

# AIR EMISSIONS GUIDE FOR AIR FORCE MOBILE SOURCES

METHODS FOR ESTIMATING EMISSIONS OF AIR POLLUTANTS FOR MOBILE  
SOURCES AT UNITED STATES AIR FORCE INSTALLATIONS



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# **AIR EMISSIONS GUIDE FOR AIR FORCE MOBILE SOURCES**

## **METHODS FOR ESTIMATING EMISSIONS OF AIR POLLUTANTS FOR MOBILE SOURCES AT U.S. AIR FORCE INSTALLATIONS**

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Based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

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## ACRONYMS

(Words formed from the initial letters of a name or parts of a series of words.)

AAFES	Army & Air Force Exchange Service
ACAM	Air Conformity Applicability Model
AFCEC	Air Force Civil Engineer Center
AFMAN	Air Force Manual
AGE	Aerospace Ground Equipment
ALAPCO	Association of Local Air Pollutant Control Officials
AMX	Aircraft Maintenance Squadron
APIMS	Air Program Information Management System
ARAR	Applicable or Relevant and Appropriate Requirements
BEE	Bioenvironmental Engineer
BOOS	Burners Out of Service
CAIR	Clean Air Interstate Rule
CALMIM	California Landfill Methane Inventory Model
CARB	California Air Resources Board
CAS	Chemical Abstracts Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CONUS	Continental United States
DAC	Defense Ammunition Center
DODIC	Department of Defense Identification Codes
ECOM	External Combustion Engine
EESOH-MIS	Enterprise Environmental, Safety and Occupational Health Management Information System
EIAP	Environmental Impact Analysis Process
EPAct	Energy Policy Act
EPCRA	Emergency Planning and Community Right-to-Know Act
FESOP	Federally Enforceable State Operating Permit
FIRE	Factor Information Retrieval System
HAP	Hazardous Air Pollutant
HAZMART	Hazardous Materials Pharmacy
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilating, and Air Conditioning
ICAO	International Civil Aviation Organization
ICOM	Internal Combustion Engine
LAER	Lowest Achievable Emissions Rate
LandGEM	Landfill Gas Emissions Model
MAJCOM	Major Command
MEM	Mass of Energetic Material

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MIDAS	Munitions Items Disposition Action System
NAAQS	National Ambient Air Quality Standards
NAICS	North American Industry Classification System
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NEW	Net Explosive Weight
OCONUS	Outside Continental United States
OTAQ	Office of Transportation and Air Quality
PEMS	Predictive Emission Monitoring System
RCRA	Resource Conservation and Recovery Act
SAR	Second Assessment Report
SAW	Submerged Arc Welding
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SMAW	Shielded Metal Arc Welding
SME	Subject Matter Expert
STAPPA	State and Territorial Air Pollution Program Administrators
TIM	Time in Mode
USAF	United States Air Force
VIN	Vehicle Identification Number

## BREVITY CODES

(Shortened form of a frequently used group of words, phrase, or sentence consisting of entirely upper-case letters. Each letter is spoken individually.)

AB	Afterburner
AEI	Air Emissions Inventory
AERR	Air Emissions Reporting Requirements
AFB	Air Force Base
AFI	Air Force Instruction
AFPMB	Armed Forces Post Management Board
AFRL	Air Force Research Laboratory
APU	Auxiliary Power Unit
BFB	Bubbling Fluidized Bed
BMP	Best Management Practices
BSFC	Brake-Specific Fuel Consumption
CAA	Clean Air Act
CAAA	Clean Air Act Amendments (of 1990)
CE	Civil Engineering
CEMS	Continuous Emission Monitoring System
CEV	Civil Engineering Environmental
CFB	Circulating Fluidized Bed
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
CI	Compression Ignition
CNG	Compressed Natural Gas
DLA	Defense Logistics Agency
DoD	Department of Defense
DOE	Department of Energy
EA	Environmental Assessment
EDMS	Emissions and Dispersion Modeling System
EF	Emission Factor
EGBE	Ethylene Glycol Butyl Ether
EIIP	Emissions Inventory Improvement Program
EIP	Emissions Inventory Plan
EIR	Emissions Inventory Report
EIS	Environmental Impact Statement
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
ESP	Electrostatic Precipitator



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ESTCP	Environmental Security Technology Certification Program
FAA	Federal Aviation Administration
FBC	Fluidized Bed Combustor
FCAW	Flux-Cored Arc Welding
FF	Fabric Filter
FFR	Fuel Flow Rates
FFV	Flexible Fuel Vehicles
FGD	Flue Gas Desulphurization
FGR	Flue Gas Recirculation
GHG	Greenhouse Gases
GMAW	Gas Metal Arc Welding
GOV	Government Owned Vehicles
GSA	General Services Administration
GSE	Ground Support Equipment
GVW	Gross Vehicle Weight
GWP	Global Warming Potential
HBFC	Hydrobromofluorocarbons
HC	Hydrocarbon
HCFC	Hydrochlorofluorocarbon
HCP	Hard Chrome Plating
HEI	High Explosive Incendiary
HEV	Hybrid Electric Vehicles
HHV	High Heat Value
HMA	Hot Mix Asphalt
HVLP	High Volume Low Pressure
HVOF	High Velocity Oxy-Fuel
IC	Internal Combustion
IPCC	Intergovernmental Panel on Climate Change
IPCT	Industrial Process Cooling Towers
IRP	Installation Restoration Program
LDF	Liquid Drift Factors
LEL	Lower Explosive Limit
LFB	Low Flyby
LFP	Low Flight Pattern
LGRVM	Vehicle Management Flight Vehicle Maintenance
LNB	Low NOX Burner
LPG	Liquefied Petroleum Gas
LTO	Landing and Takeoff
MEK	Methyl Ethyl Ketone
MM	Minutemen Missiles

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MPF	Military Personnel Flight
MPO	Metropolitan Planning Office
MSDS	Material Safety Data Sheet
MSW	Municipal Solid Waste
NACAA	National Association of Clean Air Agencies
NC	Nameplate Capacity
NDI	Non-destructive Inspection
NEI	National Emission Inventory
NMHC	Non-Methane Hydrocarbons
NMOC	Non-Methane Organic Compounds
NMTOC	Non-Methane Total Organic Compounds
NSCR	Nonselective Catalytic Reduction
NSPS	New Source Performance Standards
NSR	New Source Review
OBOD	Open Burning/Open Detonation
OBODM	Open Burning/Open Detonation Model
OCA	Off-Site Consequences Analysis
ODC	Ozone Depleting Chemicals
ODP	Ozone Depletion Potential
ODS	Ozone Depleting Substances
OIAI	Once In Always In
OLVIMS	On-line Vehicle Interactive Management System
P2	Pollution Prevention
PAH	Polycyclic Aromatic Hydrocarbon
PBT	Persistent Bioaccumulative and Toxic
PM	Particulate Matter – Aerodynamic diameter unspecified
PM10	Particulate Matter – Aerodynamic diameter < 10 micrometers
PM2.5	Particulate Matter – Aerodynamic diameter < 2.5 micrometers
POL	Petroleum, Oil, and Lubricant
POTW	Publicly Owned Treatment Works
POV	Privately Owned Vehicles
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
RMP	Risk Management Plan
RVP	Reid Vapor Pressure
SCC	Source Classification Code
SDS	Safety Data Sheets
SCR	Selective Catalytic Reduction
SF	Spillage Factor
SI	Spark Ignition

SNCR	Selective Non-Catalytic Reduction
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TGO	Touch-and-Go
THC	Total Hydrocarbons
TLG	Total Landfill Gas
TNMOC	Total Non-Methane Organic Compounds
TO	Technical Order
TOC	Total Organic Compounds
TOG	Total Organic Gas
TRI	Toxic Release Inventory
TSD	Treatment, Storage, & Disposal
TSP	Total Suspended Particulate
ULSD	Ultra Low Sulfur Diesel
US	United States
USDA	United States Department of Agriculture
UST	Underground Storage Tanks
UV	Ultraviolet
VKT	Vehicle Kilometers Traveled
VMIF	Vehicle Maintenance Index File
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound

## ABBREVIATIONS

(Shortened form of a word or phrase)

μg	Microgram(s)
A-hr	Ampere-hours
A/ft <sup>2</sup>	Ampere per square foot
Btu	British Thermal Unit
°C	Degrees Celsius
CH <sub>4</sub>	Methane
CO	Carbon Monoxide
CO <sub>2</sub>	Carbon Dioxide
Co	Cobalt
Cr	Chromium
Cr <sup>+6</sup>	Hexavalent Chromium
Cr <sub>2</sub> O <sub>3</sub>	Chromium Oxide
EtO	Ethylene Oxide
°F	Degrees Fahrenheit
ft	Foot (Feet)
g	Grams
g/L	Grams per Liter
gal	Gallon(s)
HCl	Hydrochloric Acid
hp	Horse Power
hr	Hour(s)
kg	Kilogram
kW	Kilowatt(s)
L	Liter
lb	Pound(s)
Mg	Megagram(s) [i.e., metric ton]
mg	Milligram(s)
MMBtu	Million British Thermal Units
Mn	Manganese
NH <sub>3</sub>	Ammonia
Ni	Nickel
N <sub>2</sub> O	Nitrous Oxide
NO <sub>2</sub>	Nitrogen Dioxide
NO <sub>x</sub>	Nitrogen Oxides
O <sub>3</sub>	Ozone
Pb	Lead
PERC	Perchloroethylene

PFC	Perfluorocarbon
ppm	Parts per Million
ppmv	Parts per Million by Volume
ppmw	Parts per Million by Weight
psi	Pounds per Square Inch
psia	Pounds per Square Inch Absolute
°R	Degrees Rankin
scf	Standard Cubic Foot
SF <sub>6</sub>	Sulfur Hexafluoride
SO <sub>2</sub>	Sulfur Dioxide
SO <sub>x</sub>	Sulfur Oxides
TNT	Trinitrotoluene
tpy	Tons per Year
yr	Year(s)

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## 1.0 INTRODUCTION

### 1.1 Background and Purpose

The Clean Air Act (CAA) established the requirements to quantify and report air pollutant emissions from mobile and stationary sources. The purpose of the CAA is to protect public health by addressing the risks posed by certain air pollutants. The United States Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) which require facility managers to always know if they comply with air regulations. The EPA regulates most mobile sources of air pollution (e.g., automobiles at 40 Code of Federal Regulations (CFR) 85-86, and airplanes at 40 CFR 87, etc.) under Title II of the CAA. Performance standards issued by the EPA limit the emissions of certain pollutants from these sources. Fuel-related requirements under Title II at 40 CFR 79-80 are designed to further reduce emissions from mobile sources.

For an installation, such as an Air Force base, the total air pollutant emissions are determined by conducting an Air Emissions Inventory (AEI). An air emissions inventory is the sum of all air pollutant emissions from each source over a stated period of time, typically one year. Air quality regulations vary from region to region and the local regulatory agency should be consulted prior to conducting an AEI since some local agencies have specific data reporting requirements and/or protocols that the installation must obey. An AEI must be periodically updated as required by federal, state, and local regulations. **Each installation must calculate and record all collected data in the Air Program Information Management System (APIMS).** AEIs must be updated any time there is a change in mission, equipment, and/or operating procedures that result in a substantial change (approximately 5 %) in air emissions.

**The purpose of this guide is to provide authoritative documentation for National Environmental Policy Act (NEPA) and General Conformity analyses, *not* for conducting AEIs comprised solely of mobile emissions sources (Mobile AEIs).** Mobile source AEIs are primarily conducted to provide data during the development of State Implementation Plan (SIP) budgets. However, since the SIP only accounts for criteria and precursor pollutants, it is unnecessary to calculate emissions for other pollutants though emission factors (EFs) may be provided in this guide. It is still imperative that the USAF adopts a uniform approach to calculating air pollutant emissions for the most common mobile sources found at USAF installations. This guide serves this purpose by being the USAF's single authoritative resource for mobile source emission estimating algorithms and EFs; no other algorithms or EFs shall be used unless mandated by a legally enforceable regulatory requirement (e.g., permit stipulates) or approved by Air Force Civil Engineer Center/Environmental Quality Technical Support Branch (AFCEC/CZTQ) that is reviewed on a case-by-case basis.

Any questions concerning this guide, or requests for additional information pertaining to Air Force AEIs, should be directed to the Air Quality Subject Matter Expert; AFCEC Compliance Technical Support Branch located at, 250 Donald Goodrich Drive; Building #1650 San Antonio, TX 78226.

## 1.2 Mobile Sources

This guide only addresses mobile emission sources typically found on USAF installations. A mobile source is defined as any type of non-stationary equipment that may emit an air pollutant subject to regulation by the CAA. These mobile sources include aircraft and aircraft support equipment, on-road vehicles, and non-road engines. The description of stationary sources contributing to air emissions and the method for calculating these emissions may be found in the *Air Emissions Guide for Air Force Stationary Sources*. It should be noted that certain districts may classify non-road engines as a stationary source rather than a mobile source, therefore it is important to consult with the local air quality district for clarification as needed.

## 1.3 Air Emissions Inventories (AEIs)

AFMAN 32-7002, *Environmental Compliance and Pollution Prevention*, states the following regarding AEIs:

“4.5.1. Air Emissions Inventory (AEI). The Installation Environmental Element must prepare and periodically update an AEI, using APIMS, for all installation stationary air emission sources in accordance with applicable state or local requirements promulgated per 40 CFR Part 51, Subpart A and current AF AEI guidance from AFCEC/CZ. **(T-0)**.”

“4.5.1.1. Regulatory-required stationary AEIs are completed at the frequency specified by federal, state and local regulations.

“4.5.1.2. Comprehensive stationary AEIs (applicable to all installations, including overseas) include all emissions sources (i.e., both permitted and non-permitted sources). The Installation Environmental Element will annually review/validate APIMS to ensure currency of the AEI (i.e., sources and consumption data is representative of the current base conditions). **(T-1)**. A comprehensive review of all sources and associated consumption data for the AEI will be conducted at least every three years (five years for overseas and remotely located facilities) to accurately reflect current emissions. **(T-1)**.”



4.5.1.3. Stationary source AEIs include all criteria pollutants, Hazardous Air Pollutants, and greenhouse gases and reflect the installation's current actual and PTE emissions. Annual regulatory emissions reports, a subset of the comprehensive AEI, are provided to federal, state and local (including Metropolitan Planning Organization or other regional) regulatory agencies as required. Greenhouse gas reporting mandated by E.O. 13834, is accomplished by SAF/IEE in conjunction with the Annual Energy Management and Resilience reporting process. 4.5.1.4. For installations that exceed the greenhouse gas reporting threshold, the Installation Environmental Element shall accomplish greenhouse gas reporting mandated by 40 CFR Part 98. **(T-0)**. Recommend other installations within 10% of the greenhouse gas reporting threshold accomplish greenhouse gas estimates in accordance with the nondirective Guide to the Mandatory Greenhouse Gas Reporting Rule and Greenhouse Gas Tailoring Rule, issued by AFCEC/CZ. Results will be reported to AFCEC/CZ via APIMS. **(T-1)**. Greenhouse gas reporting mandated by E.O. 13834 is accomplished by SAF/IEE in conjunction with the Annual Energy Management and Resilience reporting processes.

This guide describes the recommended methodologies for calculating actual emissions (i.e., from existing sources) and projected emissions (i.e., from projected federal actions). AEIs of these emissions may be required to fulfill a requirement for reporting for a certain period and frequency (e.g., reported for the previous calendar year on an annual basis). AEIs are usually accomplished to meet one or more regulatory requirement(s). The most common regulatory requirements for conducting a mobile source AEI are summarized below.

### **1.3.1 Title II – Emission Standards for Moving Sources**

The EPA regulates most mobile sources of air pollution under Title II of the CAA which sets the standards for motor vehicle and aircraft emissions. Under Title II, the standards are set to control emissions that may endanger public health and welfare. Title II goes on to state that for motor vehicles, it is the manufacturer's responsibility to establish and perform tests which evaluate the emissions from the device. All testing results are to be maintained/documented and must be made available to any agent of the enforcement authority when requested. Similarly, Title II of the CAA states that the Secretary of Transportation will work to ensure that all aircraft emissions comply with the established air pollution standards.

### **1.3.2 Implementation Plans**

As specified under Section 110 of the Clean Air Act, all States are required to submit a SIP to the EPA which provides for the protection and enhancement of air quality to promote public health

and welfare. The SIP provides details for implementation, maintenance, and enforcement of the National Ambient Air Quality Standards (NAAQS). For areas in the State that are classified as nonattainment with any NAAQS, the SIP must provide strategies for obtaining attainment. For areas in the State that are already classified as being in attainment, the SIP must provide strategies for maintaining attainment status. All SIPs and SIP revisions must be reviewed and approved by the EPA. If the EPA considers a SIP to be incomplete or inadequate, they may issue their own plan called a Federal Implementation Plan (FIP).

Historically, most control strategies incorporated into implementation plans have targeted stationary sources. However, due to the constant increase in the number of air pollution sources, the issuance of new ambient air quality standards, and the fact that mobile sources emit most of the overall emissions, more control strategies targeting mobile sources are now being incorporated into implementation plans. Since AEIs are typically used to assess the effect of control strategies, an increase in the number of control strategies pertaining to mobile sources will result in an increase in requirements to conduct mobile source AEIs.

### 1.3.3 General Conformity

Section 176(c) of the CAA prohibits federal activities from taking various actions in nonattainment or maintenance areas unless they first demonstrate conformance with their respective State Implementation Plan (SIP). “A Federal Agency must make a determination that a Federal action conforms to the applicable implementation plan in accordance with the requirements of this Subpart **before the action is taken**” (40 CFR 93.150(b)). A conformity review is a multi-step process used to determine and document whether a proposed action meets the conformity rule. There are two main components to this process: an **applicability analysis** first establishes if a full-scale conformity determination is required and, if it is, a **conformity determination** assesses whether the action conforms to the SIP. The general conformity program requires all federal actions in nonattainment and maintenance areas to comply with the appropriate SIP. An emissions inventory is usually required as part of the conformity determination to identify/quantify air emissions from the proposed federal actions.

### 1.3.4 National Environmental Policy Act (NEPA)

National Environmental Policy Act (NEPA) requires Federal agencies to evaluate the environmental impacts associated with major actions that they either fund, support, permit, or implement. There are as many as three levels of analysis:

- **Categorical Exclusion Determination** – A proposed action may be categorically excluded from a detailed environmental analysis if the action meets certain criteria which a previous agency has determined to have no significant environmental impact.

- **Environmental Assessment (EA)** – An EA is an evaluation to determine if a proposed action that was not categorically excluded would significantly affect the environment. If affects are not significant, the agency issues a Finding of No Significant Impact (FONSI). If the EA concludes the action results in a significant environmental impact, an Environmental Impact Statement must be prepared.
- **Environmental Impact Statement (EIS)** – An EIS is a detailed evaluation of the proposed action, and its alternatives. A draft EIS is filed with the EPA and the EPA publishes a “Notice of Availability” in the Federal Register. Publication of the “Notice of Availability” begins a 45-day public comment period and mandatory 30-day waiting period before the agency can decide on the proposed action.

### 1.3.5 Other Inventory Uses

Complying with environmental regulations is not the only reason AEIs are conducted. An AEI can be a useful tool in helping industrial facilities implement various environmental programs. The most common programs that may involve mobile source emission inventories are summarized below.

#### 1.3.5.1 Pollution Prevention (P2) Opportunities

An AEI can be a useful tool in identifying air related P2 opportunities on military installations. The inventory identifies the types of air pollution sources on base and their accompanying emissions. Due to the large amount of emissions produced from mobile sources, as well as emerging technologies/strategies for reducing mobile source emissions, implementing P2 opportunities for mobile sources is becoming more commonplace.

## 1.4 Emissions Inventory Methodologies

When conducting an AEI, the quantity of regulated pollutants emitted from all emission sources located on an Air Force installation (except those sources that are specifically exempt) must be determined. Several methods can be used to quantify air pollutants from emission sources. Data from source-specific emission tests or continuous emission monitoring systems (CEMS) are usually preferred for estimating a source’s emissions. The CEMS data provides the best representation of the tested source’s emissions. However, source-specific emission tests or continuous emission monitoring of mobile sources at a large installation, such as an Air Force base, may be impractical. Therefore, EFs and/or mass balance calculations are frequently the best or only method available for estimating emissions, despite their limitations.

An EF is a representative value that attempts to relate the quantity of a pollutant emitted with an activity. These factors are usually expressed as the weight of pollutant released per a unit weight, volume, distance, or duration of the activity emitting the pollutant (e.g., pounds of a

pollutant emitted per 1,000 pounds of fuel burned). In most cases, these factors are simply an average of all available data of acceptable quality and are generally assumed to be representative of long-term averages for all processes in the source category (i.e., a population average).

The general equation for emission estimation using an EF is:

$$E = A \times EF \times N$$

**Equation 1-1**

Where,

- E*** = Total emissions
- A*** = Activity rate
- EF*** = Emission factor
- N*** = Number of engines/aircraft/equipment

For some sources, a mass balance approach may provide a better, more accurate estimate of emissions than emission tests would. In general, mass balances are appropriate for use in situations where a high percentage of material is lost to the atmosphere (e.g., sulfur in fuel). As the term implies, all the materials going into and coming out of the process must be considered to allow an emission estimation to be credible.

## **1.5 Pollutants**

Although there are several types (groups/classes) of federal and state regulated pollutants which may be addressed in an AEI, this guide focuses on criteria pollutants, Hazardous Air Pollutants (HAPs), Volatile /Organic Compounds (VOCs), and Greenhouse Gases (GHGs).

### **1.5.1 Criteria Pollutants**

In 1971, the EPA established National Ambient Air Quality Standards (NAAQS) for six pollutants which are termed criteria pollutants. These include particulate matter (PM), ozone (O<sub>3</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), and lead (Pb). The NAAQS were established to regulate the emissions of the criteria pollutants using human health-based and/or environmentally based criteria for setting permissible levels. The criteria pollutants are described in more detail below:

**Particle Pollution (often referred to as particulate matter or PM):**

- PM includes the very fine dust, soot, smoke, and droplets formed from chemical reactions and incomplete burning of fuels.
- The fine particles can get deep into the lungs, causing increased respiratory illnesses and tens of thousands of deaths each year.
- PM is defined as any particle with an equivalent diameter which is less than or equal to 10 microns (**PM<sub>10</sub>**) and is further subdivided to include a separate standard for particles with an equivalent aerodynamic diameter of less than or equal to 2.5 microns (**PM<sub>2.5</sub>**).

**Ground-Level Ozone (O<sub>3</sub>):**

- O<sub>3</sub> is a primary component of smog that can cause human health problems and damage forests and agricultural crops.
- Repeated exposure to O<sub>3</sub> can make people more susceptible to respiratory infections and lung inflammation.
- Though there is a NAAQS, O<sub>3</sub> is not emitted directly into the air.
- Two types of chemicals that are the main ingredients (precursors) in the presence of sunlight form ground-level O<sub>3</sub>:
  - **Volatile Organic Compounds (VOCs):** Sources include vehicles burning gasoline, petroleum refineries, chemical manufacturing plants, industrial plants, solvents used in paints, and an assortment of consumer and business products.
  - **Nitrogen Oxides (NO<sub>x</sub>):** Produced when vehicles and other sources like power plants and industrial boilers burn fuels such as gasoline, coal, or oil. Nitrogen oxides produce the reddish-brown tint in smog.

**Carbon Monoxide (CO):**

- CO is produced when fossil fuel burns incompletely due to insufficient oxygen.
- Wood/coal/charcoal fires and gasoline engines always produce CO.
- In the United States, particularly in urban areas, most CO air emissions are from mobile sources.
- CO can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues.

**Sulfur Dioxide (SO<sub>2</sub>):**

- SO<sub>2</sub> is a part of a group of highly reactive gases known as “oxides of sulfur”.
- SO<sub>2</sub> is linked to several adverse effects on the respiratory system.
- SO<sub>2</sub> emissions are produced from fossil fuel combustion at power plants (73%) and other industrial facilities (20%).
- SO<sub>2</sub> in the ambient air is just one of several oxides of sulfur that contribute to air quality issues.

**Nitrogen Dioxide (NO<sub>2</sub>):**

- NO<sub>2</sub> is a subgroup of nitrogen oxides and is the most environmentally concerning component as well as an indicator for the presence of larger groups of nitrogen oxides.
- NO<sub>2</sub> forms from vehicle emissions, power plants, and off-road equipment.
- NO<sub>2</sub> contributes to the formation of ground-level O<sub>3</sub>, and fine particle pollution.
- NO<sub>2</sub> is linked to several adverse effects on the respiratory system.

**Lead (Pb):**

- Pb is a metal found naturally in the environment as well as in manufactured products.
- Prior to 1980, the major source of Pb was from vehicle exhaust. As a result, the EPA removed Pb from gasoline.
- Pb emissions from vehicles declined by 95% between 1980 and 1999.
- Today, the major sources of Pb are ore and metal processing (e.g. lead smelters).
- Depending on the level of exposure, Pb can adversely affect the nervous system, kidney function, immune system, reproductive and developmental systems and the cardiovascular system.

**1.5.2 Hazardous Air Pollutants (HAPs)**

According to the EPA (USEPA 2016), “Hazardous air pollutants, also known as toxic air pollutants or air toxics, are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.” HAPs include the toxic compounds regulated under Section 112(b) of the CAA. The EPA has been charged with continually analyzing available data on HAPs and revising the regulated list of HAPs. The EPA has also established procedures for both “listing” and “delisting” HAPs. A total of 189 compounds were on the original HAP list, though four compounds have since been removed from this list. These compounds include hydrogen sulfide

in December 1991, caprolactam in June 1996 (61FR30816), ethylene glycol monobutyl ether (EGBE) in November 2004 (69FR69320), and methyl ethyl ketone (MEK) in December 2005 (70FR75047). Changes to the HAPs list are found in 40 CFR Part 63, Subpart C. Since the information contained within this document is for NEPA and General Conformity, the inclusion of HAP emissions is purely for informational purposes.

### 1.5.3 Greenhouse Gases (GHGs)

The emissions of GHGs has garnered more attention as their potential impact on global climate change has been explored in greater detail in recent years. Consequently, the world population's contribution to GHG emissions has been under increased scrutiny. Some GHGs, such as carbon dioxide (CO<sub>2</sub>), occur naturally and are emitted to the atmosphere through natural processes as well as human activities. Other GHGs (e.g., fluorinated gases) are created and emitted solely through human activities. The principal GHGs that enter the atmosphere because of human activities are CO<sub>2</sub>, methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and fluorinated gases.

- CO<sub>2</sub> enters the atmosphere through the burning of fossil fuels, (which include oil, natural gas, and coal), solid waste, trees, and wood products, and through other chemical reactions (e.g., cement manufacturing). CO<sub>2</sub> is removed or sequestered from the atmosphere when it is absorbed by plants and the ocean as part of the global carbon cycle.
- CH<sub>4</sub> is emitted during the production and transport of coal, natural gas, and oil. CH<sub>4</sub> emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.
- N<sub>2</sub>O is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful GHGs that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting chemicals (i.e., CFCs, HCFCs, and halons).

GHGs are assigned a Global Warming Potential (GWP), a measurement of how much heat the gas traps in the atmosphere calculated over a specific time interval, which is typically 100 years. The higher the GWP, the greater the potential for the gas to trap heat, and the more harmful the gas is regarded. CO<sub>2</sub> is used as the baseline gas and is assigned a GWP of 1. GHG emissions are converted into equivalent CO<sub>2</sub> (CO<sub>2</sub>e) by taking the product of the emissions of each GHG and its respective GWP. Table A-1 of 40 CFR 98 provides the GWPs for several GHGs and is shown in Table 1-1. The GWP values used to calculate GHG emissions throughout this document are subject to change due to new data becoming available but are considered current as

of May 2019. The total GHG emissions are calculated by summing all emissions from each gas and are generally derived from the following equation:

$$E(\text{CO}_2e) = \sum_{i=1}^n [E(\text{GHG})_i \times \text{GWP}(\text{GHG})_i]$$

**Equation 1-2**

Where,

- E(CO<sub>2</sub>e)** = Greenhouse gas emissions expressed as CO<sub>2</sub> equivalent (CO<sub>2</sub>e)
- E(GHG)<sub>i</sub>** = Emissions of individual GHG species i
- GWP(GHG)<sub>i</sub>** = Global warming potential for GHG species i
- i** = GHG species, most commonly CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O



Table 1-1. Global Warming Potentials

Name	Chemical Formula	Global Warming Potential (100 yr.)	Name	Chemical Formula	Global Warming Potential (100 yr.)
Carbon dioxide	CO <sub>2</sub>	1	HFE-43-10pccc (H-Galden 1040x, HG-11)	CHF <sub>2</sub> OCF <sub>2</sub> OC <sub>2</sub> F <sub>4</sub> OCHF <sub>2</sub>	1,870
Methane	CH <sub>4</sub>	25	HFE-125	CHF <sub>2</sub> OCF <sub>3</sub>	14,900
Nitrous oxide	N <sub>2</sub> O	298	HFE-134 (HG-00)	CHF <sub>2</sub> OCHF <sub>2</sub>	6,320
HFC-23	CHF <sub>3</sub>	14,800	HFE-143a	CH <sub>3</sub> OCF <sub>3</sub>	756
HFC-32	CH <sub>2</sub> F <sub>2</sub>	675	HFE-227ea	CF <sub>3</sub> CHFOCF <sub>3</sub>	1,540
HFC-41	CH <sub>3</sub> F	92	HFE-236ea 12 (HG-10)	CHF <sub>2</sub> OCF <sub>2</sub> OCHF <sub>2</sub>	2,800
HFC-125	C <sub>2</sub> H <sub>2</sub> F <sub>5</sub>	3,500	HFE-236ea2 (Desflurane)	CHF <sub>2</sub> OCHF <sub>2</sub> CF <sub>3</sub>	989
HFC-134	C <sub>2</sub> H <sub>2</sub> F <sub>4</sub>	1,100	HFE-236fa	CF <sub>3</sub> CH <sub>2</sub> OCF <sub>3</sub>	487
HFC-134a	CH <sub>2</sub> FCF <sub>3</sub>	1,430	HFE-245cb2	CH <sub>3</sub> OCF <sub>2</sub> CF <sub>3</sub>	708
HFC-143	C <sub>2</sub> H <sub>3</sub> F <sub>3</sub>	353	HFE-245fa1	CHF <sub>2</sub> CH <sub>2</sub> OCF <sub>3</sub>	286
HFC-143a	C <sub>2</sub> H <sub>3</sub> F <sub>3</sub>	4,470	HFE-245fa2	CHF <sub>2</sub> OCH <sub>2</sub> CF <sub>3</sub>	659
HFC-152	CH <sub>2</sub> FCH <sub>2</sub> F	53	HFE-254cb2	CH <sub>3</sub> OCF <sub>2</sub> CHF <sub>2</sub>	359
HFC-152a	CH <sub>3</sub> CHF <sub>2</sub>	124	HFE-263fb2	CF <sub>3</sub> CH <sub>2</sub> OCH <sub>3</sub>	11
HFC-161	CH <sub>3</sub> CH <sub>2</sub> F	12	HFE-329mcc2	CF <sub>3</sub> CF <sub>2</sub> OCF <sub>2</sub> CHF <sub>2</sub>	919
HFC-227ea	C <sub>3</sub> HF <sub>7</sub>	3,220	HFE-338mccf2	CF <sub>3</sub> CF <sub>2</sub> OCH <sub>2</sub> CF <sub>3</sub>	552
HFC-236cb	CH <sub>2</sub> FCF <sub>2</sub> CF <sub>3</sub>	1,340	HFE-338pcc13 (HG-01)	CHF <sub>2</sub> OCF <sub>2</sub> CF <sub>2</sub> OCHF <sub>2</sub>	1,500
HFC-236ea	CHF <sub>2</sub> CHFCF <sub>3</sub>	1,370	HFE-347mcc3 (HFE-7000)	CH <sub>3</sub> OCF <sub>2</sub> CF <sub>2</sub> CF <sub>3</sub>	575
HFC-236fa	C <sub>3</sub> H <sub>2</sub> F <sub>6</sub>	9,810	HFE-347mccf2	CF <sub>3</sub> CF <sub>2</sub> OCH <sub>2</sub> CHF <sub>2</sub>	374
HFC-245ca	C <sub>3</sub> H <sub>3</sub> F <sub>5</sub>	693	HFE-347pccf2	CHF <sub>2</sub> CF <sub>2</sub> OCH <sub>2</sub> CF <sub>3</sub>	580
HFC-245fa	CHF <sub>2</sub> CH <sub>2</sub> CF <sub>3</sub>	1,030	HFE-356mcc3	CH <sub>3</sub> OCF <sub>2</sub> CHFCF <sub>3</sub>	101
HFC-365mfc	CH <sub>3</sub> CF <sub>2</sub> CH <sub>2</sub> CF <sub>3</sub>	794	HFE-356pcc3	CH <sub>3</sub> OCF <sub>2</sub> CF <sub>2</sub> CHF <sub>2</sub>	110
HFC-43-10mcc	CF <sub>3</sub> CFHCFHCF <sub>2</sub> CF <sub>3</sub>	1,640	HFE-356pccf2	CHF <sub>2</sub> CH <sub>2</sub> OCF <sub>2</sub> CHF <sub>2</sub>	265
Sulfur hexafluoride	SF <sub>6</sub>	22,800	HFE-356pccf3	CHF <sub>2</sub> OCH <sub>2</sub> CF <sub>2</sub> CHF <sub>2</sub>	502
Trifluoromethyl sulphur pentafluoride	SF <sub>5</sub> CF <sub>3</sub>	17,700	HFE-365mccf3	CF <sub>3</sub> CF <sub>2</sub> CH <sub>2</sub> OCH <sub>3</sub>	11
Nitrogen trifluoride	NF <sub>3</sub>	17,200	HFE-374pc2	CH <sub>3</sub> CH <sub>2</sub> OCF <sub>2</sub> CHF <sub>2</sub>	557
PFC-14 (Perfluoromethane)	CF <sub>4</sub>	7,390	HFE-449s1 (HFE-7100)	C <sub>4</sub> F <sub>9</sub> OCH <sub>3</sub>	297
PFC-116 (Perfluoroethane)	C <sub>2</sub> F <sub>6</sub>	12,200	HFE-569sff2 (HFE-7200)	C <sub>4</sub> F <sub>9</sub> OC <sub>2</sub> H <sub>5</sub>	59
PFC-218 (Perfluoropropane)	C <sub>3</sub> F <sub>8</sub>	8,830	Sevoflurane (HFE-347mmz1)	CH <sub>2</sub> FOCH <sub>2</sub> (CF <sub>3</sub> ) <sub>2</sub>	216
Perfluorocyclopropane	C-C <sub>3</sub> F <sub>6</sub>	17,340	HFE-356mmz1	(CF <sub>3</sub> ) <sub>2</sub> CHOCH <sub>3</sub>	27
PFC-3-1-10 (Perfluorobutane)	C <sub>4</sub> F <sub>10</sub>	8,860	HFE-338mmz1	CHF <sub>2</sub> OCH <sub>2</sub> (CF <sub>3</sub> ) <sub>2</sub>	380
PFC-318 (Perfluorocyclobutane)	C-C <sub>4</sub> F <sub>8</sub>	10,300	(Octafluorotetramethyl-kene) hydroxymethyl group	X-(CF <sub>2</sub> ) <sub>2</sub> CH(OH)-X	73
PFC-4-1-12 (Perfluoropentane)	C <sub>5</sub> F <sub>12</sub>	9,160	HFE-347mmy1	CH <sub>3</sub> OCH <sub>2</sub> (CF <sub>3</sub> ) <sub>2</sub>	343
PFC-5-1-14 (Perfluorohexane, FC-72)	C <sub>6</sub> F <sub>14</sub>	9,300	Bis(trifluoromethyl)-methanol	(CF <sub>3</sub> ) <sub>2</sub> CHOH	195
PFC-9-1-18	C <sub>10</sub> F <sub>18</sub>	7,500	2,2,3,3,3-pentafluoropropanol	CF <sub>3</sub> CF <sub>2</sub> CH <sub>2</sub> OH	42
HCFE-235da2 (Isoflurane)	CHF <sub>2</sub> OCHClCF <sub>3</sub>	350	PPPMIE (HT-70)	CF <sub>3</sub> OCF <sub>2</sub> (CF <sub>3</sub> )CF <sub>2</sub> OCF <sub>2</sub> OCF <sub>3</sub>	10,300

SOURCE: Table A-1 to Subpart A of Part 98 of Title 40 in Code of Federal Regulations

## 1.6 Document Organization

This document is organized into chapters which are specifically related to facilities or processes typically found at Air Force installations. Chapter topics may or may not correspond directly to source types identified in EPA, State, or local guidance documents, but the intent is to consider sources usually associated with a process. This document specifically addresses mobile sources of air emissions. Guidance for addressing stationary or transitory sources of air pollutants may be found in the *Air Emissions Guide for Air Force Stationary Sources* or *Air Emissions Guide for Air Force Transitory Sources*.

## 1.7 References

40 CFR 63, "Title 40-Protection of the Environment, Chapter I-Environmental Protection Agency, Subchapter C-Air Programs, Part 63-Standards for Hazardous Air Pollutants," U.S. Environmental Protection Agency

40 CFR 98, "Title 40-Protection of the Environment, Chapter I-Environmental Protection Agency, Subchapter C-Air Programs, Part 98-Mandatory Greenhouse Gas Reporting," U.S. Environmental Protection Agency

40 CFR 85, "Title 40-Protection of the Environment, Chapter I-Environmental Protection Agency, Subchapter C-Air Programs, Part 85-Control of Air Pollution from Mobile Sources," U.S. Environmental Protection Agency

40 CFR 86, "Title 40-Protection of the Environment, Chapter I-Environmental Protection Agency, Subchapter C-Air Programs, Part 86-Control of Emissions from New and In-Use Highway Vehicles and Engines," U.S. Environmental Protection Agency,

40 CFR 87, "Title 40-Protection of the Environment, Chapter I-Environmental Protection Agency, Subchapter C-Air Programs, Part 87-Control of Air Pollution from Aircraft and Aircraft Engines," U.S. Environmental Protection Agency,

40 CFR 79, "Title 40-Protection of the Environment, Chapter I-Environmental Protection Agency, Subchapter C-Air Programs, Part 79-Registration of Fuel and Fuel additives," U.S. Environmental Protection Agency

40 CFR 80, "Title 40-Protection of the Environment, Chapter I-Environmental Protection Agency, Subchapter C-Air Programs, Part 80-Regulation of Fuel and Fuel Additives," U.S. Environmental Protection Agency

AFMAN 2020, Air Force Manual 32-7002, "Environmental Compliance and Pollution Prevention," Current 4 February 2020

CAA 1990, "List of Hazardous Air Pollutants," Clean Air Act Section 112 (b), 1990

CAA 2005, "Transformation and Conformity Regulations," Clean Air Act Section 176 (c), August 2005

E.O. 2009, "Federal Leadership in Environmental, Energy, and Economic Performance," Executive Order 13514, October 2009

FR 2004, “List of Hazardous Air Pollutants, Petition Process, Lesser Quantity Designations, Source Category List; Petition To Delist of Ethylene Glycol Monobutyl Ether: Final Rule,” 69 FR 69320, November 2004

FR 1996, “Deletion of Caprolactam From the List of Hazardous Air Pollutants: Final Rule,” 61 FR 30816, June 1996

FR 2005, “List of Hazardous Air Pollutants, Petition Process, Lesser Quantity Designations, Source Category List-methyl ethyl ketone: Final Rule,” 70 FR 75047, December 2005

USEPA 2000, “Taking Toxics Out of the Air.” United States Environmental Protection Agency, Office of Air Quality, Planning and Standards, August 2000

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## 2.0 AIRCRAFT FLIGHT OPERATIONS (AOPS)

### 2.1 Introduction

Emissions from stationed aircraft and transient aircraft operations typically account for the bulk of the mobile source emissions associated with an Air Force base. Emissions from aircraft operations include emissions from aircraft training and flight operations, engine testing, and emissions from each aircraft's associated Auxiliary Power Units (APUs). Aircraft operations result in the release of criteria pollutants, GHGs, and HAPs to the atmosphere.

Aircraft engine emissions can be classified as being either stationary or mobile in nature depending upon whether the engine is physically attached to the aircraft (mobile) or removed from the aircraft and secured to a stationary device such as a test stand (stationary). Emissions from USAF aircraft training and flight operations, as well as trim pad and on-wing engine testing, are considered mobile in nature because the engine is secured to the aircraft which is considered a mobile source. Operations in which the engine is removed from the aircraft and secured to a non-mobile device (i.e. in engine test cells or on outdoor test pads) result in emissions that are regarded as stationary. **Calculations of these stationary emissions are described in the *Air Emissions Guide for Air Force Stationary Sources*.**

Additionally, some aircraft are outfitted with small turbine engines known as APUs that provide auxiliary power to the aircraft while on the ground, and occasionally through takeoff and climb out modes. APUs are sources of air pollution and, similarly to aircraft engines, are regarded as mobile sources unless operating after being removed from the aircraft and secured to a stationary stand.

#### 2.1.1 Landing and Takeoff Cycle (LTO)

The EPA has established formal procedures for calculating exhaust emissions associated with aircraft operations based on a Landing and Takeoff (LTO) cycle (USEPA 1992). Under the EPA procedures, an emissions inventory for aircraft operations focuses only on pollutants emitted in the vertical column (generally bound by the perimeter of the base) of air referred to as the "mixing zone" or "inversion layer". Exhaust emissions occurring within this area are calculated for one complete LTO cycle for each aircraft type by applying aircraft engine-specific emission factors. These EFs are derived from fuel flow rates, and the period of time (or time-in-mode, TIM) that each engine operates at a power setting during an LTO. Additionally, EFs are derived from the activity based operational data such as the number of aircraft, the number of engines per aircraft, the annual number of sorties or LTOs, etc. Emissions occurring above the mixing zone are typically not considered during the emissions inventory process and is discussed in more detail in the following section.

A sortie may include any number of aircraft flight patterns consisting of one takeoff and one return landing. Given this, the number of sorties equates to the number of LTOs since an LTO is only a fraction of a sortie that only includes the very short beginning and very short ending equivalent to two aircraft operations – one arrival and one departure. Each LTO cycle for fixed-wing aircraft is comprised of five flight modes: taxi/idle out, takeoff, climb out, approach, and taxi/idle in. Each of these modes have a corresponding engine power setting/mode. Engine power modes are aircraft engine operational settings defined by the percent of total engine thrust. The engine power modes for a specific engine are the percent of total thrust setting an engine was tested as required under 40 CFR 87, *Control of Air Pollution from Aircraft and Aircraft Engines*. Engine power modes are considered interchangeable with aircraft flight modes because during each aircraft flight mode of operation, the aircraft engines operate at a standard power setting for a given aircraft category. The five flight modes and corresponding engine power modes are described below:

- **Taxi Out:** The time from engine startup to takeoff. Engine Power Mode – “Idle”
- **Takeoff:** Characterized by full engine thrust, the time it takes the aircraft to reach 500 feet Above Ground Level (AGL). Equates to both the “Military” and “Afterburner” engine power modes.
- **Climb Out:** Initial aircraft ascent from 500 ft AGL until the aircraft exits the mixing zone (default is 3,000 ft). Engine power mode – “Intermediate”
- **Approach:** Aircraft return descent when the aircraft enters the mixing zone to 0 ft AGL (touchdown). Engine power mode – “Approach”
- **Taxi In:** The time spent after landing until the aircraft is parked and the engines are shut down.

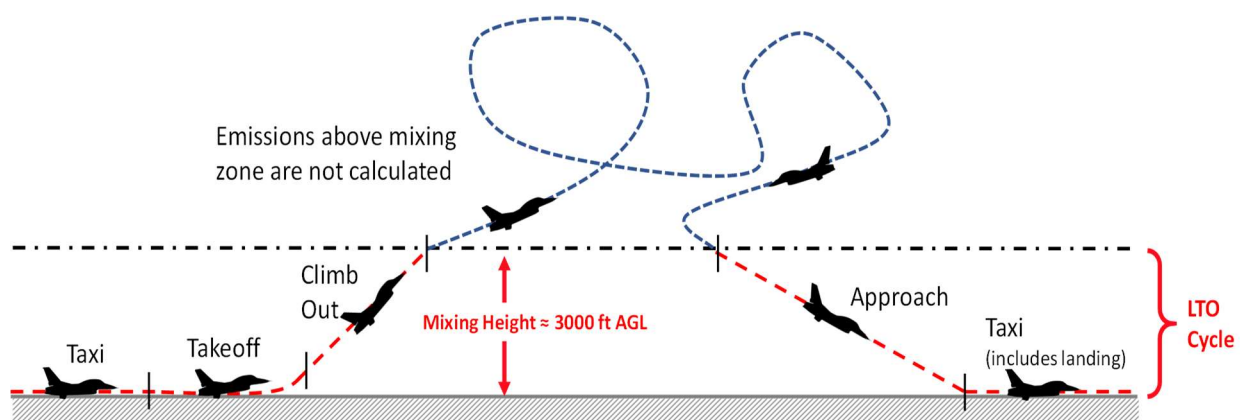


Figure 2-1. LTO Cycle

Note that helicopters are typically operated at modes/engine power settings that, while similar, reflect operational differences between fixed-wing aircraft and rotorcraft. These modes/power

settings may include ground idle, flight idle, normal, military, and sometimes overspeed power settings. APUs, however, operate either under a no-load or a constant load (typically maximum load) power setting.

### 2.1.2 Closed Pattern (CP) Cycle

A CP cycle (also known as a Touch and Go [TGO] or Low Fly By [LFB] cycle) is a flight maneuver that involves practice landing on a runway by briefly touching the landing gear to the runway, or coming very close, and transitioning immediately into climb out and associate flying to maneuver into another practice landing (See Figure 2-2). As with the LTO cycle, you only account for aircraft flight below the mixing height.

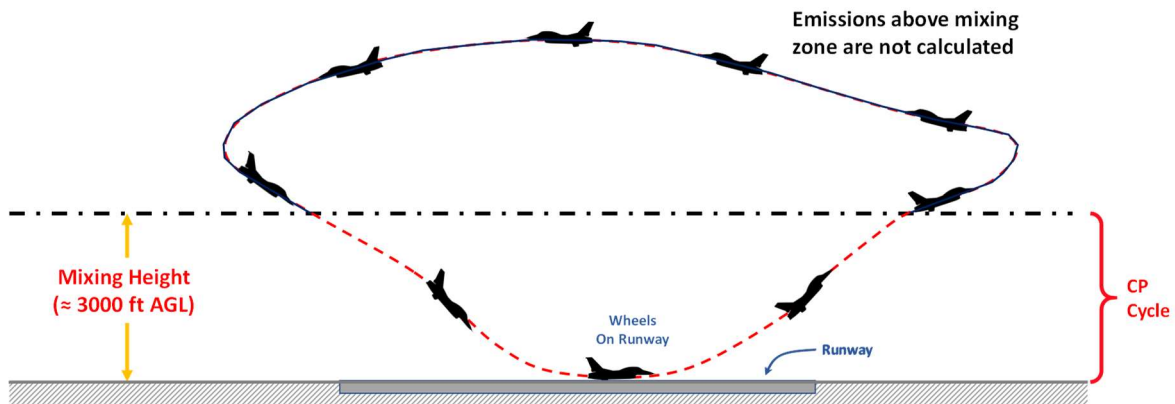


Figure 2-2. CP Cycle

### 2.1.3 Low Flight Pattern (LFP)

A LFP is a flight maneuver that occurs below the mixing height (EPA default = 3,000 ft AGL) that is not part of an LTO or CP cycle.

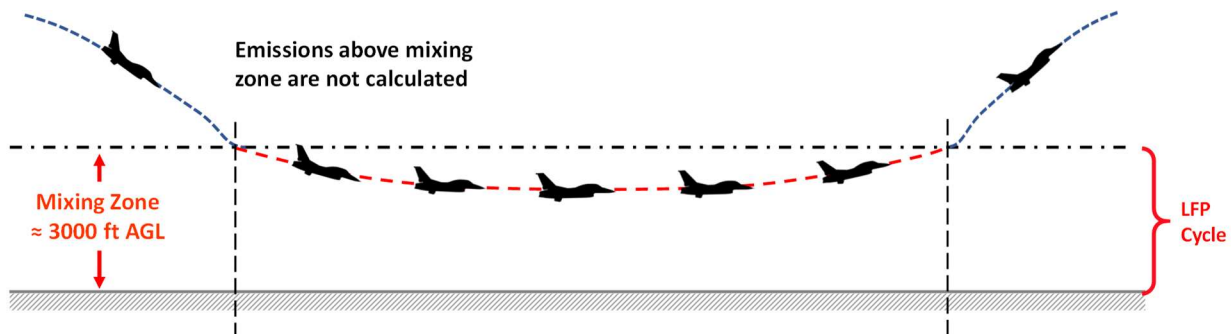


Figure 2-3. LFP Cycle

## 2.2 Mixing Zone Height and Time in Mode (TIM)

### 2.2.1 Mobile Air Emissions Inventories

Under the EPA procedures, an emissions inventory for aircraft operations only includes pollutants emitted in the mixing zone. The height of the mixing zone, which begins at the earth's surface, can range from several hundred to several thousand feet in altitude. However, the EPA recommends using a default mixing height of 3000 feet AGL per the General Conformity Rule (40 CFR 93 Subpart B). Generally, the default mixing zone height of 3,000 feet AGL should be used unless a specific height is prescribed in an applicable State Implementation Plan (SIP).

Calculation of emissions using an LTO approach utilizes default TIMs, based on the default mixing height, which are provided in Table 2-4. The Federal Aviation Administration (FAA) has adopted the EPA default TIM values in its recommended procedures (FAA 2000). Generally, these default TIM values should always be used for mobile air emissions inventories.

### 2.2.2 Air Impact Assessments

For air impact assessments under NEPA and General Conformity, a locally calculated mixing height may be used to demonstrate insignificant (de minimis) air quality impacts associated with a proposed action. In accordance with General Conformity, 40 CFR 93.153(c)(2)(xxii), a “Federal agency can use 3,000 feet above ground level as a default mixing height, unless the agency demonstrates that use of a different mixing height is appropriate because the change in emissions at and above that height caused by the Federal action is de minimis.” Additionally, in accordance with the 40 CFR 93 Preamble, EPA “added regulatory language to sub-paragraph (xxii) to allow federal agencies to use a different mixing height if they can demonstrate that emissions at and above that height are de minimis.” Therefore, a calculated local mixing height would only be used for air impact assessment (NEPA and General Conformity assessments) and only if it would result in a de minimis level of emissions. In other words, the default 3,000 feet mixing height will always be used initially and, if an action’s emissions are not de minimis, the calculated local average mixing height may be used if (and only if) the adjustment in emission would result in the action being de minimis. Therefore, the local average mixing height should never be used in areas where the average calculated local average mixing height is greater than 3,000 feet.

The *USAF Air Quality Environmental Impact Analysis Processes (EIAP) Guide* should be consulted for more details on the specific use of local average mixing height. Additionally, to ensure proper use and to refine emissions estimates, contact the AFCEC Air Quality Subject Matter Expert to obtain approval and location-specific data for seasonal or annual average mixing heights.



## 2.3 Aircraft Flight Operations Data Quality

It is important to note that power settings, EFs, and fuel flow rates are derived from engine testing on the ground and intended for aircraft engine test cells (a stationary source that is regulated) and are indirectly applied to flight LTO cycle operations. The default TIMs were reverse engineered using these ground-based parameters (i.e., power settings, EFs, and fuel flow rates) to provide rough (order of magnitude) emissions approximations for aircraft flight operations. Therefore, be aware of the relatively poor resulting data quality of any estimate of any aircraft flight operation.

## 2.4 Jet Fuel

Military turbofan and turboprop engines and APUs consume JP-8 fuel, while their commercial counterparts consume a nearly identical fuel known as Jet-A. While most aircraft operations involve engines that use either JP-8 or Jet-A fuel, small, piston engine-driven planes that consume aviation grade gasoline, or AVGAS, may periodically operate on a USAF installation. Additionally, recent Air Force and commercial initiatives are expected to result in the increased use of so-called synthetic aviation fuel or "synfuel" over the next several years. These "synfuels" are derived from either coal or natural gas using the Fischer-Tropsch (FT) process and burn much cleaner than fuels produced from crude oil. Regardless of fuel type, emissions of concern from aircraft operations and testing include the criteria pollutants (VOC, CO, NO<sub>2</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, and SO<sub>2</sub>), and HAPs that are commonly associated with fuel combustion processes (including, but not limited to: benzene, naphthalene, and 1,3-butadiene).

### 2.4.1 Synthetic Aviation Fuel

Currently, there are on-going Department of Defense (DoD) and USAF initiatives to reduce dependency on foreign petroleum sources. This includes development of battlefield fuels with essentially no sulfur and reduced aromatic content using FT gasification technology on domestic energy sources such as coal and natural gas. These "synthetic" fuels will increasingly be used to offset conventional JP-8 and diesel fuels in Air Force equipment, particularly aircraft. Testing and certification of 50-50 blends of petroleum- and FT-based JP-8 in B-52s has already been completed by the Air Force Research Laboratory (AFRL). The data indicates the 50-50 blend reduces SO<sub>2</sub>, CO<sub>2</sub>, and PM emissions considerably (USAF 2007). When estimating emissions from aircraft operations in which a synthetic fuel blended with petroleum JP-8 was used, the following emission reduction factors should be applied:

**Table 2-1. Fuel Emission Reduction Factors (FERFs) for JP-8/Synthetic Fuel Blends**

<b>Pollutant</b>	<b>Reduction Factor (%)</b>
PM	35
SO <sub>2</sub>	50
CO <sub>2</sub>	1.8

SOURCE: USAF Alternative Fuels Program, AFRL/WS/06-0078.  
22nd Annual UC Symposium on Aviation Noise and Air  
Quality. March 2007.

## 2.5 Emission Factors

Air pollutant EFs for aircraft operations include emissions from the aircraft engines (either fixed wing or rotary) and any APUs used on the airframe. The EFs have been developed through testing by either the manufacturers themselves or another party. Though the EFs were developed for stationary jet engine testing and are most suited for this application, it is considered acceptable to use them for the estimating emissions from aircraft flight operations. Criteria pollutant and GHG EFs for each engine are provided in Table 2-8 while speciated VOC and HAP EFs for select engines and APUs are provided in Table 2-9. Criteria pollutants for some APUs are provided in Table 2-11. The aircraft engine EFs presented in Table 2-8 are provided for each power setting which correspond to the flight operating mode in an LTO cycle. Note that, in several instances a surrogate engine may have been used to fill data gaps. In those instances, it is acceptable to use manufacturer provided data if it is available.

