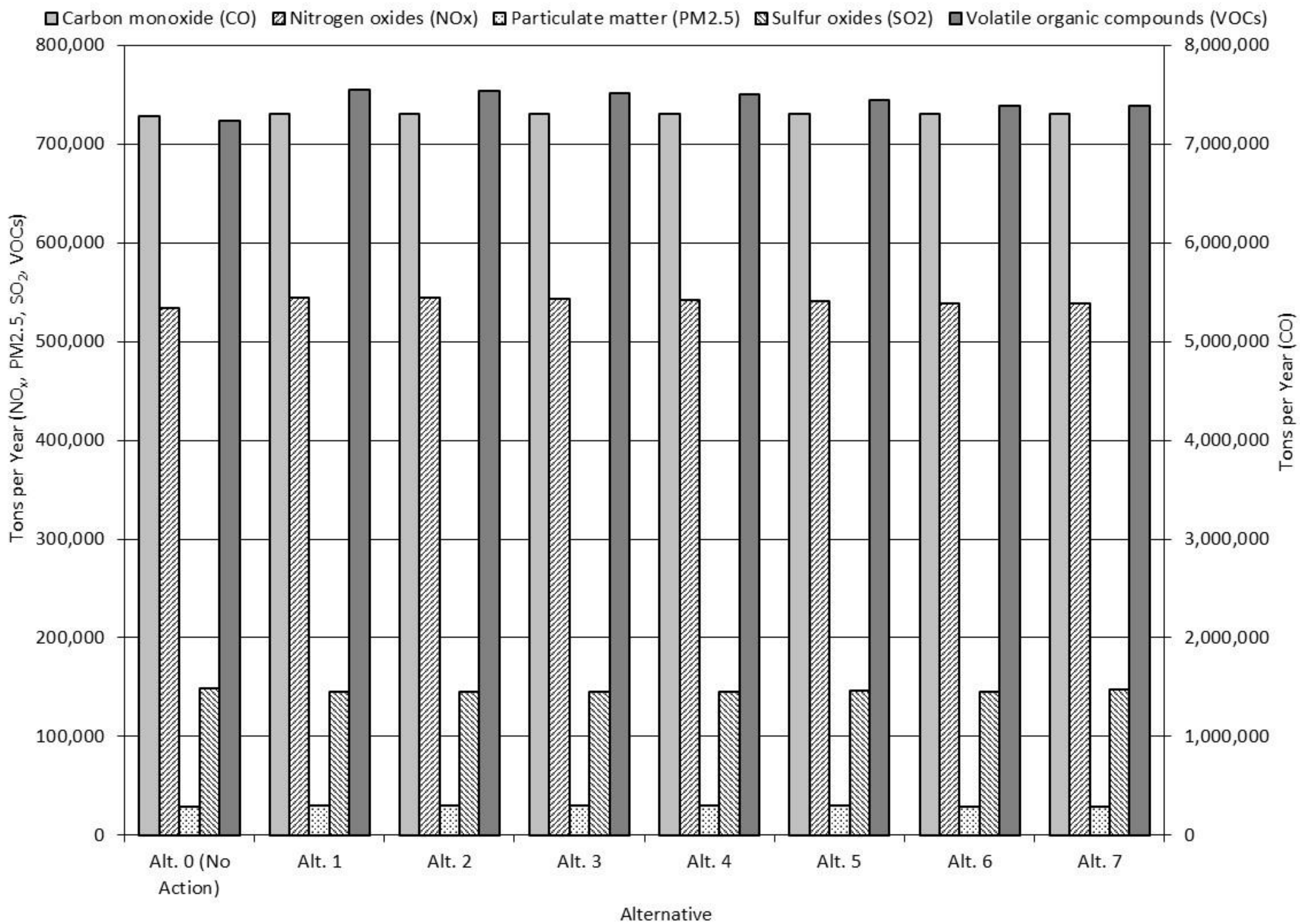
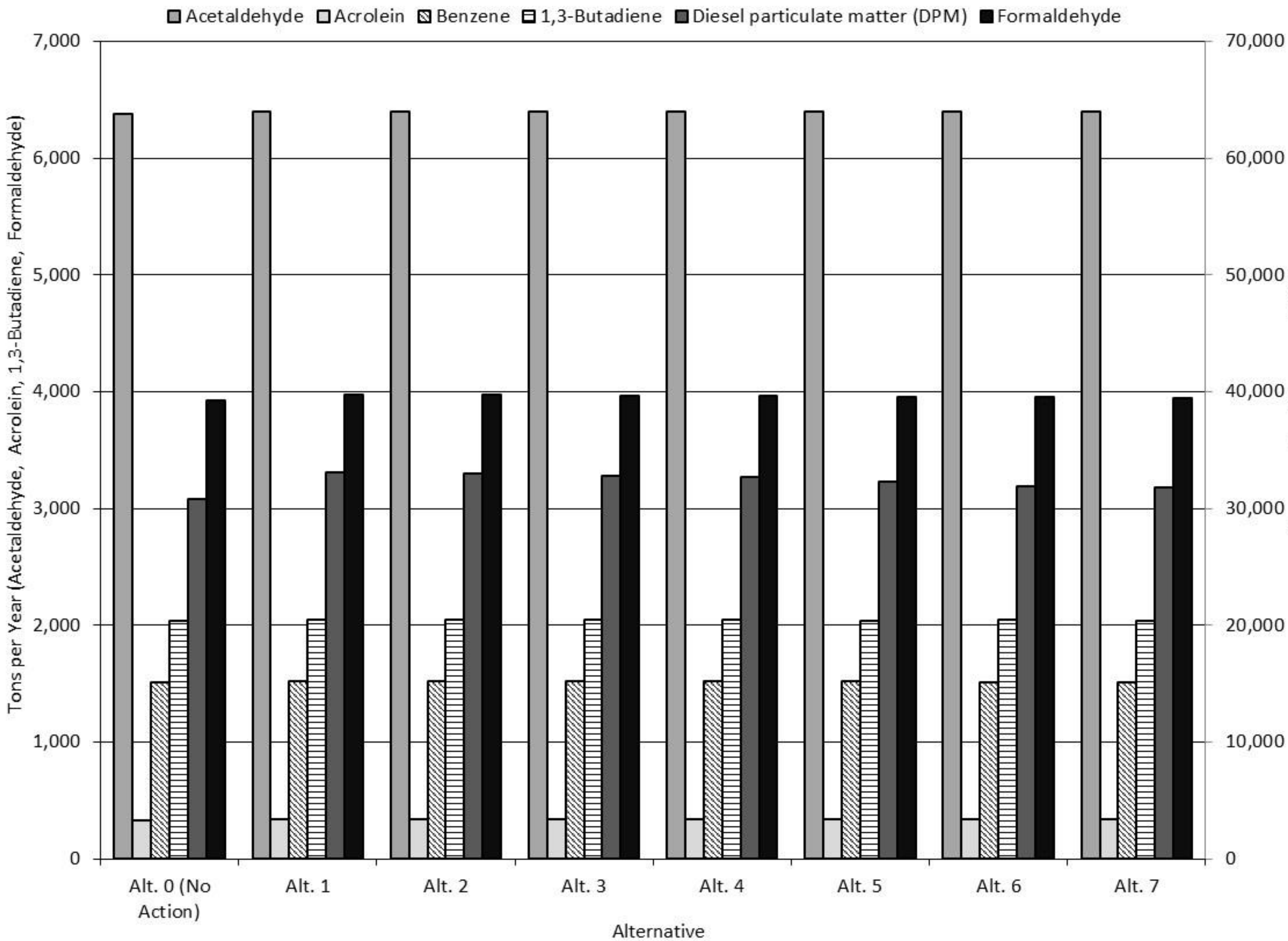