## 2.6 Emissions Calculation

Emissions calculation procedures for aircraft operations under various operational cycles are described in the following paragraphs. EFs and fuel flow rates for specific aircraft engines is provided in Table 2-8. For engine models not listed in Table 2-8, contact the Air Quality SME for assistance in selecting a representative surrogate engine.

### 2.6.1 Aircraft Emissions

The EFs listed have been determined through testing and may be found in a variety of sources. It is important to note that some sources, such as the Airport Air Quality Manual and International Civil Aviation Organization (ICAO), do not provide PM<sub>10</sub> and PM<sub>2.5</sub> EFs directly (ICAO 2011). For those sources, the total PM was calculated and was conservatively assumed to be equal to PM<sub>10</sub>. A similarly conservative estimate was made for PM<sub>2.5</sub> by assuming that 90% of the total PM<sub>10</sub> value is composed of PM<sub>2.5</sub>. These assumptions are noted in the appropriate tables. Additionally, there are several engines for which some EF data may have been missing. For

these engines, either the EFs from a surrogate were used or the missing data was interpolated or extrapolated. These values are clearly marked in the tables with an (S) for EFs in which a surrogate was used, or a (C) when the values were calculated. The engines used as surrogates are provided in the notes. Common airframe/engine combinations for military fixed wing, rotary, and commercial aircraft are provided in Table 2-5, Table 2-6, and Table 2-7

### 2.6.1.1 LTO Emissions

LTO emissions are calculated based on the type of aircraft, the engine model and number per airframe, the operational mode and TIM for each mode, and the power setting associated with each operational mode. The fuel flow rate associated with each power setting, engine specific EFs, the mixing zone height, and the number of LTO cycles conducted during the year are also considered in the LTO emissions calculation. As TIM and fuel flow rate for each power setting vary among aircraft engines and airframes, the calculation procedure will need to be repeated for individual aircraft types. A description of the operating modes for commercial and military aircraft and the default TIMs are provided in Table 2-3 and Table 2-4 respectively.

Aircraft engine emissions per airframe based on an LTO cycle account only for those emissions occurring below the mixing height and are calculated as follows:

$$E(\text{Pol})_{\text{Aircraft}} = \sum_{i=1}^n \left[ \frac{\text{TIM}_i}{60} \times \frac{\text{FFR}_i}{1,000} \times \text{EF}(\text{Pol})_i \times \frac{\text{FERF}(\text{Pol})}{100} \right] \times N$$

Equation 2-1

Where,

<b>E(Pol)<sub>Aircraft</sub></b>	= Annual pollutant emissions per engine on airframe being evaluated (lb/yr)
<b>N</b>	= Number of units (engines) per airframe being evaluated
<b>60</b>	= Factor to convert minutes to hours
1000	= Factor to convert lb fuel burned to 10 <sup>3</sup> lb fuel burned (min lb/hr 10 <sup>3</sup> lb)
<b>i</b>	= Mode identifier. 1 = Idle in/out, 2 = Takeoff, 3 = Afterburner Takeoff, 4 = Climb out, and 5 = Approach)
<b>TIM<sub>i</sub></b>	= Time spent in each mode per LTO cycle (min/cycle)
<b>FFR<sub>i</sub></b>	= Fuel flow rate during operational mode per aircraft engine (lb/hr)
<b>EF(Pol)<sub>i</sub></b>	= Pollutant emission factor for specified mode (lb/10 <sup>3</sup> lb fuel burned)
<b>FERF(Pol)<sub>i</sub></b>	= Fuel emission reduction factor, if applicable (%). In cases where alternative fuel is not used, then a value of 100% must be used
<b>100</b>	= Factor to convert percent to a fraction (%)

Note that, when calculating the emissions for each LTO, the pollutant EF for the appropriate power setting must be selected from Table 2-8. For engines equipped with afterburner, 50% of the total time in “takeoff” is assumed to be in the “military” power setting and 50% in the

Afterburner power setting. Also, some aircraft may utilize a different power setting during a flight mode than what is given in Table 2-3 (e.g., an engine may be in the “military” power setting during the “climb out” phase of the LTO). Typically, however, the engine power settings correspond to the flight modes and should be selected when calculating emissions for an LTO.

Some of the data required to calculate aircraft emissions per LTO cycle may be found in the following tables:

- FERF, if synthetic fuel blends are used, are provided in Table 2-1
- Regional sulfur content of JP-8, if required for enhanced accuracy, is provided in Table 2-2
- TIM spent in each LTO cycle mode is found in Table 2-4
- Fuel flow rates for each LTO cycle mode and associated engine-specific EFs are found in Table 2-8 and Table 2-9

### **2.6.1.2 CP Emissions**

Used primarily for NEPA/General Conformity air impact studies under EIAP assessments, Touch and Go (TGO) and Low Fly By (LFB) training operations may dictate the need to conduct aircraft operations that deviate from a standard LTO cycle. A TGO cycle is a common flight maneuver that involves practice landing on a runway by briefly touching (or simulating the touching of) the landing gear to the runway and transitioning immediately into climb out. During an LFB, the aircraft generally drops below the mixing height and returns to a higher altitude without touching (or simulating the touching of) the landing gear to the runway. TGO and LFB emissions are calculated in essentially the same manner as LTO emissions; however, only some modes of a complete LTO are considered. For TGO emissions estimating, generally only the default TIMs for approach, takeoff, and climb out are used. For LFB emissions estimating, one half of the default TIMs for approach and climb out are used.

### **2.6.1.3 LFP Emissions**

Another training operation primarily used for NEPA/General Conformity air impact studies under EIAP is a Low Flight Pattern (LFP), which is any aircraft maneuver below the mixing zone height and not associated with an LTO, TGO, or LFB. When calculating emissions in this manner, one must know both the number of LFPs per year and the average time of the LFP. Generally, for LFP emissions estimating, use only the intermediate power setting for the entire time of the LFP.

## **2.6.2 Auxiliary Power Unit Emissions**

APU emissions are based on the APU model associated with each aircraft type, EFs, and the length of time the APU was operating during an LTO cycle. The EFs for APUs are presented in units of lb/hr, so the operating time for each APU must be known or approximated. Common

aircraft/APU combinations and typical APU operating times are found in Table 2-5, Table 2-6, and Table 2-7. Criteria pollutant and GHG EFs for APUs can be found in Table 2-11.

APU emissions are calculated using a two-step approach that consists of the following:

- 1) Calculate pollutant emissions for each APU per LTO; and
- 2) Multiply the emissions per LTO by the total number of LTO cycles per year.

These steps are simplified by the following equation:

$$E(\text{Pol})_{\text{APU}} = L \times N \times \frac{OT}{60} \times EF(\text{Pol}) \times \frac{FERF}{100}$$

**Equation 2-2**

Where,

- E(Pol)<sub>APU</sub>** = Annual pollutant emissions produced by the APU for the aircraft being evaluated (lb/yr)
- L** = Number of LTO cycles per year (cycle/yr)
- N** = Number of units (APU) per airframe being evaluated
- OT** = Operating time per LTO cycle (min/cycle)
- 60** = Factor to convert minutes to hours (min/hr)
- EF(Pol)** = APU-specific emission factor for each pollutant (lb/hr)

Some of the data required to calculate emissions from APU operations may be found in the following tables:

- Typical airframe/APU combinations and operating times are provided for military fixed wing, rotary, and commercial aircraft in Table 2-5, Table 2-6, and Table 2-7 respectively
- Criteria and GHG EFs are provided in Table 2-11
- Speciated VOC and HAP EFs for select APUs are provided in Table 2-9

### 2.6.3 Trim Pad and On-Wing Testing

Emissions associated with trim pad and on-wing testing are based on the type of aircraft, engine model, testing times, the power settings and associated fuel flow rate, and engine-specific EFs. Estimating emissions from aircraft engine testing may be challenging since the data required for calculations may be difficult to obtain. Emissions are calculated by multiplying the fuel flow rate at the selected power setting by the amount of time the engine is operated at that power setting and applying pollutant specific EFs. After the emissions are calculated for a pollutant at each power setting, the values are summed to obtain the total annual emissions of that pollutant.

Aircraft engine emissions from trim pad and on-wing testing may be calculated using a three-step approach that consists of the following:

- 1) Determine the engine operating mode based on the aircraft fuel flow rate at each test setting
- 2) Calculating pollutant emissions using the appropriate EF and total time spent within each operating mode;
- 3) Summing emissions from each mode to obtain annual emissions for that engine

These steps are simplified by the following equation:

$$E(\text{Pol})_{\text{Testing}} = \sum_{i=1}^n \left[ \frac{\text{TIM}_i}{60} \times \frac{\text{FFR}_i}{1000} \times \text{EF}(\text{Pol})_i \times \frac{\text{FERF}(\text{Pol})}{100} \right]$$

Equation 2-3

Where,

$E(\text{Pol})_{\text{Testing}}$  = Annual pollutant emissions produced by engine being evaluated (lb/yr)

$\text{TIM}_i$  = Time spent in the fuel flow range specified for the entire year (min/yr)

**Note that the  $\text{TIM}_i$  refers to the total time spent within the fuel flow range corresponding to an operating mode, and not the aircraft default TIMs as these apply to aircraft flight patterns.**

The fuel flow rate and engine-specific EFs required to calculate emissions using Equation 2-3 may be found in Table 2-8 and Table 2-9. To correctly estimate emissions from jet engine testing, one must take care to select the appropriate emission factor. The appropriate EF is determined by the engine's fuel flow rate and, ideally, the fuel flow rates and operating time for each test profile are recorded by a data logger. Since the fuel flow rate will vary from each test and operating mode, the EFs developed for each mode on each aircraft engine are deemed suitable across a range of fuel flow rates. This means that while the following tables provide an EF for a specific engine at a precise fuel flow rate, that EF is valid for a range of fuel flow rates and should be used for emissions calculations. The tables in this guide only provide the specific fuel flow rates and corresponding EF at which the engine was tested. To find the range of fuel flow rates and appropriate EF, refer to the "Aircraft Engine Testing" section of the *Air Emissions Guide for Air Force Stationary Sources* since off-wing engine testing is more common and a stationary source of emissions (and therefore subject to more regulation).

The fuel flow ranges provided in the *Air Emissions Guide for Air Force Stationary Sources* for most power settings were determined by taking the midpoint of the fuel flow rates between power settings at which the engine was tested. The exception to this method is for the afterburner (AB) setting since the AB setting uses more fuel and combustion efficiency is drastically different from the other operating modes. For those engines equipped with AB, the

engine is assumed to operate at 100% power when in the military setting, so any fuel flow rate greater than that of the military operating mode for which the engine was tested is assumed to be in AB and the appropriate AB EF should be selected. Refer to the tables in the *Air Emissions Guide for Air Force Stationary Sources* for additional information regarding aircraft engine testing.

#### 2.6.4 Calculating SO<sub>2</sub> Emissions

SO<sub>2</sub> emissions are created when sulfur in the fuel reacts and combines with oxygen during the combustion process. Fuels with higher sulfur content will produce higher amounts of SO<sub>2</sub> than low-sulfur fuels. It is generally assumed that during combustion, all sulfur in the fuel reacts to form SO<sub>2</sub> or sulfates. The sulfur content in commercial jet fuel is limited to 0.3 weight percent (wt. %); however, the sulfur content for most in-use fuel is significantly less than this limit. For air impact assessments under NEPA and General Conformity, the use of a national average sulfur content is appropriate for estimating sulfur emissions from aircraft operations. For JP-8 fuel, the weighted national average was calculated using data obtained from the Defense Logistics Agency (DLA), Defense Energy Support Center, *Petroleum Quality Information System Fuels Data* (1997-2013). **Using this national weighted average, a national EF was derived and should be used as the default value for all aircraft engines within the continental United States when estimating SO<sub>x</sub> emissions.** For enhanced accuracy, regional averages have also been calculated. The default national average and regional averages are provided in Table 2-2.

The sulfur content in fuel varies significantly by the region in which the fuel is obtained. For a more accurate accounting of SO<sub>x</sub> emissions from aircraft flight operations, a base-specific SO<sub>x</sub> EF may be estimated using the weight percent sulfur content of the fuel as provided by the fuel supplier. Assuming all the sulfur in the fuel is converted to SO<sub>2</sub> during the combustion process, a base-specific SO<sub>x</sub> EF may be calculated according to the following equation:

$$EF(SO_x) = S \times 20$$

Equation 2-4

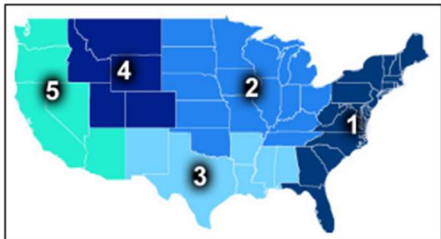
Where,

**EF(SO<sub>x</sub>)** = SO<sub>x</sub> emission factor (lb SO<sub>2</sub>/10<sup>3</sup> lb fuel burned)

**S** = Weight percent sulfur content of the fuel

**20** = Conversion factor derived by converting the weight percent of sulfur to a weight fraction, converting this into units of lb/1,000 lb, and then multiplying by the ratio of the molecular weight of SO<sub>2</sub> to the molecular weight of sulfur.

**Table 2-2. Average Sulfur Content of JP-8**

Geographic Region	States or Countries	Weighted-Average Sulfur Content (Weight %)	Emission Factor (lb/10 <sup>3</sup> lb fuel)
National Average		0.054	1.07
1. East Coast U.S.	ME, VT, NH, MA, RI, CT, NY, PA, NJ, DE, MD, VA, WV, NC, SC, GA, FL	0.110	2.19
2. East Central U.S.	ND, SD, MN, IA, NE, WI, MI, OH, KY, TN, IN, IL, MO, KS, OK	0.067	1.35
3. Gulf Coast U.S.	AL, MS, AR, LA, TX, NM	0.053	1.05
4. West Central U.S.	MT, ID, WY, UT, CO	0.028	0.56
5. West Coast U.S.	WA, OR, CA, NV, AZ	0.053	1.07
Middle East	Kuwait, Bahrain, Pakistan, United Arab Emirates	0.069	1.39
European	Europe, Israel, Turkey	0.118	2.37
Pacific	Korea, Japan, HI, AK, Australia, Russia, Singapore	0.096	1.91
Caribbean	Coastal Aruba	0.045	0.89

Source: *Petroleum Quality Information System Fuels Data*. Defense Logistics Agency, Defense Energy Support Center, 1997 – 2013. Values were calculated using the weight percent sulfur for years 1997 – 2013. Emission factors were calculated using Equation 2-4, though note that the values may not be exactly 20 times the weighted average due to rounding.

### 2.6.5 Calculating HAP Emissions

Since the information contained within this document is for NEPA and General Conformity, the inclusion of HAP emissions is purely for informational purposes. Despite the limited information available, there are aircraft engine-specific and APU-specific HAP EFs provided in Table 2-9.



### 2.6.6 Lead (Pb) Emissions

Prolonged exposure to high levels of Pb may result in harmful health effects, especially in young children. Though Pb is a criteria pollutant, this document does not provide any Pb EFs for aircraft and APUs because of the transition to unleaded aviation fuel.

### 2.6.7 Greenhouse Gas (GHG) Emissions

Since GHG emissions are becoming increasingly more important, it is common to record the carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) emissions produced when measuring emissions from mobile and stationary sources. It is also common practice to report GHG emissions in terms of equivalent CO<sub>2</sub> (CO<sub>2</sub>e). This document provides a total GHG composite EF consisting of CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O presented in CO<sub>2</sub>e for aircraft engines in Table 2-8 and Table 2-11 for APUs. For more guidance on the calculation of GHG emissions, refer to the *USAF Guide to the Mandatory Greenhouse Gas Reporting Rule*.

### 2.6.8 HAP Speciation

Though HAP emissions have been speciated for some engines, there is very little data available for most aircraft engines likely found at USAF installations. If speciated HAP data for an engine is unavailable, it is recommended that a surrogate engine is used. If there is no suitable surrogate data available, speciated HAP emissions may be estimated using the total VOC emissions and mass fraction of the speciated HAP. The mass fractions for several HAPs are provided in Table 2-10 and those recommended by the EPA as stated in the document *Recommended Best Practice for Quantifying Speciated Organic Gas Emissions From Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines*. Emissions of a speciated HAP are calculated by first converting the total VOC emissions to Total Organic Gases (TOG) and multiplying this by the mass fraction of the speciated HAP of interest. This calculation is shown in the following equation:

$$E(\text{Pol}) = \frac{E(\text{VOC})}{0.99} \times MF(\text{Pol})$$

**Equation 2-5**

Where,

**E(Pol)** = Emissions of speciated HAP (lb/yr)

**E(VOC)** = Emissions of total VOC (lb/yr)

**0.99** = Factor converting VOC to TOG

**MF(Pol)** = Mass fraction of the HAP of interest as provided in Table 2-10

### 2.6.9 International Civil Aviation Organization (ICAO) Emission Factors

The ICAO is a United Nations specialized agency that was created in 1944, with the goal of encouraging the safe and orderly development of international civil aviation. The organization develops and maintains safety standards, practices, and procedures for a safe and efficient air transport network that supports global, social, and economic priorities. As the need to develop aviation security policies and measures arose in the late 1960s, ICAO developed enhanced, uniform security measures, policies, and guidelines to address any acts of unlawful interference within the aviation system. All security initiatives placed by ICAO rely on the cooperation and commitment among the member states.

To make advances in environmental stewardship, ICAO has developed additional standards, policies, and guidance material to specifically address aircraft noise and engine emissions. Most of ICAOs work within the environmental field is undertaken by the ICAO Committee on Aviation Environmental Protection (CAEP), including the collection of aircraft exhaust data from engine manufacturers for engines that have entered production. Many of these engines are used on military aircraft found at USAF bases, and are often given a military designation to differentiate them from their civilian engine counterparts. Military-sponsored emissions tests have not been conducted on these engines and EFs have not been developed for them. The data collected by CAEP may be utilized to assist in the calculation of aircraft engine emissions. This document includes EFs that have been developed from various studies as well as those provided by ICAO. This section of this document serves to briefly describe how the ICAO EFs were calculated so they may be used to calculate emissions from aircraft flight operations.

The aircraft exhaust data gathered by CAEP has been standardized per engine based on percent engine thrust. These values are used with the emission data sheets provided by ICAO to calculate aircraft engine emissions. ICAO emissions data sheets provide NO<sub>x</sub> and CO emission indices, but do not provide VOC or PM emission indices directly. ICAO provides hydrocarbon (HC) emission indices which are multiplied by a scaling factor of 1.15 to estimate VOCs. This scaling factor is provided by a combined FAA and EPA report titled *Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines (May 2009)*.

ICAO does not directly provide PM emissions, but describes three types of PM, and outlines a method to calculate each. The first type of PM consists mainly of black carbon and is designated as non-volatile (EI(PM)<sub>nvol</sub>). The second type of PM is designated volatile sulfate (EI(PM)<sub>vol-FSC</sub>) and is dependent on the sulfur content of the fuel burned in the engine. The last type of PM is designated organic volatiles (EI(PM)<sub>vol-FuelOrganics</sub>) and results from the incomplete combustion of fuel. The sum of these three values is assumed to represent PM<sub>10</sub>, with PM<sub>2.5</sub> assumed to equal 90% of the PM<sub>10</sub> total.

When calculating the non-volatile portion of the PM emissions indices, the first step is to verify that a smoke number (SN), which acts as a surrogate or indicator of plume opacity, has been provided for each mode. If not, the *ICAO Airport Air Quality Manual* may be consulted to estimate those SNs that are missing. Next, calculate the carbon index, which is “a measure of the black carbon mass per standard volume of flow” (ICAO 2011). Depending on the value of the SN, two different equations are used to calculate Carbon Index. For those SNs less than or equal to 30, the first equation is used, while the second is used for those SNs greater than 30.

$$CI = 0.06949(SN)^{1.234} \quad SN \leq 30$$

$$CI = 0.0297(SN)^2 - 1.803(SN) + 31.94 \quad SN > 30$$

Where,

CI = Carbon Index (mg/m<sup>3</sup>)

SN = Smoke Number

The volumetric flow rate ( $Q_{Core}$  or  $Q_{Mixed}$ ) is calculated according to the engine type reported on the ICAO data sheet, or in the database. For engines listed as turbofan (TF),  $Q_{Core}$  is calculated using the first equation below. For those listed as mixed turbofan (MTF),  $Q_{Mixed}$  may be calculated using the second equation. The Air-Fuel Ratio (AFR) used in calculations is usually proprietary information, but ICAO has developed average AFR values that may be used, which are provided in the *ICAO Airport Air Quality Manual* (ICAO 2011).

$$Q_{Core} = 0.776(AFR) + 0.877 \quad \text{For Turbofan Engines}$$

$$Q_{Mixed} = 0.7769(AFR)(1 + BPR) + 0.877 \quad \text{For Mixed Turbofan Engines}$$

Where,

$Q_{Core}$  = Volumetric flow rate for TF engine (m<sup>3</sup>/kg)

$Q_{Mixed}$  = Volumetric flow rate for MTF engine (m<sup>3</sup>/kg)

AFR = Air-fuel ratio as given in ICAO

BPR = Bypass Ratio as provided on ICAO datasheet or in ICAO database

Finally, the emission index (EI) for non-volatile PM ( $EI(PM)_{nvol}$ ) is calculated by multiplying the Carbon Index by the volumetric flow rate as shown below.

$$EI(PM)_{nvol} = CI \times Q$$

Where,

$EI(PM)_{nvol}$  = Emission Index for non-volatile PM (mg/kg)

Q = Volumetric flow rate; either  $Q_{Core}$  or  $Q_{Mixed}$

The volatile PM sulfate portion of the PM emission index ( $EI(PM)_{vol-FSC}$ ) is a function of the fuel sulfur content and the fuel sulfur conversion efficiency. If the sulfur content is unknown, the national average weight percent as given in Table 2-2 may be used in the calculations. Similarly, if the fuel sulfur conversion efficiency is unknown, ICAO recommends that a median value of 2.4 wt.% be used. The following equation is used to determine  $EI(PM)_{vol-FSC}$ .

$$EI(PM)_{vol-F} = (10)^6 \times \left[ \frac{(FSC/100) \times (\varepsilon/100) \times 96}{32} \right]$$

Where,

$EI(PM)_{vol-FSC}$	= Emission index for volatile sulfate PM (mg/kg)
FSC	= Fuel sulfur content. <b>Use Table 2-2 if unknown (%)</b>
$(10)^6$	= Factor for converting units to mg/kg
100	= Factor converting percent to a fraction (%)
$\varepsilon$	= Fuel sulfur conversion efficiency. <b>Use 2.4 if unknown (%)</b>
96	= Molecular weight of sulfate (g/mol)
32	= Molecular weight of sulfur (g/mol)

Finally, the organic volatiles ( $EI(PM)_{vol-FuelOrganics}$ ) portion of the PM EI is calculated by taking the product of the HC EI and the ratio of  $EI(PM)_{vol-FuelOrganics}$  to the HC EI of a reference engine. ICAO uses the CFM56-2-C1 as the reference engine for this ratio. The calculation of  $EI(PM)_{vol-FuelOrganics}$  is shown in the following equation:

$$EI(PM)_{vol-FuelOrganic} = \delta \times EI_{HC}$$

Where,

$EI(PM)_{vol-FuelOrganics}$	= Emission index for PM from fuel organics (mg/kg)
$\delta$	= Ratio of $EI_{PM_{vol-FuelOrganics}}$ to $EI_{HC}$ for the CFM56-2-C1 engine
$EI_{HC}$	= Hydrocarbon emission index of the engine

After  $EI(PM)_{nvol}$ ,  $EI(PM)_{vol-FSC}$ , and  $EI(PM)_{vol-FuelOrganics}$  are calculated, the emission index for  $PM_{10}$  is estimated by summing these values and converting into the correct units, as shown:

$$EI(PM_{10}) = \frac{[EI(PM)_{nvol} + EI(PM)_{vol-F} + EI(PM)_{vol-FuelOrga}]}{1000}$$

Where,

$EI(PM_{10})$	=	Emission index for $PM_{10}$ (g/kg)
$EI(PM)_{nvol}$	=	Emission index for non-volatile PM (mg/kg)
$EI(PM)_{vol-FSC}$	=	Emission index for volatile sulfate PM (mg/kg)
$EI(PM)_{vol-FuelOrganics}$	=	Emission index for volatile fuel organic PM (mg/kg)
1000	=	Factor to convert units from mg to g (mg/g)

$PM_{2.5}$  may then be determined from  $PM_{10}$  by assuming  $PM_{2.5}$  is equal to 90% of the  $PM_{10}$  value.

$$EI(PM_{2.5}) = EI(PM_{10}) \times 0.90$$

Where,

$EI(PM_{2.5})$	=	Emission index for $PM_{2.5}$ (g/kg)
$EI(PM_{10})$	=	Emission index for $PM_{10}$ (g/kg)
0.90	=	Fraction of total $PM_{2.5}$ to $PM_{10}$

EFs have been calculated using ICAO data for engines that are most likely to be found at USAF installations. These have been added to EFs that have already been developed from government-subsidized studies. For any engine whose EF is not listed, if ICAO emissions data is available, the EFs may be calculated as described in this section as needed.

## 2.7 Information Resources

The Flightline Operations Group and aircraft pilots should be contacted to obtain the information required to calculate emissions from aircraft flying operations (i.e., the number of LTOs, TGOs, LFBs, TIM, etc.). The Aircraft Maintenance Squadron (AMX) should be contacted to obtain the information needed to calculate emissions from on-wing engine testing operations. This includes the types of engines tested, the number of tests conducted during the year on each engine type, the average time spent at each power setting during a typical test, and the associated fuel flow rate at each power setting. Additionally, the base's Weather Department should be contacted to obtain the average mixing zone height for the base.

## 2.8 Example Calculations

The following section provides example calculations for aircraft operations.

### 2.8.1 Problem 1 - Landing and Takeoff Cycle Emissions

A USAF installation needs to calculate the annual CO emissions from LTO operations associated with their F-15D aircraft. The following information was obtained from the base:

Aircraft Model: F-15D  
 Engine Model: F100-PW-220  
 Number of Engines: 2  
 Number of Annual LTOs: 2,500

The TIM data from Table 2-4 and the mode specific fuel flow rates and EFs from Table 2-8 for the F100-PW-220 engine are presented in the following table:

LTO Mode	Average TIM (min.)	Typical Power Setting	Average Fuel Flow Rate (lb/hr)	CO Emission Factor (lb/1000 lb <sub>fuel</sub> )
Taxi/Idle-out	18.50	Idle	2,084	35.32
Takeoff	0.40*	Military	9,679	0.86
		Afterburner	41,682	11.87
Climb out	0.80	Intermediate	5,770	0.86
Approach	3.50	Approach	3,837	1.92
Taxi/Idle-in	11.30	Idle	2,084	35.32

\*Since this engine has afterburner, it is assumed that the duration of the Takeoff mode is 50% Afterburner and 50% Military

The annual CO emissions from F-15D LTO cycles are calculated using Equation 2-1 as shown:

$$E(Pol)_{Aircraft} = \frac{L \times N}{60,000} \times \sum_{i=1}^n \left[ TIM_i \times FFR_i \times EF(Pol)_i \times \frac{FERF(Pol)}{100} \right]$$

The calculations can be broken up into three distinct steps:

**Step 1 – Calculate CO pollutant emissions for each engine in each mode in the LTO cycle.**

$$E(Pol)_{mode} = TIM_i \times FFR_i \times EF(Pol) \times \frac{FERF(Pol)}{100}$$

$$E(CO)_{Idle-out} = 18.50 \left( \frac{min}{cycle} \right) \times 2084 \left( \frac{lb \text{ fuel}}{hr} \right) \times 35.32 \left( \frac{lb}{10^3 \text{ lb fuel}} \right) = 1,361,727.28 \frac{min \cdot lb \text{ fuel} \cdot lb}{cycle \cdot hr \cdot 10^3 \text{ lb fuel}}$$

$$E(\text{CO})_{\text{Approach}} = 3.50 \left( \frac{\text{min}}{\text{cycle}} \right) \times 3837 \left( \frac{\text{lb fuel}}{\text{hr}} \right) \times 1.92 \left( \frac{\text{lb}}{10^3 \text{ lb fuel}} \right) =$$

$$25,784.64 \frac{\text{min} \cdot \text{lb fuel} \cdot \text{lb}}{\text{cycle} \cdot \text{hr} \cdot 10^3 \text{ lb fuel}}$$

$$E(\text{CO})_{\text{Takeoff(Mil)}} = 0.20 \left( \frac{\text{min}}{\text{cycle}} \right) \times 9679 \left( \frac{\text{lb fuel}}{\text{hr}} \right) \times 0.86 \left( \frac{\text{lb}}{10^3 \text{ lb fuel}} \right) =$$

$$1,664.79 \frac{\text{min} \cdot \text{lb fuel} \cdot \text{lb}}{\text{cycle} \cdot \text{hr} \cdot 10^3 \text{ lb fuel}}$$

$$E(\text{CO})_{\text{Takeoff(AB)}} = 0.20 \left( \frac{\text{min}}{\text{cycle}} \right) \times 41682 \left( \frac{\text{lb fuel}}{\text{hr}} \right) \times 11.87 \left( \frac{\text{lb}}{10^3 \text{ lb fuel}} \right) =$$

$$98,953.07 \frac{\text{min} \cdot \text{lb fuel} \cdot \text{lb}}{\text{cycle} \cdot \text{hr} \cdot 10^3 \text{ lb fuel}}$$

$$E(\text{CO})_{\text{Climb out}} = 0.80 \left( \frac{\text{min}}{\text{cycle}} \right) \times 5770 \left( \frac{\text{lb fuel}}{\text{hr}} \right) \times 0.86 \left( \frac{\text{lb}}{10^3 \text{ lb fuel}} \right) =$$

$$3,969.76 \frac{\text{min} \cdot \text{lb fuel} \cdot \text{lb}}{\text{cycle} \cdot \text{hr} \cdot 10^3 \text{ lb fuel}}$$

$$E(\text{CO})_{\text{Idle-in}} = 11.30 \left( \frac{\text{min}}{\text{cycle}} \right) \times 2084 \left( \frac{\text{lb fuel}}{\text{hr}} \right) \times 35.32 \left( \frac{\text{lb}}{10^3 \text{ lb fuel}} \right) =$$

$$831,757.74 \frac{\text{min} \cdot \text{lb fuel} \cdot \text{lb}}{\text{cycle} \cdot \text{hr} \cdot 10^3 \text{ lb fuel}}$$

**Step 2**– Calculate the total CO emissions for a single F-15D LTO.

$$E(\text{Pol})_{\text{LTO}} = \sum_{i=1}^n [E(\text{Pol})_{\text{Mode}_i} + \dots + E(\text{Pol})_{\text{Mode}_n}]$$

$$E(\text{CO})_{\text{LTO}} = (1,361,727.28 + 25,784.64 + 1,664.79 + 98,953.07 + 3,969.76 +$$

$$831,757.74) \frac{\text{lb}}{\text{cycle}} = 2,323,857.28 \frac{\text{min} \cdot \text{lb fuel} \cdot \text{lb}}{\text{cycle} \cdot \text{hr} \cdot 10^3 \text{ lb fuel}}$$

**Step 3** – Determine the total CO emissions from annual F-15D operations.

$$E(\text{Pol})_{\text{Aircraft}} = \frac{L \times N}{60,000} \times E(\text{POL})_{\text{LTO}}$$

$$E(\text{CO})_{\text{Aircraft}} = \frac{2500 \left( \frac{\text{cycle}}{\text{yr}} \right) \times 2}{60,000 \left( \frac{\text{min} \cdot \text{lb}}{\text{hr} \cdot 10^3 \text{ lb}} \right)} \times 2,323,857.28 \frac{\text{min} \cdot \text{lb fuel} \cdot \text{lb}}{\text{cycle} \cdot \text{hr} \cdot 10^3 \text{ lb fuel}}$$

$$E(\text{CO})_{\text{Total}} = 193,654.8 \frac{\text{lb}}{\text{yr}}$$

### 2.8.2 Problem 2 - Auxiliary Power Unit Emissions

A USAF installation also needs to calculate the annual NO<sub>x</sub> emissions associated with the operation of the APUs on their aircraft. The following information was obtained:

APU Model	GTCP165-1
# APU per aircraft	1
Power Setting	Constant
Operating Time per LTO	15 minutes
Total LTO per year	1300

The annual NO<sub>x</sub> emissions from APU use is calculated using Equation 2-2 as shown:

$$E(Pol)_{APU} = L \times N \times \frac{OT}{60} \times EF(Pol) \times \frac{FERF}{100}$$

The calculations can be broken up into two distinct steps:

**Step 1 – Calculate the NO<sub>x</sub> emissions for a single LTO cycle.** Note that Table 2-11 lists the NO<sub>x</sub> EF for the GTCP165-1 as **1.22lb/hr**.

$$E(NO_x)_{LTO} = \frac{15(\frac{min}{cycle})}{60(\frac{min}{hr})} \times 1.22 \left(\frac{lb}{hr}\right) = 0.305 \frac{lb}{cycle}$$

**Step 2 – Calculate the NO<sub>x</sub> pollutant emissions from annual APU operations.**

$$E(Pol)_{APU} = L \times N \times E(Pol)_{LTO}$$

$$E(NO_x)_{APU} = 1300 \left(\frac{cycles}{yr}\right) \times 1 \times 0.305 \left(\frac{lb}{cycle}\right)$$

$$E(NO_x)_{APU} = 396.5 \frac{lb}{yr}$$

### 2.8.3 Problem 3 - On-Wing Engine Testing

A USAF installation performs on-wing evaluations of the F110-GE-100 engines used on their F-16D aircraft. The base must calculate CO and SO<sub>x</sub> emissions from on-wing testing operations. The base and the fuel supplier are in Louisiana, and the base wants the SO<sub>x</sub> emissions specific for Louisiana sulfur content. Approximately 30 on-wing engine tests following similar procedures were conducted during the year. For these similar on-wing tests, the procedure,



average fuel flow rate (FFR), and average operating times are summarized as follows:

Procedure	Avg FFR (lb/hr)	Avg Operating Time (min)
Stabilize at Idle	809.33	5
Accelerate and Hold	4,147.78	5
Stabilize at Idle	981.21	1
Accelerate and Hold	8,170.88	5
Decelerate and Hold	1,232.67	5
Accelerate and Hold	12,223.02	2
Decelerate and hold	1,187.40	2
Accelerate and hold	17,959.14	0.25
Decelerate and hold	2,201.55	2
Stabilize at Idle	1,205.45	5
Shut down engine	---	---

**Step 1 – Determine the engine power mode for each test setting.** The operating mode encompasses a range of fuel flow rates. Select the operating mode by finding where the average fuel flow rate in the table above falls within the fuel flow range for the operating mode. Typically, this is simply by finding the numerically closest fuel flow rate in Table 2-8 to the average rates recorded in the table above, but refer to the appropriate tables of the latest version of the *Air Emissions Guide for Air Force Stationary Sources* for assistance as needed. The operating modes are as follows:

Procedure	Avg FFR (lb/hr)	Avg Operating Time (min)	Engine Power Mode
Stabilize at Idle	809.33	5	Idle
Accelerate and Hold	4,147.78	5	Approach
Stabilize at Idle	981.21	1	Idle
Accelerate and Hold	8,170.88	5	Intermediate
Decelerate and Hold	1,232.67	5	Idle
Accelerate and Hold	12,223.02	2	Military
Decelerate and hold	1,187.40	2	Idle
Accelerate and hold	17,959.14	0.25	Afterburner
Decelerate and hold	2,201.55	2	Idle
Stabilize at Idle	1,205.45	5	Idle

**Step 2 – Calculate CO and SO<sub>x</sub> emissions for each operating mode.** In this example, calculating the emissions while operating in the “idle” mode is the most complicated since the engine is tested in that mode at several points and different fuel flow rates. Note also that this example states that the base conducted 30 “similar” tests, and without calculating emissions using data from each test, the following method is an approximation. It is up to the base to determine the level of precision required when estimating emissions from on-wing engine testing. The emission factors for CO and SO<sub>x</sub> for each mode are provided in Table 2-8.

$$E(Pol)_{mode} = \frac{1}{60,000} \times \left[ TIM_i \times FFR_i \times EF(Pol) \times \frac{FERF(Pol)}{100} \right]$$

$$E(CO)_{Idle} = \frac{1}{60,000} \left( \frac{hr \cdot 10^3 lb}{min \cdot lb} \right) \times [(5 \times 809.33) + (1 \times 981.21) + (5 \times 1232.67) + (2 \times 1187.40) + (2 \times 2201.55) + (5 \times 1205.45)] \left( \frac{min \cdot lb \cdot fuel}{test \cdot hr} \right) \times 24.11 \left( \frac{lb}{10^3 lb \cdot fuel} \right) \times 30 \left( \frac{tests}{yr} \right) = 289.28 \frac{lb}{yr}$$

$$E(SO_x)_{Idle} = \frac{1}{60,000} \left( \frac{hr \cdot 10^3 lb}{min \cdot lb} \right) \times [(5 \times 809.33) + (1 \times 981.21) + (5 \times 1232.67) + (2 \times 1187.40) + (2 \times 2201.55) + (5 \times 1205.45)] \left( \frac{min \cdot lb \cdot fuel}{test \cdot hr} \right) \times 1.07 \left( \frac{lb}{10^3 lb \cdot fuel} \right) \times 30 \left( \frac{tests}{yr} \right) = 12.84 \frac{lb}{yr}$$

CO and SO<sub>x</sub> emissions for other modes are similarly calculated and is summarized as follows:

Mode	CO Emissions (min lb fuel lb/hr 10 <sup>3</sup> lb fuel yr)	SO <sub>x</sub> Emissions (min lb fuel lb/hr 10 <sup>3</sup> lb fuel yr)
Idle	289.28	12.84
Approach	59.83	11.10
Intermediate	70.88	21.86
Military	41.31	13.08
Afterburner	151.33	2.40

**Step 3 – Determine the total CO and SO<sub>x</sub> emissions.**

$$E(Pol)_{Aircraft} = \sum_{i=1}^n E(POL)_{Mode}$$

$$E(CO)_{Aircraft} = (289.28 + 59.83 + 70.88 + 41.31 + 151.33) \left( \frac{lb}{yr} \right)$$

$$E(CO)_{Aircraft} = 612.63 \frac{lb}{yr}$$

$$E(SO_x)_{Aircraft} = (12.84 + 11.10 + 21.86 + 13.08 + 2.40) \left( \frac{lb}{yr} \right)$$

$$E(SO_x)_{Aircraft} = 61.27 \frac{lb}{yr}$$

Note that, the Air Emissions Guide for Air Force Stationary Sources provides an example of how to estimate emissions for jet engine testing. The two examples show a slightly different but virtually identical method for estimating emissions from both processes.

**Table 2-3. Comparison of Commercial and Military LTO Cycle Modes**

Engine Type	Commercial LTO Cycle Modes	Military LTO Cycle Modes	Typical Engine Power Setting (%)
Turbofan	Taxi/Idle out	Idle	7
	Takeoff	Military or Afterburner (AB)	100 or 110-150 <sup>a</sup>
	Climb out	Intermediate	70-85 <sup>a</sup>
	Approach	Approach	30
	Taxi/Idle in	Idle	7
Turboprop	Taxi/Idle out	Idle	7
	Takeoff	Military	90
	Climb out	Intermediate	70-85 <sup>a</sup>
	Approach	Approach	30
	Taxi/Idle in	Idle	7

SOURCE (unless otherwise noted): *Airport Air Quality Manual*, International Civil Aviation Organization, 2011.

- a. Power setting percentage from *Air Emissions Factor Guide to Air Force Mobile Sources*, 2009 which cites Emissions and Dispersion Modeling System (EDMS) as the original source. For military aircraft equipped with afterburner (AB), it should be generally assumed that the duration of Takeoff mode is 50% AB and 50% military.

**Table 2-4. Default Time-in-Mode for Various Aircraft Categories**

Aircraft Type	Typical Duration by Mode (Minutes)					
	Taxi/Idle-out	Takeoff <sup>a</sup>	Climb out	Approach	Taxi/Idle-in	Total
<b>Military Aircraft</b>						
<b>Combat:</b>						
USAF	18.50	0.40	0.80	3.50	11.30	34.50
USAF F-35 <sup>b</sup>	18.50	1.065 (Military) 0.013 (AB)	0.012	2.501	11.30	33.391
USN	6.50	0.40	0.50	1.60	6.50	15.50
<b>Trainer - Turbine: <sup>c</sup></b>						
USAF T-38	12.80	0.40	0.90	3.80	6.40	24.30
USAF General	6.80	0.50	1.40	4.00	4.40	17.10
USN	6.50	0.40	0.50	1.60	6.50	15.50
<b>Transport - Turbine: <sup>c</sup></b>						
USAF general	9.20	0.40	1.20	5.10	6.70	22.60
USN	19.00	0.50	2.50	4.50	7.00	33.50
USAF B-52 and KC-135	32.80	0.70	1.60	5.20	14.90	55.20
<b>Military - Piston</b>	6.50	0.60	5.00	4.60	6.50	23.20
<b>Military - Helicopter</b>	8.00	2.27 <sup>d</sup>	4.53 <sup>d</sup>	6.80	7.00	28.60
<b>Civilian Aircraft</b>						
<b>Commercial Carrier:</b>						
Jumbo, Long and Medium range jet	19.00	0.70	2.20	4.00	7.00	32.90
<b>General Aviation:</b>						
Business Jet	6.50	0.40	0.50	1.60	6.50	15.50
Turboprop	19.00	0.50	2.50	4.50	7.00	33.50
Piston	12.00	0.30	5.00	6.00	4.00	27.30

SOURCE (unless otherwise noted): *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources*, EPA420-R-92-009, December 1992. USAF – United States Air Force. USN – United States Navy

- For military aircraft equipped with afterburner (AB), it should be generally assumed that the duration of Takeoff mode is 50% AB and 50% military.
- SOURCE: *F-35A/B/C Flight Profiles (Karnes 3.2) for US Air Force, US Navy and US Marine Corps Airfield Noise and Air Studies*, June 2015. Note that the duration of "Takeoff" mode is the total of the TIM in military and AB for each takeoff
- Turbines include both turbofan and turboprop engines.
- SOURCE: *Air Emissions Factor Guide to Air Force Mobile Sources*, December 2009. This document cites Emissions and Dispersion Modeling System (EDMS) as the original source.

**Table 2-5. Military Airframe/Engine/APU Combinations**

Aircraft Model(s)	Time-In-Mode Category <sup>a</sup>	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU Hours of Operation Per LTO <sup>b</sup>	Notes:
A-3A	Combat: USN	J57-P-6B (2)	---	---	c, h(1)
A-3B	Combat: USN	J57-P-10 (2)	---	---	h(1)
A-4	Combat: USN	J52-P-2 (1)	---	---	c, h(4)
		J52-P-8 (1)	---	---	c, h(4)
		J65-W-2 (1)	---	---	c, h(4)
		J65-W-4 (1)	---	---	c, h(4)
A-4C	Combat: USN	J65-W-16A (1)	---	---	c, h(1)
		J65-W-20 (1)	---	---	h(3)
A-4E	Combat: USN	J52-P-6A (1)	---	---	c, h(1)
		J52-P-8A, -8B (1)	---	---	c, h(1)
A-4F	Combat: USN	J52-P-8A, -8B (1)	---	---	c, h(1)
A-4L	Combat: USN	J65-W-20 (1)	---	---	h(1)
A-4M	Combat: USN	J52-P-408 (1)	---	---	h(1)
A-6A	Combat: USN	J52-P-6A, -6B (2)	---	---	c, h(1), h(3)
		J52-P-8A, -8B (2)	---	---	c, h(1)
A-6B	Combat: USN	J52-P-6A (2)	---	---	c, h(1)
		J52-P-8A (2)	---	---	c, h(1)
A-6C	Combat: USN	J52-P-8A (2)	---	---	c, h(1)
A-6E	Combat: USN	J52-P-8A, -8B (2)	---	---	c, h(1)
A-6F	Combat: USN	F404-GE-400D (2)	---	---	c, h(1)
A-7A	Combat: USN	TF30-P-6B (1)	---	---	h(3)
A-7B, -7C	Combat: USN	TF30-P-8 (1)	---	---	c, h(1)
		TF30-P-408 (1)	---	---	c, h(1)
A-7D, -7K	Combat: USAF	TF41-A-1 (1)	---	---	h(1), h(5)
A-7E	Combat: USN	TF41-A-2 (1)	---	---	h(1)
A-10	Combat: USAF	TF34-GE-100A (2)	---	---	h(2)
		TF34-GE-400 (2)	---	---	h(3)
A-10A	Combat: USAF	TF34-GE-100 (2)	GTCP 36-50 (1)	1.00	b, c, h(1)
A-10C	Combat: USAF	TF34-GE-100 (2)	---	---	h(6)
A-29	Combat: USAF	PT6A-68C (1)	---	---	h(17)
A-37	Combat: USAF	J69-T-25 (2)	---	---	h(3)
A-37A, -37B	Combat: USAF	J85-GE-17A (2)	---	---	h(4)
AC-130A	Transport - Turbine: USAF general	T56-A-1A (4)	---	---	h(1)
		T56-A-9 (4)	---	---	h(1)
AC-130H	Transport - Turbine: USAF general	T56-A-15 (4)	GTCP 85-180L (1)	1.00	c, e, h(1), i(1)
AC-130J	Transport - Turbine: USAF general	AE2100D3 (4)	---	---	c, h(6)
AC-130U, -130W	Transport - Turbine: USAF general	T56-A-15 (4)	---	---	h(1), h(6)
AT-6B	Trainer - Turbine: USAF General	PT6A-68D (1)	---	---	h(14)
AT-38B	Trainer - Turbine: USAF T-38	J85-GE-5, -5A, -5G, -5J (2)	---	---	c, h(1)
AU-24	Combat: USAF	PT6A-27 (1)	---	---	h(3)
B-1A	Combat: USAF	F101-GE-100 (4)	---	---	h(5)
B-1B	Combat: USAF	F101-GE-102 (4)	GTCP 165-9 (1)	2.00	b, c, h(1)
B-2A	Combat: USAF	F118-GE-100 (4)	131-3A (2)	4.00	b, c, h(1)
B-52D	Transport - Turbine: USAF B-52	J57-P-19W (8)	---	---	h(5)
		J57-P/F-43WB (8)	---	---	h(5)
B-52G	Transport - Turbine: USAF B-52	J57-P-22 (8)	---	---	h(3)

**Table 2-5. Military Airframe/Engine/APU Combinations (continued)**

Aircraft Model(s)	Time-In-Mode Category <sup>a</sup>	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU Hours of Operation Per LTO <sup>b</sup>	Notes:
B-52H	Transport - Turbine: USAF B-52	TF33-P-3 (8)	---	---	h(3)
		TF33-P-5 (8)	---	---	h(3)
		TF33-P-7 (8)	---	---	h(3)
		TF33-P-103 (8)	---	---	h(6)
C-1	General Aviation: Piston	R-1820-82 (2)	---	---	h(3)
C-1A	General Aviation: Piston	R-1820-82, -82A (2)	---	---	c, h(1)
C-2	Transport - Turbine: USN	T56-A-7 (2)	---	---	h(3)
C-2A	Transport - Turbine: USN	T56-A-8, -8A, -8B (2)	---	---	c, h(1)
		T56-A-425 (2)	---	---	c, h(7)
C-5A	Transport - Turbine: USAF general	TF39-GE-1, -1A, -1C (4)	GTCP 85-98d (1)	8.00	c, e, h(1), h(3), h(9), i(1)
C-5B, -5C	Transport - Turbine: USAF general	TF39-GE-1C (4)	GTCP 85-98d (1)	8.00	e, h(1), i(1)
C-5M	Transport - Turbine: USAF general	CF6-80C2L1F (4)	---	---	c, h(1)
		F138-GE-100 (4)	---	---	c, h(1), l(2)
C-9	Transport - Turbine: USAF general	JT8D-17 (2)	---	---	g, h(3)
C-9A	Transport - Turbine: USAF general	JT8D-9A (2)	GTCP 85-98d (1)	6.00	h(1), i(1)
C-9B	Transport - Turbine: USN	JT8D-9A (2)	---	---	c, h(1)
C-9C	Transport - Turbine: USAF general	JT8D-9A (2)	---	---	c, h(1)
C-11A	General Aviation: Business Jet	F113-RR-100 (2)	---	---	h(1), k, l(1)
		SPEY Mk511-8 (2)	---	---	c, h(1)
C-12	General Aviation: Turboprop	PT6A-27 (2)	---	---	h(3)
C-12A	General Aviation: Turboprop	PT6A-38 (2)	---	---	h(1)
		PT6A-41 (2)	---	---	h(3)
C-12C, -12D, -12L	General Aviation: Turboprop	PT6A-41 (2)	---	---	h(1)
C-12F, -12R, -12T, -12U	General Aviation: Turboprop	PT6A-42 (2)	---	---	h(1), h(6)
C-12J	General Aviation: Turboprop	PT6A-65B (2)	---	---	c, h(6)
C-12S	General Aviation: Turboprop	PT6A-60A (2)	---	---	h(1)
C-17A	Transport - Turbine: USAF general	F117-PW-100 (4)	331 250G (1)	0.50	b, h(1)
		PW2040 (4)	331 250G (1)	0.50	b, h(1), l(2)
C-18B	Transport - Turbine: USAF general	JT3D-7 (4)	T41M-9A (1)	0.50	b, c, h(1)
C-20A	General Aviation: Business Jet	F113-RR-100 (2)	GTCP 36-100 (1)	0.50	b, h(1), l(1)
		SPEY Mk511-8 (2)	GTCP 36-100 (1)	0.50	b, c, h(1)
C-20B, -20C, -20D, -20E, -20J	General Aviation: Business Jet	F113-RR-100 (2)	---	---	h(1), k, l(1)
		SPEY Mk511-8 (2)	---	---	c, h(1)
C-20F, -20G, -20H	General Aviation: Business Jet	TAY Mk611-8 (2)	---	---	h(1)
C-21A	General Aviation: Business Jet	TFE731-2-2B (2)	---	---	h(1)
C-22A	Transport - Turbine: USAF general	JT8D-7A (3)	GTCP 85-98ck (1)	1.00	c, h(1), i(1)
C-22B	Transport - Turbine: USAF general	JT8D-7 (3)	GTCP 85-98ck (1)	1.00	h(1), i(1)
C-23A	General Aviation: Turboprop	PT6A-45R (2)	---	---	c, h(1)
C-23B, -23C	General Aviation: Turboprop	PT6A-65AR (2)	---	---	c, h(1)
C-26A	General Aviation: Turboprop	TPE331-11U (2)	---	---	c, h(1)
C-26B, -26D	General Aviation: Turboprop	TPE331-12UA-701G (2)	---	---	c, h(1)
C-27J	Transport - Turbine: USAF general	AE2100D2 (2)	---	---	c, h(6)
C-28A	General Aviation: Piston	GTSIO-520-M (2)	---	---	h(1)
C-32A	Transport - Turbine: USAF general	F117-PW-100 (2)	331-49-7081 (1)	3.00	b, h(1), k
		PW2040 (2)	331-49-7081 (1)	3.00	b, h(1)
C-37A	General Aviation: Business Jet	BR700-710A1-10 (2)	---	---	h(6)
C-38A	General Aviation: Business Jet	TFE731-40 (2)	---	---	c, h(1)
C-40A	Transport - Turbine: USN	CFM56-7B24 (2)	---	---	d, h(1)

**Table 2-5. Military Airframe/Engine/APU Combinations (continued)**

Aircraft Model(s)	Time-In-Mode Category <sup>a</sup>	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU Hours of Operation Per LTO <sup>b</sup>	Notes:
C-40B	Transport - Turbine: USAF general	CFM56-7B27 (2)	131-9 (1)	0.50	b, c, h(1)
		CFM56-7B3 (2)	131-9 (1)	0.50	b, c, h(1)
C-40C	Transport - Turbine: USAF general	CFM56-7B3 (2)	---	---	c, d, h(1)
		CFM56-7B27 (2)	---	---	d, h(1)
C-123K	Transport - Turbine: USAF general	J85-GE-17 (2)	---	---	c, h(1)
		R-2800-99W (2)	---	---	h(1)
C-130A, -130D	Transport - Turbine: USAF general	T56-A-9, -9A, -9B (4)	GTCP 85L (1)	1.00	b, c, h(1)
C-130B	Transport - Turbine: USAF general	T56-A-7, -7A (4)	GTCP71/71A (1)	1.00	b, c, h(1)
C-130E	Transport - Turbine: USAF general	T56-A-7, -7A (4)	GTCP71/71A (1)	1.00	b, c, h(1)
C-130F	Transport - Turbine: USN	T56-A-7, -7A (4)	GTCP71/71A (1)	1.00	b, c, h(1)
C-130H	Transport - Turbine: USAF general	T56-A-15 (4)	GTCP 85-180L (1)	1.00	c, e, h(1), i(1)
C-130J	Transport - Turbine: USAF general	T56-A-15 (4)	GTCP 85L (1)	1.00	b, h(1)
		AE2100D3 (4)	---	---	c, h(6)
C-130T	Transport - Turbine: USN	T56-A-16 (4)	---	---	h(1)
C-135A	Transport - Turbine: USAF general	J57-P/F-59W (4)	T41M-9A (1)	1.00 to 2.00	b, c, h(5)
			ASHG70-1 (1)	1.00 to 2.00	b, c, h(5)
C-135B, -135C	Transport - Turbine: USAF general	J57-P/F-59W (4)	T41M-9A (1)	1.00 to 2.00	b, c, h(5)
			ASHG70-1 (1)	1.00 to 2.00	b, c, h(5)
		TF33-P-5 (4)	T41M-9A (1)	1.00 to 2.00	b, c, h(1)
			ASHG70-1 (1)	1.00 to 2.00	b, c, h(1)
C-135E	Transport - Turbine: USAF general	TF33-P-102 (4)	T41M-9A (1)	1.00 to 2.00	b, c, h(1)
			ASHG70-1 (1)	1.00 to 2.00	b, c, h(1)
C-137B, -137C	Transport - Turbine: USAF general	JT3D-3B (4)	---	---	h(1)
C-140A	General Aviation: Business Jet	J60-P-5A, -5B (4)	---	---	h(5)
C-140B	General Aviation: Business Jet	J60-P-5 (4)	---	---	c, h(6)
C-141	Transport - Turbine: USAF general	TF33-P-3 (4)	GTCP 165-1 (1)	3.00	h(3), i(2)
		TF33-P-5 (4)	GTCP 165-1 (1)	3.00	h(3), i(2)
C-141A, -141B, -141C	Transport - Turbine: USAF general	TF33-P-7 (4)	GTCP85-106/106A (1)	3.00	b, c, h(1), h(3)
C-145A	Trainer - Turbine: USAF General	PT6A-65B (2)	---	---	c, h(6)
C-146A	Transport - Turbine: USAF general	PW119C (2)	---	---	c, h(6)
CT-1B	General Aviation: Business Jet	JT15D-5 (2)	---	---	d, h(1)
CT-39A	General Aviation: Business Jet	J60-P-3, -3A (2)	---	---	c, h(1)
CT-39E, -39G	General Aviation: Business Jet	JT12A-8 (2)	---	---	c, h(1)
CT-43A	Transport - Turbine: USAF general	JT8D-9A (2)	---	---	h(1)
CT-49A	Transport - Turbine: USAF general	JT3D-7 (4)	---	---	d, h(1)
CV-22, -22A	Transport - Turbine: USAF general	AE1107C (2)	---	---	f, h(1)
		T406-AD-400 (2)	---	---	f, h(1), k(2)
DC-130A	Transport - Turbine: USAF general	T56-A-9, -9A (4)	---	---	c, h(1)
DF-8L	Combat: USN	J57-P-4A (1)	---	---	c, h(1)
DT-2B	Trainer - Turbine: USN	J60-P-6 (2)	---	---	c, h(1)
E-1B	General Aviation: Piston	R-1820-82A (2)	---	---	c, h(1)
E-2	Transport - Turbine: USN	T56-A-7 (2)	---	---	h(3)
E-2B	Transport - Turbine: USN	T56-A-8, -8A, -8B (2)	---	---	c, h(1)
E-2C	Transport - Turbine: USN	T56-A-422 (2)	---	---	c, h(1)
		T56-A-427 (2)	---	---	c, h(10)
E-2D	Transport - Turbine: USN	T56-A-427 (2)	---	---	c, h(10)



**Table 2-5. Military Airframe/Engine/APU Combinations (continued)**

Aircraft Model(s)	Time-In-Mode Category <sup>a</sup>	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU Hours of Operation Per LTO <sup>b</sup>	Notes:
E-3A	Transport - Turbine: USAF general	TF33-P-3 (4)	---	---	d, h(3)
		TF33-P-5 (4)	---	---	d, h(3)
		TF33-P-7 (4)	---	---	d, h(3)
		TF33-P-100A (4)	---	---	c, d, h(1)
E-3B, -3C	Transport - Turbine: USAF general	TF33-P-100A (4)	GTCP 165-1 (1)	2.00	c, h(1), i(1)
E-4A	Transport - Turbine: USAF general	F103-GE-100 (4)	---	---	h(5)
E-4B	Transport - Turbine: USAF general	CF6-50E2 (4)	GTCP 660-4 (1)	2.00	h(6), i(1)
E-6B	Transport - Turbine: USN	CFM56-2A-2 (4)	---	---	c, h(7)
E-8C	Transport - Turbine: USAF general	JT3D-3B (4)	GTCP 85 (1)	2.00	e, h(1), k
		TF33-PW-102C (4)	GTCP 85 (1)	2.00	c, e, h(1)
E-9A	Transport - Turbine: USAF general	PW120A (2)	---	---	c, h(6)
EA-3B	Combat: USN	J57-P-10 (2)	---	---	h(1)
EA-4F	Combat: USN	J52-P-6A, -6B (1)	---	---	c, h(1)
		J52-P-8A (1)	---	---	c, h(1)
EA-6A	Combat: USN	J52-P-8A, -8B (2)	---	---	c, h(1)
EA-6B	Combat: USN	J52-P-8A, -8B (2)	---	---	c, h(1)
		J52-P-408 (2)	---	---	h(1)
EA-7L	Combat: USN	TF41-A-2 (1)	---	---	h(1)
		TF30-P-408 (1)	---	---	c, h(1)
EB-57B	Combat: USAF	J65-W-5, -5B (2)	---	---	c, h(1)
EC-18B, -18D	Transport - Turbine: USAF general	JT3D-7 (4)	---	---	h(1)
EC-24A	Transport - Turbine: USN	JT3D-3B (4)	---	---	h(1)
EC-37B	Transport - Turbine: USAF general	BR700-710C4-11 (2)	---	---	h(15)
EC-130E	Transport - Turbine: USAF general	T56-A-7, -7A (4)	---	---	c, h(1)
		T56-A-15 (4)	---	---	h(6)
EC-130H	Transport - Turbine: USAF general	T56-A-15 (4)	GTCP 85-180L (1)	1.00	h(1), i(1)
EC-130J, -130SJ	Transport - Turbine: USAF general	AE2100D3 (4)	---	---	c, h(6)
EC-130Q	Transport - Turbine: USAF general	T56-A-423 (4)	---	---	c, h(1)
EC-130V	Transport - Turbine: USN	T56-A-15 (4)	---	---	d, h(1)
EC-135A, -135G, -135L	Transport - Turbine: USAF general	J57-P/F-59W (4)	---	---	h(1), h(5)
EC-135B	Transport - Turbine: USAF general	TF33-P-5 (4)	---	---	h(1)
EC-135C, -135J	Transport - Turbine: USAF general	TF33-P-9 (4)	---	---	h(1)
EC-135E	Transport - Turbine: USAF general	TF33-P-102 (4)	---	---	h(1)
EC-135H, -135K, -135P	Transport - Turbine: USAF general	J57-P/F-59W (4)	---	---	h(1), k
		TF33-P-102 (4)	---	---	h(5)
EC-135N	Transport - Turbine: USAF general	J57-P/F-43WB (4)	---	---	h(1)
EC-135Y	Transport - Turbine: USAF general	J57-P/F-43WB (4)	---	---	h(1)
		J57-P/F-59W (4)	---	---	h(1)
EC-137D	Transport - Turbine: USAF general	JT3D-3B (4)	---	---	h(1)
EF-4J	Combat: USN	J79-GE-8B (2)	---	---	c, h(1)
EF-111A	Combat: USAF	TF30-P-109 (2)	---	---	h(1)
EKA-3B	Combat: USN	J57-P-10 (2)	---	---	h(1)
EP-3A	Transport - Turbine: USN	T56-A-10W (4)	---	---	c, h(1)
EP-3B, -3J	Transport - Turbine: USN	T56-A-14 (4)	---	---	h(1)
ERA-3B	Combat: USN	J57-P-10 (2)	---	---	h(1)
ES-2D	General Aviation: Piston	R-1820-82A (2)	---	---	c, h(1)
F-4	Combat: USN	J79-GE-10 (2)	---	---	c, h(3)
F-4B, -4N	Combat: USN	J79-GE-8B, -8C (2)	---	---	c, h(1)

**Table 2-5. Military Airframe/Engine/APU Combinations (continued)**

Aircraft Model(s)	Time-In-Mode Category <sup>a</sup>	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU Hours of Operation Per LTO <sup>b</sup>	Notes:
F-4C, -4D	Combat: USAF	J79-GE-15 (2)	---	---	h(1)
F-4E, -4G	Combat: USAF	J79-GE-17 (2)	---	---	h(1)
F-4J	Combat: USN	J79-GE-8B (2)	---	---	c, h(1)
F-4S	Combat: USN	J79-GE-10B (2)	---	---	c, h(1)
F-5A, -5B	Combat: USAF	J85-GE-13 (2)	---	---	d, h(3)
F-5E, -5F	Combat: USAF	J85-GE-21 (2)	---	---	d, h(1)
F-8	Combat: USN	J57-P-22 (1)	---	---	c, h(3)
F-8J	Combat: USN	J57-P-420 (1)	---	---	h(1)
F-8K	Combat: USN	J57-P-16, -16B (1)	---	---	c, h(1)
F-14A	Combat: USN	TF30-P-412 (2)	---	---	c, h(1)
		TF30-P-414A (2)	---	---	c, h(7)
F-14C	Combat: USN	TF30-P-412 (2)	---	---	c, h(1)
F-14B, -14D	Combat: USN	F110-GE-400 (2)	---	---	h(1)
F-15A, -15B	Combat: USAF	F100-PW-100 (2)	---	---	h(1)
F-15C, -15D	Combat: USAF	F100-PW-100 (2)	---	---	h(1)
		F100-PW-220 (2)	---	---	h(1)
		F100-PW-229 (2)	---	---	h(6)
F-15E	Combat: USAF	F100-PW-220 (2)	---	---	h(1)
		F100-PW-229 (2)	---	---	h(1)
F-16	Combat: USAF	F100-PW-100 (1)	T-62T-40-8 (1)	1.00	b, c, h(3)
F-16A, -16B	Combat: USAF	F100-PW-200 (1)	T-62T-40-8 (1)	1.00	b, c, h(1)
		F100-PW-220 (1)	T-62T-40-8 (1)	1.00	b, c, h(7)
F-16C, -16D	Combat: USAF	F100-PW-200 (1)	T-62T-40-8 (1)	1.00	b, c, h(1)
		F100-PW-220 (1)	T-62T-40-8 (1)	1.00	b, c, h(6)
		F100-PW-229 (1)	T-62T-40-8 (1)	1.00	b, c, h(1)
		F110-GE-100 (1)	T-62T-40-8 (1)	1.00	b, c, h(1)
		F110-GE-129 (1)	T-62T-40-8 (1)	1.00	b, c, h(1)
F-16N	Combat: USN	F110-GE-100 (1)	---	---	h(1)
F-22A, -22B	Combat: USAF	F119-PW-100 (2)	---	---	h(1)
F-35A	Combat: USAF	F135-PW-100 (1)	---	---	c, h(1)
F-35B	Combat: USN	F135-PW-600 (1)	---	---	c, d, h(11)
F-35C	Combat: USN	F135-PW-100 (1)	---	---	c, h(7)
F-100	Combat: USAF	J57-P-22 (1)	---	---	c, h(3)
F-106A, -106B	Combat: USAF	J75-P-17 (1)	---	---	h(1)
F-111, -111F	Combat: USAF	TF30-P-100 (2)	---	---	h(1), h(3)
F-111A	Combat: USAF	TF30-P-3 (2)	---	---	h(1)
F-111D, -111E	Combat: USAF	TF30-P-3 (2)	---	---	h(1)
		TF30-P-9 (2)	---	---	h(5)
F-111G	Combat: USAF	TF30-P-107 (2)	---	---	h(1)
F-117A	Combat: USAF	F404-GE-F1D2 (2)	3800100-4 (1)	2.00	b, c, h(8)
F/A-18A, -18B	Combat: USN	F404-GE-400 (2)	---	---	h(1), h(7)
F/A-18C, -18D	Combat: USN	F404-GE-400 (2)	---	---	h(1)
		F404-GE-402 (2)	---	---	c, h(7)
F/A-18E, -18F	Combat: USN	F404-GE-400 (2)	---	---	h(7)
		F414-GE-400 (2)	---	---	c, h(7)
FA-22A	Combat: USAF	F119-PW-100 (2)	---	---	h(1)
FB-22A	Combat: USAF	F119-PW-100 (2)	---	---	h(1)
FB-111A	Combat: USAF	TF30-P-7 (2)	---	---	h(1)

**Table 2-5. Military Airframe/Engine/APU Combinations (continued)**

Aircraft Model(s)	Time-In-Mode Category <sup>a</sup>	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU Hours of Operation Per LTO <sup>b</sup>	Notes:
HC-130H	Transport - Turbine: USAF general	T56-A-15 (4)	GTCP 85-180L (1)	1.00	c, h(1), i(1)
HC-130J	Transport - Turbine: USAF general	AE2100D3 (4)	---	---	c, h(6)
HC-130P/N	Transport - Turbine: USAF general	T56-A-15 (4)	---	---	h(6)
HV-22A, -22B	Transport - Turbine: USN	AE1107C (2)	---	---	f, h(1), k
		T406-AD-400 (2)	---	---	f, h(1), l(2)
JA-6A	Combat: USN	J52-P-6A, -6B (2)	---	---	c, h(1)
		J52-P-8A, -8B (2)	---	---	c, h(1)
KA-3B	Combat: USN	J57-P-10 (2)	---	---	h(1)
KA-6D	Combat: USN	J52-P-6A (2)	---	---	c, h(1)
		J52-P-8A (2)	---	---	c, h(1)
KC-10, -10A	Transport - Turbine: USAF general	CF6-50C2 (3)	TSCP 700-4B (1)	6.00	h(1), i(1)
		F103-GE-100 (3)	TSCP 700-4B (1)	6.00	h(5), i(1)
		F103-GE-101 (3)	TSCP 700-4B (1)	6.00	h(12), i(1)
KC-46A	Transport - Turbine: USAF general	PW4062 (2)	GTCP 331-200 (1)	0.87	e, h(6), j
			GTCP 331-200ER (1)	0.87	e, h(6), j
KC-130F, -130R, -130T	Transport - Turbine: USN	T56-A-16 (4)	---	---	h(1)
KC-135	Transport - Turbine: USAF KC-135	J57-P-22 (4)	---	---	h(3)
KC-135A	Transport - Turbine: USAF KC-135	J57-P/F-43WB (4)	---	---	h(1)
		J57-P/F-59W (4)	---	---	h(1)
KC-135D, -135Q	Transport - Turbine: USAF KC-135	J57-P/F-59W (4)	---	---	h(1), h(5)
KC-135E	Transport - Turbine: USAF KC-135	TF33-P-102 (4)	GTCP 85-180L (1)	1.00	c, e, h(1), i(1)
KC-135R, -135T	Transport - Turbine: USAF KC-135	CFM56-2B-1 (4)	---	---	h(1), k
		F108-CF-100 (4)	---	---	h(1), l(2)
KC-767A	Transport - Turbine: USAF general	CF6-80C2B6F (2)	---	---	h(13)
		CF6-80C2B7F (2)	---	---	h(13)
		PW4062 (2)	---	---	h(13)
KS-3A	Combat: USN	TF34-GE-2 (2)	---	---	c, h(1)
LC-130F, -130R	Transport - Turbine: USN	T56-A-16 (4)	---	---	h(1)
LC-130H	Transport - Turbine: USAF general	T56-A-15 (4)	---	---	h(1)
MC-12W	General Aviation: Turboprop	PT6A-60 (2)	---	---	c, h(6)
MC-130E	Transport - Turbine: USAF general	T56-A-7 (4)	---	---	h(1)
		T56-A-15, -15A (4)	---	---	c, h(1), h(6)
MC-130H	Transport - Turbine: USAF general	T56-A-15 (4)	GTCP 85-180L (1)	1.00	e, h(1), i(1)
MC-130J	Transport - Turbine: USAF general	AE2100D3 (4)	---	---	c, h(6)
MC-130P, -130W	Transport - Turbine: USAF general	T56-A-15 (4)	---	---	h(1), h(6)
MQ-1B	Military - Piston	Rotax 914F (1)	---	---	h(6)
MQ-1C	Military - Piston	TAE-125 (1)	---	---	h(13)
MQ-9	Combat: USAF	TPE331-10GD (1)	---	---	c, h(6)
MV-22A, -22B	Transport - Turbine: USN	AE1107C (2)	---	---	f, h(1), k
		T406-AD-400 (2)	---	---	f, h(1), l(2)
NA-3B	Combat: USN	J57-P-10 (2)	---	---	h(1)
NA-4E	Combat: USN	J52-P-6A (1)	---	---	c, h(1)
		J52-P-8A, -8B (1)	---	---	c, h(1)
NA-4F	Combat: USN	J52-P-8A (1)	---	---	c, h(1)
NA-4M	Combat: USN	J52-P-408 (1)	---	---	h(1)
NA-6A	Combat: USN	J52-P-6A, -6B (2)	---	---	c, h(1)
		J52-P-8A, -8B (2)	---	---	c, h(1)
NA-6E	Combat: USN	J52-P-8B (2)	---	---	h(1)

**Table 2-5. Military Airframe/Engine/APU Combinations (continued)**

Aircraft Model(s)	Time-In-Mode Category <sup>a</sup>	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU Hours of Operation Per LTO <sup>b</sup>	Notes:
NA-7A	Combat: USN	TF30-P-6 (1)	---	---	c, h(1)
NA-7C	Combat: USN	TF30-P-8 (1)	---	---	c, h(1)
NA-7E	Combat: USN	TF41-A-2 (1)	---	---	h(1)
NB-52B	Transport - Turbine: USAF B-52	J57-P-19W (8)	---	---	h(1)
NC-12B	General Aviation: Turboprop	PT6A-41 (2)	---	---	h(1)
NC-21A	General Aviation: Business Jet	TFE731-2-2B (2)	---	---	h(1)
NC-130A	Transport - Turbine: USAF general	T56-A-9, -9A, -9B (4)	---	---	c, h(1)
NC-130B, -130E	Transport - Turbine: USAF general	T56-A-7, -7A (4)	---	---	c, h(1)
NC-130H	Transport - Turbine: USAF general	T56-A-15 (4)	GTCP 85-180L (1)	1.00	c, e, h(1), i(1)
NC-135A	Transport - Turbine: USAF general	J57-P/F-43WB (4)	---	---	h(5)
NC-135W	Transport - Turbine: USAF general	TF33-P-5 (4)	---	---	h(1)
NC-141A	Transport - Turbine: USAF general	TF33-P-7 (4)	GTCP 85-106/106A (1)	3.00	b, c, h(1)
NF-4D	Combat: USAF	J79-GE-15 (2)	---	---	h(1)
		J79-GE-17 (2)	---	---	h(1)
NF-14B	Combat: USN	F401-PW-400 (2)	---	---	c, h(1)
NF-14D	Combat: USN	F110-GE-400 (2)	---	---	h(1)
NF-16A	Combat: USAF	F100-PW-200 (1)	---	---	h(1)
NF-16D	Combat: USAF	F100-PW-200 (1)	---	---	h(1)
		F100-PW-229 (1)	---	---	h(1)
		F110-GE-100 (1)	---	---	h(1)
		F110-GE-129 (1)	---	---	h(1)
NF-106B	Combat: USAF	J75-P-17 (1)	---	---	h(5)
NF/A-18A, -18B, -18C, -18D	Combat: USN	F404-GE-400 (2)	---	---	h(1)
NKC-135A	Transport - Turbine: USAF KC-135	J57-P/F-43WB (4)	---	---	h(1)
		J57-P/F-59W (4)	---	---	h(1)
NKC-135E	Transport - Turbine: USAF KC-135	TF33-P-102 (4)	GTCP 85-180L (1)	2.00	c, h(1), i(1)
NP-3A	Transport - Turbine: USN	T56-A-10W (4)	---	---	c, h(1)
NP-3C, -3D	Transport - Turbine: USN	T56-A-14 (4)	---	---	h(1)
NRA-3B	Combat: USN	J57-P-10 (2)	---	---	h(1)
NT-33A	Trainer - Turbine: USAF General	J33-A-35 (1)	---	---	h(1)
NT-34C	General Aviation: Piston	PT6A-25 (1)	---	---	c, h(1)
NT-39A	General Aviation: Business Jet	J60-P-3, -3A (2)	---	---	c, h(1)
NTA-4F, -4J	Combat: USN	J52-P-6A (1)	---	---	c, h(1)
NUP-3A	Transport - Turbine: USN	T56-A-14 (4)	---	---	h(1)
O-1	General Aviation: Piston	O-470C (1)	---	---	h(3)
O-2A, -2B	General Aviation: Piston	IO-360-C (1)	---	---	h(1), h(3)
		IO-360-D (1)	---	---	h(3)
OA-4M	Combat: USN	J52-P-6A, -6B (1)	---	---	c, h(1)
		J52-P-8A (1)	---	---	c, h(1)
OA-10A	Combat: USAF	TF34-GE-100 (2)	---	---	h(1)
OA-37B	Combat: USAF	J85-GE-17A (2)	---	---	h(1)
OC-135B	Transport - Turbine: USAF general	TF33-P-5 (4)	---	---	h(1)
OT-47B	General Aviation: Business Jet	JT15D-5D (2)	---	---	c, h(1)
OV-10A	General Aviation: Turboprop	T76-G-10A (2)	---	---	c, g, h(1)
		T76-G-12A (2)	---	---	c, g, h(1)
		T76-G-418 (2)	---	---	g, h(1)
		T76-G-419 (2)	---	---	g, h(1)
P-3A	Transport - Turbine: USN	T56-A-10W (4)	---	---	c, h(1)

**Table 2-5. Military Airframe/Engine/APU Combinations (continued)**

Aircraft Model(s)	Time-In-Mode Category <sup>a</sup>	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU Hours of Operation Per LTO <sup>b</sup>	Notes:
P-3B	Transport - Turbine: USN	T56-A-14 (4)	---	---	h(1)
P-3C	Transport - Turbine: USN	T56-A-7 (4)	---	---	h(3)
		T56-A-14 (4)	---	---	h(1)
QF-4B	Combat: USN	J79-GE-8B, -8C (2)	---	---	c, h(1)
QF-4E	Combat: USAF	J79-GE-10 (2)	---	---	c, h(1)
		J79-GE-17 (2)	---	---	h(1)
QF-4G	Combat: USAF	J79-GE-15 (2)	---	---	h(1)
		J79-GE-17 (2)	---	---	h(1)
QF-106A, -106B	Combat: USAF	J75-P-17 (1)	---	---	h(1)
QRF-4C	Combat: USAF	J79-GE-10 (2)	---	---	c, h(1)
		J79-GE-17 (2)	---	---	h(1)
QT-33A	Trainer - Turbine: USN	J33-A-35 (1)	---	---	h(1)
RA-3B	Combat: USN	J57-P-10 (2)	---	---	h(1)
RA-5C	Combat: USN	J79-GE-8B, -8C (2)	---	---	c, h(1)
		J79-GE-10 (2)	---	---	c, h(1)
RC-12D, -12G, -12H	General Aviation: Turboprop	PT6A-41 (2)	---	---	h(1)
RC-12F, -12M	General Aviation: Turboprop	PT6A-42 (2)	---	---	h(1)
RC-12K, -12N, -12P, -12Q	General Aviation: Turboprop	PT6A-67 (2)	---	---	h(1)
RC-135M, -135X	Transport - Turbine: USAF general	TF33-P-5 (4)	---	---	h(1), h(5), h(6)
RC-135S	Transport - Turbine: USAF general	TF33-P-5 (4)	---	---	h(1)
		CFM56-2B-1 (4)	---	---	h(6), k
		F108-CF-201 (4)	---	---	h(6), l(2)
RC-135T	Transport - Turbine: USAF general	TF33-P-102 (4)	---	---	h(5)
RC-135U	Transport - Turbine: USAF general	TF33-P-9 (4)	---	---	h(1)
		CFM56-2B-1 (4)	---	---	h(6), k
		F108-CF-201 (4)	---	---	h(6), l(2)
RC-135V, -135W	Transport - Turbine: USAF general	TF33-P-5 (4)	---	---	h(1)
		CFM56-2B-1 (4)	---	---	h(6), k
		F108-CF-201 (4)	---	---	h(6), l(2)
RF-4B	Combat: USN	J79-GE-8B, -8C (2)	---	---	c, h(1)
RF-4C	Combat: USAF	J79-GE-15 (2)	---	---	h(1)
RF-5E	Combat: USAF	J85-GE-21 (2)	---	---	h(1)
RF-8G	Combat: USN	J57-P-22 (1)	---	---	c, h(1)
RF/A-18A	Combat: USN	F404-GE-400 (2)	---	---	h(1)
RP-3A	Transport - Turbine: USN	T56-A-10W (4)	---	---	c, h(1)
RP-3D	Transport - Turbine: USN	T56-A-14 (4)	---	---	h(1)
RQ-4	Combat: USAF	AE3007H (1)	---	---	c, h(1)
		F137-RR-100 (1)	---	---	c, h(6)
RQ-4A	Combat: USAF	AE3007 (1)	---	---	c, h(1)
		F137-RR-100 (1)	---	---	c, h(6)
RQ-4B	Combat: USAF	AE3007H (1)	---	---	c, h(1)
RU-21A, -21D, -21E, -21H	General Aviation: Turboprop	PT6A-20 (2)	---	---	c, h(1)
RU-21B, -21C	General Aviation: Turboprop	PT6A-29 (2)	---	---	c, h(1)
RU-21J	General Aviation: Turboprop	PT6A-41 (2)	---	---	h(1)
S-2, -2G	General Aviation: Piston	R-1820-82 (2)	---	---	h(1), h(3)
S-2D, -2E	General Aviation: Piston	R-1820-82A (2)	---	---	c, h(1)
S-3A	Combat: USN	TF34-GE-400 (2)	---	---	h(3)

**Table 2-5. Military Airframe/Engine/APU Combinations (continued)**

Aircraft Model(s)	Time-In-Mode Category <sup>a</sup>	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU Hours of Operation Per LTO <sup>b</sup>	Notes:
SV-22A	Transport - Turbine: USN	AE1107C (2)	---	---	f, h(1), k
		T406-AD-400 (2)	---	---	f, h(1), l(2)
T-1A	Trainer - Turbine: USAF general	JT15D-5B (2)	---	---	h(1)
T-2	Trainer - Turbine: USN	J85-GE-5F (2)	---	---	h(3)
T-2B	Trainer - Turbine: USN	J60-P-6 (2)	---	---	c, h(1)
T-2C	Trainer - Turbine: USN	J85-GE-4, -4A (2)	---	---	c, h(1)
T-6A	Trainer - Turbine: USAF general	PT6A-68 (1)	---	---	g, h(1)
T-7A	Trainer-Turbine: USAF general	F404-GE-102 (1)	4501687C (1)	0.25	h(18)
T-28	General Aviation: Piston	R-1820-82 (1)	---	---	h(3)
T-28B, -28C	General Aviation: Piston	R-1820-86A (1)	---	---	c, h(1)
T-33A	Trainer - Turbine: USAF general	J33-A-35 (1)	---	---	h(1)
T-34	General Aviation: Piston	O-470C (1)	---	---	h(3)
T-34A, -34B	General Aviation: Piston	IO-470-4 (1)	---	---	c, h(1)
T-34C	General Aviation: Piston	PT6A-27 (1)	---	---	h(3)
T-37, -37B	Trainer - Turbine: USAF general	J69-T-25 (2)	---	---	h(1), h(3)
T-38	Trainer - Turbine: USAF T-38	J85-GE-5F (2)	---	---	h(3)
T-38A	Trainer - Turbine: USAF T-38	J85-GE-5, -5A, -5G, -5J, -5M (2)	---	---	c, h(1)
T-38C	Trainer - Turbine: USAF T-38	J85-GE-5, -5A, -5G, -5J, -5R (2)	---	---	c, h(1)
T-38N	Trainer - Turbine: USAF T-38	J85-GE-5H, -5N (2)	---	---	c, h(1)
T-39A, -39D	General Aviation: Business Jet	J60-P-3A (2)	---	---	h(1), h(5)
T-39B	General Aviation: Business Jet	J60-P-3, -3A (2)	---	---	c, h(1)
T-39G, -39N	General Aviation: Business Jet	JT12A-8 (2)	---	---	c, h(1)
T-41	General Aviation: Piston	IO-360-C (1)	---	---	h(3)
T-41A	General Aviation: Piston	IO-3000-D (1)	---	---	c, h(1)
T-41B	General Aviation: Piston	IO-360-D (1)	---	---	h(1)
T-41C, -41D	General Aviation: Piston	IO-360-D34 (1)	---	---	h(1)
T-43A	Transport - Turbine: USAF general	JT8D-9 (2)	---	---	h(1)
T-44	Trainer - Turbine: USN	PT6A-27 (2)	---	---	h(3)
T-45A, -45C	Trainer - Turbine: USN	F405-RR-401 (1)	---	---	h(7)
T-45B	Trainer - Turbine: USN	Mk-851-49	---	---	c, h(1)
T-47A	General Aviation: Business Jet	JT15D-5 (2)	---	---	h(1)
T-50A	Trainer - Turbine: USAF general	F404-GE-102 (1)	---	---	h(16)
TA-3B	Combat: USN	J57-P-10 (2)	---	---	h(1)
TA-4B	Combat: USN	J65-W-20 (1)	---	---	h(1)
TA-4F	Combat: USN	J52-P-6A, -6B (1)	---	---	c, h(1)
		J52-P-8A (1)	---	---	c, h(1)
TA-4J	Combat: USN	J52-P-6A (1)	---	---	
TA-7C	Combat: USN	TF30-P-8 (1)	---	---	c, h(1)
TC-18E	Transport - Turbine: USAF general	TF33-P-100A (4)	---	---	c, h(1)
TC-18F	Transport - Turbine: USAF general	JT3D-3B (4)	---	---	h(1)
TC-130H	Transport - Turbine: USAF general	T56-A-15 (4)	---	---	h(1)
TC-135S, -135W	Transport - Turbine: USAF general	TF33-P-5 (4)	---	---	h(1)
TE-2A, -2C	Transport - Turbine: USN	T56-A-8, -8A, -8B (2)	---	---	c, h(1)
TE-8A	Transport - Turbine: USAF general	JT3D-3B (4)	---	---	h(1)
TF-16N	Combat: USN	F110-GE-100 (1)	---	---	h(1)
TF-18A	Combat: USN	F404-GE-400 (2)	---	---	h(1)
TF/A-18A	Combat: USN	F404-GE-400 (2)	---	---	h(1)
TP-3A	Transport - Turbine: USN	T56-A-10W (4)	---	---	c, h(1)
TTS-2A	General Aviation: Piston	R-1820-82 (2)	---	---	h(1)

**Table 2-5. Military Airframe/Engine/APU Combinations (continued)**

Aircraft Model(s)	Time-In-Mode Category <sup>a</sup>	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU Hours of Operation Per LTO <sup>b</sup>	Notes:
TS-2A	General Aviation: Piston	R-1820-82 (2)	---	---	h(1)
TU-2R, -2S	Combat: USAF	F118-GE-101 (1)	---	---	c, h(6)
U-2S	Combat: USAF	F118-GE-101 (1)	---	---	c, h(6)
U-21	General Aviation: Turboprop	PT6A-27 (2)	---	---	h(3)
U-21A, -21G	General Aviation: Turboprop	PT6A-20 (2)	---	---	c, h(1)
U-21F	General Aviation: Turboprop	PT6A-28 (2)	---	---	c, h(1)
U-21J	General Aviation: Turboprop	PT6A-41 (2)	---	---	h(1)
U-28A	General Aviation: Turboprop	PT6A-67B (1)	---	---	h(6)
UA-3B	Combat: USN	J57-P-10 (2)	---	---	h(1)
UC-12B	General Aviation: Turboprop	PT6A-41 (2)	---	---	h(1)
UC-12F, -12M	General Aviation: Turboprop	PT6A-42 (2)	---	---	h(1)
UC-26C	General Aviation: Turboprop	TPE331-7 (2)	---	---	c, h(1)
UC-35A, -35C	General Aviation: Business Jet	JT15D-5D (2)	---	---	c, h(1)
UC-123K	Transport - Turbine: USAF general	J85-GE-17 (2)	---	---	c, h(1)
UP-3A	Transport - Turbine: USN	T56-A-10W (4)	---	---	c, h(1)
UP-3B	Transport - Turbine: USN	T56-A-14 (4)	---	---	h(1)
US-2A, -2B, -2C	General Aviation: Piston	R-1820-82 (2)	---	---	h(1)
US-2D	General Aviation: Piston	R-1820-82A (2)	---	---	c, h(1)
UV-18A	Transport - Turbine: USAF general	PT6A-20 (2)	---	---	c, h(1)
UV-18B	Transport - Turbine: USAF general	PT6A-27 (2)	---	---	h(1)
UV-20A	General Aviation: Turboprop	PT6A-27 (2)	---	---	h(1)
VC-25A	Transport - Turbine: USAF general	CF6-80C2B1 (4)	GTCP 660-4 (1)	8.00	e, h(1)
VC-137B, -137C	Transport - Turbine: USAF general	JT3D-3B (4)	---	---	h(8)
VC-140B	General Aviation: Business Jet	J60-P-5A, -5B (4)	---	---	h(5)
WC-130E	Transport - Turbine: USAF general	T56-A-7 (4)	---	---	h(5)
		T56-A-15 (4)	---	---	h(5)
WC-130H	Transport - Turbine: USAF general	T56-A-15 (4)	GTCP 85-180L (1)	1.00	c, e, h(1), i(1)
WC-130J	Transport - Turbine: USAF general	AE2100D3 (4)	---	---	c, h(6)
WC-135B, -135W	Transport - Turbine: USAF general	TF33-P-5 (4)	---	---	h(1)
WC-135C	Transport - Turbine: USAF general	TF33-P-9 (4)	---	---	h(1)
WP-3A	Transport - Turbine: USN	T56-A-10W (4)	---	---	c, h(1)
X-29A	Combat: USAF	F404-GE-400 (1)	---	---	g, h(1)
X-31A	Combat: USN	F404-GE-400 (1)	---	---	h(1)
X-44A	Combat: USAF	F119-PW-100 (2)	---	---	h(1)
YA-7D	Combat: USAF	TF41-A-1 (1)	---	---	h(1)
YC-14A	Transport - Turbine: USAF general	CF6-50A (2)	---	---	h(1)
YE-2C	Transport - Turbine: USN	T56-A-8, -8A, -8B (2)	---	---	c, h(1)
YF-4J	Combat: USN	J79-GE-8B (2)	---	---	c, h(1)
YF-15A, -15B	Combat: USAF	F100-PW-100 (2)	---	---	h(1)
YF-16A, -16B	Combat: USAF	F100-PW-200 (1)	---	---	h(1)
YOV-10D	General Aviation: Turboprop	T76-G-10, -10A (2)	---	---	c, h(1)
		T76-G-12, -12A (2)	---	---	c, h(1)
YP-3C	Transport - Turbine: USN	T56-A-14 (4)	---	---	h(1)
YS-2G	General Aviation: Piston	R-1820-82 (2)	---	---	h(1)
YT-2B	Trainer - Turbine: USN	J60-P-6 (2)	---	---	c, h(1)
YT-34C	General Aviation: Piston	PT6A-25 (1)	---	---	c, h(1)

Notes for Table 2-5 follow Table 2-6.

**Table 2-6. Military Helicopter/Engine/APU Combinations**

Aircraft Model(s)	Time-In-Mode Category <sup>a</sup>	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU hours of Operation Per LTO <sup>b</sup>	Notes:
AH-1G	Military - Helicopter	T53-L-11D (1)	---	---	h(3)
		T53-L-13, -13A, -13B (1)	---	---	c, h(1)
AH-1J	Military - Helicopter	T400-CP-400 (1)	---	---	h(1)
AH-64A	Military - Helicopter	T700-GE-700 (2)	---	---	h(1)
CH-3B	Military - Helicopter	T58-GE-8B (2)	---	---	c, h(1)
CH-3E	Military - Helicopter	T58-GE-5 (2)	---	---	h(8)
CH-46	Military - Helicopter	T58-GE-5 (2)	---	---	h(3)
CH-46A	Military - Helicopter	T58-GE-8B, -8F (2)	---	---	c, h(1)
CH-46E	Military - Helicopter	T58-GE-16 (2)	---	---	h(1)
CH-53A	Military - Helicopter	T64-GE-6B (2)	---	---	h(1)
CH-53D	Military - Helicopter	T64-GE-413 (2)	---	---	h(1)
EH-1H	Military - Helicopter	T53-L-13 (1)	---	---	h(1)
EH-1X	Military - Helicopter	T53-L-13 (1)	---	---	h(1)
EH-60A	Military - Helicopter	T700-GE-700 (2)	---	---	h(1)
HH-1H	Military - Helicopter	T53-L-13B (1)	---	---	h(1)
HH-1K	Military - Helicopter	T53-L-13, -13A, -13B (1)	---	---	c, h(1)
HH-1N	Military - Helicopter	T400-CP-400 (2)	---	---	h(7)
HH-2D	Military - Helicopter	T58-GE-8B, -8F (2)	---	---	c, h(1)
HH-3A	Military - Helicopter	T58-GE-8F (2)	---	---	h(1)
HH-3E	Military - Helicopter	T58-GE-5 (2)	---	---	h(8)
HH-3F	Military - Helicopter	T58-GE-8B, -8F (2)	---	---	c, h(1)
HH-43	Military - Helicopter	T53-L-11D (1)	---	---	h(3)
HH-46A	Military - Helicopter	T58-GE-8B, -8F (2)	---	---	c, h(1)
HH-52	Military - Helicopter	T58-GE-5 (2)	---	---	h(3)
HH-52A	Military - Helicopter	T58-GE-8B (1)	---	---	c, h(1)
HH-53	Military - Helicopter	T64-GE-6B (2)	---	---	h(3)
HH-60G	Military - Helicopter	T700-GE-700 (2)	---	---	h(6)
		T700-GE-701C (2)	---	---	h(6)
MH-53J	Military - Helicopter	T64-GE-415 (2)	T-62T-27 (1)	4.00	h(1), i(1)
MH-53M	Military - Helicopter	T64-GE-100 (2)	---	---	h(6)
MH-60A	Military - Helicopter	T700-GE-700 (2)	---	---	h(1)
MH-60G	Military - Helicopter	T700-GE-700 (2)	---	---	h(1)



**Table 2-6. Military Helicopter/Engine/APU Combinations (continued)**

Aircraft Model(s)	Time-In-Mode Category <sup>a</sup>	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU hours of Operation Per LTO <sup>b</sup>	Notes:
MH-139	Military - Helicopter	PT6C-67C (2)	---	---	h(14)
NCH-46A	Military - Helicopter	T58-GE-8B, -8F (2)	---	---	c, h(1)
NRH-53D	Military - Helicopter	T64-GE-415 (2)	---	---	h(1)
NSH-3A	Military - Helicopter	T58-GE-8B (2)	---	---	c, h(1)
NUH-1E	Military - Helicopter	T53-L-11D (1)	---	---	h(1)
NUH-1N	Military - Helicopter	T400-CP-400 (2)	---	---	h(1)
NVH-3A	Military - Helicopter	T58-GE-8F (2)	---	---	h(1)
OH-6A	Military - Helicopter	T63-A-5A (1)	---	---	h(3)
OH-58	Military - Helicopter	T63-A-5A (1)	---	---	h(3)
RH-53D	Military - Helicopter	T64-GE-415A (2)	---	---	c, h(1)
SH-2D	Military - Helicopter	T58-GE-5 (2)	---	---	h(3)
		T58-GE-8B (2)	---	---	c, h(1)
SH-2F	Military - Helicopter	T58-GE-5 (2)	---	---	h(3)
		T58-GE-8F (2)	---	---	h(1)
SH-3A	Military - Helicopter	T58-GE-8B (2)	---	---	c, h(1)
SH-3G	Military - Helicopter	T58-GE-8B, -8F (2)	---	---	c, h(1)
SH-60	Military - Helicopter	T700-GE-700 (2)	---	---	h(7)
TH-1L	Military - Helicopter	T53-L-13, -13A, -13B (1)	---	---	c, h(1)
TH-53A	Military - Helicopter	T64-GE-100 (2)	---	---	h(16)
UH-1E	Military - Helicopter	T53-L-11D (1)	---	---	h(1)
UH-1H	Military - Helicopter	T53-L-11D (1)	---	---	h(3)
		T53-L-13 (1)	---	---	h(1)
UH-1L	Military - Helicopter	T53-L-13, -13A, -13B (1)	---	---	c, h(1)
UH-1N	Military - Helicopter	T400-CP-400 (2)	---	---	h(6)
UH-1V	Military - Helicopter	T53-L-13 (1)	---	---	h(1)
UH-2C	Military - Helicopter	T58-GE-8B, -8F (2)	---	---	c, h(1)
UH-3A	Military - Helicopter	T58-GE-8B (2)	---	---	c, h(1)
UH-46A	Military - Helicopter	T58-GE-8B, -8F (2)	---	---	c, h(1)
UH-60A	Military - Helicopter	T700-GE-700 (2)	T-62T-40-1 (1)	1.00	c, b, h(1)
UH-60C	Military - Helicopter	T700-GE-700 (2)	---	---	h(1)
UH-60Q	Military - Helicopter	T700-GE-700 (2)	---	---	h(1)
YSH-2E	Military - Helicopter	T58-GE-8B, -8F (2)	---	---	c, h(1)

Notes for Table 2-5 and Table 2-6 on the following page.

Notes for Table 2-5 and Table 2-6:

- Note that some Aircraft model/engine/Auxiliary Power Unit (APU) combinations may be missing due to unverified sources and/or missing emission factors for either engine(s) and/or APU(s).
- a. Time-in-Mode category selected for the aircraft based on that aircraft's expected flight pattern and not based on its mission designation.
  - b. SOURCE: *Flightline Emission Factors-Aircraft/Auxiliary Power Units/Aerospace Ground Support Equipment*, IERA-RS-BR-SR-2005-0001, December 2004. This reference cites survey responses as source of data.
  - c. This document does not have emission factors for at least one engine/APU listed for this aircraft.
  - d. Time-in-Mode category for this aircraft was selected as the recommended category for calculating emissions though this aircraft is operated by another military branch.
  - e. APU operating time an estimate based on similar APUs on similar aircraft.
  - f. Aircraft may also be operated as a military helicopter. If the aircraft is primarily operated in this mode at the installation, then use the appropriate Time-in-Mode category.
  - g. This aircraft is operated by multiple military branches.
  - h. The Airframe/Engine combination source was reported in the following documents:
    - (1) SOURCE: *Model Designation of Military Aerospace Vehicles*, Department of Defense, May 2004.
    - (2) SOURCE: Air Force Reserve Website ([www.afreserve.com](http://www.afreserve.com)).
    - (3) SOURCE: *Air Pollutant Emission Factors for Military and Civil Aircraft*, EPA-450/3-78-117, October 1978.
    - (4) SOURCE: Smithsonian National Air and Space Museum website ([www.airandspace.si.edu](http://www.airandspace.si.edu)).
    - (5) SOURCE: *Aircraft Engine Emissions Estimator*, AFESC, November 1985.
    - (6) SOURCE: US Air Force fact sheets accessed via official Air Force website ([www.af.mil](http://www.af.mil)).
    - (7) SOURCE: US Navy fact sheets accessed via official navy website ([www.navy.mil](http://www.navy.mil)).
    - (8) SOURCE: National Museum of the Air Force accessed via official website ([www.nationalmuseum.af.mil](http://www.nationalmuseum.af.mil)).
    - (9) SOURCE: GE Aviation website ([www.geaviation.com](http://www.geaviation.com)).
    - (10) SOURCE: Northrop Grumman website ([www.northropgrumman.com](http://www.northropgrumman.com)).
    - (11) SOURCE: Pratt and Whitney website ([www.pw.utc.com](http://www.pw.utc.com)).
    - (12) SOURCE: *Energy and Environmental Viability of Select Alternative Jet Fuel Pathways*, Carter, Nicholas A., et al. AIAA 2011-5968. 2011.
    - (13) SOURCE: *Flightline Emission Factors-Aircraft/Auxiliary Power Units/Aerospace Ground Support Equipment*, IERA-RS-BR-SR-2005-0001, December 2004.
    - (14) SOURCE: Beechcraft website ([www.beechcraft.com](http://www.beechcraft.com)).
    - (15) SOURCE: Gulfstream website ([www.gulfstream.com](http://www.gulfstream.com))
    - (16) SOURCE: Airforce Monthly website ([www.airforcemonthly.com](http://www.airforcemonthly.com))
    - (17) SOURCE: Embraer website ([www.embraer.com](http://www.embraer.com))
    - (18) SOURCE: Airframe/engine/APU combination and run times collected from field data.
  - i. The Airframe/APU combination was reported in the following documents:
    - (1) SOURCE: *Air Emissions Factor Guide to Air Force Mobile Sources*, AFCEC 2009.
    - (2) SOURCE: EDMS input from Paine Field.
  - j. According to the source document, the actual APU operating time may range between 0.23 - 0.26 if there is gate power or 0.87 if there is no gate power. The most conservative value of 0.87 is listed here.
  - k. This engine is not explicitly listed in the source document as the engine in this aircraft. It is listed here, however, because it is an alternate designation of an engine listed in the source document.
  - l. This is the military designation of a civilian engine listed for the aircraft in the source document. The source for the military designation of the civilian engine is:
    - (1) SOURCE: *Air Force One*, Robert F. Dorr, 2002.
    - (2) The Federal Business Opportunities website ([www.fbo.gov](http://www.fbo.gov))
- “---” – Indicates either no APU for that aircraft or no data available.

**Table 2-7. Commercial Airframe/Engine/APU Combinations**

Aircraft Model(s)	Time-In-Mode Category	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU hours of Operation Per LTO * [Without Gate Power]	Notes:
A300 Series	<b>Commercial Carrier:</b> Jumbo, long, and medium range jet	CF6-50A, -50C, -50C1, -50C2 (2) CF6-80C2A1, -80C2A3, -80C2A5 (2) JT9D-7R4H1 (2) PW4158 (2)	GTCP 331-250 (1)	0.23 - 0.26 [1.0 - 1.5]	b, c(2), c(3), d(2)
A310 Series	<b>Commercial Carrier:</b> Jumbo, long, and medium range jet	CF6-80A3, -80C2A2(2) JT9D-7R4D1, -7R4E1 (2) PW4152 (2) PW4156A (2)	GTCP 331-250 (1)	0.23 - 0.26 [1.0 - 1.5]	b, c(2), c(3), d(2)
A318 Series	<b>Commercial Carrier:</b> Jumbo, long, and medium range jet	CFM56-5B8, -5B9 (2) PW6122A (2) PW6124A (2)	GTCP 36-300 (1)	0.23 - 0.26 [0.87]	b, c(3), c(4), d(2)
A319 Series	<b>Commercial Carrier:</b> Jumbo, long, and medium range jet	CFM56-5A4, -5A5, -5B5, -5B6, -5B7 (2) V2522-A5 (2) V2524-A5 (2) V2527-A5 (2)	GTCP 36-300 (1)	0.23 - 0.26 [0.87]	b, c(3), c(4), c(5), d(2)
A320 Series	<b>Commercial Carrier:</b> Jumbo, long, and medium range jet	CFM56-5-A1, -5A3, -5B4, -5B5, -5B6 (2) V2500-A1 (2) V2527-A5 (2)	GTCP 36-300 (1)	0.23 - 0.26 [0.87]	b, c(3), c(4), c(5), d(2)
A321 Series	<b>Commercial Carrier:</b> Jumbo, long, and medium range jet	CFM56-5B1, -5B2, 5B3 (2) V2533-A5 (2) V2530-A5 (2)	GTCP 36-300 (1)	0.23 - 0.26 [0.87]	b, c(3), c(4), c(5), d(2)
A330 Series	<b>Commercial Carrier:</b> Jumbo, long, and medium range jet	CF6-80E1, -E1A1, -E1A3, -E1A4 (2) PW4164 (2) PW4168, PW4168A (2) PW4170 (2) Trent 768-60 (2) Trent 772-60 (2)	GTCP 331-250 (1)	0.23 - 0.26 [1.0 - 1.5]	b, c(3), c(4), c(5), d(2)
A340 Series	<b>Commercial Carrier:</b> Jumbo, long, and medium range jet	CFM56-5C2, -5C2/4, -5C2/F, -5C2/F4, -5C2/G, -5C2/G4, -5C2/P (4) CFM56-5C3/F, -5C3/F4, 5C3/G, -5C3/G4, -5C3/P (4) CFM56-5C4, -5C4/1, -5C4/P, -5C4/1P (4) Trent 553-61, -553A2-61 (4) Trent 556-61, -556A2-61 (4)	---	---	b, c(4), c(5)
A380 Series	<b>Commercial Carrier:</b> Jumbo, long, and medium range jet	GP7270 (4) Trent 970B-84 (4) Trent 972B-84 (4)	---	---	b, c(2), c(4)
ACJ318	<b>General Aviation:</b> Business Jet	CFM56-5B9/3 (2)	---	---	c(5)
ACJ319	<b>General Aviation:</b> Business Jet	CFM56-5B7/3 (2)	---	---	c(5)
ACJ320	<b>General Aviation:</b> Business Jet	CFM56-5B4/3 (2)	---	---	c(5)
ACJ330	<b>General Aviation:</b> Business Jet	Trent 772B-60 (2)	---	---	b, c(5)
ACJ340	<b>General Aviation:</b> Business Jet	Trent 553-61 (4)	---	---	c(5)
ACJ380	<b>General Aviation:</b> Business Jet	Trent 970-84 (4)	---	---	c(5)
B707 Series	<b>Commercial Carrier:</b> Jumbo, long, and medium range jet	JT3D-3, -3B (4) JT3D-7 (4)	GTCP 85 (1)	0.23 - 0.26 [0.87]	b, c(1), c(2), c(6), d(1)
B717 Series	<b>Commercial Carrier:</b> Jumbo, long, and medium range jet	BR700-715A1-30, -715C1-30 (2)	---	---	c(2)

**Table 2-7. Commercial Airframe/Engine/APU Combinations (continued)**

Aircraft Model(s)	Time-In-Mode Category	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU hours of Operation Per LTO * [Without Gate Power]	Notes:
B727 Series	Commercial Carrier: Jumbo, long, and medium range jet	JT8D-7, -7A, -7B (3) JT8D-9, -9A (3) JT8D-11 (3) JT8D-15, -15A (3) JT8D-17, -17A, -17AR, -17R (3)	GTCP 85-98 (1)	0.23 - 0.26 [0.87]	b, c(1), c(2), c(6), d(1)
B737 Series	Commercial Carrier: Jumbo, long, and medium range jet	CFM56-3-B1, -3B-2, -3C-1 (2) CMF56-7B18/3, -7B20, -7B20/2, -7B20/3, -7B20E (2) CFM56-7B22, -7B22/2, -7B22/3, -7B22E (2) CFM56-7B24, -7B24/2, -7B24/3, -7B24/3B1, -7B24E, -7B24E/B1 (2) CFM56-7B26, -7B26E/B1, -7B26E/B2, -7B26E/B2F, -7B26/2, 7B26/3, -7B26/3F, -7B26E, -7B26E/F (2) CFM56-7B27, -7B27/2, -7B27/3, 7B27/3F, -7B27E, -7B27E/F, -7B27/3B1, -7B27/3B1F, -7B27E/B1, -7B27E/B1F, -7B27/3B3, -7B27E/B3 (2) JT8D-7, -7A, -7B (2) JT8D-9A (2) JT8D-15, -15A (2) JT8D-17, -17A (2)	GTCP 85-129 (1)	0.23 - 0.26 [0.87]	b, c(4), d(3)
B747 Series	Commercial Carrier: Jumbo, long, and medium range jet	CF6-50E, -50E1, -50E2 (4) CF6-80C2B1, -80C2B1F, -80C2B5F (4) Genx-2B67, -2B67B (4) JT9D-7, -7A, -7F, -7J, 7Q, -7Q3, -7R4G2 (4) JT9D-70A (4) PW4056 (4) RB211-524D4-19, -524D4-39, -524B2-19, -524C2-19, -524G2-19, -524G3-19, -524H2-19 (4) RB211-524G2-T-19, -524G3-T-19, -524H2-T-19 (4)	GTCP 660-4 (1) PW901A (1)	0.23 - 0.26 [1.0 - 1.5]	b, c(2), c(4), d(3)
B757 Series	Commercial Carrier: Jumbo, long, and medium range jet	RB211-535C-37, -535E4-B-37, -535E4-37, -535E4-C-37 (2) PW2037 (2) PW2040 (2)	GTCP 331-200ER (1)	0.23 - 0.26 [0.87]	b, c(2), c(4), d(3)
B767 Series	Commercial Carrier: Jumbo, long, and medium range jet	CF6-80A, -80A2, -80C2B2, -80C2B2F, -80C2B4, -80C2B4F, -80C2B6, -80C2B6F, -80C2B7F, -80C2B8F (2) JT9D-7R4D, -7R4E, -7R4E4 (2) PW4056, PW4060, PW4060A, PW4060C, PW4062 (2) RB211-524H36, -524H-T-36 (2)	GTCP 331-200 (1) GTCP 331-200ER (1)	0.23 - 0.26 [0.87]	b, c(2), c(4), d(1), d(3)
B777 Series	Commercial Carrier: Jumbo, long, and medium range jet	GE90-76B, -77B, -85B, -90B, -94B, -110B1, -110B1L, -115B, -115BL (2) PW4074, -4074D, -4077, -4077D, -4084, -4084D, -4090, -4090-3, -4098 (2) Trent 875, -877, -884, -884B, -892, -892B, -895 (2)	GTCP 331-500 (1)	0.23 - 0.26 [1.0 - 1.5]	b, c(2), c(4), c(6), d(3)
B787 Series	Commercial Carrier: Jumbo, long, and medium range jet	Genx-1B64, -1B64/P1, -1B67, -1B67/P1, -1B70, -1B70/P1, -1B70/75/P1 (2) Trent 1000-A, -1000-C, -1000-E (2)	---	---	b, c(2), c(4)
BAe 146-100A, -200A	General Aviation: Business Jet	ALF 502R-3, -3A, -5 (4)	---	---	b, c(2)
BAe 146-300A	General Aviation: Business Jet	ALF 502R-3A, -5 (4)	---	---	b, c(2)
BAe Avro 146-RJ100A	General Aviation: Business Jet	LF507-1F (4)	---	---	c(2)
BAe Avro 146-RJ70A	General Aviation: Business Jet	LF507-1F (4)	---	---	c(2)
BAe Avro 146-RJ85A	General Aviation: Business Jet	LF507-1F (4)	---	---	c(2)
BD-100-1A10	General Aviation: Business Jet	AS907-1-1A (2)	---	---	c(2)
BD-700-1A10, -1A11	General Aviation: Business Jet	BR700-710A2-20 (2)	---	---	c(2)
Beechcraft 76	General Aviation: Turboprop	PT6A-27 (2)	---	---	c(1)
Beechcraft 99A, -99B, -A99A, -B99	General Aviation: Turboprop	PT6A-27 (2)	---	---	c(2)
BH.125 Series 400A	General Aviation: Business Jet	TFE731-3, -3R (2)	---	---	b, c(2)
BH.125 Series 600A	General Aviation: Business Jet	TFE731-3, -3R (2)	---	---	b, c(2)