Figure S-2. Nationwide Toxic Air Pollutant Emissions (tons/year) from U.S. Passenger Cars and Light Trucks for 2035 by Alternative



Greenhouse Gas Emissions and Climate Change

This section describes how the Proposed Action and alternatives could affect the anticipated pace and extent of future changes in global climate. In this EIS, the discussion of climate change direct and indirect impacts focuses on impacts associated with increases in GHG emissions from the Proposed Action and alternatives as compared to projected GHG emissions under the No Action Alternative, including impacts on atmospheric carbon dioxide (CO_2) concentrations, global mean surface temperature, sea level, precipitation, and ocean pH.

Earth absorbs heat energy from the sun and returns most of this heat to space as terrestrial infrared radiation. GHGs trap heat in the lower atmosphere (the atmosphere extending from Earth's surface to approximately 4 to 12 miles above the surface), absorb heat energy emitted by Earth's surface and lower atmosphere, and reradiate much of it back to Earth's surface, thereby causing warming. This process, known as the *greenhouse effect*, is responsible for maintaining surface temperatures that are warm enough to sustain life. Human activities, particularly fossil-fuel combustion, have been identified by the Intergovernmental Panel on Climate Change (IPCC) as primarily responsible for increasing the concentrations of GHGs in the atmosphere; this buildup of GHGs is changing Earth's energy balance. Climate simulations have been used to support arguments that the warming experienced over the past century requires the inclusion of both natural GHGs and other climatic forcers (e.g., solar activity) as well as human-made climate forcers.

Global climate change refers to long-term (i.e., multi-decadal) trends in global average surface temperature, precipitation, ice cover, sea level, cloud cover, sea-surface temperatures and currents, ocean pH, and other climatic conditions. Average surface temperatures have increased since the Industrial Revolution (IPCC 2013a). From 1880 to 2016, Earth's global average surface temperature rose by more than 0.9°C (1.6°F) (GCRP 2017). Global mean sea level rose by about 1.0 to 1.7 millimeters per year from 1901 to 1990, a total of 11 to 14 centimeters (4 to 5 inches) (GCRP 2017). After 1993, global mean sea level rose at a faster rate of about 3 millimeters (0.12 inches) per year (GCRP 2017). Consequently, global mean sea level has risen by about 7 centimeters (3 inches) since 1990, and by 16 to 21 centimeters (7 to 8 inches) since 1900 (GCRP 2017).

Global atmospheric CO_2 concentration has increased 46.4 percent from approximately 278 parts per million (ppm) in 1750 (before the Industrial Revolution) (IPCC 2013a) to approximately 407 ppm in 2018 (NOAA 2019). Atmospheric concentrations of methane (CH_4) and nitrous oxide (N_2O) increased approximately 150 and 20 percent, respectively, over roughly the same period (IPCC 2013a). IPCC concluded, "[h]uman influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea-level rise, and in changes in some climate extremes. … This evidence for human influence has grown since [the IPCC *Working Group 1 (WG1) Fourth Assessment Report (AR4)*]. It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century" (IPCC 2013a).