**Table 2-7. Commercial Airframe/Engine/APU Combinations (continued)**

Aircraft Model(s)	Time-In-Mode Category	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU hours of Operation Per LTO * [Without Gate Power]	Notes:
Cessna 150, -150A, -150B, -150C, -150D, -150E, -150F, -150G, -150H, -150I, -150K, -150L, -150M	General Aviation: Piston	O-200-A (1)	---	---	b, c(2)
Cessna 172I, -172K, -172L, -172M	General Aviation: Piston	O-320-E2D (1)	---	---	b, c(2)
Cessna 172N	General Aviation: Piston	O-320-H2AD (1)	---	---	b, c(2)
Cessna 172P	General Aviation: Piston	O-320-D2J (1)	---	---	b, c(2)
Cessna 336	General Aviation: Piston	IO-360-A (2) TSIO-360-C (2)	---	---	b, c(1), c(2), c(6)
Cessna 337, -337A, -337B	General Aviation: Piston	IO-360-C, -360-CB, -360-D, -360-DB, -360-G, -360-GB (2)	---	---	b, c(2)
Cessna 337C, -337D, -337E, -337F, -337G	General Aviation: Piston	IO-360-C, -360-CB, -360-G, -360-GB (2)	---	---	b, c(2)
Cessna 337H	General Aviation: Piston	IO-360-G, -360-GB (2)	---	---	b, c(2)
Cessna Citation I	General Aviation: Business Jet	JT15D-1, -1A, -1B (2)	---	---	c(1), c(3)
Cessna Citation II, -II/S	General Aviation: Business Jet	JT15D-4, -4B (2)	---	---	c(3)
Cessna Citation Ultra	General Aviation: Business Jet	JT15D-5D (2)	---	---	b, c(3)
Cessna Citation V	General Aviation: Business Jet	JT15D-5A (2)	---	---	c(3)
Cessna M337B	General Aviation: Piston	IO-360-D, -360-DB (2)	---	---	b, c(2)
Cessna P337H	General Aviation: Piston	TSIO-360-C, -360-CB (2)	---	---	b, c(2)
Cessna T337B	General Aviation: Piston	TSIO-360-A, -360-AB, -360-B, -360-BB (2)	---	---	b, c(2)
Cessna T337C, -T337D, -T337E, -T337F	General Aviation: Piston	TSIO-360-A, -360-AB (2)	---	---	b, c(2)
Cessna T337H	General Aviation: Piston	IO-360-G, -360-GB (2) TSIO-360-JB (2)	---	---	b, c(2)
Cheyenne III, -IIIA	General Aviation: Turboprop	PT6A-41 (2)	---	---	c(3)
CL-600-1A11	General Aviation: Business Jet	ALF 502L, -502L-2 (2)	---	---	b, c(2)
CL-600-2A12	General Aviation: Business Jet	CF34-3A, -3A2 (2)	---	---	b, c(2)
CL-600-2B16	General Aviation: Business Jet	CF34-3A, -3A1, -3A2, -3B (2)	---	---	b, c(2)
CL-600-2B19	General Aviation: Business Jet	CF34-3A1, -3B1 (2)	---	---	b, c(2)
CL-600-2C10	General Aviation: Business Jet	CF34-8C1, -8C5B1 (2)	---	---	c(2)
CL-600-2D15	General Aviation: Business Jet	CF34-8C5, -8C5A1 (2)	---	---	c(2)
CL-600-2D24	General Aviation: Business Jet	CF34-8C5, -8C5A1 (2)	---	---	c(2)
CL-600-2E25	General Aviation: Business Jet	CF34-8C5, -8C5A1, -8C5A2 (2)	---	---	c(2)
DC-10 Series	Commercial Carrier: Jumbo, long, and medium range jet	CF6-6D, -6D1, -6D1A, -6K, -6K2 (3) CF6-50A, -50C, -50C1, -50C2, -50C2B, -50C2R, -50CA (3) JT9D-20, -20J, -59A (3)	TSCP 700-4B (1)	0.23 - 0.26 [1.0- 1.5]	b, c(1), c(2), d(2)
DC-8 Series	Commercial Carrier: Jumbo, long, and medium range jet	CFM56-2-C1, -2-C3, -2-C5 (4) JT3D-3, -3B, -7 (4)	---	---	b, c(2)
DC-9 Series	Commercial Carrier: Jumbo, long, and medium range jet	JT8D-7, -7A, -7B, -9, -9A (2) JT8D-11, -15, 15A, -17, -17A (2) JT8D-209, -217, -217A, -217C, -219 (2)	GTCP 85-98D (1)	0.23 - 0.26 [0.87]	b, c(1), c(2), d(1), d(2)
DH.125 Series 1A, -3A, -3A/RA, -400A	General Aviation: Business Jet	TTE731-3, -3R (2)	---	---	b, c(2)
DHC-6-300, -400	General Aviation: Turboprop	PT6A-27 (2)	---	---	c(2)
F.27 Mark 100, -200, -300, -400, -600, -700	General Aviation: Turboprop	SPEY Mk511, -Mk511-7E (2)	---	---	b, c(2)
F.28 Mark 0070	General Aviation: Business Jet	TAY Mk650-15 (2)	---	---	c(2)
F.28 Mark 0100	General Aviation: Business Jet	TAY Mk620-15 (2) TAY Mk650-15 (2)	---	---	c(2)
F.28 Mark 1000, -2000	General Aviation: Business Jet	SPEY MK555-15 (2)	---	---	b, c(2)
F.28 Mark 3000, -4000	General Aviation: Business Jet	SPEY MK555-15H (2)	---	---	b, c(2)

Table 2-7. Commercial Airframe/Engine/APU Combinations (continued)

Aircraft Model(s)	Time-In-Mode Category	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU hours of Operation Per LTO <sup>a</sup> (Without Gate Power)	Notes:
Falcon 20	General Aviation: Business Jet	CF700-2D (2)	---	---	c(1)
G-1159, -1159A, -1159B	General Aviation: Business Jet	SPEY Mk511-8 (2)	GTCP 36-6 (1)	0.23 - 0.26 [0.87]	b, c(2), d(2)
G200	General Aviation: Business Jet	PW306A (2)	---	---	c(3)
G-21	General Aviation: Turboprop	PT6A-27 (2)	---	---	c(1)
G280	General Aviation: Business Jet	AS907-2-1G (2)	---	---	c(2)
GIV	General Aviation: Business Jet	TAY Mk611-8 (2)	---	---	c(2)
GIV-X	General Aviation: Business Jet	TAY Mk611-8C (2)	---	---	b, c(2)
GV	General Aviation: Business Jet	BR700-710A1-10 (2)	---	---	c(2)
GVI	General Aviation: Business Jet	BR725A1-12 (2)	---	---	c(2)
GV-SP	General Aviation: Business Jet	BR700-710C4-11 (2)	---	---	c(2)
Hawker 4000	General Aviation: Business Jet	PW308A (2)	---	---	c(3)
Hawker 400A, -400XP	General Aviation: Business Jet	JT15D-5, -5R (2)	---	---	b, c(3)
HS.125 Series 403B, -600A, -700A, -700B, -F3B, -F3B/RA, -F400B, -F600B	General Aviation: Business Jet	TFE731-3, -3R (2)	---	---	b, c(2)
JetStar 1329-25	General Aviation: Business Jet	TFE731-3-1F (4)	---	---	b, c(2)
King Air B200	General Aviation: Turboprop	PT6A-41 (2)	---	---	c(3)
L-1011-385-1	Commercial Carrier: Jumbo, long, and medium range jet	RB211-22C-02, -22B-02 (3)	---	---	b, c(2)
L-1011-385-1-14	Commercial Carrier: Jumbo, long, and medium range jet	RB211-22B-02, -524B-02, -524B4-02, -524B3-02 (3)	---	---	b, c(2)
L-1011-385-1-15	Commercial Carrier: Jumbo, long, and medium range jet	RB211-22B-02, -22B4D-02, -524B-02, -524B4-02, -524B3-02 (3)	---	---	b, c(2)
Learjet 31, -31A	General Aviation: Business Jet	TFE731-2-3B (2)	---	---	b, c(2)
Learjet 35, -36	General Aviation: Business Jet	TFE731-2, -2-2B (2)	---	---	c(1)
Learjet 35A, -36A	General Aviation: Business Jet	TFE731-2-2B (2)	---	---	c(1)
Learjet 55	General Aviation: Business Jet	TFE731-3A-2B1, -3A-2B, -3AR-2B1, -3AR-2B (2)	---	---	b, c(2)
Learjet 55B	General Aviation: Business Jet	TFE731-3AR-2B1, -3AR-2B (2)	---	---	b, c(2)
Learjet 55C	General Aviation: Business Jet	TFE731-3AR-3B1, -3AR-3B, -3AR-2B1, -3AR-2B (2)	---	---	b, c(2)
MD-10-10F	Commercial Carrier: Jumbo, long, and medium range jet	CF6-6D, -6K (3)	TSCP 700-4B (1)	0.23 - 0.26 [1.0 - 1.5]	c(2), d(2)
MD-10-30F	Commercial Carrier: Jumbo, long, and medium range jet	CF6-50C2 (3)	TSCP 700-4B (1)	0.23 - 0.26 [1.0 - 1.5]	c(2), d(2)
MD-11, -11F	Commercial Carrier: Jumbo, long, and medium range jet	CF6-80C2D1F (3) PW4460 (3)	TSCP 700-4 (1)	0.23 - 0.26 [1.0 - 1.5]	c(2), d(2)
MD-88	Commercial Carrier: Jumbo, long, and medium range jet	JT8D-217A, -217C, -219 (2)	---	---	c(2)
MD-90, -90-30	Commercial Carrier: Jumbo, long, and medium range jet	V2525-D5 (2) V2528-D5 (2)	---	---	c(2)
MU-300, -300-10	General Aviation: Business Jet	JT15D-4, -4D (2)	---	---	b, c(2)
NA-265-80	General Aviation: Business Jet	CF700-2D-2 (2)	---	---	b, c(2)
PA-18A	General Aviation: Piston	O-320 (1)	---	---	c(2)
PA-23, -23-160	General Aviation: Piston	O-320 (2)	---	---	c(2)
PA-28-140	General Aviation: Piston	O-320-E2A (1)	---	---	b, c(2)
PA-28-150	General Aviation: Piston	O-320-A2B, -E2A (1)	---	---	b, c(2)
PA-28-151	General Aviation: Piston	O-320-E3D (1)	---	---	b, c(2)

Table 2-7. Commercial Airframe/Engine/APU Combinations (continued)

Aircraft Model(s)	Time-In-Mode Category	Engine Model(s) (Number of Engines)	APU Model(s) (Number of APUs)	APU hours of Operation Per LTO * (Without Gate Power)	Notes:
PA-28-160	General Aviation: Piston	O-320-B2B, -D2A (1)	---	---	b, c(2)
PA-28-161	General Aviation: Piston	O-320-D2A, -D3G (1)	---	---	b, c(2)
PA-28-201T	General Aviation: Piston	TSIO-360-FB (1)	---	---	b, c(2)
PA-28R-180	General Aviation: Piston	IO-360-B1E (1)	---	---	b, c(2)
PA-28R-200	General Aviation: Piston	IO-360-C1C, -C1C6 (1)	---	---	b, c(2)
PA-28R-201, -28RT-201	General Aviation: Piston	IO-360-C1C6 (1)	---	---	b, c(2)
PA-28R-201T	General Aviation: Piston	TSIO-360-F, -360-FB (1)	---	---	b, c(2)
PA-28RT-201T	General Aviation: Piston	TSIO-360-FB (1)	---	---	b, c(2)
PA-28S-160	General Aviation: Piston	O-320-D2A (1)	---	---	b, c(2)
PA-31	General Aviation: Piston	TIO-540, -540-A1A, -540-A1B, -540-A2A, -540-A2B, -540-A2C (2)	---	---	b, c(1)
PA-31-325	General Aviation: Piston	TIO-540-F2BD (2)	---	---	b, c(2)
PA-31-350	General Aviation: Piston	TIO-540-J2BD, -540-J2B (2)	---	---	b, c(2)
PA-32-301T	General Aviation: Piston	TIO-540-S1AD (1)	---	---	b, c(2)
PA-32-301XTC	General Aviation: Piston	TIO-540-AH1A (1)	---	---	b, c(2)
PA-32R-301T	General Aviation: Piston	TIO-540-S1AD, 540-AH1A (1)	---	---	b, c(2)
PA-32RT-300T	General Aviation: Piston	TIO-540-S1AD (1)	---	---	b, c(2)
PA-36-285	General Aviation: Turboprop	6-285-B, -285-BA, -285-C, -285-CA (1)	---	---	b, c(2)
PA-42	General Aviation: Turboprop	PT6A-41 (2)	---	---	c(2)
PA-46-350P, -46R-350T	General Aviation: Turboprop	TIO-540-AE2A (1)	---	---	b, c(2)
SA226-AT	General Aviation: Turboprop	TPE331-3U-303G, -3U-304G, -3UW-303G (2)	---	---	b, c(2)
SA226-T	General Aviation: Turboprop	TPE331-3U-303G, -3U-304G (2)	---	---	b, c(2)
SA226-TC	General Aviation: Turboprop	TPE331-3U-303G, -3U-304G, -3UW-303G, -3UW-304G (2)	---	---	b, c(2)
SC-7	General Aviation: Turboprop	TPE331-2-201A (2)	---	---	b, c(1)
Super King Air A100-1, -200, -200C, -200CT, -200T, -A200, -A200C, -A200CT, -B200, -B200C, -B200CT, -B200T	General Aviation: Turboprop	PT6A-41 (2)	---	---	c(2)
TU-154-B	Commercial Carrier: Jumbo, long, and medium range jet	NK-8-2U (3)	---	---	c(7)
Twin Commander 685	General Aviation: Piston	GTSIO-520-F, -520-K (2)	---	---	b, c(2)

Note that some Aircraft model/engine/APU combinations may be missing due to unverified sources and/or missing emission factors for either engine(s) and/or APU(s).

- SOURCE: *Airport Air Quality Manual*, International Civil Aviation Organization, 2011. ICAO provides a range for both narrow body and wide body aircraft. The values given out of the brackets assume gate power while the bracketed values are in instances where there is no gate power.
- This document does not have emission factors for at least one engine/APU listed for this aircraft.
- The Aircraft/Engine combination source was reported in one of the following documents:
  - SOURCE: *Air Pollutant Emission Factors for Military and Civil Aircraft*, EPA-450/3-78-117, October 1978.
  - SOURCE: The Federal Aviation Administration (FAA) Type Certificate Data Sheet (TCDS) for the airframe model listed.
  - SOURCE: Pratt & Whitney website ([www.pw.utc.com](http://www.pw.utc.com)).
  - SOURCE: The European Aviation Safety Agency (EASA) TCDS for the airframe model listed.
  - Airbus website ([www.airbus.com](http://www.airbus.com)).
  - Boeing Website ([www.boeing.com](http://www.boeing.com)).
  - Tupolev website ([www.tupolev.ru/english/](http://www.tupolev.ru/english/)).
- Airframe/APU combination source was reported in one of the following:
  - SOURCE: Emissions and Dispersion Modeling System Input from Paine Field
  - SOURCE: FAA TCDS for the listed airframe
  - SOURCE: EASA TCDS for the listed airframe

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
6-285-B	Idle (Taxi)	<40%	72	0.46	1.07	363.70	12.33	---	0.76 (S)	0.68 (S)	3214.59
	Approach	40%	84	4.72	1.07	1022.63	18.50	---	0.12 (S)	0.11 (S)	3214.59
	Climb out	75-100%	166	5.50	1.07	668.07	9.63	---	0.30 (S)	0.27 (S)	3214.59
	Takeoff	100%	153	5.88	1.07	998.04	13.38	---	0.31 (S)	0.28 (S)	3214.59
Notes: c(1), d(5) - PM <sub>10</sub> and PM <sub>2.5</sub> data at all power settings, e, h, i, k(8)											
AE1107C	Idle	---	362	4.15	1.07	8.35	0.10	---	1.58	1.42	3214.59
	Flight Idle	---	663	6.05	1.07	3.47	0.02	---	1.58	1.42	3214.59
	Intermediate	---	948	7.87	1.07	1.82	0.02	---	1.58	1.42	3214.59
	Max Continuous	---	2507	18.03	1.07	0.29	0.01	---	1.58	1.42	3214.59
Notes: c(6) - This is the commercial designation of the T406-AD-400 engine, h, k(4)											
AE3007A	Idle (Taxi)	7%	389	3.83	1.07	17.35	2.89	---	0.05	0.05	3214.59
	Approach	30%	929	7.79	1.07	3.28	0.74	---	0.07	0.07	3214.59
	Climb out	85%	2500	17.47	1.07	0.92	0.33	---	0.06	0.05	3214.59
	Takeoff	100%	2992	20.54	1.07	0.75	0.29	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(5)											
ALF 502L-2	Idle (Taxi)	7%	379	3.38	1.07	45.63	7.65	---	0.10	0.09	3214.59
	Approach	30%	930	6.47	1.07	3.97	0.21	---	0.11	0.10	3214.59
	Climb out	85%	2568	12.03	1.07	0.30	0.03	---	0.11	0.09	3214.59
	Takeoff	100%	3174	13.43	1.07	0.40	0.02	---	0.07	0.07	3214.59
Notes: c(2), e, f, h, k(8)											
ALF 502R-3	Idle (Taxi)	7%	343	3.30	1.07	44.67	7.49	---	0.09	0.08	3214.59
	Approach	30%	815	6.15	1.07	8.43	0.33	---	0.09	0.08	3214.59
	Climb out	85%	2286	9.94	1.07	0.50	0.06	---	0.10	0.09	3214.59
	Takeoff	100%	2759	11.20	1.07	0.43	0.06	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(8)											
ALF 502R-5	Idle (Taxi)	7%	324	3.78	1.07	40.93	6.20	---	0.09	0.08	3214.59
	Approach	30%	821	6.60	1.07	7.10	0.25	---	0.09	0.08	3214.59
	Climb out	85%	2345	10.56	1.07	0.25	0.06	---	0.11	0.10	3214.59
	Takeoff	100%	2842	13.35	1.07	0.30	0.07	---	0.11	0.10	3214.59
Notes: c(2), e, f, h, k(8)											
AS907-1-1A	Idle (Taxi)	7%	381	3.91	1.07	33.24	1.45	---	0.10	0.09	3214.59
	Approach	30%	825	8.81	1.07	6.28	0.14	---	0.06	0.05	3214.59
	Climb out	85%	2286	16.17	1.07	0.63	0.07	---	0.31	0.28	3214.59
	Takeoff	100%	2754	17.90	1.07	0.56	0.06	---	0.36	0.33	3214.59
Notes: c(2), e, f, h, k(1)											
AS907-2-1G	Idle (Taxi)	7%	389	3.97	1.07	30.48	1.14	---	0.11	0.10	3214.59
	Approach	30%	849	8.96	1.07	6.07	0.14	---	0.06	0.06	3214.59
	Climb out	85%	2444	16.44	1.07	0.60	0.07	---	0.31	0.28	3214.59
	Takeoff	100%	2952	18.43	1.07	0.57	0.06	---	0.36	0.33	3214.59
Notes: c(2), e, f, h, k(1)											



**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
BR700-710A1-10	Idle (Taxi)	7%	706	4.69	1.07	27.82	1.25	---	0.06	0.05	3214.59
	Approach	30%	1698	7.68	1.07	4.78	0.06	---	0.05	0.04	3214.59
	Climb out	85%	4714	15.07	1.07	0.93	0.02	---	0.35	0.31	3214.59
	Takeoff	100%	5659	18.79	1.07	1.04	0.02	---	0.37	0.33	3214.59
Notes: c(2), e, f, h, k(8)											
BR700-710A2-20	Idle (Taxi)	7%	706	4.67	1.07	28.00	1.29	---	0.06	0.05	3214.59
	Approach	30%	1698	7.67	1.07	4.81	0.06	---	0.05	0.04	3214.59
	Climb out	85%	4722	15.03	1.07	0.93	0.02	---	0.34	0.31	3214.59
	Takeoff	100%	5667	18.73	1.07	1.04	0.02	---	0.37	0.33	3214.59
Notes: c(2), e, f, h, k(8)											
BR700-710C4-11	Idle (Taxi)	7%	659	4.50	1.07	31.57	2.63	---	0.06	0.06	3214.59
	Approach	30%	1706	7.71	1.07	4.92	0.06	---	0.05	0.04	3214.59
	Climb out	85%	4897	15.43	1.07	0.92	0.02	---	0.35	0.32	3214.59
	Takeoff	100%	5929	19.52	1.07	1.04	0.02	---	0.37	0.33	3214.59
Notes: c(2), e, f, h, k(8)											
BR700-715A1-30	Idle (Taxi)	7%	762	5.37	1.07	16.27	0.24	---	0.07	0.06	3214.59
	Approach	30%	1944	11.19	1.07	3.76	0.01	---	0.06	0.06	3214.59
	Climb out	85%	5476	18.65	1.07	0.75	0.02	---	0.09	0.08	3214.59
	Takeoff	100%	6635	23.97	1.07	0.78	0.00	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(8)											
BR700-715C1-30	Idle (Taxi)	7%	833	4.28	1.07	17.85	0.07	---	0.04	0.04	3214.59
	Approach	30%	2159	9.23	1.07	3.23	0.02	---	0.07	0.06	3214.59
	Climb out	85%	6389	20.05	1.07	0.64	0.07	---	0.13	0.12	3214.59
	Takeoff	100%	7810	27.92	1.07	0.80	0.01	---	0.13	0.12	3214.59
Notes: c(2), e, f, h, k(8)											
BR725A1-12	Idle (Taxi)	7%	675	3.38	1.07	41.90	3.45	---	0.06	0.05	3214.59
	Approach	30%	1754	7.81	1.07	5.93	0.00	---	0.04	0.03	3214.59
	Climb out	85%	5159	13.32	1.07	0.32	0.00	---	0.13	0.12	3214.59
	Takeoff	100%	6262	16.92	1.07	0.40	0.00	---	0.11	0.10	3214.59
Notes: c(2), e, f, h, k(8)											
CF6-6D	Idle (Taxi)	7%	1371	4.50	1.07	54.20	24.15	---	0.20	0.18	3214.59
	Approach	30%	3841	11.40	1.07	6.50	0.81	---	0.10	0.09	3214.59
	Climb out	85%	11357	32.60	1.07	0.50	0.35	---	0.07	0.07	3214.59
	Takeoff	100%	13778	40.00	1.07	0.50	0.35	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-6D1A	Idle (Taxi)	7%	1397	4.60	1.07	52.00	22.89	---	0.19	0.17	3214.59
	Approach	30%	3921	11.80	1.07	5.50	0.69	---	0.09	0.08	3214.59
	Climb out	85%	11921	33.90	1.07	0.50	0.35	---	0.07	0.07	3214.59
	Takeoff	100%	14381	41.60	1.07	0.50	0.35	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
CF6-6K	Idle (Taxi)	7%	1371	4.50	1.07	54.20	24.15	---	0.20	0.18	3214.59
	Approach	30%	3841	11.40	1.07	6.50	0.81	---	0.10	0.09	3214.59
	Climb out	85%	11357	32.60	1.07	0.50	0.35	---	0.07	0.07	3214.59
	Takeoff	100%	13778	40.00	1.07	0.50	0.35	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-6K2	Idle (Taxi)	7%	1397	4.60	1.07	52.00	22.89	---	0.19	0.17	3214.59
	Approach	30%	3921	11.80	1.07	5.50	0.69	---	0.09	0.08	3214.59
	Climb out	85%	11921	33.90	1.07	0.50	0.35	---	0.07	0.07	3214.59
	Takeoff	100%	14381	41.60	1.07	0.50	0.35	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-50A	Idle (Taxi)	7%	1294	3.40	1.07	24.04	3.13	---	0.06	0.06	3214.59
	Approach	30%	4960	9.72	1.07	4.35	0.36	---	0.06	0.06	3214.59
	Climb out	85%	14183	23.27	1.07	0.49	0.16	---	0.11	0.10	3214.59
	Takeoff	100%	17206	27.17	1.07	0.43	0.17	---	0.11	0.10	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-50C	Idle (Taxi)	7%	1683	3.50	1.07	62.30	26.45	---	0.22	0.20	3214.59
	Approach	30%	5103	9.40	1.07	5.20	1.15	---	0.11	0.10	3214.59
	Climb out	85%	15199	29.00	1.07	0.50	0.81	---	0.10	0.09	3214.59
	Takeoff	100%	18881	35.00	1.07	0.50	0.69	---	0.12	0.11	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-50C1, -50C2	Idle (Taxi)	7%	1706	3.60	1.07	61.80	25.07	---	0.21	0.19	3214.59
	Approach	30%	5238	9.50	1.07	4.30	1.15	---	0.11	0.10	3214.59
	Climb out	85%	15675	29.70	1.07	0.50	0.81	---	0.10	0.09	3214.59
	Takeoff	100%	19738	36.30	1.07	0.50	0.69	---	0.12	0.11	3214.59
Notes: c(2) - CF6-50C2 is the commercial designation of the F103-GE-101 engine, e, f, h, k(1)											
CF6-50C2B	Idle (Taxi)	7%	1294	3.40	1.07	24.04	3.13	---	0.06	0.06	3214.59
	Approach	30%	5294	10.49	1.07	3.42	0.30	---	0.06	0.06	3214.59
	Climb out	85%	15849	26.34	1.07	0.44	0.17	---	0.11	0.10	3214.59
	Takeoff	100%	19127	29.59	1.07	0.46	0.15	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-50C2R	Idle (Taxi)	7%	1683	3.50	1.07	62.30	26.45	---	0.22	0.20	3214.59
	Approach	30%	5103	9.40	1.07	5.20	1.15	---	0.11	0.10	3214.59
	Climb out	85%	15199	29.00	1.07	0.50	0.81	---	0.10	0.09	3214.59
	Takeoff	100%	18881	35.00	1.07	0.50	0.69	---	0.12	0.11	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-50CA	Idle (Taxi)	7%	1294	3.40	1.07	24.04	3.13	---	0.06	0.06	3214.59
	Approach	30%	5087	10.09	1.07	3.99	0.33	---	0.06	0.06	3214.59
	Climb out	85%	14881	24.30	1.07	0.46	0.16	---	0.11	0.10	3214.59
	Takeoff	100%	18103	28.03	1.07	0.44	0.16	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
CF6-50E, -50E1	Idle (Taxi)	7%	1294	3.40	1.07	24.04	3.13	---	0.06	0.06	3214.59
	Approach	30%	5262	10.16	1.07	3.71	0.32	---	0.06	0.06	3214.59
	Climb out	85%	15397	25.50	1.07	0.45	0.17	---	0.11	0.10	3214.59
	Takeoff	100%	18738	28.97	1.07	0.45	0.16	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-50E2	Idle (Taxi)	7%	1706	3.60	1.07	61.80	25.07	---	0.21	0.19	3214.59
	Approach	30%	5238	9.50	1.07	4.30	1.15	---	0.11	0.10	3214.59
	Climb out	85%	15675	29.70	1.07	0.50	0.81	---	0.10	0.09	3214.59
	Takeoff	100%	19738	36.30	1.07	0.50	0.69	---	0.12	0.11	3214.59
Notes: c(2) - CF6-50E2 is the commercial designation of the F103-GE-100 engine, e, f, h, k(1)											
CF6-80A	Idle (Taxi)	7%	1190	3.40	1.07	28.20	7.23	---	0.09	0.08	3214.59
	Approach	30%	4881	10.30	1.07	3.10	0.54	---	0.08	0.07	3214.59
	Climb out	85%	14246	25.60	1.07	1.10	0.33	---	0.11	0.10	3214.59
	Takeoff	100%	17024	29.80	1.07	1.00	0.33	---	0.13	0.11	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80A2, -80A3	Idle (Taxi)	7%	1190	3.40	1.07	28.20	7.22	---	0.09	0.08	3214.59
	Approach	30%	5087	10.80	1.07	2.80	0.52	---	0.07	0.07	3214.59
	Climb out	85%	14960	26.60	1.07	1.10	0.43	---	0.11	0.10	3214.59
	Takeoff	100%	17889	29.60	1.07	1.00	0.35	---	0.13	0.11	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2A1	Idle (Taxi)	7%	1579	3.99	1.07	42.24	10.57	---	0.12	0.11	3214.59
	Approach	30%	5048	9.76	1.07	2.19	0.23	---	0.06	0.06	3214.59
	Climb out	85%	15500	24.85	1.07	0.54	0.10	---	0.07	0.06	3214.59
	Takeoff	100%	19048	32.22	1.07	0.56	0.09	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2A2	Idle (Taxi)	7%	1500	3.95	1.07	46.01	12.05	---	0.13	0.11	3214.59
	Approach	30%	4603	9.44	1.07	2.94	0.26	---	0.06	0.06	3214.59
	Climb out	85%	13849	20.69	1.07	0.55	0.12	---	0.06	0.06	3214.59
	Takeoff	100%	16802	27.93	1.07	0.57	0.09	---	0.07	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2A3	Idle (Taxi)	7%	1603	3.92	1.07	41.51	10.28	---	0.12	0.10	3214.59
	Approach	30%	5151	9.93	1.07	2.07	0.22	---	0.06	0.06	3214.59
	Climb out	85%	15897	25.46	1.07	0.56	0.09	---	0.07	0.06	3214.59
	Takeoff	100%	19500	34.50	1.07	0.58	0.07	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2A5	Idle (Taxi)	7%	1643	3.79	1.07	41.65	10.34	---	0.12	0.10	3214.59
	Approach	30%	5452	9.11	1.07	1.93	0.23	---	0.06	0.06	3214.59
	Climb out	85%	16524	22.86	1.07	0.52	0.09	---	0.07	0.06	3214.59
	Takeoff	100%	20484	34.38	1.07	0.52	0.08	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
CF6-80C2A5F	Idle (Taxi)	7%	1746	4.90	1.07	16.96	1.36	---	0.05	0.04	3214.59
	Approach	30%	5484	12.64	1.07	1.92	0.13	---	0.04	0.04	3214.59
	Climb out	85%	16714	21.27	1.07	0.04	0.05	---	0.06	0.06	3214.59
	Takeoff	100%	20873	28.11	1.07	0.05	0.06	---	0.07	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2B1	Idle (Taxi)	7%	1556	3.73	1.07	43.22	10.88	---	0.12	0.11	3214.59
	Approach	30%	4889	8.83	1.07	2.37	0.24	---	0.06	0.06	3214.59
	Climb out	85%	14865	21.26	1.07	0.55	0.10	---	0.06	0.06	3214.59
	Takeoff	100%	18135	28.11	1.07	0.58	0.09	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2B1F	Idle (Taxi)	7%	1579	4.73	1.07	19.23	1.77	---	0.05	0.04	3214.59
	Approach	30%	5159	12.47	1.07	2.13	0.13	---	0.04	0.04	3214.59
	Climb out	85%	15738	19.72	1.07	0.04	0.06	---	0.06	0.05	3214.59
	Takeoff	100%	19222	24.94	1.07	0.04	0.06	---	0.07	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2B2	Idle (Taxi)	7%	1508	4.45	1.07	22.41	2.27	---	0.05	0.05	3214.59
	Approach	30%	4643	11.79	1.07	2.61	0.14	---	0.05	0.04	3214.59
	Climb out	85%	13937	18.25	1.07	0.05	0.06	---	0.05	0.05	3214.59
	Takeoff	100%	16857	22.02	1.07	0.04	0.06	---	0.07	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2B2F	Idle (Taxi)	7%	1492	4.52	1.07	21.56	2.14	---	0.05	0.05	3214.59
	Approach	30%	4706	11.80	1.07	2.64	0.14	---	0.05	0.04	3214.59
	Climb out	85%	14103	18.09	1.07	0.06	0.06	---	0.05	0.05	3214.59
	Takeoff	100%	17048	21.55	1.07	0.04	0.06	---	0.07	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2B4	Idle (Taxi)	7%	1595	4.68	1.07	19.76	1.83	---	0.05	0.04	3214.59
	Approach	30%	5087	12.37	1.07	2.12	0.14	---	0.05	0.04	3214.59
	Climb out	85%	15595	20.17	1.07	0.04	0.06	---	0.06	0.05	3214.59
	Takeoff	100%	19119	25.93	1.07	0.05	0.06	---	0.07	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2B4F	Idle (Taxi)	7%	1579	4.73	1.07	19.23	1.77	---	0.05	0.04	3214.59
	Approach	30%	5159	12.47	1.07	2.13	0.13	---	0.04	0.04	3214.59
	Climb out	85%	15738	19.72	1.07	0.04	0.06	---	0.06	0.05	3214.59
	Takeoff	100%	19302	25.08	1.07	0.04	0.06	---	0.07	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2B5F	Idle (Taxi)	7%	1635	4.91	1.07	17.45	1.51	---	0.05	0.04	3214.59
	Approach	30%	5532	12.74	1.07	1.83	0.13	---	0.04	0.04	3214.59
	Climb out	85%	17159	21.76	1.07	0.04	0.06	---	0.06	0.06	3214.59
	Takeoff	100%	21310	28.58	1.07	0.05	0.06	---	0.07	0.07	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
CF6-80C2B6	Idle (Taxi)	7%	1627	4.76	1.07	18.89	1.70	---	0.05	0.04	3214.59
	Approach	30%	5333	12.53	1.07	1.91	0.13	---	0.04	0.04	3214.59
	Climb out	85%	16635	21.69	1.07	0.04	0.06	---	0.07	0.06	3214.59
	Takeoff	100%	20476	28.57	1.07	0.06	0.05	---	0.07	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2B6F	Idle (Taxi)	7%	1611	4.81	1.07	18.42	1.64	---	0.05	0.04	3214.59
	Approach	30%	5413	12.63	1.07	1.93	0.13	---	0.04	0.04	3214.59
	Climb out	85%	16699	21.05	1.07	0.04	0.06	---	0.06	0.06	3214.59
	Takeoff	100%	20587	27.38	1.07	0.05	0.06	---	0.07	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2B7F	Idle (Taxi)	7%	1611	4.81	1.07	18.42	1.64	---	0.05	0.04	3214.59
	Approach	30%	5413	12.63	1.07	1.93	0.13	---	0.04	0.04	3214.59
	Climb out	85%	16699	21.05	1.07	0.04	0.06	---	0.06	0.06	3214.59
	Takeoff	100%	20587	27.38	1.07	0.05	0.06	---	0.07	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2B8F	Idle (Taxi)	7%	1627	4.59	1.07	16.69	1.31	---	0.05	0.04	3214.59
	Approach	30%	5437	12.42	1.07	1.69	0.10	---	0.04	0.04	3214.59
	Climb out	85%	16714	20.84	1.07	0.02	0.05	---	0.06	0.05	3214.59
	Takeoff	100%	20500	26.85	1.07	0.03	0.05	---	0.07	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80C2D1F	Idle (Taxi)	7%	1556	3.80	1.07	41.78	10.38	---	0.12	0.11	3214.59
	Approach	30%	5214	9.16	1.07	1.94	0.23	---	0.06	0.06	3214.59
	Climb out	85%	16389	24.02	1.07	0.52	0.09	---	0.07	0.06	3214.59
	Takeoff	100%	20603	32.65	1.07	0.52	0.08	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80E1A1	Idle (Taxi)	7%	1794	4.47	1.07	43.24	11.13	---	0.10	0.09	3214.59
	Approach	30%	5667	9.84	1.07	1.70	0.16	---	0.05	0.04	3214.59
	Climb out	85%	17452	27.11	1.07	0.34	0.08	---	0.07	0.07	3214.59
	Takeoff	100%	21445	37.87	1.07	0.38	0.06	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80E1A2	Idle (Taxi)	7%	1810	4.53	1.07	42.67	10.78	---	0.10	0.09	3214.59
	Approach	30%	5746	9.91	1.07	1.61	0.16	---	0.05	0.04	3214.59
	Climb out	85%	17818	28.02	1.07	0.34	0.08	---	0.08	0.07	3214.59
	Takeoff	100%	21960	39.29	1.07	0.38	0.06	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
CF6-80E1A3	Idle (Taxi)	7%	1802	4.69	1.07	37.02	10.96	---	0.10	0.09	3214.59
	Approach	30%	5992	10.29	1.07	1.23	0.21	---	0.05	0.04	3214.59
	Climb out	85%	18945	31.74	1.07	0.31	0.08	---	0.08	0.08	3214.59
	Takeoff	100%	23722	45.63	1.07	0.34	0.08	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
CF6-80E1A4	Idle (Taxi)	7%	1802	4.62	1.07	38.09	11.90	---	0.10	0.09	3214.59
	Approach	30%	5905	10.13	1.07	1.33	0.21	---	0.05	0.04	3214.59
	Climb out	85%	18548	30.30	1.07	0.30	0.08	---	0.08	0.07	3214.59
	Takeoff	100%	23048	43.15	1.07	0.34	0.07	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
CF34-3A, -3A1	Idle (Taxi)	7%	394	3.82	1.07	42.60	4.54	---	0.09	0.08	3214.59
	Approach	30%	944	6.86	1.07	1.90	0.15	---	0.06	0.06	3214.59
	Climb out	85%	2653	10.14	1.07	0.00	0.07	---	0.09	0.08	3214.59
	Takeoff	100%	3230	11.61	1.07	0.00	0.07	---	0.16	0.14	3214.59
Notes: c(2), e, f, h, k(4)											
CF34-3B	Idle (Taxi)	7%	388	3.72	1.07	47.59	5.39	---	0.09	0.08	3214.59
	Approach	30%	921	6.63	1.07	1.88	0.15	---	0.06	0.06	3214.59
	Climb out	85%	2610	9.68	1.07	0.00	0.06	---	0.09	0.08	3214.59
	Takeoff	100%	3167	11.28	1.07	0.00	0.07	---	0.14	0.12	3214.59
Notes: c(2), e, f, h, k(1)											
CF34-8C1	Idle (Taxi)	7%	548	4.31	1.07	24.92	0.09	---	0.04	0.04	3214.59
	Approach	30%	1334	11.10	1.07	2.91	0.07	---	0.04	0.04	3214.59
	Climb out	85%	3921	12.82	1.07	0.50	0.02	---	0.04	0.04	3214.59
	Takeoff	100%	4795	14.67	1.07	0.41	0.02	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
CF34-8C5	Idle (Taxi)	7%	508	4.60	1.07	18.25	0.15	---	0.04	0.04	3214.59
	Approach	30%	1421	10.75	1.07	4.24	0.07	---	0.04	0.04	3214.59
	Climb out	85%	4206	12.60	1.07	0.57	0.02	---	0.05	0.04	3214.59
	Takeoff	100%	5143	14.69	1.07	0.64	0.02	---	0.07	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
CF34-8C5A1	Idle (Taxi)	7%	516	4.65	1.07	17.85	0.15	---	0.04	0.04	3214.59
	Approach	30%	1452	10.87	1.07	4.17	0.07	---	0.04	0.04	3214.59
	Climb out	85%	4310	12.82	1.07	0.57	0.02	---	0.05	0.04	3214.59
	Takeoff	100%	5278	15.09	1.07	0.66	0.02	---	0.08	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
CF34-8C5A2	Idle (Taxi)	7%	524	4.70	1.07	17.30	0.15	---	0.04	0.04	3214.59
	Approach	30%	1492	11.06	1.07	4.05	0.07	---	0.04	0.04	3214.59
	Climb out	85%	4468	13.15	1.07	0.57	0.02	---	0.05	0.05	3214.59
	Takeoff	100%	5484	15.81	1.07	0.71	0.02	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
CF34-8C5B1	Idle (Taxi)	7%	500	4.50	1.07	19.52	0.18	---	0.04	0.04	3214.59
	Approach	30%	1357	10.42	1.07	4.44	0.08	---	0.04	0.04	3214.59
	Climb out	85%	3944	12.03	1.07	0.58	0.03	---	0.04	0.04	3214.59
	Takeoff	100%	4810	13.89	1.07	0.60	0.02	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
CF700-2D	Idle (Taxi)	<30%	460	0.89	1.07	155.00	20.70	---	3.0E-03 (S)	2.7E-03 (S)	3214.59
	Approach	30%	919	1.80	1.07	62.00	1.61	---	0.01 (S)	0.01 (S)	3214.59
	Climb out	90 - 100%	2322	4.30	1.07	11.34	0.11	---	0.01 (S)	0.01 (S)	3214.59
	Takeoff	>100%	2607	5.60	1.07	9.98	0.11	---	0.02 (S)	0.02 (S)	3214.59
Notes: c(1), d(8) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, j, k(8)											
CFM56-2A Series	Idle (Taxi)	7%	1032	4.30	1.07	23.50	1.30	---	0.06	0.05	3214.59
	Approach	30%	2524	8.70	1.07	3.40	0.09	---	0.06	0.05	3214.59
	Climb out	70%	7230	17.30	1.07	0.90	0.05	---	0.06	0.05	3214.59
	Takeoff	100%	8841	20.40	1.07	0.90	0.05	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-2B-1	Idle (Taxi)	9%	1136	3.88	1.07	23.65	0.19	0.125	2.07	1.86	3214.59
	Approach	30%	2547	5.73	1.07	8.57	0.06	0.027	1.55	1.40	3214.59
	Intermediate	70%	5650	11.04	1.07	2.32	0.03	0.008	0.65	0.58	3214.59
	Military	78%	6458	12.05	1.07	0.36	0.03	0.009	1.59	1.43	3214.59
Notes: c(3) - CFM56-2B-1 is the commercial designation of the F108-CF-100 engine, h, k(5)											
CFM56-2-C5	Idle (Taxi)	7%	1016	4.00	1.07	30.70	2.10	---	0.07	0.06	3214.59
	Approach	30%	2468	8.20	1.07	4.20	0.09	---	0.06	0.05	3214.59
	Climb out	85%	6500	16.00	1.07	0.90	0.06	---	0.05	0.05	3214.59
	Takeoff	100%	7818	18.50	1.07	0.90	0.05	---	0.07	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-3-B1	Idle (Taxi)	7%	905	3.90	1.07	34.40	2.62	---	0.07	0.06	3214.59
	Approach	30%	2302	8.30	1.07	3.80	0.09	---	0.06	0.05	3214.59
	Climb out	85%	6286	15.50	1.07	0.95	0.06	---	0.05	0.05	3214.59
	Takeoff	100%	7508	17.70	1.07	0.90	0.05	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-3-B2	Idle (Taxi)	7%	944	4.10	1.07	30.10	2.01	---	0.06	0.06	3214.59
	Approach	30%	2492	8.70	1.07	3.40	0.08	---	0.06	0.05	3214.59
	Climb out	85%	6968	16.70	1.07	0.90	0.05	---	0.05	0.05	3214.59
	Takeoff	100%	8381	19.40	1.07	0.90	0.04	---	0.07	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-3C-1	Idle (Taxi)	7%	984	4.30	1.07	26.80	1.63	---	0.06	0.06	3214.59
	Approach	30%	2667	9.10	1.07	3.10	0.08	---	0.06	0.05	3214.59
	Climb out	85%	7571	17.80	1.07	0.90	0.05	---	0.06	0.05	3214.59
	Takeoff	100%	9159	20.70	1.07	0.90	0.03	---	0.07	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-5-A1	Idle (Taxi)	7%	802	4.00	1.07	17.60	1.61	---	0.06	0.06	3214.59
	Approach	30%	2310	8.00	1.07	2.50	0.46	---	0.09	0.08	3214.59
	Climb out	85%	6841	19.60	1.07	0.90	0.26	---	0.13	0.12	3214.59
	Takeoff	100%	8341	24.60	1.07	0.90	0.26	---	0.14	0.13	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
CFM56-5A3	Idle (Taxi)	7%	829	4.10	1.07	16.20	1.50	---	0.07	0.06	3214.59
	Approach	30%	2437	8.30	1.07	2.40	0.35	---	0.09	0.08	3214.59
	Climb out	85%	7341	21.10	1.07	0.90	0.23	---	0.13	0.12	3214.59
	Takeoff	100%	8976	26.40	1.07	0.90	0.23	---	0.14	0.13	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-5A4	Idle (Taxi)	7%	754	4.04	1.07	20.30	2.01	---	0.07	0.06	3214.59
	Approach	30%	2071	8.51	1.07	3.10	0.58	---	0.09	0.08	3214.59
	Climb out	85%	5873	19.11	1.07	1.10	0.26	---	0.11	0.10	3214.59
	Takeoff	100%	7119	22.64	1.07	1.10	0.26	---	0.13	0.12	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-5A5	Idle (Taxi)	7%	778	4.29	1.07	18.50	1.76	---	0.07	0.06	3214.59
	Approach	30%	2190	8.94	1.07	2.80	0.52	---	0.09	0.08	3214.59
	Climb out	85%	6341	19.98	1.07	1.10	0.26	---	0.12	0.11	3214.59
	Takeoff	100%	7714	24.79	1.07	1.10	0.26	---	0.13	0.12	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-5B1	Idle (Taxi)	7%	929	4.60	1.07	28.40	3.69	---	0.06	0.05	3214.59
	Approach	30%	2889	10.80	1.07	1.57	0.14	---	0.05	0.04	3214.59
	Climb out	85%	8833	27.20	1.07	0.50	0.12	---	0.10	0.09	3214.59
	Takeoff	100%	10786	35.10	1.07	0.50	0.12	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-5B2	Idle (Taxi)	7%	944	4.70	1.07	27.40	3.50	---	0.06	0.05	3214.59
	Approach	30%	2984	11.00	1.07	1.40	0.14	---	0.05	0.04	3214.59
	Climb out	85%	9191	28.50	1.07	0.50	0.12	---	0.10	0.09	3214.59
	Takeoff	100%	11318	37.80	1.07	0.50	0.12	---	0.08	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-5B4	Idle (Taxi)	7%	849	4.30	1.07	31.90	4.45	---	0.06	0.06	3214.59
	Approach	30%	2587	10.00	1.07	2.33	0.15	---	0.05	0.04	3214.59
	Climb out	85%	7627	23.30	1.07	0.50	0.12	---	0.10	0.09	3214.59
	Takeoff	100%	9254	28.70	1.07	0.50	0.12	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-5B4/3, -5B7/3	Idle (Taxi)	7%	810	4.22	1.07	32.07	2.21	---	0.06	0.06	3214.59
	Approach	30%	2508	8.85	1.07	3.24	0.06	---	0.05	0.05	3214.59
	Climb out	85%	7452	17.23	1.07	0.16	0.02	---	0.09	0.08	3214.59
	Takeoff	100%	9064	21.57	1.07	0.25	0.02	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-5B9/3	Idle (Taxi)	7%	754	3.92	1.07	38.80	3.46	---	0.07	0.06	3214.59
	Approach	30%	2206	8.26	1.07	4.42	0.08	---	0.05	0.05	3214.59
	Climb out	85%	6294	14.76	1.07	0.17	0.03	---	0.08	0.07	3214.59
	Takeoff	100%	7587	17.54	1.07	0.16	0.02	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											