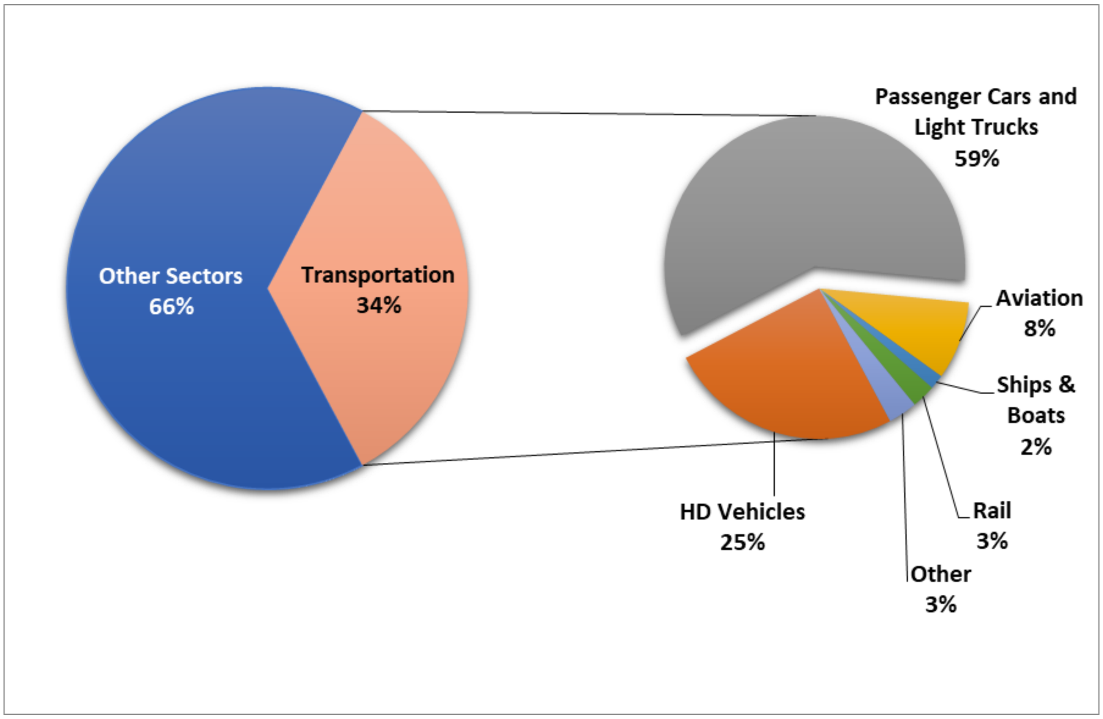
This EIS draws primarily on panel-reviewed synthesis and assessment reports from IPCC and the U.S. Global Change Research Program (GCRP), supplemented with past reports from the U.S. Climate Change Science Program (CCSP), the National Research Council, and the Arctic Council.

Contribution of the U.S. Transportation Sector to U.S. and Global Carbon Dioxide Emissions

Human activities that emit GHGs to the atmosphere include fossil fuel production and combustion; industrial processes and product use; agriculture, forestry, and other land use; and waste management. Emissions of CO_2, CH_4, and N_2O account for approximately 98 percent of annual anthropogenic GHG emissions. Isotopic- and inventory-based studies have indicated that the rise in the global CO_2 concentration is largely a result of the release of carbon that has been stored underground through the combustion of fossil fuels (coal, petroleum, and natural gas) used to produce electricity, heat buildings, and power motor vehicles and airplanes, among other uses.

According to the World Resources Institute's Climate Watch, emissions from the United States account for approximately 15 percent of total global CO_2 emissions. EPA's National Greenhouse Gas Inventory for 1990 to 2017 indicates that, in 2017, the U.S. transportation sector contributed about 34 percent of total U.S. CO_2 emissions, with passenger cars and light trucks accounting for 59 percent of total U.S. CO_2 emissions from transportation. Therefore, approximately 20 percent of total U.S. CO_2 emissions are from passenger cars and light trucks, and these vehicles in the United States account for 3 percent of total global CO_2 emissions (based on comprehensive global CO_2 emissions data available for 2017).[2] Figure S-3 shows the proportion of U.S. CO_2 emissions attributable to the transportation sector and the contribution of each mode of transportation to those emissions.

Figure S-3. Contribution of Transportation to U.S. Carbon Dioxide Emissions and Proportion Attributable by Mode, 2017



Source: EPA 2019
HD = heavy duty

[2] The estimate for CO_2 emissions from fossil fuel combustion and industry is from the World Resources Institute. It excludes emissions and sinks from land use change and forestry.

Key Findings for Climate

The Proposed Action and alternatives would increase U.S. passenger car and light truck fuel consumption and CO_2 emissions compared with the No Action Alternative, resulting in minor increases to the anticipated increases in global CO_2 concentrations, temperature, precipitation, and sea level, and decreases in ocean pH that would otherwise occur. They could also, to a small degree, increase the impacts and risks of climate change. Uncertainty exists regarding the magnitude of impact on these climate variables, as well as to the impacts and risks of climate change.

Estimates of GHG emissions and increases are presented for each of the action alternatives. Key climate effects on atmospheric CO_2 concentration, global mean surface temperature, precipitation, sea level, and ocean pH, which result from changes in GHG emissions, are also presented for each of the action alternatives. These effects are gradual and increase over time. Changes to these climate variables are typically modeled to 2100 or longer because of the amount of time it takes to show the full extent of the effects of GHG emissions on the climate system.

The impacts of the Proposed Action and alternatives on global mean surface temperature, precipitation, sea level, and ocean pH would be extremely small in relation to global emissions trajectories. This is because of the global and multi-sectoral nature of climate change. These effects would be small, would occur on a global scale, and would not disproportionately affect the United States.

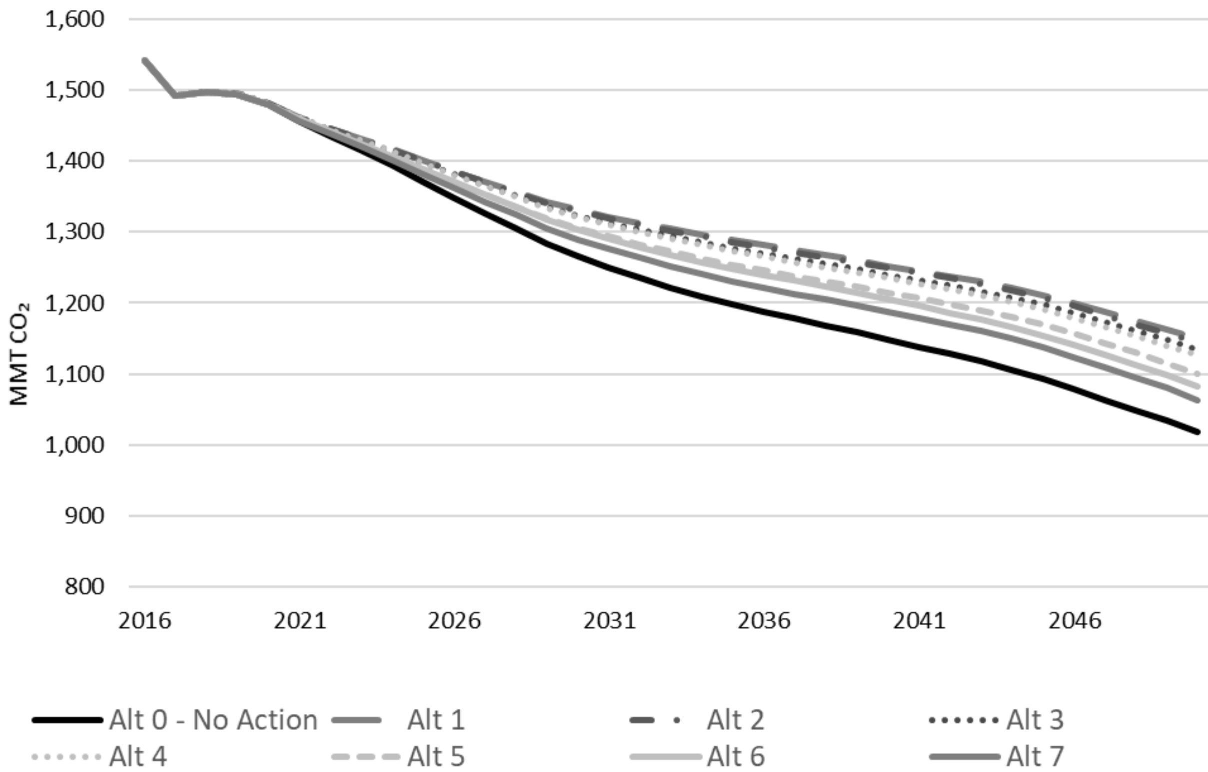
Direct and Indirect Impacts

Greenhouse Gas Emissions

The alternatives would have the following impacts related to GHG emissions:

- Figure S-4 shows projected annual CO_2 emissions from passenger cars and light trucks under each alternative. Passenger cars and light trucks are projected to emit 85,900 million metric tons of carbon dioxide ($MMTCO_2$) from 2021 through 2100 under the No Action Alternative. Alternative 1 would increase these emissions by 10 percent through 2100. Alternative 7 would increase these emissions by 4 percent through 2100. Emissions would be lowest under the No Action Alternative, while Alternatives 1 through 7 would have higher emissions than the No Action Alternative. Emissions increases would be highest under Alternative 1 and would decrease across the action alternatives.
- Compared with total projected CO_2 emissions of 935 $MMTCO_2$ from all passenger cars and light trucks under the No Action Alternative in the year 2100, the Proposed Action and alternatives are expected to increase CO_2 emissions from passenger cars and light trucks in the year 2100 from 4 percent under Alternative 7 to 13 percent under Alternative 1.
- Compared with total global CO_2 emissions from all sources of 4,950,865 $MMTCO_2$ under the No Action Alternative from 2021 through 2100, the Proposed Action and alternatives are expected to increase global CO_2 emissions between 0.06 (Alternative 7) and 0.17 (Alternative 1) percent by 2100.
- The emission increases in 2025 compared with emissions under the No Action Alternative are approximately equivalent to the annual emissions from 2,020,000 vehicles under Alternative 7 to 5,586,000 vehicles under Alternative 1. (A total of 254,969,000 passenger cars and light trucks vehicles are projected to be on the road in 2025 under the No Action Alternative.)