**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
CFM56-5C2	Idle (Taxi)	7%	933	4.19	1.07	34.00	6.53	---	0.12	0.11	3214.59
	Approach	30%	2824	10.00	1.07	1.75	0.09	---	0.08	0.07	3214.59
	Climb out	85%	8540	25.80	1.07	0.80	0.01	---	0.34	0.31	3214.59
	Takeoff	100%	10381	32.60	1.07	0.93	0.01	---	0.41	0.37	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-5C2/P	Idle (Taxi)	7%	865	3.90	1.07	35.10	6.67	---	0.12	0.11	3214.59
	Approach	30%	2714	9.30	1.07	2.10	0.00	---	0.07	0.07	3214.59
	Climb out	85%	8214	23.80	1.07	0.70	0.00	---	0.34	0.30	3214.59
	Takeoff	100%	9937	29.70	1.07	0.80	0.00	---	0.39	0.35	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-5C3/P	Idle (Taxi)	7%	889	4.00	1.07	33.40	6.21	---	0.12	0.11	3214.59
	Approach	30%	2817	9.60	1.07	1.90	0.00	---	0.07	0.07	3214.59
	Climb out	85%	8611	25.10	1.07	0.70	0.00	---	0.36	0.32	3214.59
	Takeoff	100%	10445	31.60	1.07	0.80	0.00	---	0.43	0.38	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-5C4	Idle (Taxi)	7%	984	4.28	1.07	30.93	5.75	---	0.12	0.11	3214.59
	Approach	30%	3064	10.67	1.07	1.40	0.07	---	0.08	0.07	3214.59
	Climb out	85%	9484	29.05	1.07	0.85	0.01	---	0.39	0.35	3214.59
	Takeoff	100%	11556	37.67	1.07	1.00	0.01	---	0.46	0.42	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-5C4/P	Idle (Taxi)	7%	913	4.10	1.07	31.60	5.75	---	0.12	0.11	3214.59
	Approach	30%	2937	9.90	1.07	1.60	0.00	---	0.07	0.07	3214.59
	Climb out	85%	9071	26.70	1.07	0.70	0.00	---	0.38	0.34	3214.59
	Takeoff	100%	11072	34.10	1.07	0.80	0.00	---	0.44	0.39	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B18/3	Idle (Taxi)	7%	730	3.65	1.07	46.64	5.19	---	0.08	0.07	3214.59
	Approach	30%	2032	7.78	1.07	5.54	0.09	---	0.05	0.05	3214.59
	Climb out	85%	5571	13.00	1.07	0.28	0.03	---	0.07	0.06	3214.59
	Takeoff	100%	6683	14.81	1.07	0.17	0.03	---	0.07	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B20	Idle (Taxi)	7%	794	4.30	1.07	25.90	3.57	---	0.06	0.05	3214.59
	Approach	30%	2175	9.50	1.07	3.20	0.12	---	0.04	0.04	3214.59
	Climb out	85%	6040	17.40	1.07	0.50	0.12	---	0.08	0.07	3214.59
	Takeoff	100%	7246	20.50	1.07	0.60	0.12	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B20/2	Idle (Taxi)	7%	810	3.75	1.07	49.71	9.33	---	0.09	0.08	3214.59
	Approach	30%	2206	9.39	1.07	11.37	0.41	---	0.07	0.06	3214.59
	Climb out	85%	5984	10.81	1.07	11.38	0.26	---	0.06	0.05	3214.59
	Takeoff	100%	7167	13.25	1.07	4.26	0.08	---	0.05	0.04	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
CFM56-7B20/3, -7B20E	Idle (Taxi)	7%	746	3.77	1.07	43.31	4.42	---	0.08	0.07	3214.59
	Approach	30%	2127	7.98	1.07	5.03	0.09	---	0.05	0.05	3214.59
	Climb out	85%	5921	13.53	1.07	0.23	0.03	---	0.07	0.06	3214.59
	Takeoff	100%	7111	15.61	1.07	0.15	0.03	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B22	Idle (Taxi)	7%	833	4.50	1.07	22.80	2.88	---	0.05	0.05	3214.59
	Approach	30%	2365	10.00	1.07	2.50	0.12	---	0.04	0.04	3214.59
	Climb out	85%	6698	19.00	1.07	0.60	0.12	---	0.10	0.09	3214.59
	Takeoff	100%	8103	23.10	1.07	0.50	0.12	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B22/2	Idle (Taxi)	7%	833	3.94	1.07	45.35	8.35	---	0.09	0.08	3214.59
	Approach	30%	2405	6.37	1.07	30.87	6.97	---	0.38	0.34	3214.59
	Climb out	85%	6643	12.16	1.07	6.58	0.12	---	0.05	0.04	3214.59
	Takeoff	100%	8000	15.08	1.07	2.18	0.07	---	0.05	0.04	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B22/3, -7B22E	Idle (Taxi)	7%	786	3.95	1.07	37.90	3.25	---	0.07	0.06	3214.59
	Approach	30%	2310	8.35	1.07	4.18	0.08	---	0.05	0.05	3214.59
	Climb out	85%	6603	14.67	1.07	0.17	0.03	---	0.08	0.07	3214.59
	Takeoff	100%	7968	17.40	1.07	0.16	0.02	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B24	Idle (Taxi)	7%	865	4.40	1.07	22.00	2.76	---	0.05	0.05	3214.59
	Approach	30%	2508	10.10	1.07	2.20	0.12	---	0.04	0.04	3214.59
	Climb out	85%	7222	20.50	1.07	0.60	0.12	---	0.10	0.09	3214.59
	Takeoff	100%	8754	25.30	1.07	0.40	0.12	---	0.11	0.10	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B24/2	Idle (Taxi)	7%	865	4.08	1.07	42.72	7.53	---	0.08	0.07	3214.59
	Approach	30%	2484	6.72	1.07	30.32	6.91	---	0.38	0.34	3214.59
	Climb out	85%	7159	13.23	1.07	4.30	0.08	---	0.05	0.04	3214.59
	Takeoff	100%	8643	16.63	1.07	1.38	0.06	---	0.05	0.04	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B24/3	Idle (Taxi)	7%	817	4.09	1.07	34.71	2.65	---	0.07	0.06	3214.59
	Approach	30%	2444	8.60	1.07	3.68	0.07	---	0.05	0.05	3214.59
	Climb out	85%	7103	15.60	1.07	0.15	0.03	---	0.08	0.07	3214.59
	Takeoff	100%	8619	18.93	1.07	0.18	0.02	---	0.09	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B24E, -7B24E/B1	Idle (Taxi)	7%	794	4.10	1.07	34.70	2.65	---	0.07	0.06	3214.59
	Approach	30%	2381	8.60	1.07	3.70	0.12	---	0.06	0.05	3214.59
	Climb out	85%	7143	15.60	1.07	0.20	0.00	---	0.08	0.07	3214.59
	Takeoff	100%	8730	18.90	1.07	0.20	0.00	---	0.09	0.09	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs  
(cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
CFM56-7B26	Idle (Taxi)	7%	897	4.70	1.07	18.80	2.19	---	0.05	0.05	3214.59
	Approach	30%	2683	10.80	1.07	1.60	0.12	---	0.04	0.04	3214.59
	Climb out	85%	7929	22.50	1.07	0.60	0.12	---	0.11	0.10	3214.59
	Takeoff	100%	9691	28.80	1.07	0.20	0.12	---	0.12	0.11	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B26/2	Idle (Taxi)	7%	897	4.27	1.07	39.93	6.76	---	0.08	0.07	3214.59
	Approach	30%	2651	7.26	1.07	26.07	5.44	---	0.31	0.28	3214.59
	Climb out	85%	7849	14.77	1.07	2.51	0.07	---	0.05	0.04	3214.59
	Takeoff	100%	9548	19.20	1.07	0.77	0.03	---	0.04	0.04	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B26/3, -7B26E, -7B26E/B1, -7B26E/B2, -7B26E/B2F, -7B26E/F	Idle (Taxi)	7%	857	4.27	1.07	30.94	2.01	---	0.06	0.06	3214.59
	Approach	30%	2627	8.93	1.07	3.07	0.06	---	0.05	0.05	3214.59
	Climb out	85%	7825	17.08	1.07	0.16	0.02	---	0.09	0.08	3214.59
	Takeoff	100%	9627	21.79	1.07	0.20	0.02	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B27	Idle (Taxi)	7%	921	4.80	1.07	17.90	1.96	---	0.05	0.04	3214.59
	Approach	30%	2770	11.00	1.07	1.40	0.12	---	0.04	0.04	3214.59
	Climb out	85%	8278	23.70	1.07	0.50	0.12	---	0.11	0.10	3214.59
	Takeoff	100%	10191	30.90	1.07	0.20	0.12	---	0.12	0.11	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B27/2	Idle (Taxi)	7%	913	4.36	1.07	38.73	6.39	---	0.08	0.07	3214.59
	Approach	30%	2786	7.53	1.07	24.28	4.84	---	0.28	0.25	3214.59
	Climb out	85%	8198	15.59	1.07	1.97	0.07	---	0.05	0.04	3214.59
	Takeoff	100%	10040	20.81	1.07	0.54	0.06	---	0.05	0.04	3214.59
Notes: c(2), e, f, h, k(1)											
CFM56-7B27/3, -7B27E, -7B27E/B1, -7B27E/B1F, -7B27E/B3, -7B27E/F	Idle (Taxi)	7%	873	4.36	1.07	29.39	1.77	---	0.06	0.06	3214.59
	Approach	30%	2722	9.09	1.07	2.82	0.06	---	0.05	0.05	3214.59
	Climb out	85%	8183	17.89	1.07	0.17	0.02	---	0.10	0.09	3214.59
	Takeoff	100%	10262	23.94	1.07	0.31	0.03	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
CT7-5	Idle (Taxi)	7%	131	2.20	1.07	35.33	3.78	---	0.18	0.16	3214.59
	Approach	30%	364	6.88	1.07	5.29	1.42	---	0.37	0.33	3214.59
	Climb out	70%	756	13.17	1.07	2.59	0.95	---	0.57	0.51	3214.59
	Takeoff	100%	809	13.77	1.07	2.59	0.95	---	0.69	0.62	3214.59
Notes: c(13), j, k(8)											
F100-PW-100	Idle (Taxi)	3%	1127	4.64	1.07	49.58	3.79	1.538	3.13	2.82	3214.59
	Approach	13%	2765	12.52	1.07	3.99	1.06	0.853	1.57	1.41	3214.59
	Intermediate	45%	7685	27.09	1.07	0.72	0.14	0.044	0.72	0.65	3214.59
	Military	100%	10996	35.01	1.07	0.70	0.12	0.067	1.24	1.12	3214.59
	Afterburner-1	134%	54007	6.62	1.07	9.57	0.13	0.026	0.87	0.78	3214.59
Notes: c(14), h, k(5)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
F100-PW-200	Idle (Taxi)	3%	1006	6.21	1.07	24.06	2.05	1.294	2.47	2.22	3214.59
	Approach	13%	3251	17.93	1.07	1.22	0.05	0.003	2.37	2.13	3214.59
	Intermediate	45%	5651	26.55	1.07	0.38	0.07	0.018	1.58	1.42	3214.59
	Military	100%	8888	34.32	1.07	0.56	0.11	0.026	1.66	1.49	3214.59
	Afterburner-5	134%	40123	6.63	1.07	10.42	0.69	0.046	3.07	2.76	3214.59
Notes: c(5), h, k(5)											
F100-PW-220	Idle (Taxi)	---	2084	4.61	1.07	35.32	7.94	---	0.67	0.60	3214.59
	Approach	---	3837	12.50	1.07	1.92	5.12	---	0.70	0.63	3214.59
	Intermediate	---	5770	22.20	1.07	0.86	2.89	---	0.70	0.63	3214.59
	Military	---	9679	29.60	1.07	0.86	2.08	---	0.91	0.82	3214.59
	Afterburner-5	---	41682	8.20	1.07	11.87	1.60	---	0.38	0.35	3214.59
Notes: c(17), e, g, h, k(5)											
F100-PW-229	Idle (Taxi)	5%	1087	3.80	1.07	10.17	0.45	---	0.67 (S)	0.60 (S)	3214.59
	Approach	21%	3098	15.08	1.07	1.17	0.24	---	0.70 (S)	0.63 (S)	3214.59
	Intermediate	49%	5838	17.54	1.07	0.15	0.35	---	0.70 (S)	0.63 (S)	3214.59
	Military	86%	11490	29.29	1.07	0.33	0.31	---	0.91 (S)	0.82 (S)	3214.59
	Afterburner-1	102%	20793	14.30	1.07	21.51	5.26	---	0.38 (S)	0.35 (S)	3214.59
Notes: c(3), d(2) - PM <sub>2.5</sub> and PM <sub>10</sub> data at all power settings, e, h, k(5)											
F101-GE-100	Idle (Taxi)	---	476	7.30	1.07	120.10	28.98	---	0.09	0.08	3214.59
	Approach	---	4533 (S)	9.16 (S)	1.07	1.03 (S)	0.02 (S)	---	4.21 (S)	3.74 (S)	3214.59
	Intermediate	---	6557 (S)	13.15 (S)	1.07	0.85 (S)	0.04 (S)	---	1.35 (S)	0.72 (S)	3214.59
	Military	---	10000	2.30	1.07	7.60	0.46	---	0.03	0.03	3214.59
	Afterburner	---	66747	4.60	1.07	16.70	0.12	---	0.05	0.05	3214.59
Notes: c(7), d(3) - All pollutants and fuel flow rates at Approach and Intermediate power settings, e, h, k(8)											
F101-GE-102	Idle (Taxi)	5%	1117	4.10	1.07	24.46	0.16	0.127	2.18	1.96	3214.59
	Approach	47%	4533	9.16	1.07	1.03	0.02	0.009	4.21	3.79	3214.59
	Intermediate	66%	6557	13.15	1.07	0.85	0.04	0.009	1.35	1.21	3214.59
	Military	77%	7828	12.83	1.07	0.83	0.12	0.014	1.68	1.51	3214.59
	Afterburner-1	106%	15314	16.92	1.07	43.49	1.46	0.969	2.87	2.58	3214.59
Notes: c(3), h, k(5)											
F103-GE-100, -101	Idle (Taxi)	7%	1706	3.60	1.07	61.80	25.07	---	0.21	0.19	3214.59
	Approach	30%	5238	9.50	1.07	4.30	1.15	---	0.11	0.10	3214.59
	Climb out	85%	15675	29.70	1.07	0.50	0.81	---	0.10	0.09	3214.59
	Takeoff	100%	19738	36.30	1.07	0.50	0.69	---	0.12	0.11	3214.59
Notes: c(2) - F103-GE-100 is the military designation of the CF6-50E2 engine and F103-GE-101 is the military designation of the CF6-50C2 engine, e, f, h, k(1)											
F108-CF-100, -201	Idle (Taxi)	9%	1136	3.88	1.07	23.65	0.19	0.125	2.07	1.86	3214.59
	Approach	30%	2547	5.73	1.07	8.57	0.06	0.027	1.55	1.40	3214.59
	Intermediate	70%	5650	11.04	1.07	2.32	0.03	0.008	0.65	0.58	3214.59
	Military	78%	6458	12.05	1.07	0.36	0.03	0.009	1.59	1.43	3214.59
Notes: c(3) - F108-CF-100 is the military designation of the CFM56-2B-1 engine, this engine used as a surrogate at all settings for F108-CF-201 engine, h, k(5)											
F110-GE-100	Idle (Taxi)	3%	1111	3.77	1.07	24.11	0.22	0.164	2.60	2.34	3214.59
	Approach	44%	5080	9.78	1.07	5.77	0.03	0.015	1.37	1.23	3214.59
	Intermediate	66%	7332	16.92	1.07	3.47	0.05	0.025	0.58	0.52	3214.59
	Military	100%	11358	29.00	1.07	3.38	0.04	0.019	0.14	0.13	3214.59
	Afterburner-1	113%	18088	14.26	1.07	67.41	1.21	0.697	3.35	3.01	3214.59
Notes: c(3), h, k(5)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
F110-GE-129	Idle (Taxi)	4%	961	2.62	1.07	45.04	4.90	---	2.60 (S)	2.34 (S)	3214.59
	Approach	45%	4832	13.42	1.07	1.93	0.03 (S)	---	1.37 (S)	1.23 (S)	3214.59
	Intermediate	65%	6939	17.82	1.07	1.53	0.05 (S)	---	0.58 (S)	0.52 (S)	3214.59
	Military	76%	8611	20.34	1.07	1.17	0.93	---	0.14 (S)	0.13 (S)	3214.59
	Afterburner-1	99%	15564	7.09	1.07	63.28	53.46	---	3.35 (S)	3.01 (S)	3214.59
Notes: c(3), d(4) - VOC at Approach and Intermediate settings and PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(5)											
F110-GE-400	Idle (Taxi)	7%	1287	2.76	1.07	16.57	3.48	---	0.02	0.02	3214.59
	Approach	30%	5809	12.41	1.07	0.96	0.44	---	0.02	0.02	3214.59
	Climb out	70%	11868	58.57	1.07	0.84	0.38	---	0.26	0.23	3214.59
	Takeoff	100%	11833	28.47	1.07	0.84	0.38	---	0.31	0.28	3214.59
Notes: c(13), j, k(8)											
F113-RR-100	Idle (Taxi)	7%	1008	3.60	1.07	31.77	4.24	---	0.16	0.15	3214.59
	Approach	30%	2206	7.20	1.07	2.65	0.21	---	0.22	0.20	3214.59
	Climb out	85%	5762	17.30	1.07	0.63	0.14	---	0.24	0.22	3214.59
	Takeoff	100%	7071	22.70	1.07	0.12	0.10	---	0.23	0.21	3214.59
Notes: c(2) - F113-RR-100 is the military designation of the SPEY Mk511 engine, e, f, h, k(8)											
F117-PW-100	Idle (Taxi)	4%	978	3.76	1.07	22.70	0.37	0.291	10.67	9.60	3214.59
	Approach	31%	4645	15.49	1.07	0.51	0.05	0.019	5.53	4.98	3214.59
	Intermediate	68%	10408	32.72	1.07	0.32	0.04	0.012	2.31	2.08	3214.59
	Takeoff	---	13905 (S)	35.04 (S)	1.07	0.32 (S)	0.01 (S)	0.006 (C)	0.06 (S)	0.05 (S)	3214.59
Notes: c(3) - F117-PW-100 is the military designation of the PW2040 engine, d(1) - HAPs at Takeoff setting only, d(16) - All remaining pollutants at Takeoff setting, h, k(5)											
F118-GE-100	Idle (Taxi)	---	1097	4.30	1.07	20.98	0.29	0.234	1.25	1.12	3214.59
	Approach	---	3773	11.09	1.07	2.02	0.05	0.017	4.70	4.23	3214.59
	Intermediate	---	6350	18.01	1.07	0.85	0.03	0.013	3.05	2.75	3214.59
	Military	---	10887	33.12	1.07	0.65	0.03	0.007	1.64	1.48	3214.59
Notes: c(3), h, k(5)											
F119-PW-100	Idle (Taxi)	10%	1377	3.01	1.07	48.15	1.67	1.492	2.42	1.76	3214.59
	Approach	20%	2740	6.59	1.07	7.92	0.05	0.047	1.96	1.73	3214.59
	Intermediate	70%	10110	12.40	1.07	2.14	0.03	0.030	1.40	1.09	3214.59
	Military	100%	18612	19.81	1.07	0.75	0.01	0.010	1.12	0.97	3214.59
	Afterburner	150%	50170	7.37	1.07	16.10	1.8E-03 (C)	0.002 (C)	0.85 (C)	0.75 (C)	3214.59
Notes: c(4), d(1) - VOC, HAP, PM <sub>10</sub> , and PM <sub>2.5</sub> pollutants at Afterburner setting only, k(5)											
F135-PW-100	Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors										
F402-RR-406A	Idle (Taxi)	7%	1251	1.80	1.07	106.08	18.75	---	0.49	0.44	3214.59
	Approach	30%	3735	4.99	1.07	21.46	1.05	---	0.30	0.27	3214.59
	Intermediate	70%	7125	9.48	1.07	8.35	0.43	---	0.30	0.27	3214.59
	Military	100%	8094	10.78	1.07	6.93	0.43	---	0.32	0.29	3214.59
Notes: c(13), j, k(8)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
F402-RR-408	Idle (Taxi)	7%	1449	2.20	1.07	39.72	2.41	---	0.16	0.14	3214.59
	Approach	30%	3974	5.02	1.07	16.57	0.46	---	0.19	0.17	3214.59
	Intermediate	70%	7290	7.55	1.07	9.79	0.20	---	0.02	0.02	3214.59
	Military	100%	8494	8.38	1.07	8.58	0.20	---	0.21	0.19	3214.59
Notes: c(13), j, k(8)											
F404-GE-102	Proprietary Information. Contact Air Quality Subject Matter Expert for More Information regarding this engine's Emission Factors										
F404-GE-400	Idle (Taxi)	6%	685	1.70	1.07	110.18	3.39	2.798	4.47	4.02	3214.59
	Approach	38%	3111	7.86	1.07	2.02	0.04	0.022	1.46	1.31	3214.59
	Intermediate	79%	6464	17.03	1.07	1.54	0.07	0.026	1.57	1.42	3214.59
	Military	91%	7739	25.83	1.07	1.48	0.02	0.012	1.61	1.45	3214.59
	Afterburner-3	114%	15851	5.43	1.07	50.31	1.85	1.099	3.57	3.21	3214.59
Notes: c(3), h, k(5)											
F404-GE-402	Ground Idle	---	624	1.16	1.07	137.34	66.91	---	13.79	13.79	3214.59
	Flight Idle	---	815	2.01	1.07	123.52	51.18	---	12.38	12.38	3214.59
	Average Intermediate	---	10467	25.16	1.07	1.05	0.36	---	2.81	2.81	3214.59
	Max Afterburner	---	31764	9.22	1.07	23.12	0.15	---	1.49 (C)	1.34 (C)	3214.59
Notes: c(18), d(1), e, k(4)											
F404-GE-F1D2	Idle (Taxi)	6%	685	1.70	1.07	110.18	3.39	2.798	4.47	4.02	3214.59
	Approach	38%	3111	7.86	1.07	2.02	0.04	0.022	1.46	1.31	3214.59
	Intermediate	79%	6464	17.03	1.07	1.54	0.07	0.026	1.57	1.42	3214.59
	Military	91%	7739	25.83	1.07	1.48	0.02	0.012	1.61	1.45	3214.59
Notes: c(3), h, k(5)											
F405-RR-401	Idle (Taxi)	---	498	0.27	1.07	151.21	39.12	---	8.94	8.94	3214.59
	Approach	---	1495	2.68	1.07	19.54	1.71	---	8.11	8.11	3214.59
	Climb out	---	3826	8.33	1.07	3.72	0.23	---	4.92	4.92	3214.59
	Takeoff	---	4559	10.10	1.07	3.27	0.17	---	3.65	3.65	3214.59
Notes: c(20), e, k(4)											
F414-GE-400	Ground Idle	---	695	3.18	1.07	98.18	75.13	---	12.64	12.64	3214.59
	Flight Idle	---	821	3.47	1.07	77.90	48.65	---	12.37	12.37	3214.59
	Intermediate	---	11768	38.17	1.07	0.70	0.14	---	2.78	2.78	3214.59
	Max Afterburner	---	35763	9.67	1.07	275.00	5.60	---	1.52 (C)	1.37 (C)	3214.59
Notes: c(19), d(1), e, g, k(4)											
GE90-76B	Idle (Taxi)	7%	2048	5.10	1.07	34.12	3.69	---	0.07	0.06	3214.59
	Approach	30%	5857	13.76	1.07	2.77	0.08	---	0.05	0.04	3214.59
	Climb out	85%	18103	32.43	1.07	0.32	0.03	---	0.04	0.04	3214.59
	Takeoff	100%	22191	40.25	1.07	0.31	0.03	---	0.04	0.04	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
GE90-77B	Idle (Taxi)	7%	2064	5.12	1.07	33.81	3.63	---	0.07	0.06	3214.59
	Approach	30%	5913	13.87	1.07	2.71	0.08	---	0.05	0.04	3214.59
	Climb out	85%	18326	32.78	1.07	0.32	0.03	---	0.04	0.04	3214.59
	Takeoff	100%	22460	40.83	1.07	0.31	0.03	---	0.04	0.04	3214.59
Notes: c(2), e, f, h, k(1)											
GE90-85B	Idle (Taxi)	7%	2151	5.33	1.07	31.34	3.22	---	0.06	0.06	3214.59
	Approach	30%	6381	14.77	1.07	2.16	0.07	---	0.05	0.04	3214.59
	Climb out	85%	20262	36.35	1.07	0.31	0.03	---	0.04	0.04	3214.59
	Takeoff	100%	24849	45.54	1.07	0.30	0.05	---	0.05	0.04	3214.59
Notes: c(2), e, f, h, k(1)											
GE90-90B	Idle (Taxi)	7%	2310	6.00	1.07	13.21	0.49	---	0.06	0.05	3214.59
	Approach	30%	6968	16.94	1.07	1.16	0.06	---	0.06	0.05	3214.59
	Climb out	85%	21691	39.50	1.07	0.13	0.05	---	0.05	0.05	3214.59
	Takeoff	100%	26572	52.48	1.07	0.12	0.05	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
GE90-94B	Idle (Taxi)	7%	2349	6.09	1.07	12.69	0.47	---	0.06	0.05	3214.59
	Approach	30%	7206	17.38	1.07	1.07	0.06	---	0.06	0.05	3214.59
	Climb out	85%	22603	41.74	1.07	0.12	0.05	---	0.05	0.05	3214.59
	Takeoff	100%	27889	56.41	1.07	0.12	0.05	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
GE90-110B1	Idle (Taxi)	7%	2937	5.11	1.07	40.59	5.23	---	0.07	0.07	3214.59
	Approach	30%	8571	15.78	1.07	2.29	0.07	---	0.05	0.04	3214.59
	Climb out	85%	27540	33.85	1.07	0.07	0.03	---	0.05	0.04	3214.59
	Takeoff	100%	34286	44.44	1.07	0.07	0.03	---	0.05	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
GE90-115B	Idle (Taxi)	7%	3016	5.19	1.07	39.11	4.88	---	0.07	0.06	3214.59
	Approach	30%	8968	16.50	1.07	1.98	0.07	---	0.05	0.04	3214.59
	Climb out	85%	29127	35.98	1.07	0.07	0.03	---	0.05	0.04	3214.59
	Takeoff	100%	37222	50.34	1.07	0.08	0.05	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
GEnx-1B64	Idle (Taxi)	7%	1579	4.24	1.07	21.62	0.93	---	0.04	0.04	3214.59
	Approach	30%	4794	9.03	1.07	2.99	0.07	---	0.08	0.07	3214.59
	Climb out	85%	14770	14.61	1.07	0.38	0.02	---	0.04	0.04	3214.59
	Takeoff	100%	17976	24.82	1.07	0.18	0.02	---	0.04	0.04	3214.59
Notes: c(2), e, f, h, k(1)											
GEnx-1B64/P1	Idle (Taxi)	7%	1667	4.37	1.07	19.73	0.74	---	0.04	0.04	3214.59
	Approach	30%	4905	9.11	1.07	2.91	0.07	---	0.07	0.06	3214.59
	Climb out	85%	14889	15.36	1.07	0.36	0.02	---	0.04	0.04	3214.59
	Takeoff	100%	18079	25.74	1.07	0.18	0.02	---	0.04	0.04	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs  
(cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
GEnx-1B67	Idle (Taxi)	7%	1611	4.30	1.07	20.70	0.83	---	0.04	0.04	3214.59
	Approach	30%	4960	9.29	1.07	2.76	0.07	---	0.08	0.07	3214.59
	Climb out	85%	15397	16.26	1.07	0.30	0.02	---	0.04	0.04	3214.59
	Takeoff	100%	18794	28.56	1.07	0.17	0.02	---	0.04	0.04	3214.59
Notes: c(2), e, f, h, k(1)											
GEnx-1B67/P1	Idle (Taxi)	7%	1698	4.43	1.07	18.94	0.67	---	0.04	0.04	3214.59
	Approach	30%	5071	9.39	1.07	2.68	0.07	---	0.08	0.07	3214.59
	Climb out	85%	15508	17.04	1.07	0.29	0.02	---	0.04	0.04	3214.59
	Takeoff	100%	18889	29.34	1.07	0.18	0.02	---	0.04	0.04	3214.59
Notes: c(2), e, f, h, k(1)											
GEnx-1B70, -1B70/P1, -1B70/75/P1	Idle (Taxi)	7%	1738	4.50	1.07	18.05	0.60	---	0.04	0.04	3214.59
	Approach	30%	5270	9.73	1.07	2.42	0.06	---	0.08	0.07	3214.59
	Climb out	85%	16278	19.30	1.07	0.24	0.02	---	0.04	0.04	3214.59
	Takeoff	100%	19881	34.61	1.07	0.17	0.02	---	0.04	0.04	3214.59
Notes: c(2), e, f, h, k(1)											
GEnx-2B67	Idle (Taxi)	7%	1714	4.43	1.07	18.95	0.66	---	0.04	0.04	3214.59
	Approach	30%	5564	9.58	1.07	2.53	0.07	---	0.08	0.07	3214.59
	Climb out	85%	15968	17.94	1.07	0.28	0.02	---	0.04	0.04	3214.59
	Takeoff	100%	19453	31.20	1.07	0.17	0.02	---	0.04	0.04	3214.59
Notes: c(2), e, f, h, k(1)											
GEnx-2B67B	Idle (Taxi)	7%	1611	4.66	1.07	16.39	0.67	---	0.04	0.04	3214.59
	Approach	30%	4183	9.27	1.07	2.81	0.07	---	0.04	0.04	3214.59
	Climb out	85%	12333	11.54	1.07	1.73	0.02	---	0.04	0.04	3214.59
	Takeoff	100%	14921	17.22	1.07	0.32	0.02	---	0.04	0.04	3214.59
Notes: c(2), e, f, h, k(1)											
GP7270	Idle (Taxi)	7%	1857	5.24	1.07	33.58	4.65	---	0.09	0.08	3214.59
	Approach	30%	5643	12.90	1.07	1.27	0.08	---	0.05	0.05	3214.59
	Climb out	85%	17214	31.37	1.07	0.09	0.03	---	0.06	0.05	3214.59
	Takeoff	100%	20929	41.73	1.07	0.11	0.03	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
GTSIO-520-F	Idle (Taxi)	---	25	0.04	1.07	1293.70	78.29	---	0.50	0.45	3214.59
	Approach	---	99	1.39	1.07	1261.60	15.39	---	0.40	0.36	3214.59
	Climb out	---	205	0.24	1.07	1470.90	19.12	---	0.70	0.63	3214.59
	Takeoff	---	260	0.36	1.07	1442.10	14.21	---	0.10	0.09	3214.59
Notes: c(16), e, g, h, k(8)											
GTSIO-520-H	Idle (Taxi)	<40%	22	0.88	1.07	720.50	47.31	---	0.50 (S)	0.45 (S)	3214.59
	Pattern	40%	102	7.70	1.07	697.40	7.52	---	0.40 (S)	0.36 (S)	3214.59
	Climb out	75%	145	9.76	1.07	728.75	7.04	---	0.70 (S)	0.63 (S)	3214.59
	Takeoff	100%	256	1.03	1.07	1045.66	11.66	---	0.10 (S)	0.09 (S)	3214.59
Notes: c(8), d(13) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, i, k(8)											



**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
GTSIO-520-K, -520-M	Idle (Taxi)	---	25	0.04	1.07	1293.70	78.29	---	0.50	0.45	3214.59
	Approach	---	99	1.39	1.07	1261.60	15.39	---	0.40	0.36	3214.59
	Climb out	---	205	0.24	1.07	1470.90	19.12	---	0.70	0.63	3214.59
	Takeoff	---	260	0.36	1.07	1442.10	14.21	---	0.10	0.09	3214.59
Notes: c(16), e, g, h, k(8)											
IO-360-A	Idle (Taxi)	32%	11	0.40	1.07	956.24	278.09	---	0.76	0.68	3214.59
	Approach	66%	22	10.62	1.07	727.75	85.31	---	0.12	0.11	3214.59
	Climb out	100%	85	17.65	1.07	840.53	55.11	---	0.30	0.27	3214.59
	Takeoff	100%	85	18.08	1.07	842.50	52.09	---	0.31	0.28	3214.59
Notes: c(16), e, g, h, k(7)											
IO-360-B	Idle (Taxi)	5-10%	8	1.16	1.07	897.40	56.58	---	0.76 (S)	0.68 (S)	3214.59
	Approach	30%	37	10.16	1.07	691.26	11.15	---	0.12 (S)	0.11 (S)	3214.59
	Climb out	75%	72	4.59	1.07	983.26	9.38	---	0.30 (S)	0.27 (S)	3214.59
	Takeoff	100%	103	1.99	1.07	1199.03	11.50	---	0.31 (S)	0.28 (S)	3214.59
Notes: c(1), d(5) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, j, k(8)											
IO-360-B1E, -360-C, -360-C1C	Idle (Taxi)	32%	11	0.40	1.07	956.24	278.09	---	0.76	0.68	3214.59
	Approach	66%	22	10.62	1.07	727.75	85.31	---	0.12	0.11	3214.59
	Climb out	100%	85	17.65	1.07	840.53	55.11	---	0.30	0.27	3214.59
	Takeoff	100%	85	18.08	1.07	842.50	52.09	---	0.31	0.28	3214.59
Notes: c(16), e, g, h, k(7)											
IO-360-C1C6	Idle (Taxi)	32%	12	0.28	1.07	882.98	263.40	---	0.30	0.27	3214.59
	Approach	61%	26	3.36	1.07	938.16	123.88	---	0.06	0.06	3214.59
	Climb out	101%	81	6.63	1.07	753.23	53.27	---	0.09	0.08	3214.59
	Takeoff	101%	81	7.48	1.07	757.17	47.22	---	0.10	0.09	3214.59
Notes: c(16), e, g, h, k(7)											
IO-360-CB	Idle (Taxi)	32%	11	0.40	1.07	956.24	278.09	---	0.76	0.68	3214.59
	Approach	66%	22	10.62	1.07	727.75	85.31	---	0.12	0.11	3214.59
	Climb out	100%	85	17.65	1.07	840.53	55.11	---	0.30	0.27	3214.59
	Takeoff	100%	85	18.08	1.07	842.50	52.09	---	0.31	0.28	3214.59
Notes: c(16), e, g, h, k(7)											
IO-360-D	Idle (Taxi)	---	30	1.10	1.07	848.00	166.75	---	60.00	54.00	3214.59
	Approach	---	50	4.00	1.07	912.45	54.17	---	47.95	43.16	3214.59
	Intermediate	---	70	6.60	1.07	972.00	20.01	---	40.00	36.00	3214.59
	Military	---	90	5.80	1.07	1030.00	25.88	---	20.00	18.00	3214.59
Notes: c(7), e, h, k(8)											
IO-360-D34, -360-DB, -360-G, -360-GB	Idle (Taxi)	32%	11	0.40	1.07	956.24	278.09	---	0.76	0.68	3214.59
	Approach	66%	22	10.62	1.07	727.75	85.31	---	0.12	0.11	3214.59
	Climb out	100%	85	17.65	1.07	840.53	55.11	---	0.30	0.27	3214.59
	Takeoff	100%	85	18.08	1.07	842.50	52.09	---	0.31	0.28	3214.59
Notes: c(16), e, g, h, k(7)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
J33-A-35	Idle (Taxi)	---	1190	1.50	1.07	127.00	22.43	---	0.73	0.66	3214.59
	Approach	---	1984	1.90	1.07	84.60	7.48	---	0.57	0.51	3214.59
	Intermediate	---	4762	2.70	1.07	49.10	1.50	---	0.02	0.02	3214.59
	Military	---	5556	3.60	1.07	31.30	0.58	---	0.02	0.02	3214.59
Notes: c(7), e, g, h, k(8)											
J52-P-6B	Idle (Taxi)	<35%	714	2.07	1.07	86.37	27.46	---	19.94	17.95	3214.59
	3000lb Thrust	35% (C)	2301	3.91	1.07	16.57	0.94	---	0.18 (S)	0.16 (S)	3214.59
	75% Thrust	75%	3977	5.84	1.07	6.00	0.75	---	0.18 (S)	0.16 (S)	3214.59
	Military	>75%	6328	9.00	1.07	3.01	0.38	---	7.75	6.98	3214.59
Notes: c(9), d(6) - PM <sub>10</sub> and PM <sub>2.5</sub> at 3000lb and 75% thrust power settings only, e, g, h, j - Percent thrust for 3000lb setting assumes maximum thrust of 8500lb for this engine, k(8)											
J52-P-8B	Idle (Taxi)	<32%	680	1.79	1.07	63.78	48.53	---	0.18 (S)	0.16 (S)	3214.59
	3000lb Thrust	32% (C)	2300	6.34	1.07	10.54	1.98	---	0.18 (S)	0.16 (S)	3214.59
	75% Thrust	75%	4320	10.10	1.07	3.00	0.67	---	0.13 (S)	0.12 (S)	3214.59
	Military	>75%	7370	13.05	1.07	0.71	1.07	---	0.13 (S)	0.12 (S)	3214.59
Notes: c(9), d(6) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, j - Percent thrust for 3000lb setting assumes maximum thrust of 9300lb for this engine, k(8)											
J52-P-408	Idle (Taxi)	7%	1466	2.79	1.07	50.10	3.62	---	0.18	0.16	3214.59
	Approach	30%	3325	7.25	1.07	16.07	0.29	---	0.18	0.16	3214.59
	Intermediate	70%	6502	7.53	1.07	7.70	0.03	---	0.13	0.12	3214.59
	Military	100%	6483	7.53	1.07	7.70	0.03	---	0.13	0.12	3214.59
Notes: c(13), e, j, k(8)											
J57-P-10	Idle (Taxi)	<75%	1100	1.87	1.07	80.52	111.09	---	0.16 (S)	0.14 (S)	3214.59
	75% Thrust	75%	5670	7.40	1.07	3.21	0.87	---	0.93 (S)	0.84 (S)	3214.59
	Normal Rated	76-99%	7250	9.00	1.07	1.79	1.15	---	1.92 (S)	1.73 (S)	3214.59
	Military	100%	8370	10.37	1.07	1.16	0.99	---	1.72 (S)	1.55 (S)	3214.59
Notes: c(9), d(7) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, j - Assumes 100% thrust at Military setting, k(8)											
J57-P-19W	Idle (Taxi)	---	952	2.20	1.07	79.00	88.55	---	0.16	0.14	3214.59
	Approach	---	3333	5.80	1.07	7.90	1.61	---	0.93	0.84	3214.59
	Intermediate	---	6508	9.50	1.07	2.40	0.23	---	1.92	1.73	3214.59
	Military	---	7460	11.00	1.07	1.90	0.12	---	1.72	1.55	3214.59
Notes: c(7), e, g, h, k(8)											
J57-P-22	Idle (Taxi)	---	1087	2.48	1.07	59.25	59.03	---	7.64	6.87	3214.59
	Approach	---	1693	2.95	1.07	23.51	14.26	---	5.32 (C)	4.79 (C)	3214.59
	Climb out	---	8358	11.16	1.07	1.78	0.74	---	1.44	1.29	3214.59
	Takeoff	---	8358	11.16	1.07	1.78	0.74	---	1.44	1.29	3214.59
Notes: c(1), d(1), e, g, h, k(8)											
J57-P-420	Idle (Taxi)	<30%	1322	1.53	1.07	80.74	87.93	---	0.16 (S)	0.14 (S)	3214.59
	30% Thrust	30%	3413	4.45	1.07	14.83	5.22	---	0.93 (S)	0.84 (S)	3214.59
	75% Thrust	75%	5767	6.99	1.07	4.32	1.25	---	1.92 (S)	1.73 (S)	3214.59
	Intermediate	75-100%	10570	12.97	1.07	0.34	0.56	---	1.72 (S)	1.55 (S)	3214.59
	Afterburner	>100%	39721	5.16	1.07	14.20	2.92	---	3.10 (C)	2.80 (C)	3214.59
Notes: c(9), d(1) - PM <sub>10</sub> and PM <sub>2.5</sub> at Afterburner power setting only, d(7) - PM <sub>10</sub> and PM <sub>2.5</sub> at all other power settings, e, j, k(8)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
J57-P/F-43WB	Idle (Taxi)	---	952	2.20	1.07	78.00	86.25	---	0.14	0.13	3214.59
	Approach	---	1825	4.45	1.07	16.85	6.33	---	0.41	0.37	3214.59
	Intermediate	---	6667	9.90	1.07	2.30	0.12	---	1.23	1.11	3214.59
	Military	---	7778	11.00	1.07	1.50	0.12	---	1.74	1.57	3214.59
Notes: c(7), e, g, h, k(8)											
J57-P/F-59W	Idle (Taxi)	---	1270	2.40	1.07	65.00	60.84	---	0.13	0.12	3214.59
	Approach	---	1825	3.30	1.07	32.50	16.33	---	0.22	0.20	3214.59
	Intermediate	---	3889	6.10	1.07	8.90	1.27	---	0.60	0.54	3214.59
	Military	---	7937	11.30	1.07	2.40	0.23	---	0.84	0.76	3214.59
Notes: c(7), e, g, h, k(8)											
J60-P-3A	Idle (Taxi)	---	556	1.50	1.07	70.00	10.58	---	0.02	0.02	3214.59
	Approach	---	556	1.70	1.07	50.50	6.44	---	0.02	0.02	3214.59
	Intermediate	---	1429	4.00	1.07	5.80	0.23	---	0.23	0.21	3214.59
	Military	---	3413	4.60	1.07	4.00	0.12	---	0.17	0.15	3214.59
Notes: c(7), e, g, h, k(8)											
J60-P-5A, -5B	Idle (Taxi)	---	476	1.50	1.07	70.00	10.58	---	0.02	0.02	3214.59
	Approach	---	556	1.70	1.07	50.50	6.44	---	0.02	0.02	3214.59
	Intermediate	---	1429	4.00	1.07	5.80	0.23	---	0.23	0.21	3214.59
	Military	---	2460	4.60	1.07	4.00	0.12	---	0.17	0.15	3214.59
Notes: c(7), e, g, h, k(8)											
J65-W-5F	Idle (Taxi)	---	1320	2.46	1.07	47.16	11.25	---	0.18 (S)	0.16 (S)	3214.59
	7450 rpm	---	4370	7.30	1.07	12.61	1.09	---	0.18 (S)	0.16 (S)	3214.59
	8000 rpm	---	5970	5.71	1.07	7.39	0.83	---	0.13 (S)	0.12 (S)	3214.59
	8300 rpm	---	7040	5.15	1.07	4.57	0.38	---	0.13 (S)	0.12 (S)	3214.59
	Military	---	6946	5.23	1.07	5.31	0.70	---	0.13 (S)	0.12 (S)	3214.59
Notes: c(9), d(6) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(8)											
J65-W-20	Idle (Taxi)	---	1333	2.78	1.07	50.19	4.31	---	0.18 (S)	0.16 (S)	3214.59
	75% rpm	---	2346	4.82	1.07	21.82	1.57	---	0.18 (S)	0.16 (S)	3214.59
	85% rpm	---	3260	7.27	1.07	16.13	0.32	---	0.18 (S)	0.16 (S)	3214.59
	90% rpm	---	3951	7.97	1.07	14.30	0.15	---	0.18 (S)	0.16 (S)	3214.59
	Intermediate (Mil)	---	6421	7.55	1.07	7.72	0.04	---	0.13 (S)	0.12 (S)	3214.59
Notes: c(1), d(6) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(8)											
J69-T-25	Idle (Taxi)	4%	167	0.80	1.07	160.08	2.33	1.712	3.15	2.83	3214.59
	Approach	30%	568 (C)	1.71 (C)	1.07	56.03 (C)	0.14 (C)	0.233 (C)	1.52 (C)	1.37 (C)	3214.59
	Intermediate	63%	872	2.92	1.07	38.27	0.06	0.038	0.94	0.84	3214.59
	Military	84%	1085	4.53	1.07	32.86	0.03	0.015	0.67	0.61	3214.59
Notes: c(3), d(1) - All pollutants at Approach power setting only, g, h, k(5)											
J75-P-17	Idle (Taxi)	---	1700	1.29	1.07	76.18	65.41	---	0.47	0.42	3214.59
	Approach	---	11300	11.90	1.07	1.40	0.11	---	0.10	0.09	3214.59
	Intermediate	---	12386 (C)	9.79 (C)	1.07	0.94 (C)	0.20 (C)	---	0.64 (C)	0.58 (C)	3214.59
	Military	---	13200	8.20	1.07	0.60	0.26	---	1.05	0.95	3214.59
	Afterburner	---	53700	4.10	1.07	12.00	0.14	---	1.73 (C)	1.57 (C)	3214.59
Notes: c(1), d(1) - PM <sub>10</sub> and PM <sub>2.5</sub> at Afterburner power setting only, e, g, h, j - Assumes military setting has maximum percent thrust of 100%, k(8)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs  
(cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
J79-GE-8D	Idle (Taxi)	7%	1325	2.36	1.07	55.59	16.14	---	0.44	0.40	3214.59
	75% rpm	30%	1550	2.97	1.07	30.55	4.20	---	0.90	0.81	3214.59
	87% rpm	70%	8310	8.44	1.07	2.56	0.12	---	0.15	0.14	3214.59
	Military	100%	9544	10.42	1.07	2.56	0.12	---	0.18	0.16	3214.59
	Afterburner	110-150%	34647	4.71	1.07	8.14	0.19	---	0.56	0.50	3214.59
Notes: c(13), e, j, k(8)											
J79-GE-10D	Idle (Taxi)	7%	1375	1.33	1.07	111.18	37.37	---	0.88	0.79	3214.59
	Approach	30%	3490	4.22	1.07	20.00	2.80	---	0.63	0.57	3214.59
	Intermediate	70%	7674	8.24	1.07	4.69	1.34	---	0.72	0.65	3214.59
	Military	100%	10097	10.24	1.07	2.83	1.34	---	0.72	0.65	3214.59
	Afterburner	110-150%	35339	4.50	1.07	8.63	1.01	---	0.37	0.33	3214.59
Notes: c(13), e, j, k(8)											
J79-GE-15	Idle (Taxi)	---	1111	2.50	1.07	57.00	13.80	---	0.50	0.45	3214.59
	Approach	---	3492	4.80	1.07	9.40	1.27	---	1.80	1.62	3214.59
	Intermediate	---	5397	5.60	1.07	4.60	0.35	---	2.80	2.52	3214.59
	Military	---	8889	8.90	1.07	2.20	0.23	---	2.20	1.98	3214.59
	Afterburner	---	32223	9.10	1.07	4.00	0.01	---	0.15	0.14	3214.59
Notes: c(7), e, g, h, k(8)											
J79-GE-17	Idle (Taxi)	---	1032	2.70	1.07	66.00	26.57	---	0.18	0.16	3214.59
	Approach	---	3492	4.50	1.07	15.40	0.58	---	0.51	0.46	3214.59
	Intermediate	---	6984	5.80	1.07	7.80	0.12	---	0.72	0.65	3214.59
	Military	---	9841	10.60	1.07	5.20	0.12	---	0.92	0.83	3214.59
	Afterburner	---	34921	8.10	1.07	4.00	0.01	---	0.15	0.14	3214.59
Notes: c(7), e, g, h, k(8)											
J85-GE-5A	Idle (Taxi)	4%	434	1.34	1.07	250.22	2.00	1.306	4.70	4.23	3214.59
	Approach	13% (C)	875 (C)	1.45 (C)	1.07	115.08 (C)	1.31 (C)	0.851 (C)	2.42 (C)	2.17 (C)	3214.59
	Intermediate	15%	950	1.47	1.07	104.02	0.92	0.811	1.79	1.61	3214.59
	Military	88%	2740	2.64	1.07	32.91	0.12	0.094	1.13	1.01	3214.59
	Afterburner-1	116%	8138	1.98	1.07	13.46	0.05	0.038	0.25	0.23	3214.59
Notes: c(3), d(1) - All pollutants at Approach power setting only, h, k(5)											
J85-GE-5F	Idle (Taxi)	---	524	1.34	1.07	178.05	34.46	---	4.70 (S)	4.02 (S)	3214.59
	75% rpm	---	798	2.13	1.07	78.20	2.59	---	3.01 (C)	1.84 (C)	3214.59
	85% rpm	---	1098	2.73	1.07	58.01	1.36	---	2.15 (C)	1.20 (C)	3214.59
	Intermediate	---	1297	2.31	1.07	43.02	3.99	---	1.79 (S)	0.69 (S)	3214.59
	Afterburner	---	8470	2.60	1.07	29.00	0.92	---	0.25 (S)	0.09 (S)	3214.59
Notes: c(1), d(1) - PM <sub>10</sub> and PM <sub>2.5</sub> at 75% rpm and 85% rpm power settings, d(10) - PM <sub>10</sub> and PM <sub>2.5</sub> for remaining power settings, e, k(8)											
J85-GE-5H	Idle (Taxi)	---	434	1.14	1.07	211.97	39.12	---	4.70	4.02	3214.59
	Approach	---	875 (C)	1.64 (C)	1.07	148.04 (C)	6.56 (C)	---	2.42 (C)	2.17 (C)	3214.59
	Intermediate	---	950	1.74	1.07	123.43	6.51	---	1.79	0.69	3214.59
	Military	---	2740	2.92	1.07	36.40	0.67	---	1.13	0.04	3214.59
	Afterburner	---	8138	2.09	1.07	14.19	2.63	---	0.25	0.09	3214.59
Notes: c(10), d(1) - All pollutants at Approach setting, g, h, k(8)											
J85-GE-5M	Idle (Taxi)	---	525	0.79	1.07	191.41	4.01	3.111	7.02	6.32	3214.59
	Approach	---	703 (C)	1.09 (C)	1.07	110.79 (C)	1.50 (C)	1.117 (C)	8.83 (C)	7.94 (C)	3214.59
	Intermediate	---	1045	1.81	1.07	48.90	0.54	0.450	12.30	11.07	3214.59
	Military	---	2550	1.65	1.07	25.35	0.04	0.032	4.25	3.83	3214.59
	Afterburner	---	7695	1.21	1.07	10.19	0.05 (S)	0.038 (S)	0.25 (S)	0.09 (S)	3214.59
Notes: c(10), d(1) - All pollutants at Approach setting, d(10) - VOC, HAPs, PM <sub>10</sub> and PM <sub>2.5</sub> at Afterburner power setting only, h, k(6)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
J85-GE-5R	Idle (Taxi)	---	520	1.08	1.07	177.45	16.80	---	4.70 (S)	4.23 (S)	3214.59
	Approach	---	689 (C)	0.91 (C)	1.07	119.23 (C)	7.96 (C)	---	2.42 (S)	2.17 (S)	3214.59
	Intermediate	---	1030	0.70	1.07	65.07	2.78	---	1.79 (S)	1.61 (S)	3214.59
	Military	---	2220	1.92	1.07	30.99	0.75	---	1.13 (S)	1.01 (S)	3214.59
	Afterburner	---	7695	6.23	1.07	53.43	6.97	---	0.25 (S)	0.23 (S)	3214.59
Notes: c(10), d(1) - Fuel flow, NO <sub>x</sub> , CO, and VOC at Approach setting, d(10) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(6)											
J85-GE-13	Idle (Taxi)	---	556	1.30	1.07	178.00	34.50	---	3.0E-03	2.7E-03	3214.59
	Approach	---	1230	2.05	1.07	58.30	5.69	---	0.01	0.01	3214.59
	Intermediate	---	2222	2.30	1.07	43.00	4.03	---	0.01	0.01	3214.59
	Military	---	2778	2.60	1.07	29.00	0.92	---	0.02	0.02	3214.59
	Afterburner	---	8968	2.00	1.07	26.00	0.08	---	0.01	0.01	3214.59
Notes: c(7), e, g, h, i, k(8)											
J85-GE-17A	Idle (Taxi)	---	556	1.30	1.07	178.00	34.50	---	3.0E-03 (S)	2.7E-03 (S)	3214.59
	Approach	---	1230	2.05	1.07	58.30	5.69	---	0.01 (S)	0.01 (S)	3214.59
	Intermediate	---	2222	2.30	1.07	43.00	4.03	---	0.01 (S)	0.01 (S)	3214.59
	Military	---	3810	2.60	1.07	29.00	0.92	---	0.02 (S)	0.02 (S)	3214.59
Notes: c(7), d(8) - PM <sub>10</sub> and PM <sub>2.5</sub> for all power settings, e, g, h, k(8)											
J85-GE-21	Idle (Taxi)	---	400	1.25	1.07	159.00	27.89	---	3.0E-03 (S)	2.7E-03 (S)	3214.59
	75% rpm	---	700	2.00	1.07	92.14	14.29	---	0.01 (S)	0.01 (S)	3214.59
	85% rpm	---	1200	2.92	1.07	46.17	2.97	---	0.01 (S)	0.01 (S)	3214.59
	Intermediate (Military)	---	3200	5.00	1.07	21.56	0.29	---	0.02 (S)	0.02 (S)	3214.59
	Afterburner	---	10650	5.60	1.07	36.40	0.12	---	0.01 (S)	0.01 (S)	3214.59
Notes: c(1), d(8) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, g, h, k(8)											
JT3D-3B	Idle (Taxi)	7%	1071	2.50	1.07	98.00	128.80	---	0.91	0.82	3214.59
	Approach	30%	2746	4.80	1.07	24.50	4.60	---	0.41	0.37	3214.59
	Climb out	85%	7397	9.90	1.07	2.80	2.30	---	0.80	0.72	3214.59
	Takeoff	100%	9318	12.10	1.07	1.50	4.60	---	1.28	1.15	3214.59
Notes: c(2), e, f, h, k(1)											
JT3D-7 Series	Idle (Taxi)	7%	1016	2.20	1.07	138.99	141.45	---	0.97	0.87	3214.59
	Approach	30%	3087	5.30	1.07	19.50	2.42	---	0.29	0.26	3214.59
	Climb out	85%	8191	9.59	1.07	1.90	0.46	---	0.58	0.52	3214.59
	Takeoff	100%	9952	12.69	1.07	0.89	0.58	---	0.76	0.68	3214.59
Notes: c(2), e, f, h, k(1)											
JT8D-7 Series	Idle (Taxi)	7%	1025	2.70	1.07	35.50	12.19	---	0.23	0.20	3214.59
	Approach	30%	2271	5.50	1.07	10.50	1.84	---	0.22	0.20	3214.59
	Climb out	85%	6439	13.50	1.07	2.00	0.58	---	0.31	0.28	3214.59
	Takeoff	100%	7851	17.10	1.07	1.50	0.46	---	0.32	0.28	3214.59
Notes: c(2), e, f, h, k(1)											
JT8D-9 Series	Idle (Taxi)	7%	1048	2.90	1.07	34.50	11.50	---	0.23	0.20	3214.59
	Approach	30%	2365	5.64	1.07	9.43	1.99	---	0.24	0.21	3214.59
	Climb out	85%	6714	14.21	1.07	1.66	0.54	---	0.31	0.28	3214.59
	Takeoff	100%	8254	17.92	1.07	1.24	0.54	---	0.33	0.30	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
JT8D-9A	Idle (Taxi)	7%	1155	2.89	1.07	14.11	2.95	---	0.21	0.19	3214.59
	Approach	30%	2409	5.99	1.07	2.14	0.57	---	0.25	0.23	3214.59
	Intermediate	70%	6794	14.47	1.07	1.07	0.16	---	0.27	0.24	3214.59
	Military	100%	8334	19.26	1.07	1.07	0.16	---	0.27	0.24	3214.59
Notes: c(13), j, k(8)											
JT8D-11	Idle (Taxi)	7%	1155	2.75	1.07	35.00	11.50	---	0.23	0.20	3214.59
	Approach	30%	2650	5.80	1.07	9.40	1.61	---	0.22	0.19	3214.59
	Climb out	85%	7251	14.60	1.07	1.90	0.52	---	0.31	0.28	3214.59
	Takeoff	100%	8897	18.90	1.07	1.20	0.46	---	0.32	0.29	3214.59
Notes: c(2), e, f, h, k(1)											
JT8D-15	Idle (Taxi)	7%	1172	3.00	1.07	35.20	12.65	---	0.24	0.21	3214.59
	Approach	30%	2701	5.90	1.07	9.60	1.90	---	0.24	0.21	3214.59
	Climb out	85%	7500	15.00	1.07	1.00	0.29	---	0.31	0.28	3214.59
	Takeoff	100%	9349	19.10	1.07	0.70	0.29	---	0.32	0.29	3214.59
Notes: c(2), e, f, h, k(1)											
JT8D-15A	Idle (Taxi)	7%	1089	3.10	1.07	12.93	2.14	---	0.13	0.12	3214.59
	Approach	30%	2476	6.60	1.07	2.90	0.75	---	0.14	0.12	3214.59
	Climb out	85%	7107	13.90	1.07	1.20	0.38	---	0.22	0.19	3214.59
	Takeoff	100%	8849	18.10	1.07	1.08	0.29	---	0.22	0.20	3214.59
Notes: c(2), e, f, h, k(1)											
JT8D-17	Idle (Taxi)	7%	1170	3.20	1.07	10.46	1.44	---	0.13	0.12	3214.59
	Approach	30%	2810	8.00	1.07	2.67	0.60	---	0.14	0.12	3214.59
	Climb out	85%	7913	15.70	1.07	1.10	0.31	---	0.22	0.20	3214.59
	Takeoff	100%	9881	20.60	1.07	0.95	0.25	---	0.23	0.20	3214.59
Notes: c(2), e, f, h, k(1)											
JT8D-17A	Idle (Taxi)	7%	1112	3.20	1.07	12.46	7.59	---	0.17	0.15	3214.59
	Approach	30%	2622	6.70	1.07	2.88	0.74	---	0.14	0.13	3214.59
	Climb out	85%	7416	14.30	1.07	1.16	0.35	---	0.22	0.20	3214.59
	Takeoff	100%	9310	19.10	1.07	1.07	0.29	---	0.23	0.21	3214.59
Notes: c(2), e, f, h, k(1)											
JT8D-17AR	Idle (Taxi)	7%	1172	3.20	1.07	10.70	1.53	---	0.15	0.13	3214.59
	Approach	30%	2837	8.00	1.07	2.68	0.63	---	0.15	0.13	3214.59
	Climb out	85%	8310	16.00	1.07	1.08	0.31	---	0.25	0.22	3214.59
	Takeoff	100%	10833	24.50	1.07	0.93	0.24	---	0.25	0.23	3214.59
Notes: c(2), e, f, h, k(1)											
JT8D-17R	Idle (Taxi)	7%	1230	3.30	1.07	9.43	1.09	---	0.15	0.13	3214.59
	Approach	30%	2980	8.40	1.07	2.54	0.61	---	0.15	0.13	3214.59
	Climb out	85%	8754	17.60	1.07	1.03	0.31	---	0.25	0.22	3214.59
	Takeoff	100%	11246	25.30	1.07	0.95	0.24	---	0.25	0.23	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
JT8D-209	Idle (Taxi)	7%	1034	3.50	1.07	14.10	4.63	---	0.13	0.12	3214.59
	Approach	30%	2851	8.80	1.07	4.37	1.94	---	0.19	0.17	3214.59
	Climb out	85%	7800	19.00	1.07	1.40	0.58	---	0.21	0.19	3214.59
	Takeoff	100%	9452	22.80	1.07	1.03	0.40	---	0.21	0.19	3214.59
Notes: c(2), e, f, h, k(1)											
JT8D-217, -217A	Idle (Taxi)	7%	1089	4.57	1.07	15.31	0.00	---	0.07	0.06	3214.59
	Approach	30%	3042	7.66	1.07	3.54	0.00	---	0.06	0.06	3214.59
	Climb out	85%	8556	13.54	1.07	0.47	0.00	---	0.10	0.09	3214.59
	Takeoff	100%	10476	17.54	1.07	0.42	0.00	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
JT8D-217C	Idle (Taxi)	7%	1087	4.05	1.07	17.89	0.00	---	0.04	0.03	3214.59
	Approach	30%	2881	7.65	1.07	3.79	0.00	---	0.06	0.05	3214.59
	Climb out	85%	8294	13.02	1.07	0.49	0.00	---	0.08	0.07	3214.59
	Takeoff	100%	10175	16.49	1.07	0.42	0.00	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
JT8D-219	Idle (Taxi)	7%	1067	3.60	1.07	12.63	4.00	---	0.16	0.14	3214.59
	Approach	30%	3029	9.13	1.07	4.07	1.83	---	0.20	0.18	3214.59
	Climb out	85%	8611	20.80	1.07	1.20	0.48	---	0.25	0.22	3214.59
	Takeoff	100%	10746	27.00	1.07	0.73	0.31	---	0.25	0.22	3214.59
Notes: c(2), e, f, h, k(1)											
JT9D-7	Idle (Taxi)	7%	1667	3.10	1.07	84.10	41.98	---	0.27	0.24	3214.59
	Approach	30%	4833	7.60	1.07	7.80	1.50	---	0.13	0.11	3214.59
	Climb out	85%	14000	27.70	1.07	0.00	0.12	---	0.09	0.08	3214.59
	Takeoff	100%	16532	37.90	1.07	0.00	0.12	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
JT9D-7A	Idle (Taxi)	7%	1675	3.10	1.07	83.60	41.52	---	0.27	0.24	3214.59
	Approach	30%	4913	7.60	1.07	7.60	1.50	---	0.13	0.11	3214.59
	Climb out	85%	14199	28.50	1.07	0.00	0.12	---	0.09	0.08	3214.59
	Takeoff	100%	16659	38.70	1.07	0.00	0.12	---	0.11	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
JT9D-7F	Idle (Taxi)	7%	1841	3.20	1.07	68.60	29.79	---	0.24	0.21	3214.59
	Approach	30%	4952	9.10	1.07	5.80	0.69	---	0.10	0.09	3214.59
	Climb out	85%	14119	31.50	1.07	0.90	0.00	---	0.11	0.10	3214.59
	Takeoff	100%	17151	41.70	1.07	0.90	0.00	---	0.11	0.10	3214.59
Notes: c(2), e, f, h, k(1)											
JT9D-7J	Idle (Taxi)	7%	1889	3.30	1.07	66.70	28.18	---	0.23	0.21	3214.59
	Approach	30%	5389	9.40	1.07	5.50	0.58	---	0.10	0.09	3214.59
	Climb out	85%	15095	34.90	1.07	0.90	0.00	---	0.11	0.10	3214.59
	Takeoff	100%	18373	44.90	1.07	0.90	0.00	---	0.11	0.10	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
JT9D-7Q	Idle (Taxi)	7%	1881	3.00	1.07	53.00	13.80	---	0.13	0.12	3214.59
	Approach	30%	5400	7.80	1.07	1.70	0.35	---	0.07	0.06	3214.59
	Climb out	85%	15870	25.60	1.07	0.20	0.23	---	0.09	0.08	3214.59
	Takeoff	100%	19380	31.60	1.07	0.20	0.23	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
JT9D-7R4D, -7R4D1	Idle (Taxi)	7%	1630	4.10	1.07	8.84	1.44	---	0.06	0.05	3214.59
	Approach	30%	5233	9.80	1.07	1.36	0.15	---	0.05	0.05	3214.59
	Climb out	85%	13318	30.00	1.07	0.48	0.14	---	0.06	0.06	3214.59
	Takeoff	100%	16310	38.50	1.07	0.51	0.17	---	0.07	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
JT9D-7R4E, -7R4E1	Idle (Taxi)	7%	1754	4.10	1.07	8.27	1.28	---	0.06	0.05	3214.59
	Approach	30%	5182	10.40	1.07	1.23	0.15	---	0.05	0.05	3214.59
	Climb out	85%	13683	34.20	1.07	0.53	0.15	---	0.07	0.06	3214.59
	Takeoff	100%	16810	41.60	1.07	0.57	0.18	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
JT9D-7R4E4	Idle (Taxi)	7%	1750	3.50	1.07	16.00	3.85	---	0.07	0.06	3214.59
	Approach	30%	5079	8.50	1.07	1.46	0.25	---	0.06	0.05	3214.59
	Climb out	85%	14516	29.70	1.07	0.67	0.15	---	0.06	0.06	3214.59
	Takeoff	100%	17603	36.90	1.07	0.67	0.17	---	0.07	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
JT9D-7R4G2	Idle (Taxi)	7%	1777	3.80	1.07	11.82	1.78	---	0.06	0.06	3214.59
	Approach	30%	5230	8.80	1.07	1.40	0.21	---	0.06	0.05	3214.59
	Climb out	85%	14921	29.50	1.07	0.63	0.16	---	0.08	0.07	3214.59
	Takeoff	100%	19278	41.30	1.07	0.74	0.17	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
JT9D-7R4H1	Idle (Taxi)	7%	1948	3.80	1.07	11.63	1.70	---	0.06	0.06	3214.59
	Approach	30%	5736	8.90	1.07	1.39	0.21	---	0.06	0.06	3214.59
	Climb out	85%	15865	30.00	1.07	0.63	0.16	---	0.08	0.07	3214.59
	Takeoff	100%	19937	45.20	1.07	0.74	0.17	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
JT9D-20	Idle (Taxi)	7%	1675	3.10	1.07	83.60	41.52	---	0.27	0.24	3214.59
	Approach	30%	4913	7.60	1.07	7.60	1.50	---	0.13	0.11	3214.59
	Climb out	85%	14199	28.50	1.07	0.00	0.12	---	0.09	0.08	3214.59
	Takeoff	100%	16659	38.70	1.07	0.00	0.12	---	0.11	0.09	3214.59
Notes: c(2), e, f, h, k(2)											
JT9D-20J	Idle (Taxi)	7%	1889	3.30	1.07	66.70	28.18	---	0.23	0.21	3214.59
	Approach	30%	5389	9.40	1.07	5.50	0.58	---	0.10	0.09	3214.59
	Climb out	85%	15095	34.90	1.07	0.90	0.00	---	0.11	0.10	3214.59
	Takeoff	100%	18373	44.90	1.07	0.90	0.00	---	0.11	0.10	3214.59
Notes: c(2), e, f, h, k(1)											