Figure S-4. Projected Annual Carbon Dioxide Emissions ($MMTCO_2$) from All U.S. Passenger Cars and Light Trucks by Alternative



$MMTCO_2$ = million metric tons of carbon dioxide

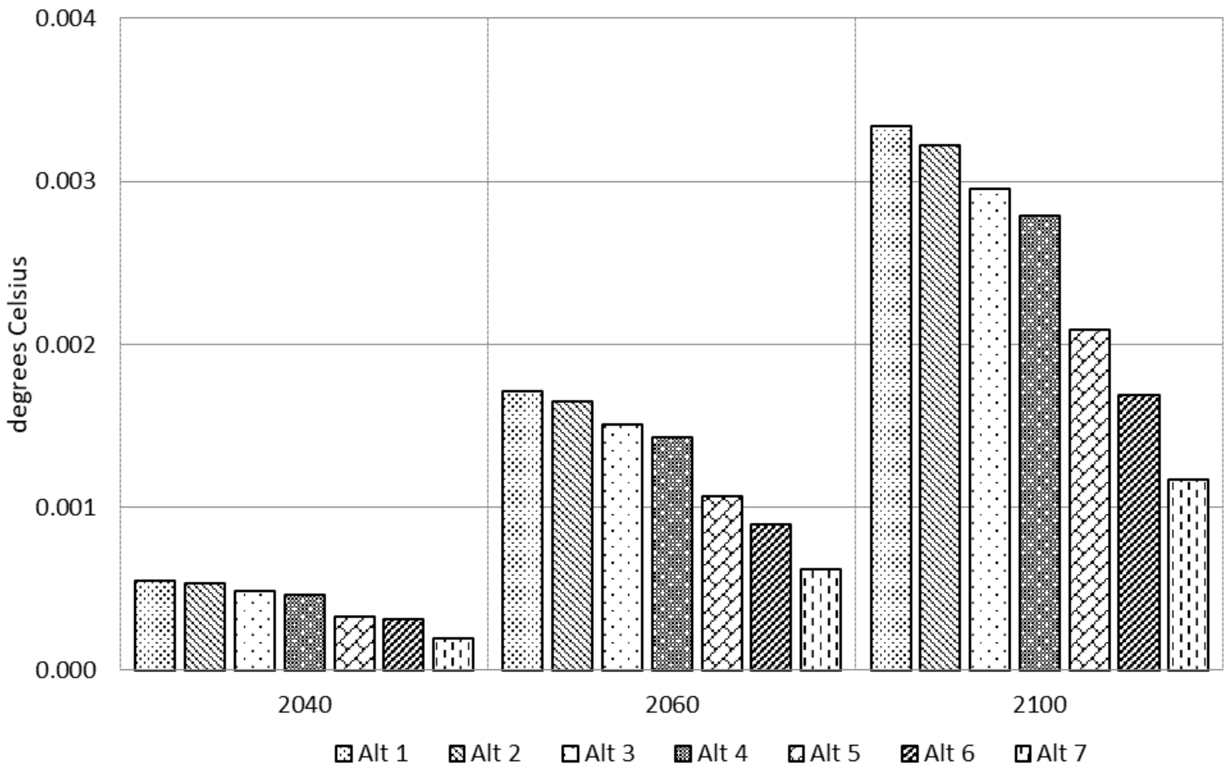
Carbon Dioxide Concentration, Global Mean Surface Temperature, Sea Level, Precipitation, and Ocean pH

CO_2 emissions affect the concentration of CO_2 in the atmosphere, which in turn affects global temperature, sea level, precipitation, and ocean pH. For the analysis of direct and indirect impacts, NHTSA used the Global Change Assessment Model Reference scenario to represent the Reference Case emissions scenario (i.e., future global emissions assuming no comprehensive global actions to mitigate GHG emissions):

- Estimated CO_2 concentrations in the atmosphere for 2100 would range from 789.89 parts per million (ppm) under Alternative 1 to approximately 789.11 ppm under the No Action Alternative, indicating a maximum atmospheric CO_2 increase of approximately 0.78 ppm compared to the No Action Alternative. Atmospheric CO_2 concentration under Alternative 7 would increase by 0.27 ppm compared with the No Action Alternative.
- Global mean surface temperature is projected to increase by approximately 3.48°C (6.27°F) under the No Action Alternative by 2100. Implementing the lowest emissions action alternative (Alternative 7) would increase this projected temperature rise by 0.001 degrees Celsius (°C) (0.002 degrees Fahrenheit [°F]), while implementing the highest emissions alternative (Alternative 1) would increase projected temperature rise by 0.003°C (0.005°F). Figure S-5 shows the increase in projected global mean surface temperature under each action alternative compared with temperatures under the No Action Alternative.

- Projected sea-level rise in 2100 ranges from a low of 76.28 centimeters (30.03 inches) under the No Action Alternative to a high of 76.35 centimeters (30.06 inches) under Alternative 1. Alternative 1 would result in an increase in sea level equal to 0.07 centimeter (0.03 inch) by 2100 compared with the level projected under the No Action Alternative compared to an increase under Alternative 7 of 0.02 centimeter (0.001 inch) compared with the No Action Alternative.
- Global mean precipitation is anticipated to increase by 5.85 percent by 2100 under the No Action Alternative. Under the action alternatives, this increase in precipitation would be increased further by 0.01 percent.
- Ocean pH in 2100 is anticipated to be 8.2175 under Alternative 7, about 0.0001 less than the No Action Alternative. Under Alternative 1, ocean pH in 2100 would be 8.2172, or 0.0004 less than the No Action Alternative.

Figure S-5. Increase in Global Mean Surface Temperature Compared with the No Action Alternative



Cumulative Impacts

The cumulative impact analysis evaluates the impact of the Proposed Action and alternatives in combination with other past, present, and reasonably foreseeable future actions that affect the same resource. The other actions that contribute to cumulative impacts can vary by resource and are defined independently for each resource. However, the underlying inputs, models, and assumptions of the CAFE model already take into account many past, present, and reasonably foreseeable future actions that affect U.S. transportation sector fuel use and U.S. mobile source air pollutant emissions. Therefore, the analysis of direct and indirect impacts of the Proposed Action and alternatives inherently incorporates projections about the impacts of past, present, and reasonably foreseeable future actions in order to develop a realistic baseline.

For energy and air quality, the focus of the cumulative impacts analysis is on trends in electric vehicle sales and use. For climate, the analysis reflects potential actions in global climate change policy to control GHG emissions. The cumulative impacts analysis for climate also includes qualitative discussions of the potential cumulative impacts of climate change on key natural and human resources and the potential nonclimate effects of CO_2.

Energy

The Presidential Executive Order on Promoting Energy Independence and Economic Growth (EO 13783, issued March 28, 2017) could substantively affect energy supply. EO 13783 requires that executive departments and agencies "review existing regulations that potentially burden the development or use of domestically produced energy resources and appropriately suspend, revise, or rescind those that unduly burden the development of domestic energy resources beyond the degree necessary to protect the public interest or otherwise comply with the law." The stated goal of this initiative is to "promote clean and safe development of our Nation's vast energy resources, while at the same time avoiding regulatory burdens that unnecessarily encumber energy production, constrain economic growth, and prevent job creation." EO 13783 also recognizes that "prudent development of these natural resources is essential to ensuring the Nation's geopolitical security."

The ongoing implementation of EO 13783 could affect cumulative energy impacts in many different ways. Eliminating unnecessary regulatory burdens that restrain oil exploration could increase U.S. oil production and thereby reduce the price of gasoline and diesel fuel. Lower-priced fuel may result in consumers purchasing a higher proportion of light trucks compared to passenger cars, resulting in lower overall new vehicle fuel economy. Alternatively, cheaper fuel prices may result in increased vehicle miles traveled (i.e., the rebound effect), resulting in increased U.S. vehicle use of these fuels. On the other hand, it is also possible that eliminating regulatory burdens that increase the cost of electricity could reduce electricity prices paid to operate electric vehicles and thereby increase demand for electric vehicles.

Although EO 13783 is expected to result in future actions that are likely to have substantive cumulative impacts on U.S. energy supply and associated impacts on U.S. light-duty vehicle fuel consumption, the variety of potential impacts on different energy sources and end-use sectors is too complex to support specific quantitative estimates of impacts on U.S. light-duty vehicle fuel consumption at this time.

In addition to U.S. energy policy, manufacturer investments in plug-in electric vehicle (PEV) technologies and manufacturing in response to government mandates (including foreign PEV quotas) may affect market trends and energy use over the long term if consumers actually choose to purchase such vehicles. Recent global trends show that PEV battery costs have declined, and vehicle manufacturers have announced more aggressive plans for global PEV production. Global efforts to comply with PEV requirements outside the United States, if enforced, could reduce the cost of PEVs, thereby reducing energy use if U.S. PEV demand increases. However, recent consumer demand for PEVs remains low compared to traditional internal combustion engine vehicles despite massive direct government subsidies, nonmonetary incentives, automaker price cross-subsidization, and future forecasts of PEV sales in the United States are subject to considerable uncertainty.

Air Quality

Market-driven changes in the energy sector are expected to affect U.S. emissions and could result in future increases or decreases in emissions. Trends in the prices of fossil fuels and the costs of renewable energy sources will affect the electricity generation mix and, consequently, the upstream emissions from energy production and distribution as well as electric vehicle use. Temporal patterns in charging of electric vehicles by vehicle owners would affect any increase in power plant emissions. Potential changes in federal regulation of emissions from power plants also could result in future increases or decreases in aggregate emissions from these sources.

The forecasts of upstream and downstream emissions that underlie the air quality impact analysis assume the continuation of existing emissions standards for vehicles, oil and gas development operations, and industrial processes such as fuel refining. These standards have become tighter over time as state and federal agencies have sought to reduce emissions to help bring nonattainment areas into attainment. To the extent that the trend toward tighter emissions standards could change in the future, total nationwide emissions from vehicles and industrial processes could change accordingly.

Cumulative changes in health impacts due to air pollution are expected to be consistent with trends in emissions. Higher emissions would be expected to lead to an overall increase in adverse health impacts while lower emissions would be expected to lead to a decrease in adverse health impacts, compared to conditions in the absence of cumulative impacts.