**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
JT9D-59A, -70A	Idle (Taxi)	7%	1881	3.00	1.07	53.00	13.80	---	0.13	0.12	3214.59
	Approach	30%	5400	7.80	1.07	1.70	0.35	---	0.07	0.06	3214.59
	Climb out	85%	15870	25.60	1.07	0.20	0.23	---	0.09	0.08	3214.59
	Takeoff	100%	19380	31.60	1.07	0.20	0.23	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
JT15D-1 Series	Idle (Taxi)	7%	183	1.75	1.07	132.00	58.08	---	0.39	0.35	3214.59
	Approach	30%	405	3.44	1.07	40.50	5.09	---	0.32	0.29	3214.59
	Climb out	85%	984	6.77	1.07	3.50	0.01	---	0.11	0.10	3214.59
	Takeoff	100%	1175	7.60	1.07	2.65	0.01	---	0.11	0.10	3214.59
Notes: c(2), e, f, h, k(2)											
JT15D-4 Series	Idle (Taxi)	7%	207	2.63	1.07	97.00	46.00	---	0.32	0.29	3214.59
	Approach	30%	468	5.29	1.07	32.00	5.92	---	0.36	0.32	3214.59
	Climb out	85%	1135	8.56	1.07	3.18	0.22	---	0.12	0.11	3214.59
	Takeoff	100%	1347	9.23	1.07	2.10	0.10	---	0.11	0.10	3214.59
Notes: c(2), e, f, h, k(2)											
JT15D-5, -5A, -5B	Idle (Taxi)	7%	235	1.66	1.07	119.20	136.97	---	0.82	0.74	3214.59
	Approach	30%	524	4.93	1.07	38.60	13.46	---	0.73	0.66	3214.59
	Climb out	85%	1371	10.08	1.07	1.15	1.50	---	0.23	0.21	3214.59
	Takeoff	100%	1630	11.13	1.07	0.00	0.00	---	0.13	0.12	3214.59
Notes: c(2), e, f, h, k(2)											
LF507-1F	Idle (Taxi)	7%	360	3.28	1.07	37.83	5.43	---	0.13	0.12	3214.59
	Approach	30%	860	6.39	1.07	4.43	0.14	---	0.09	0.09	3214.59
	Climb out	85%	2350	12.02	1.07	0.30	0.01	---	0.09	0.08	3214.59
	Takeoff	100%	2840	14.52	1.07	0.20	0.01	---	0.08	0.08	3214.59
Notes: c(2), e, f, h, k(8)											
NK-8-2U	Idle (Taxi)	7%	1905	2.70	1.07	116.00	119.37	---	0.82	0.74	3214.59
	Approach	30%	4603	5.40	1.07	21.00	5.75	---	0.43	0.39	3214.59
	Climb out	85%	9286	12.90	1.07	6.00	0.63	---	0.35	0.31	3214.59
	Takeoff	100%	13889	13.90	1.07	5.50	0.52	---	0.36	0.33	3214.59
Notes: c(2), e, f, h, k(8)											
O-200	Idle (Taxi)	<40%	8	1.58	1.07	644.42	33.36	---	0.55 (S)	0.49 (S)	3214.59
	Approach	40%	26	1.14	1.07	1187.84	38.20	---	0.13 (S)	0.12 (S)	3214.59
	Climb out	75-100%	45	4.87	1.07	974.10	23.93	---	0.17 (S)	0.16 (S)	3214.59
	Takeoff	100%	45	4.87	1.07	974.10	23.93	---	0.21 (S)	0.19 (S)	3214.59
Notes: c(1), d(25) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, j, k(8)											
O-200A	Idle (Taxi)	31%	9	0.93	1.07	969.24	198.77	---	0.55	0.49	3214.59
	Approach	71%	26	3.81	1.07	926.54	55.21	---	0.13	0.12	3214.59
	Climb out	96%	49	4.70	1.07	1047.01	56.02	---	0.17	0.16	3214.59
	Takeoff	100%	53	3.90	1.07	1033.41	55.30	---	0.21	0.19	3214.59
Notes: c(16), e, g, h, k(7)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
O-320	Idle (Taxi)	<40%	9	0.52	1.07	1077.00	42.46	---	0.47 (S)	0.42 (S)	3214.59
	Approach	40%	47	0.95	1.07	1221.51	22.13	---	0.27 (S)	0.24 (S)	3214.59
	Climb out	75-100%	67	3.97	1.07	989.51	14.24	---	0.20 (S)	0.18 (S)	3214.59
	Takeoff	100%	89	2.19	1.07	1077.44	13.55	---	0.20 (S)	0.18 (S)	3214.59
Notes: c(1), d(9) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, j, k(8)											
O-320-A2B, -320-B2B, -320-D2A	Idle (Taxi)	34%	10	1.63	1.07	766.81	111.03	---	0.47	0.42	3214.59
	Approach	70%	34	7.25	1.07	769.65	45.56	---	0.27	0.24	3214.59
	Climb out	100%	81	7.96	1.07	904.75	40.87	---	0.20	0.18	3214.59
	Takeoff	100%	81	7.96	1.07	904.75	40.87	---	0.20	0.18	3214.59
Notes: c(16), e, g, h, k(7)											
O-320-D2J	Idle (Taxi)	---	8	1.94	1.07	707.12	127.12	---	0.02	0.02	3214.59
	Approach	---	34 (S)	7.25 (S)	1.07	769.65 (S)	45.56 (S)	---	0.27 (S)	0.24 (S)	3214.59
	Climb out	---	81 (S)	7.96 (S)	1.07	904.75 (S)	40.87 (S)	---	0.20 (S)	0.18 (S)	3214.59
	Takeoff	---	81 (S)	7.96 (S)	1.07	904.75 (S)	40.87 (S)	---	0.20 (S)	0.18 (S)	3214.59
Notes: c(16), d(9) - All fuel flow rates and pollutants at Approach, Climb out, and Takeoff power settings, e, g, h, k(7)											
O-320-D3G	Idle (Taxi)	33%	9	1.19	1.07	771.19	79.91	---	0.21	0.19	3214.59
	Approach	65%	27	14.03	1.07	599.45	49.43	---	0.09	0.08	3214.59
	Climb out	101%	82	19.46	1.07	649.65	51.31	---	0.12	0.11	3214.59
	Takeoff	101%	82	19.46	1.07	649.65	51.31	---	0.12	0.11	3214.59
Notes: c(16), e, g, h, k(7)											
O-320-E2A	Idle (Taxi)	---	10	1.64	1.07	689.60	18.34	---	0.05	0.05	3214.59
	Approach	---	38	19.44	1.07	695.60	15.74	---	0.04	0.04	3214.59
	Climb out	---	63	6.92	1.07	836.60	17.32	---	0.07	0.06	3214.59
	Takeoff	---	79	6.68	1.07	815.50	14.50	---	0.10	0.09	3214.59
Notes: c(16), e, g, h, k(7)											
O-320-E2D	Idle (Taxi)	33%	10	1.49	1.07	756.45	118.10	---	0.39	0.35	3214.59
	Approach	68%	33	4.62	1.07	836.50	45.72	---	0.42	0.38	3214.59
	Climb out	100%	83	4.43	1.07	1020.21	35.43	---	0.16	0.14	3214.59
	Takeoff	100%	83	4.43	1.07	1020.21	35.43	---	0.16	0.14	3214.59
Notes: c(16), e, g, h, k(7)											
O-320-E3D	Idle (Taxi)	26%	7	0.59	1.07	706.42	197.76	---	0.19	0.17	3214.59
	Approach	67%	29	2.55	1.07	762.97	50.07	---	0.20	0.18	3214.59
	Climb out	100%	82	5.60	1.07	941.15	46.63	---	0.29	0.26	3214.59
	Takeoff	100%	82	5.60	1.07	941.15	46.63	---	0.29	0.26	3214.59
Notes: c(16), e, g, h, k(7)											
O-320-H2AD	Idle (Taxi)	35%	10	3.45	1.07	713.64	103.42	---	0.18	0.16	3214.59
	Approach	79%	44	7.94	1.07	718.04	39.68	---	0.30	0.27	3214.59
	Climb out	95%	69	3.95	1.07	941.82	41.35	---	0.16	0.15	3214.59
	Takeoff	95%	69	3.95	1.07	941.82	41.35	---	0.16	0.15	3214.59
Notes: c(16), e, g, h, k(7)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
O-470C	Idle (Taxi)	---	11	1.91	1.07	592.20	159.00	---	0.50	0.45	3214.59
	Approach	---	61	3.77	1.07	995.10	13.01	---	0.40	0.36	3214.59
	Climb out	---	99	4.32	1.07	960.80	10.98	---	0.07	0.06	3214.59
	Takeoff	---	133	2.71	1.07	1082.00	10.55	---	0.10	0.09	3214.59
Notes: c(16), e, g, h, k(8)											
PT6A-27	Idle (Taxi)	<30%	115	2.43	1.07	64.00	57.70	---	0.50 (S)	0.45 (S)	3214.59
	Approach	30%	215	8.37	1.07	23.26	2.51	---	0.10 (S)	0.09 (S)	3214.59
	Climb out	90%	400	7.00	1.07	1.20	0.00	---	0.25 (S)	0.23 (S)	3214.59
	Takeoff	100%	425	7.81	1.07	1.01	0.00	---	0.24 (S)	0.22 (S)	3214.59
Notes: c(1), d(15) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, j, k(8)											
PT6A-38	Idle (Taxi)	7%	103	2.09	1.07	82.44	2.09	---	0.50	0.45	3214.59
	Approach	30%	275	4.79	1.07	7.29	9.6E-05	---	0.10	0.09	3214.59
	Climb out	70%	450	6.69	1.07	2.17	9.6E-05	---	0.25	0.23	3214.59
	Takeoff	90%	489	7.08	1.07	2.05	9.6E-05	---	0.24	0.22	3214.59
Notes: c(13), j, k(8)											
PT6A-41	Idle (Taxi)	<30%	147	1.97	1.07	115.31	116.88	---	0.50 (S)	0.45 (S)	3214.59
	Approach	30%	273	4.65	1.07	34.80	26.12	---	0.10 (S)	0.09 (S)	3214.59
	Climb out	90%	473	7.57	1.07	6.49	2.33	---	0.25 (S)	0.23 (S)	3214.59
	Takeoff	100%	510	7.98	1.07	5.10	2.01	---	0.24 (S)	0.22 (S)	3214.59
Notes: c(1), d(15) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, j, k(8)											
PT6A-42	Idle (Taxi)	7%	103	2.16	1.07	76.55	16.61	---	0.45	0.41	3214.59
	Approach	30%	275	4.89	1.07	6.89	9.6E-05	---	0.10	0.09	3214.59
	Intermediate	70%	466	6.88	1.07	1.95	9.6E-05	---	0.24	0.22	3214.59
	Military	90%	513	7.28	1.07	1.95	9.6E-05	---	0.23	0.21	3214.59
Notes: c(13), j, k(8)											
PT6A-60A	Idle (Taxi)	---	480	2.98	1.07	42.18	166.43	---	0.09	0.08	3214.59
	Approach	---	340 (S)	4.59 (S)	1.07	20.86 (S)	3.31 (S)	---	0.74 (S)	0.67 (S)	3214.59
	Climb out	---	571 (S)	6.69 (S)	1.07	6.72 (S)	0.72 (S)	---	0.29 (S)	0.26 (S)	3214.59
	Takeoff	---	633 (S)	7.08 (S)	1.07	5.36 (S)	0.53 (S)	---	0.26 (S)	0.23 (S)	3214.59
Notes: c(16), d(11) - All fuel flow rates and pollutants at Approach, Climb out, and Takeoff power settings, e, g, h, k(1)											
PT6A-65	Idle (Taxi)	7%	131	1.89	1.07	166.43	53.66	---	1.23	1.11	3214.59
	Approach	30%	340	4.59	1.07	20.86	3.31	---	0.74	0.67	3214.59
	Intermediate	70%	571	6.69	1.07	6.72	0.72	---	0.29	0.26	3214.59
	Military	90%	633	7.08	1.07	5.36	0.53	---	0.26	0.23	3214.59
Notes: c(13), j, k(8)											
PT6A-67B	Idle (Taxi)	7%	143	1.83	1.07	183.80	61.52	---	1.38	1.24	3214.59
	Approach	30%	364	4.59	1.07	20.96	3.24	---	0.72	0.65	3214.59
	Intermediate	70%	619	6.59	1.07	6.12	0.61	---	0.32	0.29	3214.59
	Military	90%	681	6.98	1.07	5.73	0.45	---	0.25	0.23	3214.59
Notes: c(13), j, k(8)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
PT6A-67D	Idle (Taxi)	7%	149	1.83	1.07	177.91	57.94	---	1.31	1.18	3214.59
	Approach	30%	372	4.69	1.07	19.76	2.93	---	0.66	0.59	3214.59
	Intermediate	70%	643	6.69	1.07	5.35	0.50	---	0.28	0.25	3214.59
	Military	90%	713	7.18	1.07	5.09	0.35	---	0.24	0.22	3214.59
Notes: c(13), j, k(8)											
PT6A-68	Ground Idle	2%	156	1.77	1.07	117.85	7.89	6.571	3.95	3.56	3214.59
	Flight Idle	3%	180	1.95	1.07	94.99	1.33	7.546	4.18	3.76	3214.59
	Descend	19%	328	5.03	1.07	33.69	3.29	3.208	4.15	3.73	3214.59
	Approach	46%	449	4.73	1.07	10.91	0.71	0.697	3.34	3.01	3214.59
	Max. Continuous	88%	612	8.18	1.07	3.88	0.20	0.104	4.30	3.87	3214.59
Notes: c(11), h, j - Percent hp calculated assuming maximum hp of 1250 per manufacturer's stated specifications, k(6)											
PW306A	Idle (Taxi)	7%	335	4.26	1.07	36.35	5.01	---	0.07	0.06	3214.59
	Approach	30%	773	11.87	1.07	7.11	0.00	---	0.04	0.03	3214.59
	Climb out	85%	2096	19.26	1.07	2.51	0.00	---	0.05	0.05	3214.59
	Takeoff	100%	2517	20.08	1.07	2.27	0.00	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(2)											
PW308A	Idle (Taxi)	7%	353	3.65	1.07	38.21	7.61	---	0.14	0.12	3214.59
	Approach	30%	980	8.03	1.07	4.08	0.02	---	0.11	0.10	3214.59
	Climb out	85%	2374	14.06	1.07	1.06	0.00	---	0.44	0.39	3214.59
	Takeoff	100%	2860	16.74	1.07	0.83	0.00	---	0.39	0.35	3214.59
Notes: c(2), e, f, h, k(1)											
PW2037	Idle (Taxi)	7%	1206	4.10	1.07	22.36	2.21	---	0.06	0.05	3214.59
	Approach	30%	3635	9.77	1.07	1.95	0.13	---	0.06	0.06	3214.59
	Climb out	85%	10373	23.96	1.07	0.34	0.02	---	0.09	0.08	3214.59
	Takeoff	100%	12468	29.41	1.07	0.33	0.02	---	0.06	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
PW2040	Idle (Taxi)	4%	978	3.76	1.07	22.70	0.37	0.291	10.67	8.75	3214.59
	Approach	31%	4645	15.49	1.07	0.51	0.05	0.019	5.53	5.10	3214.59
	Intermediate	68%	10408	32.72	1.07	0.32	0.04	0.012	2.31	1.42	3214.59
	Takeoff	100%	13905	35.04	1.07	0.32	0.01	0.006 (C)	0.06	0.05	3214.59
Notes: c(2) - Pollutants at Takeoff power setting, c(3) - PW2040 is the commercial designation of the F117-PW-100 engine, d(1) - HAPs at Takeoff power setting only, k(5)											
PW2041	Idle (Taxi)	7%	1388	4.49	1.07	23.05	2.13	---	0.15	0.14	3214.59
	Approach	30%	4184	10.98	1.07	2.49	0.15	---	0.13	0.12	3214.59
	Climb out	70%	12345	28.94	1.07	0.20	0.03	---	0.12	0.11	3214.59
	Takeoff	100%	15362	36.92	1.07	0.20	0.03	---	0.12	0.11	3214.59
Notes: c(13), j, k(8)											
PW4056	Idle (Taxi)	7%	1492	5.00	1.07	11.60	0.76	---	0.08	0.07	3214.59
	Approach	30%	5135	11.60	1.07	0.90	0.29	---	0.08	0.07	3214.59
	Climb out	85%	15722	24.60	1.07	0.14	0.20	---	0.12	0.11	3214.59
	Takeoff	100%	19437	32.50	1.07	0.08	0.13	---	0.12	0.11	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
PW4060	Idle (Taxi)	7%	1635	3.72	1.07	44.46	13.37	---	0.11	0.10	3214.59
	Approach	30%	5524	11.91	1.07	2.04	0.12	---	0.05	0.04	3214.59
	Climb out	85%	16159	25.03	1.07	0.49	0.07	---	0.07	0.06	3214.59
	Takeoff	100%	20373	31.74	1.07	0.58	0.09	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
PW4062	Idle (Taxi)	7%	1667	3.78	1.07	42.61	12.49	---	0.11	0.10	3214.59
	Approach	30%	5698	12.17	1.07	1.93	0.10	---	0.05	0.04	3214.59
	Climb out	85%	16865	25.98	1.07	0.50	0.08	---	0.07	0.06	3214.59
	Takeoff	100%	21627	34.36	1.07	0.61	0.09	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
PW4074	Idle (Taxi)	7%	1810	4.20	1.07	21.00	3.68	---	0.06	0.05	3214.59
	Approach	30%	6310	11.00	1.07	0.40	0.23	---	0.05	0.05	3214.59
	Climb out	85%	18794	31.50	1.07	0.10	0.12	---	0.06	0.05	3214.59
	Takeoff	100%	23008	38.10	1.07	0.10	0.12	---	0.07	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
PW4074D	Idle (Taxi)	7%	2421	3.80	1.07	26.34	3.59	---	0.06	0.05	3214.59
	Approach	30%	6897	11.35	1.07	0.96	0.05	---	0.04	0.04	3214.59
	Climb out	85%	19611	32.71	1.07	0.35	0.02	---	0.05	0.04	3214.59
	Takeoff	100%	24143	42.46	1.07	0.30	0.02	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
PW4077	Idle (Taxi)	7%	1841	4.20	1.07	20.20	3.45	---	0.06	0.05	3214.59
	Approach	30%	6476	11.30	1.07	0.40	0.23	---	0.05	0.05	3214.59
	Climb out	85%	19460	32.50	1.07	0.10	0.12	---	0.06	0.05	3214.59
	Takeoff	100%	23960	39.80	1.07	0.10	0.12	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
PW4077D	Idle (Taxi)	7%	1937	3.83	1.07	32.62	5.36	---	0.07	0.06	3214.59
	Approach	30%	6627	12.10	1.07	0.60	0.08	---	0.05	0.04	3214.59
	Climb out	85%	19897	35.82	1.07	0.25	0.05	---	0.05	0.05	3214.59
	Takeoff	100%	24460	44.74	1.07	0.22	0.03	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
PW4084	Idle (Taxi)	7%	1921	4.40	1.07	18.73	3.11	---	0.06	0.05	3214.59
	Approach	30%	6944	12.00	1.07	0.40	0.23	---	0.05	0.05	3214.59
	Climb out	85%	21341	35.50	1.07	0.10	0.12	---	0.07	0.06	3214.59
	Takeoff	100%	27072	45.00	1.07	0.10	0.12	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(1)											
PW4084D	Idle (Taxi)	7%	2048	4.08	1.07	25.74	3.78	---	0.06	0.05	3214.59
	Approach	30%	7198	12.70	1.07	0.48	0.07	---	0.05	0.04	3214.59
	Climb out	85%	21992	39.47	1.07	0.24	0.03	---	0.05	0.05	3214.59
	Takeoff	100%	27865	53.02	1.07	0.18	0.03	---	0.06	0.06	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
PW4090	Idle (Taxi)	7%	2683	4.48	1.07	11.94	0.79	---	0.04	0.04	3214.59
	Approach	30%	7770	12.74	1.07	0.55	0.05	---	0.04	0.04	3214.59
	Climb out	85%	23778	41.17	1.07	0.31	0.02	---	0.06	0.05	3214.59
	Takeoff	100%	31159	57.52	1.07	0.27	0.02	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
PW4098	Idle (Taxi)	7%	2548	7.78	1.07	6.48	0.00	---	0.04	0.03	3214.59
	Approach	30%	8532	14.89	1.07	0.70	0.00	---	0.05	0.05	3214.59
	Climb out	85%	25754	36.45	1.07	0.21	0.00	---	0.07	0.07	3214.59
	Takeoff	100%	32841	51.29	1.07	0.16	0.00	---	0.06	0.06	3214.59
Notes: c(2), e, f, h, k(1)											
PW4152	Idle (Taxi)	7%	1405	4.90	1.07	12.76	0.85	---	0.07	0.07	3214.59
	Approach	30%	4706	11.10	1.07	1.09	0.17	---	0.07	0.06	3214.59
	Climb out	85%	14167	22.70	1.07	0.17	0.18	---	0.11	0.10	3214.59
	Takeoff	100%	17278	26.90	1.07	0.12	0.15	---	0.11	0.10	3214.59
Notes: c(2), e, f, h, k(1)											
PW4156	Idle (Taxi)	7%	1492	5.00	1.07	11.60	0.76	---	0.08	0.07	3214.59
	Approach	30%	5135	11.60	1.07	0.90	0.29	---	0.08	0.07	3214.59
	Climb out	70%	15722	24.60	1.07	0.14	0.20	---	0.12	0.11	3214.59
	Takeoff	100%	19437	32.50	1.07	0.08	0.13	---	0.12	0.11	3214.59
Notes: c(2), e, f, h, k(1)											
PW4158	Idle (Taxi)	7%	1675	4.80	1.07	20.99	2.05	---	0.07	0.06	3214.59
	Approach	30%	5413	11.80	1.07	1.88	0.16	---	0.06	0.05	3214.59
	Climb out	85%	15905	23.70	1.07	0.54	0.02	---	0.07	0.07	3214.59
	Takeoff	100%	19691	30.20	1.07	0.40	0.10	---	0.08	0.07	3214.59
Notes: c(2), e, f, h, k(1)											
PW4164	Idle (Taxi)	7%	1667	4.03	1.07	26.67	5.13	---	0.07	0.06	3214.59
	Approach	30%	5984	14.10	1.07	1.86	0.18	---	0.05	0.05	3214.59
	Climb out	85%	17294	31.66	1.07	0.79	0.05	---	0.05	0.05	3214.59
	Takeoff	100%	20841	38.57	1.07	0.69	0.03	---	0.05	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
PW4164-1D	Idle (Taxi)	7%	1929	3.79	1.07	17.13	1.66	---	0.05	0.04	3214.59
	Approach	30%	6151	12.10	1.07	1.55	0.07	---	0.04	0.04	3214.59
	Climb out	85%	17770	20.97	1.07	0.17	0.00	---	0.06	0.05	3214.59
	Takeoff	100%	21595	26.31	1.07	0.16	0.00	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
PW4168, -4168A	Idle (Taxi)	7%	1754	4.15	1.07	23.51	3.78	---	0.06	0.05	3214.59
	Approach	30%	6333	14.66	1.07	1.75	0.17	---	0.05	0.05	3214.59
	Climb out	85%	18468	33.91	1.07	0.74	0.05	---	0.05	0.05	3214.59
	Takeoff	100%	22508	42.39	1.07	0.72	0.03	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
PW4168-1D, -4168A-1D	Idle (Taxi)	7%	2000	4.08	1.07	14.78	1.09	---	0.04	0.04	3214.59
	Approach	30%	6492	12.39	1.07	1.26	0.06	---	0.04	0.04	3214.59
	Climb out	85%	19032	22.31	1.07	0.18	0.00	---	0.06	0.06	3214.59
	Takeoff	100%	23310	30.15	1.07	0.17	0.00	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
PW4170	Idle (Taxi)	7%	2024	4.18	1.07	14.04	0.95	---	0.04	0.04	3214.59
	Approach	30%	6611	12.49	1.07	1.17	0.06	---	0.04	0.04	3214.59
	Climb out	85%	19445	22.84	1.07	0.18	0.00	---	0.06	0.06	3214.59
	Takeoff	100%	23960	31.40	1.07	0.18	0.00	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(1)											
PW4460	Idle (Taxi)	7%	1690	4.90	1.07	20.32	1.91	---	0.07	0.06	3214.59
	Approach	30%	5579	12.00	1.07	1.78	0.16	---	0.06	0.05	3214.59
	Climb out	85%	16548	24.70	1.07	0.51	0.03	---	0.07	0.07	3214.59
	Takeoff	100%	21008	32.80	1.07	0.37	0.12	---	0.08	0.08	3214.59
Notes: c(2), e, f, h, k(1)											
PW6122A	Idle (Taxi)	7%	865	3.08	1.07	24.68	0.01	---	0.10	0.09	3214.59
	Approach	30%	2413	5.95	1.07	3.99	1.2E-03	---	0.08	0.07	3214.59
	Climb out	85%	6825	13.40	1.07	0.72	1.2E-03	---	0.14	0.12	3214.59
	Takeoff	100%	8310	17.04	1.07	0.74	0.00	---	0.13	0.12	3214.59
Notes: c(2), e, f, h, k(1)											
PW6124A	Idle (Taxi)	7%	905	3.58	1.07	25.19	2.3E-03	---	0.09	0.08	3214.59
	Approach	30%	2579	6.88	1.07	3.69	1.2E-03	---	0.08	0.07	3214.59
	Climb out	85%	7452	15.85	1.07	0.81	2.3E-03	---	0.15	0.13	3214.59
	Takeoff	100%	9278	21.03	1.07	0.68	0.00	---	0.15	0.13	3214.59
Notes: c(2), e, f, h, k(1)											
R-1820-82	Idle (Taxi)	---	89	0.00	1.07	474.16	173.15	---	0.10 (S)	0.09 (S)	3214.59
	Approach	---	323	6.50	1.07	384.83	6.41	---	0.10 (S)	0.09 (S)	3214.59
	Climb out	---	862	2.09	1.07	435.03	55.77	---	0.10 (S)	0.09 (S)	3214.59
	Takeoff	---	1166	1.72	1.07	531.73	108.89	---	0.10 (S)	0.09 (S)	3214.59
Notes: c(1), d(12) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(8)											
R-2800-99W	Idle (Taxi)	---	8	22.00	1.07	1294.00	42.48	---	0.10	0.09	3214.59
	Approach	---	175	13.64	1.07	1262.00	14.81	---	0.10	0.09	3214.59
	Climb out	---	356	2.38	1.07	499.99	18.78	---	0.10	0.09	3214.59
	Takeoff	---	1780	0.99	1.07	35.91	3.70	---	0.10	0.09	3214.59
Notes: c(16), e, g, h, k(7)											
RB211-22B	Idle (Taxi)	7%	1786	2.86	1.07	88.99	77.91	---	0.50	0.45	3214.59
	Approach	30%	4492	8.18	1.07	20.65	6.85	---	0.47	0.43	3214.59
	Climb out	85%	12270	26.89	1.07	1.68	0.29	---	0.17	0.15	3214.59
	Takeoff	100%	14897	37.33	1.07	0.78	0.17	---	0.17	0.16	3214.59
Notes: c(2), e, f, h, k(8)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
RB211-524B Series	Idle (Taxi)	7%	2159	3.53	1.07	82.20	58.19	---	0.36	0.32	3214.59
	Approach	30%	5500	9.75	1.07	20.00	5.73	---	0.33	0.30	3214.59
	Climb out	85%	15389	33.00	1.07	2.82	0.46	---	0.14	0.12	3214.59
	Takeoff	100%	18913	47.00	1.07	1.83	0.60	---	0.19	0.17	3214.59
Notes: c(2), e, f, h, k(8)											
RB211-524C2	Idle (Taxi)	7%	2381	3.37	1.07	81.00	62.33	---	0.38	0.34	3214.59
	Approach	30%	5873	10.40	1.07	18.90	5.08	---	0.30	0.27	3214.59
	Climb out	85%	16032	32.30	1.07	1.63	0.25	---	0.11	0.10	3214.59
	Takeoff	100%	19683	41.90	1.07	0.66	0.00	---	0.11	0.10	3214.59
Notes: c(2), e, f, h, k(8)											
RB211-524D4	Idle (Taxi)	7%	2381	4.11	1.07	73.80	53.43	---	0.33	0.30	3214.59
	Approach	30%	5873	9.65	1.07	16.90	5.52	---	0.32	0.29	3214.59
	Climb out	85%	15952	41.00	1.07	1.18	0.48	---	0.11	0.10	3214.59
	Takeoff	100%	19921	56.90	1.07	0.51	0.00	---	0.09	0.08	3214.59
Notes: c(2), e, f, h, k(8)											
RB211-524G	Idle (Taxi)	7%	2064	4.63	1.07	13.74	1.02	---	0.05	0.04	3214.59
	Approach	30%	5556	9.56	1.07	1.01	0.43	---	0.11	0.10	3214.59
	Climb out	85%	16508	40.54	1.07	0.43	0.31	---	0.13	0.12	3214.59
	Takeoff	100%	20794	58.71	1.07	0.59	0.45	---	0.13	0.12	3214.59
Notes: c(2), e, f, h, k(8)											
RB211-524G-T	Idle (Taxi)	7%	2064	4.00	1.07	28.82	4.54	---	0.08	0.07	3214.59
	Approach	30%	5873	9.68	1.07	1.17	0.00	---	0.09	0.08	3214.59
	Climb out	85%	16667	21.80	1.07	0.14	0.03	---	0.15	0.14	3214.59
	Takeoff	100%	20794	28.43	1.07	0.16	0.00	---	0.14	0.12	3214.59
Notes: c(2), e, f, h, k(8)											
RB211-524H	Idle (Taxi)	7%	2064	4.78	1.07	11.75	0.85	---	0.05	0.04	3214.59
	Approach	30%	5635	10.26	1.07	0.99	0.41	---	0.11	0.10	3214.59
	Climb out	85%	17222	46.31	1.07	0.38	0.38	---	0.13	0.12	3214.59
	Takeoff	100%	21667	65.84	1.07	0.87	0.39	---	0.13	0.11	3214.59
Notes: c(2), e, f, h, k(8)											
RB211-524H-T	Idle (Taxi)	7%	2064	4.16	1.07	26.17	3.81	---	0.07	0.07	3214.59
	Approach	30%	6111	9.91	1.07	1.05	0.00	---	0.09	0.08	3214.59
	Climb out	85%	17619	23.19	1.07	0.14	0.02	---	0.15	0.14	3214.59
	Takeoff	100%	22302	31.19	1.07	0.18	0.00	---	0.14	0.12	3214.59
Notes: c(2), e, f, h, k(8)											
RB211-535C	Idle (Taxi)	7%	1587	3.44	1.07	18.79	1.66	---	0.06	0.06	3214.59
	Approach	30%	4286	6.37	1.07	0.48	0.51	---	0.09	0.08	3214.59
	Climb out	85%	11667	24.89	1.07	0.27	0.16	---	0.08	0.07	3214.59
	Takeoff	100%	14286	33.71	1.07	0.70	0.29	---	0.10	0.09	3214.59
Notes: c(2), e, f, h, k(8)											



**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
RB211-535E4	Idle (Taxi)	7%	1429	4.40	1.07	20.33	0.31	---	0.05	0.05	3214.59
	Approach	30%	4127	8.38	1.07	2.72	0.05	---	0.05	0.05	3214.59
	Climb out	85%	11905	17.56	1.07	0.29	0.00	---	0.19	0.17	3214.59
	Takeoff	100%	14683	22.31	1.07	0.26	0.03	---	0.19	0.17	3214.59
Notes: c(2), e, f, h, k(8)											
Rotax 912	Idle (Taxi)	---	10	0.80	1.07	1206.17	21.03	---	1.0E-03	9.0E-04	3214.59
	Approach	---	14	14.28	1.07	569.47	12.76	---	1.0E-03	9.0E-04	3214.59
	Climb out	---	25	10.29	1.07	760.18	14.53	---	2.0E-03	1.8E-03	3214.59
	Takeoff	---	30	12.71	1.07	700.69	14.08	---	3.0E-03	2.7E-03	3214.59
Notes: c(16), e, g, h, k(8)											
Rotax 914	Idle (Taxi)	---	14	5.00	1.07	994.00	38.60	---	1.0E-03	9.0E-04	3214.59
	Approach	---	23	14.00	1.07	776.00	16.00	---	1.0E-03	9.0E-04	3214.59
	Climb out	---	44	18.00	1.07	664.00	12.30	---	2.0E-03	1.8E-03	3214.59
	Takeoff	---	57	6.00	1.07	1020.00	15.00	---	3.0E-03	2.7E-03	3214.59
Notes: c(16), e, g, h, k(8)											
Spey Mk511	Idle (Taxi)	7%	1008	3.60	1.07	31.77	4.24	---	0.16	0.15	3214.59
	Approach	30%	2206	7.20	1.07	2.65	0.21	---	0.22	0.20	3214.59
	Climb out	85%	5762	17.30	1.07	0.63	0.14	---	0.24	0.22	3214.59
	Takeoff	100%	7071	22.70	1.07	0.12	0.10	---	0.23	0.21	3214.59
Notes: c(2) - Spey MK511 is the commercial designation of the F113-RR-100 engine, e, f, h, k(8)											
Spey Mk555	Idle (Taxi)	7%	762	3.70	1.07	29.30	2.14	---	0.18	0.16	3214.59
	Approach	30%	1754	6.80	1.07	3.70	0.33	---	0.35	0.32	3214.59
	Climb out	85%	4698	16.50	1.07	0.70	0.17	---	0.35	0.32	3214.59
	Takeoff	100%	5833	21.90	1.07	0.30	0.33	---	0.32	0.29	3214.59
Notes: c(2), e, f, h, k(8)											
T53-L-11D	Ground Idle	---	145	1.58	1.07	31.51	66.80	---	1.44 (S)	1.30 (S)	3214.59
	Flight Idle	---	222	2.53	1.07	37.79	15.61	---	2.95 (S)	2.66 (S)	3214.59
	Normal Rated	---	645	6.43	1.07	6.83	0.66	---	0.31 (S)	0.28 (S)	3214.59
	Military	---	685	6.34	1.07	3.34	0.30	---	0.36 (S)	0.32 (S)	3214.59
	Takeoff	---	690	7.75	1.07	3.85	0.31	---	0.36 (S)	0.32 (S)	3214.59
Notes: c(9), d(17) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(8)											
T53-L-13	Idle (Taxi)	7%	160	1.58	1.07	31.45	64.28	---	1.44	1.30	3214.59
	Approach	30%	227	2.52	1.07	37.71	15.02	---	2.95	2.66	3214.59
	Climb out	70%	694	6.33	1.07	3.59	0.30	---	0.31	0.28	3214.59
	Takeoff	90%	696	7.73	1.07	3.59	0.30	---	0.36	0.32	3214.59
Notes: c(13), j, k(8)											
T56 Series I	Idle (Taxi)	7%	829	7.33	1.07	5.73	0.86	---	0.12	0.11	3214.59
	Approach	30%	1036	7.12	1.07	4.70	0.61	---	0.22	0.20	3214.59
	Intermediate	70%	1824	9.61	1.07	2.84	0.31	---	0.28	0.25	3214.59
	Military	90%	2059	9.87	1.07	2.82	0.31	---	0.28	0.25	3214.59
Notes: c(13), j, k(8)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
T56 Series III	Idle (Taxi)	7%	986	6.05	1.07	6.50	0.90	---	0.12	0.11	3214.59
	Approach	30%	1262	9.10	1.07	2.79	0.44	---	0.19	0.17	3214.59
	Intermediate	70%	2210	12.19	1.07	1.47	0.26	---	0.24	0.22	3214.59
	Military	90%	2476	12.76	1.07	1.47	0.26	---	0.26	0.23	3214.59
Notes: c(13), j, k(8)											
T56-A-7	Idle (Taxi)	5%	724	7.58	1.07	5.06	0.08	0.062	3.64	3.28	3214.59
	Approach	15%	880	7.54	1.07	3.89	0.06	0.043	3.85	3.47	3214.59
	Intermediate	61%	1742	9.15	1.07	1.94	0.02	0.013	1.46	1.31	3214.59
	Military	90%	2262	12.46	1.07	2.30	0.01	0.003	1.22	1.10	3214.59
Notes: c(3), h, k(5)											
T56-A-9	Idle	7%	794	3.90	1.07	32.00	24.15	---	0.83	0.75	3214.59
	Approach	30%	1423 (C)	4.40	1.07	22.20	14.26	---	0.97	0.87	3214.59
	Intermediate	70%	1825	9.20	1.07	2.40	0.58	---	0.51	0.46	3214.59
	Military	100%	1905	9.30	1.07	2.10	0.46	---	0.50	0.45	3214.59
Notes: c(7), d(1), e, k(4)											
T56-A-14	Idle (Taxi)	5%	324	3.72	1.07	30.39	15.85	---	0.43	0.39	3214.59
	Approach	15%	839	6.79	1.07	3.49	0.92	---	0.28	0.25	3214.59
	Intermediate	61%	1409	10.30	1.07	1.07	0.04	---	0.17	0.15	3214.59
	Military	90%	1563	12.05	1.07	0.95	0.04	---	0.16	0.14	3214.59
Notes: c(13), k(8)											
T56-A-15	Idle (Taxi)	7%	794	3.90	1.07	32.00	24.15	---	0.83	0.75	3214.59
	Approach	30%	1423 (C)	4.40	1.07	22.20	14.26	---	0.97	0.87	3214.59
	Intermediate	70%	1825	9.20	1.07	2.40	0.58	---	0.51	0.46	3214.59
	Military	90%	2302	9.30	1.07	2.10	0.46	---	0.50	0.45	3214.59
Notes: c(7), d(1), e, h, k(8)											
T56-A-16	Ground Idle	---	756	6.35	1.07	5.65	1.40	---	0.83 (S)	0.75 (S)	3214.59
	Flight Idle	---	836	6.52	1.07	4.54	1.09	---	0.97 (S)	0.87 (S)	3214.59
	75%	---	1996	9.93	1.07	0.42	0.20	---	0.51 (S)	0.46 (S)	3214.59
	100%	---	2136	10.29	1.07	0.68	0.14	---	0.50 (S)	0.45 (S)	3214.59
	Military	---	2219	10.45	1.07	0.65	0.16	---	0.50 (S)	0.45 (S)	3214.59
Notes: c(9), d(18) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(8)											
T58-GE-5	Idle	---	133	1.50	1.07	169.17	111.54	---	0.75	0.68	3214.59
	Normal Cruise	---	757	6.34	1.07	7.66	1.82	---	0.79	0.71	3214.59
	Intermediate (Military)	---	821	6.70	1.07	6.82	3.78	---	0.97	0.88	3214.59
	Power Takeoff	---	886	7.22	1.07	5.64	0.91	---	0.90	0.81	3214.59
Notes: c(1), e, k(4)											
T58-GE-8F	Idle	---	132	1.43	1.07	178.44	149.98	---	0.75 (S)	0.68 (S)	3214.59
	Approach	---	581	4.47	1.07	17.28	1.29	---	0.79 (S)	0.71 (S)	3214.59
	Cruise	---	627	4.68	1.07	14.13	0.92	---	0.79 (S)	0.71 (S)	3214.59
	Max Continuous	---	685	4.90	1.07	12.96	0.84	---	0.79 (S)	0.71 (S)	3214.59
	Takeoff	---	786	5.47	1.07	9.03	0.46	---	0.97 (S)	0.88 (S)	3214.59
Notes: c(9), d(19) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(8)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
T58-GE-16	Ground Idle	---	150	3.03	1.07	139.73	47.05	---	0.75 (S)	0.68 (S)	3214.59
	60% Normal	---	656	7.88	1.07	14.56	0.44	---	0.79 (S)	0.71 (S)	3214.59
	75% Normal	---	779	9.47	1.07	10.89	0.72	---	0.79 (S)	0.71 (S)	3214.59
	90% Normal	---	890	10.07	1.07	9.10	0.96	---	0.90 (S)	0.81 (S)	3214.59
	Military	---	1020	11.60	1.07	7.73	1.52	---	0.90 (S)	0.81 (S)	3214.59
Notes: c(9), d(19) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(4)											
T63-A-5A	Ground Idle	---	61	1.42	1.07	79.15	23.35	---	0.83 (S)	0.75 (S)	3214.59
	Flight Idle	---	70	1.89	1.07	61.83	12.02	---	0.83 (S)	0.75 (S)	3214.59
	30%	---	105	2.90	1.07	38.59	3.76	---	0.97 (S)	0.87 (S)	3214.59
	60%	---	157	4.11	1.07	20.79	0.78	---	0.51 (S)	0.46 (S)	3214.59
	Military	---	215	5.07	1.07	7.54	0.09	---	0.50 (S)	0.45 (S)	3214.59
Notes: c(9), d(18) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(8)											
T64-GE-6B	Idle	---	337	3.86	1.07	48.66	15.01	---	0.30	0.27	3214.59
	75% hp	---	1039	8.95	1.07	4.72	0.89	---	0.58	0.52	3214.59
	Normal Rated	---	1257	10.42	1.07	2.86	0.82	---	0.72	0.64	3214.59
	Intermediate (Military)	---	1390	11.15	1.07	2.30	0.74	---	0.79	0.71	3214.59
Notes: c(1), e, k(8)											
T64-GE-100	Ground Idle	2%	298	1.11	1.07	76.46	1.26	0.744	2.36	2.12	3214.59
	75% Normal	34%	941	6.85	1.07	7.85	0.05	0.033	1.97	1.77	3214.59
	Normal	81%	1698	9.46	1.07	2.21	0.01	0.004	1.61	1.45	3214.59
	Military	90%	1848	11.30	1.07	2.17	0.01	0.007	0.92	0.82	3214.59
Notes: c(3), e, h, k(5)											
T64-GE-413	Idle	---	260	2.62	1.07	51.83	19.87	---	2.36 (S)	2.12 (S)	3214.59
	75% hp	---	1287	8.54	1.07	1.94	0.40	---	1.97 (S)	1.77 (S)	3214.59
	Normal Rated	---	1511	9.65	1.07	1.20	0.38	---	1.61 (S)	1.45 (S)	3214.59
	Intermediate	---	1661	10.92	1.07	0.67	0.39	---	1.61 (S)	1.45 (S)	3214.59
	Maximum	---	1721	11.42	1.07	0.49	0.31	---	1.61 (S)	1.45 (S)	3214.59
Notes: c(9), d(20) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(8)											
T64-GE-415	Idle	---	269	2.12	1.07	74.33	28.00	---	2.36 (S)	2.12 (S)	3214.59
	75%	---	1493	8.09	1.07	2.10	0.15	---	1.61 (S)	1.45 (S)	3214.59
	Normal Rated	---	1730	9.29	1.07	1.50	0.09	---	1.61 (S)	1.45 (S)	3214.59
	Military	---	1916	9.99	1.07	1.29	0.32	---	0.92 (S)	0.82 (S)	3214.59
	Max. Rated	---	2005	10.83	1.07	1.47	0.22	---	0.92 (S)	0.82 (S)	3214.59
Notes: c(9), d(20) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(8)											
T76-G-10	Idle (Taxi)	---	238	7.40	1.07	23.80	8.51	---	0.38	0.34	3214.59
	Approach	---	476	8.50	1.07	17.20	0.92	---	0.50	0.45	3214.59
	Intermediate	---	794	9.90	1.07	5.90	0.12	---	0.63	0.57	3214.59
	Military	---	873	10.30	1.07	2.30	0.12	---	0.71	0.64	3214.59
Notes: c(7), e, g, h, k(8)											
T76-G-12	Idle (Taxi)	---	397	7.40	1.07	23.80	8.51	---	0.38	0.34	3214.59
	Approach	---	476	8.50	1.07	17.20	0.92	---	0.50	0.45	3214.59
	Intermediate	---	794	9.90	1.07	5.90	0.12	---	0.63	0.57	3214.59
	Military	---	857 (C)	10.30	1.07	2.30	0.12	---	0.71	0.64	3214.59
Notes: c(7), d(1), e, g, h, k(8)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
T76-G-418	Idle (Taxi)	---	238	7.40	1.07	23.80	8.51	---	0.38	0.34	3214.59
	Approach	---	476	8.50	1.07	17.20	0.92	---	0.50	0.45	3214.59
	Intermediate	---	794	9.90	1.07	5.90	0.12	---	0.63	0.57	3214.59
	Military	---	873	10.30	1.07	2.30	0.12	---	0.71	0.64	3214.59
Notes: c(7), e, g, h, k(8)											
T76-G-419	Idle (Taxi)	---	397	7.40	1.07	23.80	8.51	---	0.38	0.34	3214.59
	Approach	---	476	8.50	1.07	17.20	0.92	---	0.50	0.45	3214.59
	Intermediate	---	794	9.90	1.07	5.90	0.12	---	0.63	0.57	3214.59
	Military	---	857 (C)	10.30	1.07	2.30	0.12	---	0.71	0.64	3214.59
Notes: c(7), d(1), e, g, h, k(8)											
T400-CP-400	Ground Idle	---	136	2.21	1.07	27.94	10.99	---	0.44	0.40	3214.59
	Flight Idle	---	141	2.84	1.07	29.08	8.97	---	0.41 (C)	0.37 (C)	3214.59
	Cruise	---	279	4.66	1.07	1.79	0.00	---	0.36	0.32	3214.59
	Intermediate (Military)	---	406	5.91	1.07	0.00	0.00	---	0.25	0.22	3214.59
	Maximum	---	1069	11.51	1.07	0.00	0.22	---	0.28	0.25	3214.59
Notes: c(1), d(1) - PM <sub>10</sub> and PM <sub>2.5</sub> at Flight Idle power setting only, e, k(8)											
T406-AD-400	Idle	---	362	4.15	1.07	8.35	0.10	---	1.58	1.42	3214.59
	Flight Idle	---	663	6.05	1.07	3.47	0.02	---	1.58	1.42	3214.59
	Intermediate	---	948	7.87	1.07	1.82	0.02	---	1.58	1.42	3214.59
	Max Continuous	---	2507	18.03	1.07	0.29	0.01	---	1.58	1.42	3214.59
Notes: c(6) - T406-AD-400 is the military designation of the AE1107C engine, h, k(4)											
T700-GE-401, -401C	Idle	---	432	5.36	1.07	10.46	0.54	---	0.12	0.11	3214.59
	Approach	---	348	5.36	1.07	10.46	0.54	---	0.21	0.19	3214.59
	Climb out	---	443	5.60	1.07	10.11	0.53	---	0.46	0.41	3214.59
	Takeoff	---	442	5.59	1.07	10.15	0.53	---	0.53	0.48	3214.59
Notes: c(13), k(8)											
T700-GE-700	Ground Idle	4%	134	3.36	1.07	46.24	0.50	0.334	1.48	1.33	3214.59
	Flight Idle	56%	469	10.95	1.07	5.12	0.02	0.007	1.26	1.13	3214.59
	Flight Max	82%	626	11.87	1.07	3.51	0.01	0.003	2.22	2.00	3214.59
	Overspeed	100%	725	11.43	1.07	2.81	0.01	0.007	2.61	2.33	3214.59
Notes: c(3), h, k(5)											
TAE-125-01	Idle (Taxi)	---	2	16.91	1.07	24.80	9.78	---	0.05	0.05	3214.59
	Approach	---	20	26.96	1.07	16.06	3.29	---	0.04	0.04	3214.59
	Climb out	---	40	22.78	1.07	6.65	1.25	---	0.07	0.06	3214.59
	Takeoff	---	51	20.01	1.07	7.51	1.05	---	0.10	0.09	3214.59
Notes: c(16), e, g, h, k(8)											
TAY Mk611-8	Idle (Taxi)	7%	873	2.50	1.07	24.10	3.91	---	0.16	0.15	3214.59
	Approach	30%	1825	5.70	1.07	3.90	1.04	---	0.52	0.47	3214.59
	Climb out	85%	5000	16.80	1.07	0.80	0.35	---	0.48	0.43	3214.59
	Takeoff	100%	6032	21.10	1.07	0.70	0.92	---	0.56	0.50	3214.59
Notes: c(2), e, f, h, k(8)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
TAY Mk611-8C	Idle (Taxi)	7%	810	2.53	1.07	24.40	1.71	---	0.05	0.05	3214.59
	Approach	30%	1706	5.31	1.07	2.89	0.75	---	0.08	0.07	3214.59
	Climb out	85%	4794	15.40	1.07	0.95	0.06	---	0.10	0.09	3214.59
	Takeoff	100%	5802	19.30	1.07	0.50	0.03	---	0.11	0.10	3214.59
Notes: c(2), e, f, h, k(8)											
TAY Mk620-15	Idle (Taxi)	7%	873	2.50	1.07	24.10	3.91	---	0.16	0.15	3214.59
	Approach	30%	1825	5.70	1.07	3.90	1.04	---	0.52	0.47	3214.59
	Climb out	85%	5000	16.80	1.07	0.80	0.35	---	0.48	0.43	3214.59
	Takeoff	100%	6032	21.10	1.07	0.70	0.92	---	0.56	0.50	3214.59
Notes: c(2), e, f, h, k(8)											
TAY Mk650-15	Idle (Taxi)	7%	944	1.70	1.07	33.77	3.78	---	0.06	0.06	3214.59
	Approach	30%	2016	4.55	1.07	6.54	1.01	---	0.14	0.12	3214.59
	Climb out	85%	5675	16.47	1.07	2.01	0.47	---	0.41	0.37	3214.59
	Takeoff	100%	6937	19.81	1.07	1.74	0.43	---	0.42	0.38	3214.59
Notes: c(2), e, f, h, k(8)											
TF30-P-3	Idle (Taxi)	---	873	2.30	1.07	72.00	71.30	---	0.01	0.01	3214.59
	Approach	---	2064	4.80	1.07	9.20	2.42	---	0.05	0.05	3214.59
	Intermediate	---	4921	9.40	1.07	1.30	0.12	---	0.45	0.41	3214.59
	Military	---	6191	12.00	1.07	0.80	0.03	---	0.40	0.36	3214.59
	Afterburner	---	38413	3.10	1.07	4.06	0.01	---	0.15	0.14	3214.59
Notes: c(7), e, g, h, k(8)											
TF30-P-6B	Idle (Taxi)	<75%	689	1.31	1.07	68.21	21.53	---	0.02 (S)	0.02 (S)	3214.59
	75% Thrust	75%	3550	6.68	1.07	6.31	3.40	---	0.12 (S)	0.11 (S)	3214.59
	Normal Rated	75-99%	4700	8.06	1.07	5.55	1.61	---	0.44 (S)	0.40 (S)	3214.59
	Intermediate (Military)	100%	6835	12.04	1.07	3.09	1.16	---	0.35 (S)	0.32 (S)	3214.59
Notes: c(1), d(21) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, j - Assumes 100% thrust at Intermediate setting, k(8)											
TF30-P-7	Idle (Taxi)	---	952	3.00	1.07	53.00	34.50	---	0.02	0.02	3214.59
	Approach	---	2064	6.10	1.07	11.50	3.68	---	0.12	0.11	3214.59
	Intermediate	---	5714	14.00	1.07	1.20	0.23	---	0.44	0.40	3214.59
	Military	---	7222	20.00	1.07	0.80	0.12	---	0.35	0.32	3214.59
	Afterburner	---	38413	3.10	1.07	4.00	0.01	---	0.15	0.14	3214.59
Notes: c(7), e, g, h, k(8)											
TF30-P-9	Idle (Taxi)	---	952	3.00	1.07	53.00	34.50	---	0.02	0.02	3214.59
	Approach	---	2064	6.10	1.07	11.50	3.68	---	0.12	0.11	3214.59
	Intermediate	---	5714	14.00	1.07	1.20	0.23	---	0.44	0.40	3214.59
	Military	---	8730	20.00	1.07	0.80	0.12	---	0.35	0.32	3214.59
	Afterburner	---	54525	3.10	1.07	4.00	0.01	---	0.15	0.14	3214.59
Notes: c(7), e, k(8)											
TF30-P-100	Idle (Taxi)	---	1260	2.86	1.07	47.62	21.72	---	26.27	23.64	3214.59
	Approach	---	4562 (C)	10.95 (C)	1.07	1.70 (C)	0.41 (C)	---	24.88 (C)	22.39 (C)	3214.59
	Intermediate	---	6650	20.00	1.07	0.71	0.12	---	24.00	21.60	3214.59
	Military	---	7120	28.01	1.07	0.70	0.11	---	8.34	7.51	3214.59
	Afterburner	---	42850	4.47	1.07	24.80	2.30	---	5.36	4.82	3214.59
Notes: c(1), d(1) - All pollutants at Approach power setting, e, j - Assumes 100% thrust at Takeoff power setting, k(8)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
TF30-P-103	Idle (Taxi)	<30%	827	4.00	1.07	100.00	88.44	---	0.51	0.46	3214.59
	30%	30%	2003	7.00	1.07	36.20	12.54	---	0.82	0.74	3214.59
	75%	75%	4119	15.10	1.07	5.50	0.36	---	0.20	0.18	3214.59
	100%	100%	5541	20.10	1.07	2.10	0.10	---	16.34	14.70	3214.59
	Afterburner-1	>100%	14292	11.20	1.07	77.20	32.20	---	35.69 (C)	31.84 (C)	3214.59
Notes: c(15), d(1) - PM <sub>10</sub> and PM <sub>2.5</sub> at Afterburner power setting only, e, f, h, k(3)											
TF30-P-109	Idle (Taxi)	5%	761	2.93	1.07	48.49	7.44	3.242	1.24	1.11	3214.59
	Approach	23%	1727	6.19	1.07	20.73	2.35	1.279	1.52	1.37	3214.59
	Intermediate	47%	2921	9.58	1.07	5.17	0.80	0.072	1.64	1.47	3214.59
	Military	99%	6263	23.63	1.07	0.71	0.87	0.023	0.92	0.82	3214.59
	Afterburner-5	>99%	38460	4.89	1.07	6.19	2.50	0.034	0.51	0.46	3214.59
Notes: c(12), h, k(5)											
TF30-P-412A	Idle (Taxi)	---	999	2.40	1.07	68.17	44.20	---	26.53	23.87	3214.59
	75% rpm	---	1448	3.66	1.07	38.60	11.12	---	24.03	21.63	3214.59
	90% rpm	---	3597	9.62	1.07	6.34	0.19	---	15.01	13.51	3214.59
	Intermediate (Military)	---	7394	16.66	1.07	2.12	0.11	---	8.34	7.51	3214.59
	Afterburner	---	40000	6.75	1.07	15.00	1.15	---	17.33	15.60	3214.59
Notes: c(1), e, k(8)											
TF33-P-3, -P-5	Idle (Taxi)	<30%	846	1.77	1.07	88.53	105.76	---	5.20	4.68	3214.59
	Approach	30%	3797	7.30	1.07	9.01	4.36	---	13.98	12.59	3214.59
	Climb out	85%	7323	9.00	1.07	1.80	0.46	---	14.00	12.60	3214.59
	Takeoff	100%	9979	11.00	1.07	1.30	0.35	---	8.00	7.20	3214.59
Notes: c(1), e, h, j, k(8)											
TF33-P-7	Idle (Taxi)	4%	1093	0.78	1.07	134.96	5.32	4.640	6.13	5.51	3214.59
	Approach	45%	4884	7.12	1.07	9.67	0.24	0.190	3.68	3.31	3214.59
	Intermediate	58%	6356	8.10	1.07	4.16	0.06	0.041	5.28	4.76	3214.59
	Military	73%	8264	10.29	1.07	1.49	0.02	0.011	3.58	3.22	3214.59
Notes: c(3), e, h, k(5)											
TF33-P-9	Idle (Taxi)	---	1120	1.39	1.07	95.06	90.91	---	4.98	4.48	3214.59
	Approach	---	4140	6.37	1.07	5.24	1.37	---	3.55	3.20	3214.59
	Intermediate	---	8960	7.88	1.07	2.11	1.50	---	3.15	2.84	3214.59
	Military	---	9630	12.08	1.07	0.00	0.55	---	3.67	3.30	3214.59
Notes: c(6), e, h, k(4)											
TF33-P-100	Idle (Taxi)	---	1108	1.50	1.07	136.96	131.16	---	6.13	5.52	3214.59
	Approach	---	2794	6.22	1.07	14.60	3.62	---	5.46	4.91	3214.59
	Intermediate	---	8069	8.47	1.07	2.96	0.39	---	5.29	4.76	3214.59
	Military	---	10856	11.49	1.07	1.19	0.25	---	2.93	2.64	3214.59
Notes: c(6), h, k(8)											
TF33-P-102	Idle (Taxi)	5%	1114	1.39	1.07	95.02	3.42	2.610	4.96	4.46	3214.59
	Approach	49%	4737	6.37	1.07	5.24	0.11	0.087	3.55	3.20	3214.59
	Intermediate	59%	5782	7.88	1.07	2.11	0.06	0.032	3.15	2.84	3214.59
	Military	75%	7561	12.08	1.07	0.00	0.02	0.003	2.52	2.26	3214.59
Notes: c(3), e, h, k(5)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
TF33-P-102A	Idle (Taxi)	7%	1065	1.80	1.07	117.03	106.96	---	4.98	4.48	3214.59
	Approach	30%	3912	5.84	1.07	12.37	1.74	---	3.55	3.20	3214.59
	Intermediate	70%	6985	8.74	1.07	2.01	0.95	---	3.15	2.84	3214.59
	Military	100%	8756	12.39	1.07	0.45	0.53	---	3.67	3.30	3214.59
Notes: c(6), h, j, k(8)											
TF33-P-103	Idle (Taxi)	---	900	1.39	1.07	95.06	90.91	---	4.98	4.48	3214.59
	Approach	---	3800	6.37	1.07	5.24	1.37	---	3.55	3.20	3214.59
	Intermediate	---	6240	7.88	1.07	2.11	1.50	---	3.15	2.84	3214.59
	Military	---	7440	12.08	1.07	0.00	0.55	---	3.67	3.30	3214.59
Notes: c(6), e, h, k(4)											
TF34-GE-100	Idle (Taxi)	---	390	2.10	1.07	106.70	39.45	---	8.13 (S)	7.32 (S)	3214.59
	Approach	---	920	5.70	1.07	16.30	2.19	---	6.21 (S)	5.59 (S)	3214.59
	Intermediate	---	460	2.60	1.07	78.00	23.35	---	8.93 (S)	8.04 (S)	3214.59
	Military	---	2710	10.70	1.07	2.20	0.12	---	2.66 (S)	2.39 (S)	3214.59
Notes: c(7), d(22) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(8)											
TF34-GE-100A	Idle (Taxi)	7%	498	0.32	1.07	65.62	2.24	2.030	8.13	7.32	3214.59
	Approach	28%	933	3.09	1.07	27.92	1.44	1.340	6.21	5.59	3214.59
	Intermediate	46%	1512	5.61	1.07	8.88	0.13	0.087	8.93	8.04	3214.59
	Military	78%	2628	9.11	1.07	3.94	0.07	0.040	2.66	2.39	3214.59
Notes: c(3), h, k(5)											
TF34-GE-400	Idle (Taxi)	10% (C)	458	1.69	1.07	90.98	17.24	---	8.13 (S)	3.60 (S)	3214.59
	Approach	30% (C)	1201 (C)	2.98 (C)	1.07	72.08 (C)	13.51 (C)	---	6.21 (S)	2.12 (S)	3214.59
	Intermediate	70% (C)	2686 (C)	5.57 (C)	1.07	34.29 (C)	6.05 (C)	---	2.66 (S)	1.68 (S)	3214.59
	Military	100% (C)	3800	7.51	1.07	5.95	0.45	---	2.66 (S)	1.68 (S)	3214.59
Notes: c(9), d(1) - Fuel flow rates, NO <sub>x</sub> , CO, and VOC at Approach and Intermediate power settings, d(22) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, k(8)											
TF39-GE-1C	Idle (Taxi)	7%	1448	3.37	1.07	58.43	3.44	2.590	2.80	2.52	3214.59
	Approach	76%	10477	24.91	1.07	0.77	0.03	0.014	1.20	1.08	3214.59
	Intermediate	87%	12541	28.16	1.07	1.53	0.03	0.010	0.89	0.80	3214.59
	Military	94%	13862	32.66	1.07	1.29	0.03	0.014	1.18	1.06	3214.59
Notes: c(3), h, k(5)											
TF41-A-1	Idle (Taxi)	---	1032	1.50	1.07	119.00	105.80	---	0.15	0.14	3214.59
	Approach	---	3492	6.80	1.07	10.20	2.53	---	0.36	0.32	3214.59
	Intermediate	---	5873	12.00	1.07	3.70	0.46	---	0.52	0.47	3214.59
	Military	---	8413	21.00	1.07	1.80	0.23	---	0.67	0.60	3214.59
Notes: c(7), e, k(8)											
TF41-A-2	Idle (Taxi)	<30%	1047	4.00	1.07	176.00	114.54	---	0.65	0.59	3214.59
	30%	30%	2704	8.90	1.07	45.00	11.62	---	0.73	0.66	3214.59
	75%	75%	5810	23.80	1.07	4.70	0.10	---	16.94	15.25	3214.59
	100%	100%	8086	32.90	1.07	3.20	0.09	---	28.60	25.74	3214.59
Notes: c(15), e, f, h, k(3)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
TFE731-2, -2A	Idle (Taxi)	---	206	3.50	1.07	47.80	8.54	---	0.13 (S)	0.12 (S)	3214.59
	Approach	---	571	6.90	1.07	15.56	1.41	---	0.13 (S)	0.12 (S)	3214.59
	Intermediate	---	1476	16.08	1.07	1.62	0.07	---	0.09 (S)	0.09 (S)	3214.59
	Military	---	1786	19.15	1.07	1.13	0.06	---	0.09 (S)	0.08 (S)	3214.59
Notes: c(6), d(14) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, k(8)											
TFE731-2-2B	Idle (Taxi)	7%	190	2.82	1.07	58.60	23.05	---	0.13 (S)	0.12 (S)	3214.59
	Approach	30%	532	5.90	1.07	22.38	4.90	---	0.09 (S)	0.08 (S)	3214.59
	Climb out	85%	1373	13.08	1.07	2.03	0.15	---	0.09 (S)	0.08 (S)	3214.59
	Takeoff	100%	1627	15.25	1.07	1.39	0.13	---	0.08 (S)	0.08 (S)	3214.59
Notes: c(2), d(14) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, f, h, k(8)											
TFE731-3	Idle (Taxi)	7%	206	3.72	1.07	47.70	10.40	---	0.13 (S)	0.12 (S)	3214.59
	Approach	30%	571	6.92	1.07	15.56	1.62	---	0.09 (S)	0.08 (S)	3214.59
	Climb out	85%	1476	16.02	1.07	1.62	0.08	---	0.09 (S)	0.08 (S)	3214.59
	Takeoff	100%	1786	19.15	1.07	1.13	0.07	---	0.08 (S)	0.08 (S)	3214.59
Notes: c(2), d(14) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, f, h, k(8)											
TIO-540-A1A, -540-A1B, -540-A1B, -540-A2A, -540-A2B, -540-A2C, -540-AE2A, -540-AH1A, -540-F2BD, -540-J2B	Idle (Taxi)	---	25	0.04	1.07	1293.70	78.29	---	0.50	0.45	3214.59
	Approach	---	99	1.39	1.07	1261.60	15.39	---	0.40	0.36	3214.59
	Climb out	---	205	0.24	1.07	1470.90	19.12	---	0.70	0.63	3214.59
	Takeoff	---	260	0.36	1.07	1442.10	14.21	---	0.10	0.09	3214.59
Notes: c(16), e, g, h, k(8)											
TIO-540-J2B2	Idle (Taxi)	<40%	25	0.39	1.07	1293.70	78.29	---	0.50 (S)	0.45 (S)	3214.59
	Approach	40%	99	1.39	1.07	1261.57	15.38	---	0.40 (S)	0.36 (S)	3214.59
	Climb out	75-100%	205	0.24	1.07	1470.90	19.12	---	0.70 (S)	0.63 (S)	3214.59
	Takeoff	100%	260	0.36	1.07	1442.05	14.21	---	0.10 (S)	0.09 (S)	3214.59
Notes: c(1), d(13) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, j, k(8)											
TIO-540-J2BD, -540-S1AD	Idle (Taxi)	---	25	0.04	1.07	1293.70	78.29	---	0.50	0.45	3214.59
	Approach	---	99	1.39	1.07	1261.60	15.39	---	0.40	0.36	3214.59
	Climb out	---	205	0.24	1.07	1470.90	19.12	---	0.70	0.63	3214.59
	Takeoff	---	260	0.36	1.07	1442.10	14.21	---	0.10	0.09	3214.59
Notes: c(16), e, g, h, k(8)											
TPE331-2	Idle (Taxi)	<30%	105	2.57	1.07	64.10	104.92	---	2.68 (S)	2.41 (S)	3214.59
	Approach	30%	220	8.27	1.07	16.59	3.08	---	2.40 (S)	2.16 (S)	3214.59
	Climb out	90%	372	9.92	1.07	1.37	0.46	---	1.47 (S)	1.32 (S)	3214.59
	Takeoff	100%	405	10.22	1.07	0.94	0.45	---	1.75 (S)	1.57 (S)	3214.59
Notes: c(1), d(23) - PM <sub>10</sub> and PM <sub>2.5</sub> at all power settings, e, j, k(8)											
TPE331-3	Idle (Taxi)	<30%	112	2.86	1.07	61.52	90.97	---	2.68	2.41	3214.59
	Approach	30%	250	9.92	1.07	6.96	0.74	---	2.40	2.16	3214.59
	Climb out	90%	409	11.86	1.07	0.98	0.17	---	1.47	1.32	3214.59
	Takeoff	100%	458	12.36	1.07	0.76	0.13	---	1.75	1.57	3214.59
Notes: c(1), e, h, j, k(8)											