Greenhouse Gas Emissions and Climate Change

The global emissions scenario used in the cumulative impacts analysis differs from the global emissions scenario used for climate change modeling of direct and indirect impacts. In the cumulative impacts analysis, the Reference Case global emissions scenario used in the climate modeling analysis reflects reasonably foreseeable actions in global climate change policy.

Greenhouse Gas Emissions

The following cumulative impacts related to GHG emissions are anticipated:

- Projections of total emissions increases from 2021 to 2100 under the Proposed Action and alternatives and other reasonably foreseeable future actions compared with the No Action Alternative range from 3,100 $MMTCO_2$ (under Alternative 7) to 8,800 $MMTCO_2$ (under Alternative 1). The Proposed Action and alternatives would increase total vehicle emissions by between 4 percent (under Alternative 7) and 10 percent (under Alternative 1) by 2100.
- Compared with projected total global CO_2 emissions of 4,044,005 $MMTCO_2$ from all sources from 2021 to 2100, the incremental impact of this rulemaking is expected to increase global CO_2 emissions between 0.08 (Alternative 7) and 0.22 (Alternative 1) percent by 2100.

Climate Change Indicators

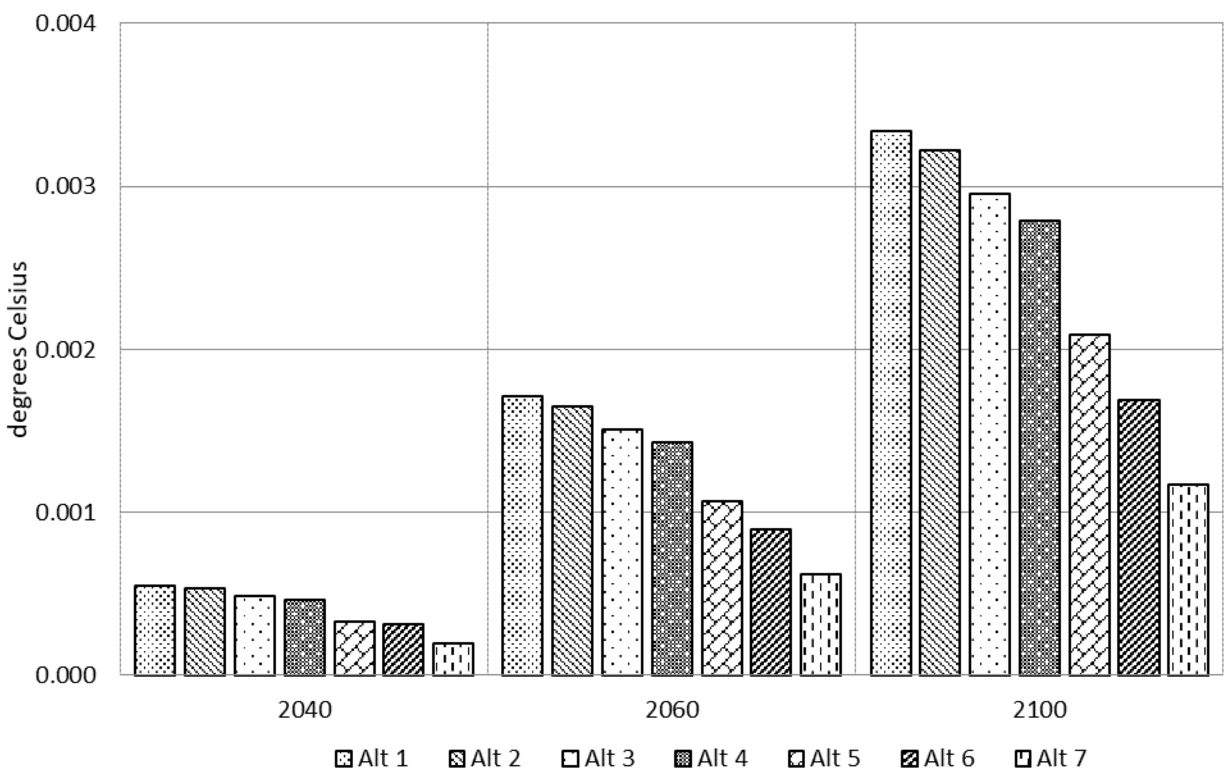
The following cumulative impacts related to the climate change indicators of atmospheric CO_2 concentration, global mean surface temperature, precipitation, sea level, and ocean pH are anticipated:

- Estimated atmospheric CO_2 concentrations in 2100 range from a low of 687.3 ppm under the No Action Alternative to a high of 688.04 ppm under Alternative 1. Alternative 7, the lowest CO_2

emissions alternative, would result in CO_2 concentrations of 687.55 ppm, an increase of 0.26 ppm compared with the No Action Alternative.

- Global mean surface temperature increases for the Proposed Action and alternatives compared with the No Action Alternative in 2100 range from a low of 0.001°C (0.002°F) under Alternative 7 to a high of 0.004°C (0.007°F) under Alternative 1. Figure S-6 illustrates the increases in global mean temperature under each action alternative compared with the No Action Alternative.
- Global mean precipitation is anticipated to increase by 4.77 percent by 2100 under the No Action Alternative. Under the action alternatives, this increase in precipitation would be increased further by 0.01 percent.
- Projected sea-level rise in 2100 ranges from a low of 70.22 centimeters (27.65 inches) under the No Action Alternative to a high of 70.30 centimeters (27.68 inches) under Alternative 1, indicating a maximum increase of sea-level rise of 0.07 centimeter (0.03 inch) by 2100. Sea-level rise under Alternative 7 would be 70.25 centimeters (27.66 inches), a 0.03-centimeter (0.01-inch) increase compared to the No Action Alternative.
- Ocean pH in 2100 is anticipated to be 8.2721 under Alternative 7, about 0.0001 less than the No Action Alternative. Under Alternative 1, ocean pH in 2100 would be 8.2719, or 0.0004 less than the No Action Alternative.

Figure S-6. Increase in Global Mean Surface Temperature Compared with the No Action Alternative, Cumulative Impacts



Health, Societal, and Environmental Impacts of Climate Change

The Proposed Action and alternatives could marginally increase the impacts of climate change that would otherwise occur under the No Action Alternative. The magnitude of the changes in climate effects that would be produced by the least stringent action alternative (Alternative 1) by the year 2100 is roughly a 0.8 ppm higher concentration of CO_2, four thousandths of a degree increase in temperature rise, a small percentage change in the rate of precipitation increase, about 0.07 centimeter (0.03 inch) of sea-level rise, and a decrease of 0.0004 in ocean pH. Because the projected increases in CO_2 and climate effects are extremely small compared with total projected future climate change, they would only marginally increase the potential risks associated with climate change.

Although NHTSA does quantify the increases in monetized damages that can be attributable to each action alternative (see CO_2 Damage Reduction Benefit metric in the Final Regulatory Impact Analysis (FRIA) benefits and net impacts tables), many specific impacts of climate change on health, society, and the environment cannot be estimated quantitatively. Therefore, NHTSA provides a qualitative discussion of these impacts by presenting the findings of peer-reviewed panel reports including those from IPCC, GCRP, the CCSP, the National Research Council, and the Arctic Council, among others. Because the impacts of the emissions increase under this rule would be marginal compared to global GHG emissions, the following climate impacts could be exacerbated but only to a marginal degree in proportion with the emissions increases reported. Uncertainty remains in the potential climate impacts reported, and emissions resulting from this rule cannot be directly attributed to any particular climate impact. Ultimately, climate impacts would vary by region, including in scope, intensity, and directionality (particularly for precipitation). The following types of long-term impacts were identified in the scientific literature and could be associated with climate change but would not likely be significantly affected by any of the alternatives:

- Impacts on freshwater resources could include changes in rainfall and streamflow patterns, changes in water availability paired with increasing water demand for irrigation and other needs, and decreased water quality from increased algal blooms. Inland flood risk could increase in response to increasing intensity of precipitation events, drought, changes in sediment transport, and changes in snowpack and the timing of snowmelt.
- Impacts on terrestrial and freshwater ecosystems could include shifts in the range and seasonal migration patterns of species, relative timing of species' life-cycle events, potential extinction of sensitive species that are unable to adapt to changing conditions, increases in the occurrence of forest fires and pest infestations, and changes in habitat productivity due to increased atmospheric concentrations of CO_2.
- Impacts on ocean systems, coastal regions, and low-lying areas could include the loss of coastal areas due to inundation, submersion or erosion from sea-level rise and storm surge, with increased vulnerability of the built environment and associated economies. Changes in key habitats (e.g., increased temperatures, decreased oxygen, decreased ocean pH, increased salinization) and reductions in key habitats (e.g., coral reefs) may affect the distribution, abundance, and productivity of many marine species.
- Impacts on food, fiber, and forestry could include increasing tree mortality, forest ecosystem vulnerability, productivity losses in crops and livestock, and changes in the nutritional quality of pastures and grazing lands in response to fire, insect infestations, increases in weeds, drought, disease outbreaks, or extreme weather events. Increased concentrations of CO_2 in the atmosphere can also stimulate plant growth to some degree, a phenomenon known as the CO_2 fertilization

effect, but the impact varies by species and location. Many marine fish species could migrate to deeper or colder water in response to rising ocean temperatures, and global potential fish catches could decrease. Impacts on food, including yields, food processing, storage, and transportation could affect food prices and food security globally.

- Impacts on rural and urban areas could affect water and energy supplies, wastewater and stormwater systems, transportation, telecommunications, provision of social services, incomes (especially agricultural), and air quality. The impacts could be greater for vulnerable populations such as lower-income populations, the elderly, those with existing health conditions, and young children.
- Impacts on human health could include increases in mortality and morbidity due to excessive heat and other extreme weather events, increases in respiratory conditions due to poor air quality and aeroallergens, increases in water and food-borne diseases, increases in mental health issues, and changes in the seasonal patterns and range of vector-borne diseases. The most disadvantaged groups such as children, the elderly, the sick, and low-income populations are especially vulnerable.
- Impacts on human security could include increased threats in response to adversely affected livelihoods, compromised cultures, increased or restricted migration, increased risk of armed conflicts, reduction in adequate essential services such as water and energy, and increased geopolitical rivalry.

In addition to the individual impacts of climate change on various sectors, compound events may occur more frequently. Compound events consist of two or more extreme weather events occurring simultaneously or in sequence when underlying conditions associated with an initial event amplify subsequent events and, in turn, lead to more extreme impacts. The effect of climate change on the frequency and severity of compound events remains uncertain, and the outcome of this rule on any of them would be minimal.