**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
Trent 553-61	Idle (Taxi)	7%	1825	5.96	1.07	10.50	0.16	---	0.04	0.04	3214.59
	Approach	30%	4762	11.37	1.07	0.66	0.05	---	0.05	0.05	3214.59
	Climb out	85%	13730	30.98	1.07	0.44	0.01	---	0.06	0.05	3214.59
	Takeoff	100%	16746	40.55	1.07	0.18	0.02	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(8)											
Trent 556-61	Idle (Taxi)	7%	1825	6.09	1.07	9.96	0.15	---	0.04	0.04	3214.59
	Approach	30%	4921	11.68	1.07	0.54	0.05	---	0.05	0.05	3214.59
	Climb out	85%	14524	33.25	1.07	0.38	0.01	---	0.06	0.05	3214.59
	Takeoff	100%	17778	44.77	1.07	0.17	0.02	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(8)											
Trent 768	Idle (Taxi)	7%	2056	4.46	1.07	26.94	3.67	---	0.06	0.06	3214.59
	Approach	30%	6198	10.12	1.07	1.71	0.05	---	0.05	0.05	3214.59
	Climb out	85%	18849	24.90	1.07	0.49	0.01	---	0.07	0.07	3214.59
	Takeoff	100%	23072	32.01	1.07	0.35	0.00	---	0.06	0.06	3214.59
Notes: c(2), e, f, h, k(8)											
Trent 772	Idle (Taxi)	7%	2143	4.66	1.07	23.97	2.83	---	0.06	0.05	3214.59
	Approach	30%	6516	10.42	1.07	1.56	0.05	---	0.06	0.05	3214.59
	Climb out	85%	20079	26.82	1.07	0.49	0.01	---	0.07	0.07	3214.59
	Takeoff	100%	24913	35.56	1.07	0.21	0.01	---	0.06	0.06	3214.59
Notes: c(2), e, f, h, k(8)											
Trent 875	Idle (Taxi)	7%	2222	4.64	1.07	19.66	2.05	---	0.05	0.05	3214.59
	Approach	30%	6984	10.43	1.07	0.86	0.00	---	0.05	0.05	3214.59
	Climb out	85%	20397	26.55	1.07	0.16	0.00	---	0.06	0.05	3214.59
	Takeoff	100%	24603	33.32	1.07	0.19	0.00	---	0.06	0.05	3214.59
Notes: c(2), e, f, h, k(8)											
Trent 877	Idle (Taxi)	7%	2222	4.75	1.07	18.42	1.78	---	0.05	0.05	3214.59
	Approach	30%	7143	10.59	1.07	0.80	0.00	---	0.05	0.05	3214.59
	Climb out	85%	21111	27.59	1.07	0.16	0.00	---	0.06	0.05	3214.59
	Takeoff	100%	25476	34.76	1.07	0.20	0.00	---	0.05	0.05	3214.59
Notes: c(2), e, f, h, k(8)											
Trent 884	Idle (Taxi)	7%	2460	5.04	1.07	15.19	1.15	---	0.05	0.04	3214.59
	Approach	30%	7698	11.07	1.07	0.65	0.00	---	0.05	0.05	3214.59
	Climb out	85%	22937	30.63	1.07	0.18	0.00	---	0.06	0.05	3214.59
	Takeoff	100%	28254	40.05	1.07	0.24	0.00	---	0.05	0.05	3214.59
Notes: c(2), e, f, h, k(8)											
Trent 892	Idle (Taxi)	7%	2381	5.33	1.07	13.07	0.81	---	0.05	0.04	3214.59
	Approach	30%	7937	11.58	1.07	0.57	0.00	---	0.05	0.05	3214.59
	Climb out	85%	24603	33.30	1.07	0.20	0.00	---	0.06	0.05	3214.59
	Takeoff	100%	31032	45.70	1.07	0.28	0.01	---	0.05	0.05	3214.59
Notes: c(2), e, f, h, k(8)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
Trent 895	Idle (Taxi)	7%	2619	5.11	1.07	14.71	1.02	---	0.05	0.04	3214.59
	Approach	30%	8333	11.39	1.07	0.54	0.00	---	0.05	0.05	3214.59
	Climb out	85%	25318	34.29	1.07	0.19	0.00	---	0.06	0.05	3214.59
	Takeoff	100%	31984	47.79	1.07	0.27	0.02	---	0.05	0.05	3214.59
Notes: c(2), e, f, h, k(8)											
Trent 970-84	Idle (Taxi)	7%	2381	5.10	1.07	15.10	0.23	---	0.04	0.04	3214.59
	Approach	30%	5556	11.40	1.07	1.40	0.00	---	0.05	0.05	3214.59
	Climb out	85%	17460	29.10	1.07	0.20	0.00	---	0.06	0.05	3214.59
	Takeoff	100%	20638	37.20	1.07	0.40	0.00	---	0.05	0.05	3214.59
Notes: c(2), e, f, h, k(8)											
Trent 972-84	Idle (Taxi)	7%	2048	5.51	1.07	13.00	0.05	---	0.04	0.04	3214.59
	Approach	30%	5833	12.23	1.07	1.10	0.08	---	0.06	0.06	3214.59
	Climb out	85%	17540	30.36	1.07	0.31	0.13	---	0.07	0.07	3214.59
	Takeoff	100%	21206	39.78	1.07	0.32	0.01	---	0.06	0.06	3214.59
Notes: c(2), e, f, h, k(8)											
Trent 1000-A	Idle (Taxi)	7%	1881	5.40	1.07	8.73	0.07	---	0.04	0.04	3214.59
	Approach	30%	4960	13.29	1.07	0.77	0.00	---	0.06	0.05	3214.59
	Climb out	85%	14897	35.87	1.07	0.45	0.00	---	0.05	0.05	3214.59
	Takeoff	100%	18111	46.67	1.07	0.53	0.00	---	0.05	0.04	3214.59
Notes: c(2), e, f, h, k(8)											
Trent 1000-C	Idle (Taxi)	7%	1952	5.66	1.07	7.66	0.05	---	0.04	0.04	3214.59
	Approach	30%	5302	13.86	1.07	0.68	0.00	---	0.06	0.05	3214.59
	Climb out	85%	16254	40.33	1.07	0.48	0.00	---	0.05	0.05	3214.59
	Takeoff	100%	19905	53.54	1.07	0.51	0.00	---	0.05	0.04	3214.59
Notes: c(2), e, f, h, k(8)											
Trent 1000-E	Idle (Taxi)	7%	1762	5.06	1.07	10.63	0.10	---	0.04	0.04	3214.59
	Approach	30%	4524	12.54	1.07	0.92	0.00	---	0.05	0.05	3214.59
	Climb out	85%	13167	30.55	1.07	0.43	0.00	---	0.06	0.05	3214.59
	Takeoff	100%	15929	39.17	1.07	0.47	0.00	---	0.05	0.05	3214.59
Notes: c(2), e, f, h, k(8)											
TSIO-360-A, -360-AB, -360-B, -360-BB, -360-C, -360-CB, -360-F, -360-FB, -360-JB	Idle (Taxi)	---	11	1.91	1.07	592.20	159.00	---	0.05	0.05	3214.59
	Approach	---	61	3.77	1.07	995.10	13.01	---	0.04	0.04	3214.59
	Climb out	---	99	4.32	1.07	960.80	10.98	---	0.07	0.06	3214.59
	Takeoff	---	133	2.71	1.07	1082.00	10.55	---	0.10	0.09	3214.59
Notes: c(16), e, g, h, k(8)											
V2500-A1	Idle (Taxi)	7%	984	5.91	1.07	7.76	0.25	---	0.08	0.07	3214.59
	Approach	30%	2651	13.45	1.07	0.77	0.17	---	0.08	0.07	3214.59
	Climb out	85%	7333	30.82	1.07	0.55	0.13	---	0.12	0.11	3214.59
	Takeoff	100%	8833	37.13	1.07	0.55	0.12	---	0.12	0.11	3214.59
Notes: c(2), e, f, h, k(1)											

**Table 2-8. Aircraft Engine Emission Factors for Criteria Pollutants, GHG, and Total HAPs (cont.)**

Aircraft Engine	Power Setting	Percent Thrust/hp	Fuel Flow Rate (lb/hr)	Emission Factors (lb/1000lb fuel)							
				NO <sub>x</sub>	SO <sub>x</sub> <sup>a</sup>	CO	VOC	HAPs	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
V2522-A5	Taxi (Idle)	7%	937	4.50	1.07	13.42	0.12	---	0.15	0.13	3214.59
	Approach	30%	2468	8.70	1.07	2.60	0.07	---	0.19	0.17	3214.59
	Climb out	85%	6484	20.80	1.07	0.67	0.05	---	0.24	0.21	3214.59
	Takeoff	100%	7706	24.50	1.07	0.57	0.05	---	0.16	0.14	3214.59
Notes: c(2), e, f, h, k(1)											
V2524-A5	Idle (Taxi)	7%	976	4.70	1.07	12.64	0.12	---	0.15	0.13	3214.59
	Approach	30%	2603	9.00	1.07	2.37	0.07	---	0.20	0.18	3214.59
	Climb out	85%	6889	22.00	1.07	0.63	0.05	---	0.23	0.20	3214.59
	Takeoff	100%	8270	26.20	1.07	0.54	0.05	---	0.15	0.14	3214.59
Notes: c(2), e, f, h, k(1)											
V2525-D5	Taxi (Idle)	7%	1016	4.70	1.07	12.43	0.12	---	0.15	0.13	3214.59
	Approach	30%	2532	8.90	1.07	2.44	0.07	---	0.20	0.18	3214.59
	Climb out	85%	6984	22.30	1.07	0.62	0.05	---	0.23	0.20	3214.59
	Takeoff	100%	8357	26.50	1.07	0.53	0.05	---	0.15	0.14	3214.59
Notes: c(2), e, f, h, k(1)											
V2527-A5	Idle (Taxi)	7%	1016	4.70	1.07	12.43	0.12	---	0.15	0.13	3214.59
	Approach	30%	2532	8.90	1.07	2.44	0.07	---	0.20	0.18	3214.59
	Climb out	85%	6984	22.30	1.07	0.62	0.05	---	0.23	0.20	3214.59
	Takeoff	100%	8357	26.50	1.07	0.53	0.05	---	0.15	0.14	3214.59
Notes: c(2), e, f, h, k(1)											
V2528-D5	Taxi (Idle)	7%	1063	4.90	1.07	11.53	0.12	---	0.13	0.12	3214.59
	Approach	30%	2802	9.60	1.07	2.03	0.07	---	0.20	0.18	3214.59
	Climb out	85%	7905	25.10	1.07	0.56	0.05	---	0.20	0.18	3214.59
	Takeoff	100%	9595	30.50	1.07	0.47	0.05	---	0.14	0.13	3214.59
Notes: c(2), e, f, h, k(1)											
V2530-A5	Idle (Taxi)	7%	1095	5.00	1.07	10.95	0.12	---	0.13	0.12	3214.59
	Approach	30%	2992	10.10	1.07	1.81	0.06	---	0.21	0.18	3214.59
	Climb out	85%	8548	27.10	1.07	0.52	0.05	---	0.19	0.17	3214.59
	Takeoff	100%	10564	33.80	1.07	0.45	0.05	---	0.14	0.13	3214.59
Notes: c(2), e, f, h, k(1)											
V2533-A5	Taxi (Idle)	7%	1082	5.24	1.07	9.32	0.12	---	0.13	0.12	3214.59
	Approach	30%	3096	10.83	1.07	1.65	0.06	---	0.21	0.19	3214.59
	Climb out	85%	9085	28.67	1.07	0.52	0.05	---	0.19	0.17	3214.59
	Takeoff	100%	11318	36.48	1.07	0.46	0.05	---	0.13	0.12	3214.59
Notes: c(2), e, f, h, k(1)											

Notes for Table 2-8:

- The emission factor for sulfur oxides assume JP-8 used as the fuel. The value provided is the national average for sulfur content in JP-8, though when conducting an air emissions inventory (AEI), the sulfur content should be obtained directly from the fuel supplier.
- The equivalent CO<sub>2</sub> (CO<sub>2e</sub>) emission factors are the total of CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O with individual emission factors of 9.75kg/gal, 0.405g/gal, and 0.081 g/gal respectively. CH<sub>4</sub> and N<sub>2</sub>O were converted to CO<sub>2e</sub> using a global warming potential (GWP) value of 25 for CH<sub>4</sub> and 298 for N<sub>2</sub>O. These were added to the CO<sub>2</sub> and are presented as the CO<sub>2e</sub> emission factors in units of lb/1000lb fuel. JP-8 with a density of 6.71 lb/gal was used for unit conversion.
- The Emission factors were found in the following sources:
  - (1) SOURCE: *Air Pollutant Emission Factors for Military and Civil Aircraft*, EPA-450/3-78-117, October 1978.
  - (2) SOURCE: *Airport Air Quality Manual*, International Civil Aviation Organization, 2011 version 24 datasheets.
  - (3) SOURCE: *Aircraft Engine and Auxiliary Power Unit Emissions Volumes I-III*, March 1999, IERA-RS-BR-TR-1999-0006.
  - (4) SOURCE: *Aircraft Engine and Auxiliary Power Unit Emissions Testing Final Report Addendum F119-PW-100* June 2002, IERA-RS-BR-SR-2002-0006.
  - (5) SOURCE: *Engine and Hush House Emissions from a F100-PW-200 Jet Engine Tested at Kelly AFB, TX* Final Volume I February 1997.

- (6) SOURCE: Air Emissions Inventory Guidance Document for Mobile Sources at Air Force Installations January 2002, IERA-RS-BR-SR-2001-0010.
  - (7) SOURCE: *Aircraft Engine Emissions Estimator*, AFESC, September 1985.
  - (8) SOURCE: *Collection and Assessment of Aircraft Emissions*, US EPA, October 1971.
  - (9) SOURCE: *Summary Tables of Gaseous and Particulate Emissions from Aircraft Engines*, Aircraft Environmental Support Office.
  - (10) SOURCE: *Clean Air Act Emission Testing of the T-38C Aircraft Engines* September 2002, IERA-RS-BR-SR-2003-001.
  - (11) SOURCE: *PT6A-68 Emissions Measurement Program Summary, September 2002*, IERA-RS-BR-SR-2003-0003.
  - (12) SOURCE: *Engine and Hush House Emissions from a TF30-P-109 Jet Engine Tested at Canon AFB, NM Final Volume I* June 1996.
  - (13) SOURCE: *Air Emissions Factor Guide to Air Force Mobile Sources*, December 2009.
  - (14) SOURCE: *Engine and Hush House Emissions from a F100-PW-100 Jet Tested at Langley Air Force Base, VA*, November 1996.
  - (15) SOURCE: *Aircraft Emissions Characterization: TF41-A2, TF30-P-103, and TF30-P109 Engines*, December 1987.
  - (16) SOURCE: *Exhaust Emissions from In-Use General Aviation Aircraft*, The National Academies of Sciences Engineering Medicine. The National Academies Press, 2016.
  - (17) SOURCE: *Source Sampling of Aerospace Ground Equipment and Jet Engines Technical Report*, Environmental Quality Management, Inc. 1996.
  - (18) SOURCE: *Fuel Flows and Emission Indexes of the F404-GE-402 Engine Burning JP-5*, AESO Memorandum Report No. 2003-01 Revision A, September 2016.
  - (19) SOURCE: *Fuel Flows and Emission Indexes of the F414-GE-400 Engines Burning JP-5*, AESO Memorandum Report No. 9725 Revision E, September 2016.
  - (20) SOURCE: *Fuel Flows and Emission Indexes of F405-RR-401 Engine Using JP-5*, AESO Memorandum Report No. 2006-03 Revision B. June 2017.
- d. Surrogate data was used for this engine. The surrogate data was found in the following sources:
- (1) Data was calculated using values provided in the source document.
  - (2) F100-PW-220
  - (3) F101-GE-102
  - (4) F110-GE-100
  - (5) IO-360-A
  - (6) J52-P-408
  - (7) J57-P-19W
  - (8) J85-GE-13
  - (9) O-320-A2B
  - (10) J85-GE-5A
  - (11) PT6A-65
  - (12) R-1820-82
  - (13) TIO-540-A1A
  - (14) LF507-1F
  - (15) PT6A-38
  - (16) PW2040
  - (17) T53-L-13
  - (18) T56-A-15
  - (19) T58-GE-5
  - (20) T64-GE-100
  - (21) TF30-P-7
  - (22) TF34-GE-100A
  - (23) TPE331-3
  - (24) F404-GE-F1D2
  - (25) O-200A
- e. Source Document provided emission factors for total hydrocarbons (THC) or non-methane total organic gas (NMTOG). These values converted to volatile organic compounds (VOC's) using the following equations:  $VOC=1.15*THC$  or

VOC=NMOG\*0.99 based on the document *Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines*, FAA 2009.

- f. PM data calculated using smoke numbers and the ICAO method. The PM calculated was assumed to be PM<sub>10</sub>.
- g. PM reported in the source document was assumed to be PM<sub>10</sub>.
- h. PM<sub>2.5</sub> calculated at 90% of PM<sub>10</sub>.
- i. For at least one setting, the emission factors reported are an average of values provided in the source document.
- j. Percent thrust is an estimate based on tables provided in the source document.
- k. Fuel used for emissions testing:
  - (1) Jet A
  - (2) Jet A-1
  - (3) JP-4
  - (4) JP-5
  - (5) JP-8
  - (6) JP-8+100
  - (7) AVGAS
  - (8) No data on fuel used in tests

“(S)” – Indicates that this emission factor is from a recommended surrogate engine. See note 4 for details.

“(C)” – Indicates this value was calculated using data provided by the source document.

“---” Indicates No Data Available

**Table 2-9. VOC and HAP Emission Factors for Select Engines****F100-PW-100**

Power Setting			Idle	Approach	Intermediate	Military	Afterburner-5
Fuel Flowrate (lb/hr)			1127	2765	7685	10996	54007
Percent Thrust/hp			3%	13%	45%	100%	134%
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	2.35E-01	1.50E-01	1.00E-02	1.00E-02	1.00E-02
Acrolein	107-02-8	X	1.11E-01	6.00E-02	ND	ND	ND
Benzaldehyde	100-52-7		2.40E-02	1.00E-02	ND	ND	ND
Benzene	71-43-2	X	4.50E-02	2.45E-03	5.25E-04	5.01E-04	2.85E-04
1,3-Butadiene	106-99-0	X	2.93E-02	ND	ND	ND	ND
2-Butanone (MEK)	78-93-3		9.00E-03	2.00E-02	0.00E+00	0.00E+00	0.00E+00
Crotonaldehyde	4170-30-3		3.40E-02	2.00E-02	ND	ND	ND
Ethylbenzene	100-41-4	X	5.93E-03	4.44E-04	ND	3.99E-04	8.38E-05
Formaldehyde	50-00-0	X	8.61E-01	6.10E-01	2.00E-02	1.00E-02	1.00E-02
Hexanal	66-25-1		2.50E-02	3.00E-02	3.00E-02	1.00E-02	0.00E+00
Naphthalene	91-20-3	X	9.50E-02	7.49E-04	4.91E-04	3.43E-04	5.40E-04
Phenol	108-95-2	X	3.99E-02	ND	ND	ND	3.38E-03
Propanal	123-38-6	X	3.90E-02	2.00E-02	1.00E-02	4.00E-02	0.00E+00
Styrene	100-42-5	X	4.09E-03	ND	ND	ND	ND
Toluene	108-88-3	X	2.20E-02	1.73E-03	9.55E-04	9.24E-04	2.98E-04
Xylenes (mixed isomers)	1330-20-7	X	5.10E-02	7.35E-03	1.92E-03	4.55E-03	9.42E-04

Notes for F100-PW-100

SOURCE: *Engine and Hush House Emissions from F100-PW-100 Jet Engine Tested at Langley Air Force Base, VA* Volumes I-III, November 1996.

"X" Indicates that compound is a HAP

"---" Indicates No Data Available

ND – Compound not detected at the detection limit. Compound may be present at a value less than the detection limit

**Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)****F100-PW-200**

Power Setting			Idle	Approach	Intermediate	Military	Afterburner-5
Fuel Flowrate (lb/hr)			1006	3251	5651	8888	40123
Percent Thrust/hp			3%	13%	45%	100%	134%
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	2.41E-01	ND	7.00E-03	1.30E-02	1.60E-02
Acrolein	107-02-8	X	8.40E-02	ND	ND	ND	ND
Benzaldehyde	100-52-7		ND	ND	ND	ND	ND
Benzene	71-43-2	X	4.73E-02	3.87E-04	1.89E-04	4.90E-04	1.82E-04
1,3-Butadiene	106-99-0	X	1.04E-02	ND	ND	ND	ND
2-Butanone (MEK)	78-93-3		4.00E-02	ND	7.00E-03	6.00E-03	8.00E-03
Crotonaldehyde	4170-30-3		3.20E-02	ND	ND	ND	ND
Ethylbenzene	100-41-4	X	2.99E-03	1.93E-04	2.70E-04	3.44E-04	4.01E-05
Formaldehyde	50-00-0	X	7.77E-01	ND	ND	2.00E-03	2.00E-02
Hexanal	66-25-1		ND	ND	ND	ND	ND
Naphthalene	91-20-3	X	3.42E-02	2.13E-04	3.96E-04	4.01E-04	4.12E-04
Phenol	108-95-2	X	1.35E-02	ND	ND	2.68E-04	1.04E-03
Propanal	123-38-6	X	4.90E-02	ND	8.00E-03	6.00E-03	7.00E-03
Styrene	100-42-5	X	5.02E-04	ND	2.78E-04	ND	ND
Toluene	108-88-3	X	1.65E-02	7.62E-04	4.34E-04	1.08E-03	8.75E-04
Xylenes (mixed isomers)	1330-20-7	X	1.83E-02	1.68E-03	1.78E-03	2.58E-03	3.17E-04

Notes for F100-PW-200 Engine:

SOURCE: *Engine and Hush House Emissions from F100-PW-200 Jet Engine Tested at Kelly Air Force Base, TX Volumes I-III, February 1997*

“X” Indicates that compound is a HAP

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

## F101-GE-102

Power Setting			Idle	Approach	Intermediate	Military	Afterburner-1
Fuel Flowrate (lb/hr)			1117	4533	6557	7828	15314
Percent Thrust/hp			5%	47%	66%	77%	106%
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	ND	ND	ND	ND	1.77E-02
Acrolein	107-02-8	X	ND	ND	ND	ND	8.23E-02
Benzaldehyde	100-52-7		ND	ND	ND	1.93E-03	4.98E-02
Benzene	71-43-2	X	1.18E-02	7.89E-04	1.32E-03	5.48E-03	2.28E-01
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		2.28E-03	ND	ND	ND	3.30E-02
Crotonaldehyde	4170-30-3		ND	ND	ND	ND	3.59E-02
Ethylbenzene	100-41-4	X	ND	ND	ND	ND	8.60E-02
Formaldehyde	50-00-0	X	1.04E-01	5.12E-03	4.64E-03	4.43E-03	3.89E-02
Hexanal	66-25-1		ND	ND	ND	ND	1.80E-02
Naphthalene	91-20-3	X	1.79E-03	AA	ND	ND	1.27E-01
Phenol	108-95-2	X	2.29E-03	1.22E-03	ND	ND	2.71E-02
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	1.08E-03	ND	3.36E-04	ND	1.21E-02
Toluene	108-88-3	X	5.55E-03	1.50E-03	1.69E-03	1.29E-03	1.26E-01
Xylenes (mixed isomers)	1330-20-7	X	9.22E-04	4.34E-04	6.65E-04	2.45E-03	2.24E-01

Notes for F101-GE-102 Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.



Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

## F108-CF-100

Power Setting			Idle	Approach	Intermediate	Military	---
Fuel Flowrate (lb/hr)			1136	2547	5650	6458	---
Percent Thrust/hp			9%	30%	70%	78%	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	AA	ND	ND	ND	---
Acrolein	107-02-8	X	ND	ND	ND	ND	---
Benzaldehyde	100-52-7		ND	ND	ND	4.09E-03	---
Benzene	71-43-2	X	1.39E-02	3.39E-03	8.30E-04	5.10E-04	---
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		5.35E-03	ND	ND	ND	---
Crotonaldehyde	4170-30-3		ND	ND	ND	ND	---
Ethylbenzene	100-41-4	X	6.84E-04	5.53E-04	ND	ND	---
Formaldehyde	50-00-0	X	9.51E-02	1.50E-02	5.58E-03	7.01E-03	---
Hexanal	66-25-1		ND	9.66E-03	ND	ND	---
Naphthalene	91-20-3	X	2.90E-03	AA	ND	ND	---
Phenol	108-95-2	X	ND	ND	ND	ND	---
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	1.48E-03	ND	ND	ND	---
Toluene	108-88-3	X	8.97E-03	6.23E-03	1.42E-03	1.11E-03	---
Xylenes (mixed isomers)	1330-20-7	X	1.65E-03	1.61E-03	5.42E-04	3.36E-04	---

Notes for F108-CF-100 Engine

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

## F110-GE-100

Power Setting			Idle	Approach	Intermediate	Military	Afterburner-1
Fuel Flowrate (lb/hr)			1111	5080	7332	11358	18088
Percent Thrust/hp			3%	44%	66%	100%	113%
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	6.62E-03	ND	1.65E-04	1.44E-04	1.24E-02
Acrolein	107-02-8	X	ND	ND	ND	ND	3.90E-02
Benzaldehyde	100-52-7		3.48E-02	ND	4.26E-03	3.06E-03	7.13E-02
Benzene	71-43-2	X	2.93E-02	1.77E-03	1.59E-03	1.61E-03	1.88E-01
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		2.44E-03	ND	ND	4.55E-04	2.02E-02
Crotonaldehyde	4170-30-3		ND	ND	ND	ND	6.08E-02
Ethylbenzene	100-41-4	X	2.00E-03	3.93E-04	3.68E-04	1.69E-04	4.47E-02
Formaldehyde	50-00-0	X	1.01E-01	1.00E-02	1.94E-02	1.53E-02	1.53E-02
Hexanal	66-25-1		ND	ND	ND	ND	1.14E-02
Naphthalene	91-20-3	X	3.31E-03	AA	AA	3.31E-04	9.73E-02
Phenol	108-95-2	X	2.95E-03	ND	ND	ND	6.63E-02
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	3.69E-03	2.98E-04	4.91E-04	2.65E-04	5.71E-03
Toluene	108-88-3	X	1.10E-02	1.34E-03	1.90E-03	7.41E-04	1.40E-01
Xylenes (mixed isomers)	1330-20-7	X	4.22E-03	1.12E-03	9.70E-04	5.07E-04	8.89E-02

Notes for F110-GE-100 Engine:

SOURCE: *Aircraft Engine and APU Emissions* Testing Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

**Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)****F117-PW-100**

Power Setting			Idle	Approach	Intermediate	Takeoff	---
Fuel Flowrate (lb/hr)			978	4645	10408	13905 (S)	---
Percent Thrust/hp			4%	31%	68%	---	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	1.20E-02	ND	ND	4.27E-04 (C)	---
Acrolein	107-02-8	X	ND	ND	ND	2.45E-04 (C)	---
Benzaldehyde	100-52-7		ND	3.16E-03	3.68E-03	---	---
Benzene	71-43-2	X	2.25E-02	8.90E-04	6.25E-04	1.68E-04 (C)	---
1,3-Butadiene	106-99-0	X	---	---	---	1.69E-04 (C)	---
2-Butanone (MEK)	78-93-3		ND	ND	ND	---	---
Crotonaldehyde	4170-30-3		1.20E-02	ND	ND	---	---
Ethylbenzene	100-41-4	X	2.82E-03	ND	ND	1.74E-05 (C)	---
Formaldehyde	50-00-0	X	2.36E-01	1.65E-02	9.50E-03	1.23E-03 (C)	---
Hexanal	66-25-1		ND	ND	ND	---	---
Naphthalene	91-20-3	X	2.39E-03	ND	ND	5.41E-05 (C)	---
Phenol	108-95-2	X	3.79E-03	ND	ND	7.26E-05 (C)	---
Propanal	123-38-6	X	---	---	---	7.27E-05 (C)	---
Styrene	100-42-5	X	1.55E-03	ND	ND	3.09E-05 (C)	---
Toluene	108-88-3	X	6.68E-03	1.41E-03	1.12E-03	6.42E-05 (C)	---
Xylenes (mixed isomers)	1330-20-7	X	3.27E-03	6.21E-04	5.47E-04	4.48E-05 (C)	---

Notes for F117-PW-100 Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"S" Indicates a surrogate engine was used for this data

"C" indicates this value was calculated. For VOC and HAP emission factors, these values were calculated taking the product of the VOC emission factor at the specified power setting and the mass fraction for this pollutant as given in Table 2-10

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

## F118-GE-100

Power Setting			Idle	Approach	Intermediate	Military	---
Fuel Flowrate (lb/hr)			1097	3773	6350	10887	---
Percent Thrust/hp			---	---	---	---	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	7.86E-03	ND	ND	ND	---
Acrolein	107-02-8	X	ND	ND	ND	ND	---
Benzaldehyde	100-52-7		6.59E-03	1.59E-03	1.65E-03	1.94E-03	---
Benzene	71-43-2	X	2.70E-02	8.58E-04	3.71E-04	3.38E-04	---
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		3.01E-03	ND	ND	ND	---
Crotonaldehyde	4170-30-3		ND	ND	ND	ND	---
Ethylbenzene	100-41-4	X	1.23E-03	3.72E-04	ND	ND	---
Formaldehyde	50-00-0	X	1.80E-01	1.22E-02	1.17E-02	6.55E-03	---
Hexanal	66-25-1		ND	ND	ND	ND	---
Naphthalene	91-20-3	X	AA	ND	ND	ND	---
Phenol	108-95-2	X	1.20E-03	ND	ND	ND	---
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	2.25E-03	ND	ND	ND	---
Toluene	108-88-3	X	9.88E-03	1.35E-03	2.98E-04	3.85E-04	---
Xylenes (mixed isomers)	1330-20-7	X	5.26E-03	1.96E-03	2.87E-04	2.05E-04	---

Notes for F118-GE-100 Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed

**Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)****F119-PW-100**

Power Setting			Idle	Approach	Intermediate	Military	Afterburner
Fuel Flowrate (lb/hr)			1377	2740	10110	18612	50170
Percent Thrust/hp			10%	20%	70%	100%	150%
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	1.11E-01	6.75E-03	2.61E-03	8.33E-04	7.69E-05 (C)
Acrolein	107-02-8	X	3.60E-02	ND	ND	ND	4.41E-05 (C)
Benzaldehyde	100-52-7		4.15E-02	ND	ND	ND	---
Benzene	71-43-2	X	1.06E-01	3.33E-03	6.86E-04	4.88E-04	3.03E-05 (C)
1,3-Butadiene	106-99-0	X	4.99E-02	ND	4.27E-04	ND	3.04E-05 (C)
2-Butanone (MEK)	78-93-3		3.33E-02	ND	ND	ND	---
Crotonaldehyde	4170-30-3		2.66E-02	ND	ND	ND	---
Ethylbenzene	100-41-4	X	1.64E-02	2.55E-04	4.99E-04	1.34E-04	3.13E-06 (C)
Formaldehyde	50-00-0	X	9.95E-01	3.56E-02	2.44E-02	7.58E-03	2.22E-04 (C)
Hexanal	66-25-1		ND	ND	ND	ND	---
Naphthalene	91-20-3	X	---	---	---	---	9.74E-06 (C)
Phenol	108-95-2	X	---	---	---	---	1.31E-05 (C)
Propanal	123-38-6	X	1.60E-02	ND	9.78E-04	4.10E-04	1.31E-05 (C)
Styrene	100-42-5	X	3.12E-02	2.55E-04	ND	ND	5.56E-06 (C)
Toluene	108-88-3	X	6.37E-02	2.68E-04	AA	AA	1.16E-05 (C)
Xylenes (mixed isomers)	1330-20-7	X	6.71E-02	8.81E-04	4.89E-04	3.77E-04	8.06E-06 (C)

Notes for F119-PW-100 Engine:

SOURCE: *Aircraft Engine and Auxiliary Power Unit Emissions Testing* Final Report Addendum F119-PW-100 June 2002, IERA-RS-BR-SR-2002-0006

"X" Indicates that compound is a HAP

"C" indicates this value was calculated. For VOC and HAP emission factors, these values were calculated taking the product of the VOC emission factor at the specified power setting and the mass fraction for this pollutant as given in Table 2-10

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

**Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)****F404-GE-400, -F1D2 (excluding AB for the -F1D2)**

Power Setting			Idle	Approach	Intermediate	Military	Afterburner-3
Fuel Flowrate (lb/hr)			685	3111	6464	7739	15851
Percent Thrust/hp			6%	38%	79%	91%	114%
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	5.69E-02	ND	ND	ND	3.38E-02
Acrolein	107-02-8	X	1.71E-01	ND	ND	ND	1.44E-01
Benzaldehyde	100-52-7		1.31E-01	ND	1.70E-03	ND	1.32E-01
Benzene	71-43-2	X	5.12E-01	7.56E-04	6.45E-04	7.38E-04	3.70E-01
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		2.31E-02	ND	ND	ND	2.74E-02
Crotonaldehyde	4170-30-3		9.14E-02	ND	ND	ND	8.45E-02
Ethylbenzene	100-41-4	X	7.48E-02	4.84E-04	3.53E-04	ND	4.86E-02
Formaldehyde	50-00-0	X	1.14E+00	1.67E-02	2.17E-02	9.02E-03	3.74E-02
Hexanal	66-25-1		ND	ND	ND	ND	1.26E-02
Naphthalene	91-20-3	X	1.31E-01	3.10E-04	7.04E-05	1.03E-04	7.32E-02
Phenol	108-95-2	X	1.15E-01	ND	ND	ND	6.69E-02
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	8.66E-02	ND	ND	ND	4.90E-03
Toluene	108-88-3	X	2.60E-01	8.73E-04	1.07E-03	6.61E-04	1.78E-01
Xylenes (mixed isomers)	1330-20-7	X	2.49E-01	2.64E-03	1.97E-03	1.01E-03	1.42E-01

Notes for F404-GE-400, -F1D2 Engines:

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

The F404-GE-F1D2 is a non-afterburning version of the F404-GE-400 and has the same emissions (without the afterburner setting) as the F404-GE-400.

Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

GTCP85-180

Power Setting			Constant	---	---	---	---
Fuel Flowrate (lb/hr)			270	---	---	---	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	2.09E-03	---	---	---	---
Acrolein	107-02-8	X	3.04E-04	---	---	---	---
Benzaldehyde	100-52-7		ND	---	---	---	---
Benzene	71-43-2	X	1.50E-02	---	---	---	---
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		9.96E-04	---	---	---	---
Crotonaldehyde	4170-30-3		5.25E-04	---	---	---	---
Ethylbenzene	100-41-4	X	1.20E-04	---	---	---	---
Formaldehyde	50-00-0	X	2.03E-02	---	---	---	---
Hexanal	66-25-1		ND	---	---	---	---
Naphthalene	91-20-3	X	AA	---	---	---	---
Phenol	108-95-2	X	1.44E-04	---	---	---	---
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	1.91E-04	---	---	---	---
Toluene	108-88-3	X	2.94E-03	---	---	---	---
Xylenes (mixed isomers)	1330-20-7	X	2.65E-03	---	---	---	---

Notes for GTCP85-180 Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

GTCP165-1

Power Setting			Constant	---	---	---	---
Fuel Flowrate (lb/hr)			273	---	---	---	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	5.61E-03	---	---	---	---
Acrolein	107-02-8	X	1.21E-02	---	---	---	---
Benzaldehyde	100-52-7		1.26E-02	---	---	---	---
Benzene	71-43-2	X	3.79E-02	---	---	---	---
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		2.77E-03	---	---	---	---
Crotonaldehyde	4170-30-3		5.83E-03	---	---	---	---
Ethylbenzene	100-41-4	X	8.63E-04	---	---	---	---
Formaldehyde	50-00-0	X	1.88E-02	---	---	---	---
Hexanal	66-25-1		ND	---	---	---	---
Naphthalene	91-20-3	X	5.54E-03	---	---	---	---
Phenol	108-95-2	X	4.48E-03	---	---	---	---
Propanal	123-38-6	X	--	---	---	---	---
Styrene	100-42-5	X	2.24E-03	---	---	---	---
Toluene	108-88-3	X	1.87E-02	---	---	---	---
Xylenes (mixed isomers)	1330-20-7	X	6.01E-03	---	---	---	---

Notes for GTCP165-1 Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.



**Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)****J69-T-25**

Power Setting			Idle	Approach	Intermediate	Military	---
Fuel Flowrate (lb/hr)			167	568 (C)	872	1085	---
Percent Thrust/hp			4%	30%	63%	84%	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	9.76E-02	5.98E-03 (C)	2.12E-03	ND	---
Acrolein	107-02-8	X	1.96E-01	3.43E-03 (C)	ND	ND	---
Benzaldehyde	100-52-7		1.04E-01	---	ND	ND	---
Benzene	71-43-2	X	1.89E-01	2.35E-03 (C)	3.47E-03	1.86E-03	---
1,3-Butadiene	106-99-0	X	---	2.36E-03 (C)	---	---	---
2-Butanone (MEK)	78-93-3		2.41E-02	---	8.70E-04	8.79E-04	---
Crotonaldehyde	4170-30-3		1.22E-01	---	ND	ND	---
Ethylbenzene	100-41-4	X	2.03E-02	2.44E-04 (C)	ND	ND	---
Formaldehyde	50-00-0	X	9.16E-01	1.72E-02 (C)	2.72E-02	1.16E-02	---
Hexanal	66-25-1		ND	---	ND	ND	---
Naphthalene	91-20-3	X	3.54E-02	7.57E-04 (C)	3.41E-04	2.22E-04	---
Phenol	108-95-2	X	2.85E-02	1.02E-03 (C)	9.86E-04	ND	---
Propanal	123-38-6	X	---	1.02E-03 (C)	---	---	---
Styrene	100-42-5	X	2.72E-02	4.33E-04 (C)	ND	ND	---
Toluene	108-88-3	X	1.12E-01	8.99E-04 (C)	1.56E-03	8.29E-04	---
Xylenes (mixed isomers)	1330-20-7	X	8.96E-02	6.27E-04 (C)	2.79E-03	4.94E-04	---

Notes for J69-T-25 Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"C" indicates this value was calculated. For VOC and HAP emission factors, these values were calculated taking the product of the VOC emission factor at the specified power setting and the mass fraction for this pollutant as given in Table 2-10

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

**Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)****J85-GE-5A**

Power Setting			Idle	Approach	Intermediate	Military	Afterburner-1
Fuel Flowrate (lb/hr)			434	875 (C)	950	2740	8138
Percent Thrust/hp			4%	13% (C)	15%	88%	116%
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	1.18E-01	5.60E-02 (C)	ND	ND	ND
Acrolein	107-02-8	X	2.70E-01	3.21E-02 (C)	ND	ND	ND
Benzaldehyde	100-52-7		1.10E-01	---	ND	ND	ND
Benzene	71-43-2	X	1.48E-01	2.20E-02 (C)	1.34E-01	1.14E-02	6.84E-03
1,3-Butadiene	106-99-0	X	---	2.21E-02 (C)	---	---	---
2-Butanone (MEK)	78-93-3		2.88E-02	---	9.09E-03	ND	3.27E-04
Crotonaldehyde	4170-30-3		1.34E-01	---	ND	ND	ND
Ethylbenzene	100-41-4	X	3.06E-02	2.28E-03 (C)	8.80E-03	3.75E-04	5.24E-04
Formaldehyde	50-00-0	X	2.26E-01	1.61E-01 (C)	5.45E-01	7.37E-02	2.40E-02
Hexanal	66-25-1		ND	---	ND	ND	ND
Naphthalene	91-20-3	X	9.65E-02	7.09E-03 (C)	1.28E-02	1.27E-03	8.16E-04
Phenol	108-95-2	X	7.17E-02	9.51E-03 (C)	1.24E-02	1.52E-03	9.39E-04
Propanal	123-38-6	X	---	9.52E-03 (C)	---	---	---
Styrene	100-42-5	X	4.17E-02	4.05E-03 (C)	1.29E-02	5.02E-04	2.85E-04
Toluene	108-88-3	X	1.67E-01	8.41E-03 (C)	4.91E-02	3.23E-03	1.74E-03
Xylenes (mixed isomers)	1330-20-7	X	1.37E-01	5.87E-03 (C)	3.62E-02	1.78E-03	2.78E-03

Notes for J85-GE-5A Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"C" indicates this value was calculated. For VOC and HAP emission factors, these values were calculated taking the product of the VOC emission factor at the specified power setting and the mass fraction for this pollutant as given in Table 2-10

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

**Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)****J85-GE-5M**

Power Setting			Idle	Approach	Intermediate	Military	---
Fuel Flowrate (lb/hr)			525	703 (C)	1045	2550	---
Percent Thrust/hp			---	---	---	---	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	2.44E-01	6.41E-02 (C)	1.91E-02	1.57E-03	---
Acrolein	107-02-8	X	3.14E-01	3.67E-02 (C)	1.24E-02	1.18E-03	---
Benzaldehyde	100-52-7		7.81E-02	---	1.24E-02	1.18E-03	---
Benzene	71-43-2	X	3.05E-02	2.52E-02 (C)	2.34E-02	2.56E-03	---
1,3-Butadiene	106-99-0	X	1.20E-02	2.53E-02 (C)	6.02E-03	ND	---
2-Butanone (MEK)	78-93-3		3.94E-02	---	6.77E-03	9.29E-04	---
Crotonaldehyde	4170-30-3		1.18E-01	---	1.24E-02	1.18E-03	---
Ethylbenzene	100-41-4	X	7.36E-03	2.61E-03 (C)	2.38E-03	8.21E-05	---
Formaldehyde	50-00-0	X	2.27E+00	1.85E-01 (C)	3.48E-01	2.39E-02	---
Hexanal	66-25-1		7.81E-02	---	1.24E-02	1.18E-03	---
Naphthalene	91-20-3	X	8.29E-02	8.12E-03 (C)	ND	ND	---
Phenol	108-95-2	X	---	1.09E-02 (C)	---	---	---
Propanal	123-38-6	X	7.81E-02	1.09E-02 (C)	1.24E-02	1.18E-03	---
Styrene	100-42-5	X	7.88E-03	4.64E-03 (C)	2.44E-03	1.08E-04	---
Toluene	108-88-3	X	2.76E-02	9.63E-03 (C)	1.14E-02	9.14E-04	---
Xylenes (mixed isomers)	1330-20-7	X	4.04E-02	6.72E-03 (C)	1.25E-02	6.65E-04	---

Notes for J85-GE-5M Engine:

SOURCE: *Clean Air Act Emissions Testing of the T-38C Aircraft Engines* September 2002, IERA-RS-BR-SR-2003-0001

"X" Indicates that compound is a HAP

"C" indicates this value was calculated. For VOC and HAP emission factors, these values were calculated taking the product of the VOC emission factor at the specified power setting and the mass fraction for this pollutant as given in Table 2-10

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

PT6A-68

Power Setting			Ground Idle	Flight Idle	Descend	Approach	Max. Continuous
Fuel Flowrate (lb/hr)			156	180	328	449	612
Percent Thrust/hp			2%	3%	19%	46%	88%
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	2.99E-01	3.47E-01	8.78E-02	1.04E-02	2.17E-03
Acrolein	107-02-8	X	7.16E-01	6.00E-01	5.06E-02	ND	ND
Benzaldehyde	100-52-7		2.34E-02	1.73E-01	4.45E-02	8.01E-03	ND
Benzene	71-43-2	X	1.67E-01	5.22E-01	8.49E-02	1.04E-02	8.63E-04
1,3-Butadiene	106-99-0	X	1.49E-01	2.67E-01	1.10E-02	ND	ND
2-Butanone (MEK)	78-93-3		3.71E-01	ND	2.65E-03	ND	ND
Crotonaldehyde	4170-30-3		2.08E-01	1.73E-01	ND	ND	ND
Ethylbenzene	100-41-4	X	4.76E-02	4.94E-02	2.52E-03	2.09E-04	1.07E-04
Formaldehyde	50-00-0	X	4.81E+00	5.27E+00	2.93E+00	6.73E-01	2.21E-02
Hexanal	66-25-1		1.56E-01	ND	ND	ND	ND
Naphthalene	91-20-3	X	ND	1.16E-02	ND	ND	7.68E-02
Phenol	108-95-2	X	---	---	---	---	---
Propanal	123-38-6	X	1.30E-01	1.08E-01	ND	ND	ND
Styrene	100-42-5	X	4.68E-02	3.80E-02	8.05E-03	ND	ND
Toluene	108-88-3	X	1.65E-01	2.42E-01	2.46E-02	2.37E-03	5.18E-04
Xylenes (mixed isomers)	1330-20-7	X	1.73E-01	1.97E-01	8.95E-03	8.60E-04	1.44E-03

Notes for PT6A-68 Engine:

SOURCE: *PT6A-68 Emissions Measurement Program Summary* September 2002, IERA-RS-BR-SR-2003-0003

"X" Indicates that compound is a HAP

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

## T56-A-7

Power Setting			Idle	Approach	Intermediate	Military	---
Fuel Flowrate (lb/hr)			724	880	1742	2262	---
Percent Thrust/hp			5%	15%	61%	90%	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	1.04E-02	AA	5.43E-04	1.64E-04	---
Acrolein	107-02-8	X	ND	ND	ND	ND	---
Benzaldehyde	100-52-7		1.13E-03	8.76E-04	4.67E-04	ND	---
Benzene	71-43-2	X	4.77E-03	4.45E-03	1.34E-03	7.84E-04	---
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		4.63E-04	3.62E-04	ND	1.75E-04	---
Crotonaldehyde	4170-30-3		ND	ND	ND	ND	---
Ethylbenzene	100-41-4	X	ND	4.06E-04	2.07E-04	1.80E-04	---
Formaldehyde	50-00-0	X	4.10E-02	3.34E-02	9.30E-03	3.81E-04	---
Hexanal	66-25-1		ND	ND	ND	ND	---
Naphthalene	91-20-3	X	1.16E-03	1.03E-03	1.77E-04	1.34E-04	---
Phenol	108-95-2	X	ND	ND	ND	ND	---
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	7.09E-04	3.67E-04	ND	ND	---
Toluene	108-88-3	X	2.71E-03	2.29E-03	9.61E-04	2.53E-05	---
Xylenes	1330-20-7	X	1.33E-03	1.05E-03	5.82E-04	8.75E-04	---

Notes for T56-A-7 Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing Volumes I-III* March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

## T64-GE-100

Power Setting			Ground Idle	75% Normal	Normal	Military	---
Fuel Flowrate (lb/hr)			298	941	1698	1848	---
Percent Thrust/hp			2%	34%	81%	90%	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	5.07E-02	1.20E-03	ND	ND	---
Acrolein	107-02-8	X	1.14E-01	1.37E-03	ND	ND	---
Benzaldehyde	100-52-7		5.90E-02	1.86E-03	ND	ND	---
Benzene	71-43-2	X	2.16E-01	1.26E-02	4.00E-03	3.88E-03	---
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		2.96E-02	2.33E-04	ND	ND	---
Crotonaldehyde	4170-30-3		5.07E-02	1.01E-03	ND	ND	---
Ethylbenzene	100-41-4	X	2.24E-02	3.07E-04	ND	ND	---
Formaldehyde	50-00-0	X	7.15E-02	1.17E-02	3.18E-04	1.83E-04	---
Hexanal	66-25-1		1.81E-02	3.83E-05	ND	ND	---
Naphthalene	91-20-3	X	5.44E-02	1.52E-03	4.96E-06	2.50E-03	---
Phenol	108-95-2	X	8.26E-03	ND	ND	ND	---
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	4.11E-02	5.12E-04	ND	ND	---
Toluene	108-88-3	X	1.02E-01	2.88E-03	1.33E-04	1.27E-04	---
Xylenes (mixed isomers)	1330-20-7	X	6.45E-02	9.68E-04	ND	ND	---

Notes for T64-GE-100 Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

## T700-GE-700

Power Setting			Ground Idle	Flight Idle	Flight Max	Overspeed	---
Fuel Flowrate (lb/hr)			134	469	626	725	---
Percent Thrust/hp			4%	56%	82%	100%	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	1.81E-02	3.03E-04	2.00E-04	ND	---
Acrolein	107-02-8	X	7.23E-03	9.68E-05	1.10E-05	ND	---
Benzaldehyde	100-52-7		ND	9.00E-04	4.15E-04	ND	---
Benzene	71-43-2	X	4.87E-02	2.97E-04	3.12E-04	3.00E-04	---
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		2.00E-03	3.26E-04	ND	ND	---
Crotonaldehyde	4170-30-3		9.93E-03	ND	ND	ND	---
Ethylbenzene	100-41-4	X	2.25E-03	2.57E-04	ND	1.99E-04	---
Formaldehyde	50-00-0	X	2.19E-01	4.09E-03	2.09E-03	4.81E-03	---
Hexanal	66-25-1		ND	ND	ND	ND	---
Naphthalene	91-20-3	X	7.33E-03	1.56E-04	6.73E-05	2.91E-05	---
Phenol	108-95-2	X	6.24E-03	ND	ND	ND	---
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	5.16E-03	ND	ND	ND	---
Toluene	108-88-3	X	1.28E-02	1.24E-03	AA	2.92E-04	---
Xylenes (mixed isomers)	1330-20-7	X	7.14E-03	5.69E-04	5.07E-04	1.24E-03	---

Notes for T700-GE-700 Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"—" Indicates No Data Available

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.

Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

## TF30-P-109

Power Setting			Idle	Approach	Intermediate	Military	Afterburner
Fuel Flowrate (lb/hr)			761	1727	2921	6263	38460
Percent Thrust/hp			5%	23%	47%	99%	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	4.47E-01	2.36E-01	9.00E-03	1.50E-02	6.70E-03
Acrolein	107-02-8	X	3.50E-02	2.30E-02	ND	ND	ND
Benzaldehyde	100-52-7		1.90E-02	7.00E-03	ND	ND	ND
Benzene	71-43-2	X	1.95E-01	5.16E-02	4.39E-03	3.74E-04	6.85E-04
1,3-Butadiene	106-99-0	X	8.34E-02	2.89E-02	ND	ND	ND
2-Butanone (MEK)	78-93-3		2.00E-02	3.60E-02	1.10E-02	4.00E-03	2.50E-03
Crotonaldehyde	4170-30-3		6.20E-02	3.30E-02	ND	ND	ND
Ethylbenzene	100-41-4	X	4.36E-02	4.99E-03	5.67E-04	3.65E-04	6.31E-05
Formaldehyde	50-00-0	X	1.82E+00	7.52E-01	4.70E-02	3.00E-03	2.44E-02
Hexanal	66-25-1		8.00E-02	1.85E-01	2.02E-01	1.17E-01	4.41E-02
Naphthalene	91-20-3	X	1.13E-01	2.24E-02	3.59E-03	8.94E-04	8.44E-04
Phenol	108-95-2	X	7.12E-02	1.70E-02	1.69E-03	2.37E-04	7.38E-04
Propanal	123-38-6	X	5.50E-02	2.50E-02	ND	ND	ND
Styrene	100-42-5	X	2.95E-02	1.28E-02	3.95E-04	ND	3.13E-05
Toluene	108-88-3	X	1.61E-01	2.45E-02	2.12E-03	8.63E-04	2.77E-04
Xylenes (mixed isomers)	1330-20-7	X	1.95E-01	1.77E-02	2.64E-03	1.77E-03	2.68E-04

Notes for TF30-P-109 Engine:

SOURCE: *Engine and Hush House Emissions from a TF30-P109 Jet Engine Tested at Cannon Air Force Base, NM*

"—" Indicates No Data Available

"X" Indicates that compound is a HAP

ND - Compound not detected at the detection limit. Compound may be present at a value less than the detection limit.

AA - Compound detected was less than the Ambient Air concentration resulting in a negative emission factor when the Ambient Air Concentration was removed.



**Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)**

TF33-P-7/7A

Power Setting			Idle	Approach	Intermediate	Military	---
Fuel Flowrate (lb/hr)			1093	4884	6356	8264	---
Percent Thrust/hp			4%	45%	58%	73%	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	ND	8.72E-03	ND	ND	---
Acrolein	107-02-8	X	ND	ND	ND	ND	---
Benzaldehyde	100-52-7		ND	ND	ND	ND	---
Benzene	71-43-2	X	5.23E-01	2.84E-02	6.49E-03	1.47E-03	---
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		1.89E-02	7.11E-03	ND	ND	---
Crotonaldehyde	4170-30-3		ND	ND	ND	ND	---
Ethylbenzene	100-41-4	X	2.00E-01	2.04E-03	5.11E-04	3.88E-04	---
Formaldehyde	50-00-0	X	2.31E+00	1.26E-01	2.80E-02	5.28E-03	---
Hexanal	66-25-1		ND	ND	ND	ND	---
Naphthalene	91-20-3	X	3.71E-01	3.13E-03	3.54E-04	AA	---
Phenol	108-95-2	X	1.67E-01	3.54E-03	1.28E-03	ND	---
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	2.42E-01	3.43E-03	7.46E-04	ND	---
Toluene	108-88-3	X	3.73E-01	1.01E-02	2.54E-03	2.27E-03	---
Xylenes (mixed isomers)	1330-20-7	X	4.62E-01	4.82E-03	1.34E-03	1.64E-03	---

Notes for TF33-P-7/7A Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing Volumes I-III March 1999*, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"---" Indicates No Data Available

ND – Compound not detected at the detection limit. Compound may be present at a value less than the detection limit

AA – Compound detected was less than the ambient air concentration resulting in a negative emission factor when the ambient air concentration was removed

**Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)**

TF33-P-102

Power Setting			Idle	Approach	Intermediate	Military	---
Fuel Flowrate (lb/hr)			1114	4737	5782	7561	---
Percent Thrust/hp			5%	49%	59%	75%	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	ND	ND	ND	ND	---
Acrolein	107-02-8	X	ND	ND	ND	ND	---
Benzaldehyde	100-52-7		ND	ND	ND	ND	---
Benzene	71-43-2	X	7.09E-01	1.14E-02	4.05E-03	9.53E-04	---
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		3.64E-02	1.59E-03	7.45E-04	ND	---
Crotonaldehyde	4170-30-3		ND	ND	ND	ND	---
Ethylbenzene	100-41-4	X	8.63E-02	8.23E-04	4.79E-04	ND	---
Formaldehyde	50-00-0	X	9.43E-01	6.65E-02	2.27E-02	ND	---
Hexanal	66-25-1		ND	ND	ND	ND	---
Naphthalene	91-20-3	X	2.15E-01	1.10E-03	7.35E-04	1.30E-04	---
Phenol	108-95-2	X	8.41E-02	1.76E-03	ND	ND	---
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	1.09E-01	1.18E-03	4.38E-04	ND	---
Toluene	108-88-3	X	2.65E-01	2.28E-03	2.65E-03	9.50E-04	---
Xylenes (mixed isomers)	1330-20-7	X	1.98E-01	2.40E-03	1.04E-03	1.08E-03	---

Notes for TF33-P-102 Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

"X" Indicates that compound is a HAP

"---" Indicates No Data Available

ND – Compound not detected at the detection limit. Compound may be present at a value less than the detection limit

AA – Compound detected was less than the ambient air concentration resulting in a negative emission factor when the ambient air concentration was removed

Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

## TF34-GE-100A

Power Setting			Idle	Approach	Intermediate	Military	---
Fuel Flowrate (lb/hr)			498	933	1512	2628	---
Percent Thrust/hp			7%	28%	46%	78%	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	1.27E-01	3.08E-02	ND	ND	---
Acrolein	107-02-8	X	6.10E-02	1.36E-02	5.42E-03	2.96E-03	---
Benzaldehyde	100-52-7		5.10E-02	2.03E-02	7.80E-03	5.94E-03	---
Benzene	71-43-2	X	2.81E-01	6.37E-02	9.57E-03	4.27E-03	---
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		1.50E-02	5.94E-03	ND	ND	---
Crotonaldehyde	4170-30-3		5.10E-02	ND	ND	ND	---
Ethylbenzene	100-41-4	X	2.62E-02	3.50E-03	ND	6.82E-04	---
Formaldehyde	50-00-0	X	1.22E+00	5.31E-01	6.61E-02	2.82E-02	---
Hexanal	66-25-1		ND	ND	ND	ND	---
Naphthalene	91-20-3	X	4.48E-02	8.51E-03	1.59E-03	3.20E-05	---
Phenol	108-95-2	X	2.73E-02	6.61E-01	ND	ND	---
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	4.41E-02	6.72E-03	ND	ND	---
Toluene	108-88-3	X	1.12E-01	1.40E-02	3.21E-03	1.34E-04	---
Xylenes (mixed isomers)	1330-20-7	X	8.17E-02	1.16E-02	1.52E-03	3.14E-03	---

Notes for TF34-GE-100A Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing* Volumes I-III March 1999, IERA-RS-BR-TR-1999-0006

“X” Indicates that compound is a HAP

“---” Indicates No Data Available

ND – Compound not detected at the detection limit. Compound may be present at a value less than the detection limit

AA – Compound detected was less than the ambient air concentration resulting in a negative emission factor when the ambient air concentration was removed

Table 2-9. VOC and HAP Emission Factors for Select Engines (cont.)

## TF39-GE-1C

Power Setting			Idle	Approach	Intermediate	Military	---
Fuel Flowrate (lb/hr)			1448	10477	12541	13862	---
Percent Thrust/hp			7%	76%	87%	94%	---
Compound Name	CAS Number	HAP	Emission Factors (lb/1000lb fuel burned)				
Acetaldehyde	75-07-0	X	2.12E-01	3.16E-03	2.61E-04	6.17E-04	---
Acrolein	107-02-8	X	2.06E-01	ND	ND	ND	---
Benzaldehyde	100-52-7		1.42E-01	1.15E-03	1.88E-03	1.70E-03	---
Benzene	71-43-2	X	3.58E-01	1.56E-03	1.41E-03	2.16E-03	---
1,3-Butadiene	106-99-0	X	---	---	---	---	---
2-Butanone (MEK)	78-93-3		2.59E-02	ND	1.16E-03	2.46E-04	---
Crotonaldehyde	4170-30-3		8.77E-02	ND	ND	ND	---
Ethylbenzene	100-41-4	X	2.01E-02	ND	4.99E-04	AA	---
Formaldehyde	50-00-0	X	1.42E+00	8.15E-03	4.90E-03	1.05E-02	---
Hexanal	66-25-1		ND	ND	ND	ND	---
Naphthalene	91-20-3	X	9.74E-02	AA	AA	AA	---
Phenol	108-95-2	X	4.38E-02	ND	ND	ND	---
Propanal	123-38-6	X	---	---	---	---	---
Styrene	100-42-5	X	4.49E-02	ND	ND	6.94E-04	---
Toluene	108-88-3	X	1.28E-01	AA	AA	AA	---
Xylenes (mixed isomers)	1330-20-7	X	5.82E-02	9.26E-04	2.58E-03	AA	---

Notes for TF39-GE-1C Engine:

SOURCE: *Aircraft Engine and APU Emissions Testing Volumes I-III March 1999*, IERA-RS-BR-TR-1999-0006

“X” Indicates that compound is a HAP

“---” Indicates No Data Available

ND – Compound not detected at the detection limit. Compound may be present at a value less than the detection limit

AA – Compound detected was less than the ambient air concentration resulting in a negative emission factor when the ambient air concentration was removed

**Table 2-10. HAP Mass Fractions in Aircraft Engine Exhaust**

Compound Name	CAS	Mass Fraction
Acetaldehyde	75-07-0	0.04272
Acrolein	107-02-8	0.02449
Benzene	71-43-2	0.01681
1,3-Butadiene	106-99-0	0.01687
Ethylbenzene	100-41-4	0.00174
Formaldehyde	50-00-0	0.1231
Isopropylbenzene	98-82-8	0.00003
Methanol	67-56-1	0.01805
1-Methylnaphthalene	90-12-0	0.00247
2-Methylnaphthalene	91-57-6	0.00206
Naphthalene	91-20-3	0.00541
Phenol	108-95-2	0.00726
Propionaldehyde	123-38-6	0.00727
Styrene	100-42-5	0.00309
Toluene	108-88-3	0.00642
Xylenes - Mixed isomers	1330-20-7	0.00448

SOURCE: Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines, FAA, 2009

**Table 2-11. Criteria Pollutant and GHG Emission Factors for APUs**

APU Model	Manufacturer	Emission Factors in lb/hr of Operation						
		NO <sub>x</sub>	CO	VOC	SO <sub>x</sub> <sup>a</sup>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub> <sup>b</sup>
4501687C	Hamilton Sundstrand	1.38	1.07	0.01	0.23	---	---	740.44
GTC 85-72 (200 hp) <sup>d</sup>	Honeywell Inc.	0.81	3.11	0.03	0.23	---	---	674.49
GTCP 30-300	Honeywell Inc.	2.85	---	0.06	0.30	---	---	---
GTCP 36-6 <sup>c</sup>	Honeywell Inc.	0.87	1.41	0.06	0.16	---	---	---
GTCP 36-50	Honeywell Inc.	4.25	11.65	0.05	0.15	---	---	---
GTCP 36-300 (80 hp)	Honeywell Inc.	2.85	0.58 <sup>f</sup>	0.06	0.30	---	---	---
GTCP 85 (200 hp)	Honeywell Inc.	1.12	---	0.24	0.25	---	---	---
GTCP 85-98ck (200 hp)	Honeywell Inc.	1.12	4.23 <sup>f</sup>	0.24	0.25	---	---	---
GTCP 85-98d	Honeywell Inc.	1.78	1.64	0.04	0.32	---	---	---
GTCP 85-129 (200 hp)	Honeywell Inc.	1.12	4.23 <sup>f</sup>	0.24	0.25	---	---	---
GTCP 85-129ck (200 hp)	Honeywell Inc.	1.12	4.23 <sup>f</sup>	0.24	0.25	---	---	---
GTCP 85-180 <sup>g</sup>	Honeywell Inc.	1.28	2.05	0.01	0.29	0.05	0.01	906.25
GTCP 95-2 (300 hp) <sup>d</sup>	Honeywell Inc.	1.65	0.94	0.11	0.32	---	---	948.89
GTCP 100-54 (400 hp) <sup>d</sup>	Honeywell Inc.	2.46	2.43	0.07	0.45	---	---	1337.86
GTCP 165-1 <sup>g</sup>	Honeywell Inc.	1.22	3.76	0.49	0.29	0.13	0.04	910.75
GTCP 331-200/250 (143 hp)	Honeywell Inc.	2.55	---	0.12	0.29	---	---	---
GTCP 331-200ER (143 hp)	Honeywell Inc.	2.55	1.11 <sup>f</sup>	0.12	0.29	---	---	---
GTCP 331-500 (143 hp)	Honeywell Inc.	7.86	0.05 <sup>f</sup>	0.07	0.58	---	---	---
GTCP 660-4 (300 hp)	Honeywell Inc.	4.60	7.46 <sup>f</sup>	0.24	0.93	---	---	---
PW901A	Pratt & Whitney	2.72	14.48 <sup>f</sup>	1.29	0.93	---	---	---
ST-6 <sup>h</sup>	United Technologies Corporation	3.92	0.02	0.01	0.48	---	---	---
T-62T-27 (100 hp) <sup>d</sup>	United Technologies Corporation	0.40	4.36	0.79	0.11	---	---	344.76
T-62T-47C1 <sup>f</sup>	United Technologies Corporation	1.01	9.46	0.04	0.25	---	---	---
TSCP 700 (142 hp)	Honeywell Inc.	2.77	---	0.08	0.35	---	---	---
TSCP 700-4B (142 hp)	Honeywell Inc.	2.77	0.48 <sup>f</sup>	0.08	0.35	---	---	---
WR27-1 <sup>d</sup>	Williams International	0.65	0.79	0.03	0.15	---	---	444.77

Notes for Table 2-11 on following page

## Notes for Table 2-11:

SOURCE (unless otherwise stated): Technical Data to Support FAA's Advisory Circular on Reducing Emissions from Commercial Aviation memorandum. This document states the original source as Proposed Federal Implementation Plan for California, Docket No. A-94-09 memorandum.

- a. SO<sub>x</sub> Emission factors assume that JP-8, with an average wt. % of 0.054 Sulfur, is used to power the APU.
- b. Greenhouse Gas (GHG) emission factors are presented in equivalent CO<sub>2</sub> (CO<sub>2</sub>e). Original source document provided emission factors for CO<sub>2</sub> and CH<sub>4</sub>. CH<sub>4</sub> emissions were then multiplied by the global warming potential (GWP) which is stated as 25 per Table A-1 to Subpart A of 40 CFR 98.
- c. SOURCE: Emission factors for this unit calculated using collected field data
- d. SOURCE: Summary Tables of Gaseous and Particulate Emissions from Aircraft Engines, June 1990.
- e. SOURCE: *Air Pollutant Emission Factors for Military and Civil Aircraft*, October 1978.
- f. SOURCE: Technical Data to Support FAA's Advisory Circular on Reducing Emissions from Commercial Aviation memorandum. This document states the original source as United Air Lines' APU Emissions Database (note: data for LAX 1991)
- g. SOURCE: Aircraft Engine and Auxiliary Power Unit Emissions Testing Volume I -III, March 1999
- h. SOURCE: Technical Data to Support FAA's Advisory Circular on Reducing Emissions from Commercial Aviation memorandum. This document states the original source as AIA Exhaust Emissions Data Sheet letter

"---" Indicates No Data Available

Installation Name: Responsible Organization (Name & Office Symbol): POC (Name & Phone #):				Inventory Year (CY):				
Building Number or Location	Type of Test Facility *	Type of Aircraft & Engine Tested	Number of Engines Tested During the Year (test/yr)	Average Run Time per Test at Each Power Setting (min/test)	Total Run Time per Test at Each Power Setting [if known] (min/yr)	Average Fuel Flow Rate at Each Power Setting (lb/hr)	Total Fuel Burned During the year [if known] (lb/yr)	Total Synthetic Fuel Used (gal)
		Aircraft: Engine:		Idle: Approach: Intermediate: Military: Afterburner:	Idle: Approach: Intermediate: Military: Afterburner:	Idle: Approach: Intermediate: Military: Afterburner:		
		Aircraft: Engine:		Idle: Approach: Intermediate: Military: Afterburner:	Idle: Approach: Intermediate: Military: Afterburner:	Idle: Approach: Intermediate: Military: Afterburner:		
		Aircraft: Engine:		Idle: Approach: Intermediate: Military: Afterburner:	Idle: Approach: Intermediate: Military: Afterburner:	Idle: Approach: Intermediate: Military: Afterburner:		
		Aircraft: Engine:		Idle: Approach: Intermediate: Military: Afterburner:	Idle: Approach: Intermediate: Military: Afterburner:	Idle: Approach: Intermediate: Military: Afterburner:		

\*eg Hush House, Trim Pad, etc.

**Figure 2-4. Example Data Collection Form for On-Wing Engine Testing**





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## 3.0 FLIGHTLINE GROUND SUPPORT EQUIPMENT (AGE)

### 3.1 Introduction

Most USAF bases operate a variety of Ground Support Equipment (GSE) or Aerospace Ground Equipment (AGE) to support flightline operations and service aircraft. Emissions from AGE or GSE vary by device type, time of operation, and fuel flow rate. For simplicity, both GSE and AGE are generically referred to as GSE in this section. Common examples of military GSE include generators, air conditioners, start carts, heaters, hydraulic test stands, portable light units, air compressors, cargo and bomb lifts, jacking units, aircraft deicers, tractors, tugs, and other service equipment. GSE are designed to be mobile so that they can be used at any number of locations on the flightline and can be easily transported to support readiness and deployment activities around the world. Depending on whether the GSE is designed to be self-propelled, it can be categorized as either vehicular or non-vehicular in nature. Although essentially non-road engines, this section addresses emissions from flightline GSE only. Other non-road engines and equipment are addressed separately in this document in the **NONROAD ENGINES AND EQUIPMENT (NRDE)** chapter. Emissions of concern from the operation of GSE include the criteria pollutants and several HAPs that are commonly associated with fuel combustion processes (including, but not limited to: benzene, naphthalene, and 1,3-butadiene).

GSE operated on an USAF installation are powered by internal combustion engines fueled by JP-8, diesel fuel, motor gasoline (MOGAS), Compressed Natural Gas (CNG), or Liquefied Petroleum Gas (LPG). The process in which fuel ignition occurs in the engine determines whether GSE is categorized as Compression Ignition (CI) or Spark Ignition (SI) in nature. CI GSE include turbine engines fueled with JP-8, and non-turbine engines fueled with diesel. SI GSE may be fueled with MOGAS, CNG, or LPG.

Individual pollutant emissions from each type of GSE are usually calculated using operating time and/or fuel consumption information applied across an operational parameter such as an LTO cycle or over an inventory period (typically one year). Military aircraft and GSE combinations and EF data are provided in Table 3-2. This information was obtained from a survey developed and distributed by Air Force Institute for Operational Health (AFIOH/RSEQ) to various flight squadrons and AGE shops throughout the USAF (Wade 2004). **These aircraft-GSE combinations are provided as a guideline though do not necessarily reflect all potential combinations.** In instances where military GSE information was unavailable, data was obtained from the FAA Emissions and Dispersion Modeling System (EDMS). Common, non-model specific GSE data from EDMS are provided in Table 3-5.

**While most USAF GSE is intended to be mobile by design, there may be instances where the regular use of the equipment results in it not being moved at least once in a 12-month**

**period. In such instances, the GSE is generally considered stationary in nature by regulators, a determination that has implications from an air permitting perspective.** If an air program manager is uncertain whether a piece of GSE should be considered mobile or stationary for regulatory purposes, he/she should coordinate with their Major Command for assistance and consider consulting with the Air Force Regional Environmental Offices to obtain their insight on state-specific requirements as they may apply to GSE.

## 3.2 Emission Factors

EFs for flightline GSE have been developed through measurement and testing and are provided in a variety of sources. EFs may be model specific and provided in units of pounds per hour (lb/hr) as provided in Table 3-3, based on the GSE and fuel type as shown in Table 3-6. For equipment that use either diesel or JP-8, the High Heat Value (HHV) of diesel was used for unit conversion where necessary, since the HHV for diesel is higher than JP-8 and conversion results in conservative estimates. EFs are selected based on the calculation method as described in the next section.

## 3.3 Emissions Calculation

Information commonly collected and used to calculate emissions from GSE operations include the type and model of the equipment, the operating time, type and volume of fuel consumed, and engine operating load and rated power. There are multiple methods used for calculation of emissions, depending on the available information. A sample data collection form for GSE is provided in Figure 3-1 at the end of the chapter.

### 3.3.1 Sortie/LTO Method (Preferred Method)

**The Sortie/LTO Method is the Air Force's default method** and should be used for all GSE that are included in Table 3-2 and Table 3-3. This method involves applying an EF to the operating time of each GSE during a set period (e.g., an aircraft sortie or LTO cycle, annually, or another inventory period). Emissions using this method are calculated as follows:

$$E(\text{Pol}) = OT \times EF(\text{Pol}) \times N$$

**Equation 3-1**

Where,

- E(Pol)** = Emissions of each individual pollutant for each piece of GSE (lb/yr)
- EF(Pol)** = Emission factor of each pollutant (lb/hr)
- OT** = Operating time of GSE per sortie (hr/sortie)
- N** = Number of sorties per year (sortie/yr)

The EFs and operating times for calculating emissions for GSE using the sortie/LTO method may be found in the following tables:

- Operating times per LTO for each GSE and associated aircraft are in Table 3-2.
- EFs for each GSE are found in Table 3-3.

### 3.3.2 Horsepower/Load Factor Method

The horsepower/load factor method is an alternative method for emissions calculations using the engine's rated hp and typical load factor. The load factor is defined as the ratio of the power an engine draws while in operation to its rated power. To calculate emissions using this method, the rated horsepower, load factor, and operating time for each GSE must be known. Emissions from common, non-model specific GSE may be calculated using the data provided in Table 3-5 and Table 3-6. The following general equation is used:

$$E(Pol) = OT \times \frac{LF}{100} \times hp_{rtd} \times \frac{1}{1000} \times EF(Pol) \times N$$

**Equation 3-2**

Where,

- E(Pol)** = Emissions of each individual pollutant (lb/yr)  
**OT** = Operating time (hr/unit)  
**LF** = Load factor (%)  
**100** = Factor for converting percent to a fraction (%)  
**hp<sub>rtd</sub>** = Engine rated hp (hp)  
**1000** = Factor converting from hp to 10<sup>3</sup> hp (hp/10<sup>3</sup> hp)  
**EF(Pol)** = Emission factor of each pollutant (lb/10<sup>3</sup> hp-hr)  
**N** = Number of ground support equipment used each year (units/yr)

Assuming a load factor of 100% will result in conservative emissions estimates. However, Table 3-5 does provide average operating loads for the many common GSE types. Alternatively, the load factor may be calculated according to the following equation if the engine horsepower and horsepower under load are known:

$$LF = \frac{hp}{hp_{rtd}}$$

**Equation 3-3**

Where,

- hp** = Engine horsepower under load (hp)

The EFs and operating times for common GSE needed to calculate emissions using the horsepower/load factor method may be found in the following tables:

- The typical commercial GSE assignments are given in Table 3-4.
- Table 3-5 provides the average rated hp for each GSE.
- EFs for common GSE are provided in a lb/10<sup>3</sup> hp-hr basis in Table 3-6.
- Table 3-7 provides EFs for several speciated HAPs for uncontrolled diesel reciprocating internal combustion engines.

### 3.3.3 Fuel Consumption Method

Another method that can be used to calculate GSE emissions involves multiplying the volume of fuel consumed by an EF that is provided in terms of a mass of pollutant emitted per volume of fuel consumed such as lb/hr or gal/hr. As with the horsepower/load factor method, the fuel consumption method also requires that the user know the operating time for each GSE. The following equation can be used as an alternative method of calculating GSE HAP emissions based exclusively on fuel consumption data:

$$E(Pol) = FC \times \frac{1}{1000} \times EF(Pol) \times N$$

**Equation 3-4**

Where,

**FC** = Fuel consumption (gal/unit)

In cases where fuel consumption data is unknown, fuel consumption may be estimated using the operating time and fuel flow rate as shown:

$$FC = OT \times FFR$$

**Equation 3-5**

Where,

**FFR** = Fuel flow rate. This may be available from the manufacturer (gal/hr)

Alternatively, fuel consumption may also be estimated using engine and operating parameters including hp (if known), hours of operation, brake-specific fuel consumption (BSFC) factor, and the heating value of the fuel. The following equation is used:

$$FC = OT \times \frac{(hp \times BSFC)}{HV}$$

**Equation 3-6**



Where,

**BSFC** = Brake specific fuel consumption (Btu/hp-hr). **Given in Table 3-1**

**HV** = Heating value of the fuel (Btu/gal). **Given in Table 3-1**

To calculate GSE emissions using the fuel consumption method, the following tables are used:

- Table 3-5 provides typical hp for common GSE
- Table 3-7 provides the EPAs EFs for HAPs from uncontrolled diesel reciprocating internal combustion engines.

### 3.3.4 Calculating SO<sub>2</sub> Emissions

A more precise method for estimating SO<sub>2</sub> emissions involves applying fuel flow rate data to derive an SO<sub>2</sub> EF based on pounds of pollutant emitted per hour of operation (lb/hr). There is a conservative assumption that all the sulfur in the fuel is converted to SO<sub>2</sub> during the combustion process. Under this assumption, and with the density and sulfur content values known, an SO<sub>2</sub> EF is calculated using the following equation:

$$EF(SO_2) = FFR \times \rho \times \frac{S}{100} \times 2$$

**Equation 3-7**

Where,

**EF(SO<sub>2</sub>)** = SO<sub>2</sub> emission factor (lb/hr)

**ρ** = Density of fuel (lb/gal)

**S** = Weight percent sulfur content of fuel (%)

**100** = Factor for converting a percent to a fraction (%)

**2** = Conversion factor which is the ratio of the molecular weight of SO<sub>2</sub> to the molecular weight of S

The value for S typically varies from supplier to supplier and the geographic location where the fuel is produced. For enhanced accuracy of the emissions inventory, the sulfur content and density of the fuel should be obtained from the fuel supplier whenever possible. In the absence of such information, the average density and sulfur content is listed in Table 3-1. The sulfur content of JP-8 varies by region, so if the region-specific sulfur content is required, then refer to Table 2-2.

**Table 3-1. Fuel Data**

<b>Fuel Type</b>	<b>Heating Value (Btu/unit fuel) <sup>a</sup></b>	<b>BSFC (Btu/hp-hr) <sup>b</sup></b>	<b>Density (lb/gal) <sup>c</sup></b>	<b>Sulfur Content (wt. %) <sup>c</sup></b>
Diesel	138,000 Btu/gal	8,089	7.14	0.025
MOGAS	125,000 Btu/gal	7,000	6.15	0.018
JP-8	124,000 Btu/gal <sup>d</sup>	---	6.71 <sup>e</sup>	0.054 <sup>e</sup>
LPG	92,000 Btu/gal	10,577 <sup>f</sup>	4.41	Negligible
CNG	1,026 Btu/ft <sup>3</sup>	7,858	0.046	0.001

a. SOURCE (Unless otherwise noted): Table C-1 to Subpart C of 40 CFR 98.

b. SOURCE (Unless otherwise noted): *Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry*, American Petroleum Institute, 2009.

c. SOURCE (Unless otherwise noted): Department of Energy, Energy Information Administration report DOE/EIA-0464/ (2005), *Household Vehicles Energy Use: Latest Data & Trends*, Appendix C, Table C4

d. SOURCE: Defense Logistics Agency, Defense Energy Support Center, *Petroleum Quality Information System Fuels Data (2005)*, April 2006.

e. SOURCE: *Petroleum Quality Information System Fuels Data*. Defense Logistics Agency, Defense Energy Support Center, 2001 – 2013. Values were calculated as the average weighted average density for years 2001 – 2013.

f. SOURCE: *Exhaust Emission Factors for Nonroad Engine Modeling: Spark Ignition*, EPA420-R-05-019, 2005. “---” – Indicates no data available

### 3.3.5 Calculating Emissions from Synthetic Aviation Fuel

On-going DoD and USAF initiatives to reduce dependency on foreign petroleum sources are expected to result in the increased use of non-petroleum fuels in a 50-50 blend with JP-8. Testing and certification of such fuels in aircraft engines indicate the blend reduces PM emissions by an average of 35%, sulfur emissions by 50%, and CO<sub>2</sub> emissions by 1.8% (USAF Research Laboratory 2007). Accordingly, when collecting information on GSE operations verify the blend percentage and whether synthetic fuel was used. If a 50-50 blend was used, apply the appropriate emission reduction factors as given in Table 2-1.

## 3.4 Information Resources

The base AGE shop is responsible for the operation and repair of most pieces of GSE. Therefore, they should be able to provide most, if not all, of the information needed to calculate the emissions from the GSE used on the installation. In the absence of base-specific data, default EPA information can be used. In some cases, it may be necessary to contact the GSE manufacturer to obtain necessary information. An example of a data collection form that can be used to collect data on GSE is provided in Figure 3-1.

### 3.5 Example Calculations

The following section provides examples of how to calculate emissions from GSE operations using the various methodologies identified above and their associated equations.

#### 3.5.1 Problem 1 - Sortie/LTO Method

A USAF base needs to calculate annual NO<sub>x</sub> and xylene emissions from GSE operations associated with their B-1B aircraft. The following information was obtained from the base:

B-1B Aircraft	
GSE Types	A/M32A-86D Generator, A/M32A-95 Start Cart, B-1B AC unit, MJ-40 Bomb lift, NF-2 Light Cart
Sorties/year	200

**Step 1 – Record the operating times and NO<sub>x</sub> emission factors for each GSE.** Since the table above does not provide specific operating times for these GSE, then the typical operating times for these GSE may be used. Table 3-2 lists the operating times for the generator as **2.20 hr**, the start cart as **0.50 hr**, the AC unit as **2.40 hr**, the bomb lift as **2.50 hr**, and the light cart as **0.50 hr**. Table 3-3 has the NO<sub>x</sub> EFs as **6.102 lb/hr** for the generator, **1.470 lb/hr** for the start cart, **7.659 lb/hr** for the AC unit, **0.340 lb/hr** for the bomb lift, and **0.110 lb/hr** for the light cart.

**Step 2 – Calculate annual NO<sub>x</sub> emissions for each GSE.** Using the information in the table above, the data collected in Step 1, and Equation 3-1, the NO<sub>x</sub> emissions for each GSE are calculated as follows:

$$E(Pol) = OT \times EF(Pol) \times N$$

$$E(NO_x)_{A/M32A-86} = 2.20 \frac{hr}{sortie} \times 6.102 \frac{lb}{hr} \times 200 \frac{sortie}{yr} = 2,684.88 \frac{lb}{yr}$$

$$E(NO_x)_{A/M32A-95} = 0.50 \frac{hr}{sortie} \times 1.470 \frac{lb}{hr} \times 200 \frac{sortie}{yr} = 147.00 \frac{lb}{yr}$$

$$E(NO_x)_{B-1B AC Unit} = 2.40 \frac{hr}{sortie} \times 7.659 \frac{lb}{hr} \times 200 \frac{sortie}{yr} = 3,676.32 \frac{lb}{yr}$$

$$E(NO_x)_{MJ-40} = 2.50 \frac{hr}{sortie} \times 0.340 \frac{lb}{hr} \times 200 \frac{sortie}{yr} = 170.00 \frac{lb}{yr}$$

$$E(NO_x)_{NF-2} = 0.50 \frac{hr}{sortie} \times 0.110 \frac{lb}{hr} \times 200 \frac{sortie}{yr} = 11.00 \frac{lb}{yr}$$

**Step 3 – Calculate total NO<sub>x</sub> emissions.** Sum the emissions from each GSE to get the total NO<sub>x</sub> emissions for GSE the B-1B:

$$E(NO_X)_{Total} = (2684.88 + 147 + 3676.32 + 170 + 11) \frac{lb}{yr}$$

$$E(NO_X)_{Total} = 6,689.2 \frac{lb}{yr}$$

Next, calculate xylene emissions.

**Step 4 – Record the fuel flow rate for each GSE.** Table 3-3 shows that the fuel flow rate is **6.47 gal/hr** for the generator and **17.14 gal/hr** for the AC unit. Since the fuel flow rate of the start cart, bomb lift, and light cart are not provided in the table, surrogates must be selected. Ideally, the best surrogates will be similar GSE types with similar hp. For this example, the A/M32A-86D was selected as a surrogate for the A/M32A-95, the elevator loader was selected for the MJ-40, and the generator light cart was selected for the NF-2 light cart. The fuel flow rates for the surrogate equipment are listed as **6.47 gal/hr** for the A/M32A-86D, **6.29 gal/hr** for the elevator loader, and **0.62 gal/hr** for the generator light cart.

**Step 5 – Calculate the fuel consumption for each GSE.** Use the operating times and fuel flow rates recorded in Step 1 and Step 4 above respectively and Equation 3-5:

$$FC = OT \times FFR$$

$$FC_{A/M32A-86D} = 2.20 \frac{hr}{unit} \times 6.47 \frac{gal}{hr} = 14.23 \frac{gal}{unit}$$

$$FC_{A/M32A-95} = 0.50 \frac{hr}{unit} \times 6.47 \frac{gal}{hr} = 3.24 \frac{gal}{unit}$$

$$FC_{B-1B AC Unit} = 2.40 \frac{hr}{unit} \times 17.14 \frac{gal}{hr} = 41.14 \frac{gal}{unit}$$

$$FC_{MJ-40} = 2.50 \frac{hr}{unit} \times 6.29 \frac{gal}{hr} = 15.73 \frac{gal}{unit}$$

$$FC_{NF-2} = 0.50 \frac{hr}{unit} \times 0.62 \frac{gal}{hr} = 0.31 \frac{gal}{unit}$$

**Step 6 – Calculate the total fuel flow for GSE.** Sum the values calculated in Step 5 as follows:

$$FC_{GSE(Total)} = (14.23 + 3.24 + 41.14 + 15.73 + 0.31) \frac{gal}{unit} = 74.65 \frac{gal}{unit}$$

**Step 7 – Record the xylene emission factor.** Table 3-7 lists the total xylenes EF as **3.93E-02 lb/10<sup>3</sup> gal**.

**Step 8 – Calculate xylene emissions.** With the estimated fuel consumption calculated in Step 6 and the EF data from Step 7, use Equation 3-4 to calculate xylene emissions:

$$E(Pol) = FC \times \frac{1}{1000} \times EF(Pol) \times N$$

$$E(Xylenes) = 74.65 \frac{gal}{unit} \times \frac{1}{1000} \left( \frac{10^3 gal}{gal} \right) \times 0.0393 \frac{lb}{10^3 gal} \times 200 \frac{unit}{yr}$$

$$E(Xylenes) = 0.587 \frac{lb}{yr}$$

### 3.5.2 Problem 2 - Horsepower/Load Factor Method

A USAF base periodically operates two diesel-powered baggage tractors used to transport the luggage of visiting dignitaries. Using the following information obtained from the base, calculate CO and 1,3-butadiene emissions:

GSE Type – Baggage tractor	
# of GSE	2
Operating Time	15 hr/unit

**Step 1 – Record the average rated power and average operating load.** This information is provided in Table 3-5. The average rate power is given as **83 hp** and the operating load is shown as **55%**.

**Step 2 – Record the emission factors for this GSE for CO and 1,3-butadiene.** Table 3-6 gives the EF for CO for diesel baggage tractors as **11.00 lb/10<sup>3</sup> hp-hr**. Table 3-7 lists the EF for 1,3-butadiene as **3.16E-04 lb/10<sup>3</sup> hp-hr**.

**Step 3 – Calculate CO and 1,3-butadiene emissions.** Use the data collected in Step 1 and Step 2 with Equation 3-2 to calculate the CO and 1,3-butadiene emissions:

$$E(Pol) = OT \times \frac{LF}{100} \times hp_{rtd} \times \frac{1}{1000} \times EF(Pol) \times N$$

For CO:

$$E(CO)_{Baggage} = 15 \frac{hr}{unit} \times \frac{55\%}{100\%} \times 83 hp \times \frac{1}{1000} \left( \frac{10^3 hp}{hp} \right) \times 11.00 \frac{lb}{10^3 hp-hr} \times 2 \frac{unit}{yr}$$

$$E(CO)_{Baggage} = 15.06 \frac{lb}{yr}$$

For 1,3-Butadiene:

$$E(1,3 - \text{Butadiene})_{\text{Baggage}} = 15 \frac{\text{hr}}{\text{unit}} \times \frac{55\%}{100\%} \times 83 \text{hp} \times \frac{1}{1000} \left( \frac{10^3 \text{hp}}{\text{hp}} \right) \times 0.000316 \frac{\text{lb}}{10^3 \text{hp-hr}} \times 2 \frac{\text{unit}}{\text{yr}}$$

$$E(1,3 - \text{Butadiene})_{\text{Baggage}} = 4.33\text{E} - 04 \frac{\text{lb}}{\text{yr}}$$

### 3.5.3 Problem 3 - Fuel Consumption Method

A USAF base wants to estimate total toluene emissions for the previous year resulting from the operation of air start units using JP-8. The following information was obtained from the base.

GSE Type – Air Start Units	
GSE Model	A/M32A-95
# of GSE	35
Fuel Consumption	5,000 gal/unit

**Step 1 – Record the toluene emission factor.** Table 3-7 provides HAP speciation for diesel-fired engines. This table lists the toluene as **5.64E-02 lb/10<sup>3</sup>gal**.

**Step 2 – Calculate the toluene emissions.** Use the EF in Step 1, the data from the table above, and Equation 3-4:

$$E(\text{Pol}) = FC \times \frac{1}{1000} \times EF(\text{Pol}) \times N$$

$$E(\text{Toluene}) = 5000 \frac{\text{gal}}{\text{unit}} \times \frac{1}{1000} \left( \frac{10^3 \text{gal}}{\text{gal}} \right) \times 0.0564 \frac{\text{lb}}{10^3 \text{gal}} \times 35 \frac{\text{unit}}{\text{yr}}$$

$$E(\text{Toluene}) = 9.87 \frac{\text{lb}}{\text{yr}}$$

### 3.5.4 Problem 4 - Estimating SO<sub>2</sub> Emissions

A USAF base has been asked to estimate SO<sub>2</sub> emissions from the operation of its GSE. The following information was obtained from the base:

Equipment Data – GSE	
# of GSE	40
Fuel	JP-8
Fuel Flow Rate	18 gal/hr
Operating time	2 hours

Calculate SO<sub>2</sub> emissions for the AFB which is in the East Central United States.

**Step 1 – Record the density and sulfur content of JP-8.** Table 3-1 lists the density of JP-8 as **6.71 lb/gal**. Though Table 3-1 also provides the sulfur content, since it is known that the AFB is located in the East Central portion of the United States, a more accurate value given in Chapter 2 in Table 2-2 of this document states the sulfur content of JP-8 in that particular region is **0.067%**.

**Step 2 - Calculate the SO<sub>2</sub> emission factor.** This is accomplished using Equation 3-7:

$$EF(SO_2) = FFR \times \rho \times \frac{S}{100} \times 2$$

$$EF(SO_2) = 18 \frac{\text{gal}}{\text{hr}} \times 6.71 \frac{\text{lb}}{\text{gal}} \times \frac{0.067\%}{100\%} \times 2 = \mathbf{0.162 \frac{\text{lb}}{\text{hr}}}$$

**Step 3 – Calculate SO<sub>2</sub> emissions.** Use the EF calculated in Step 2 and Equation 3-1:

$$E(\text{Pol}) = OT \times EF(\text{Pol}) \times N$$

$$E(SO_2) = 2 \frac{\text{hr}}{\text{unit}} \times 0.162 \frac{\text{lb}}{\text{hr}} \times 40 \frac{\text{units}}{\text{yr}}$$

$$\boxed{E(SO_2) = 12.96 \frac{\text{lb}}{\text{yr}}}$$

**Table 3-2. Military Aircraft and GSE Assignments**

Aircraft	GSE Type	GSE Model	Operating Time Per Sortie or LTO (hr)
A-3A, -3B	See Generic 2		
A-4, -4C, -4E, -4F, -4L, -4M	See Generic 2		
A-6A, -6B, -6C, -6E, -6F	See Generic 2		
A-7A, -7B, -7C, -7D, -7E, -7K	See Generic 2		
A-10, -10A, -10C	Generator Set	A/M32A-86D	1.00
	Start Cart	A/M32A-60A	1.00
		A/M32A-95	1.00
	Heater	1H1	2.00
	Hydraulic Test Stand	MJ-2A	2.00
	Light Cart	FL-1D (S)	2.00
		NF-2	2.00
Air Compressor	MC-1A	2.00	
	MC-2A (S)	1.00	
Bomb Lift	MJ-1B <sup>(a)</sup>	1.00 - 8.00	
A-37	See Generic 2		
AC-130A, -130H, -130U, -130W	See C-130A		
AH-1G, -1J	See Generic 4		
AH-64A	See Generic 4		
AT-38B	See T-38		
AU-24	See Generic 2		
B-1A, -1B	Generator Set	A/M32A-86D	2.20
	Start Cart	A/M32A-95	0.50
	Heater/Air Conditioner	B-1B Heater/Air Conditioner	2.40
	Heater	H1	4.00
	Light Cart	FL-1D (S)	0.50
		NF-2	0.50
Bomb Lift	MJ-40	2.50	
B-2A	Generator Set	A/M32A-86D	3.00
	Start Cart	A/M32A-60A	2.00
		A/M32A-95	2.00
	Air Conditioner	Ace 401	12.00
		PD501	12.00
	Heater	H1	2.00
	Hydraulic Test Stand	MJ-2/TTU-228	1.00
		MJ-2/TTU-229	1.50
		A/M27T-13	4.00
	Light Cart	NF-2	4.00
FL-1D (S)		4.00	
Air Compressor	MC-1A	1.50	
	MC-6 (S)	5.00	
	MC-7	1.50	
Bomb Lift	MJ-40	2.00	
B-52D, -52G, -52H	Generator Set	A/M32A-86D	4.00
	Start Cart	A/M32A-95	1.00
	Air Conditioner	MA-3D	1.00
	Light Cart	NF-2	1.00
	Air Compressor	MC-1A	1.00
	Bomb Lift	MJ-1B	2.00
C-1, -1A	See Generic 1		
C-2, -2A	See Generic 4		



**Table 3-2. Military Aircraft and GSE Assignments (continued)**

Aircraft	GSE Type	GSE Model	Operating Time Per Sortie or LTO (hr)
C-5A, -5B, -5C, -5M	Generator Set	A/M32A-86D	13.00
	Start Cart	A/M32A-95	2.00
	Air Conditioner	MA-3D	3.00 - 12.00
	Heater	H1	9.00
		BT400-46HT	10.00
	Hydraulic Test Stand	MJ-1-1 <sup>(a)</sup>	1.00
		M32T1 (S)	1.00
		MJ-2A	1.00
	Light Cart	NF-2	16.00
	Air Compressor	MC-2A (S)	16.00
MC-1A		7.00	
MC-7		2.00	
Pumping Unit	AF/M27M-1 <sup>(a)</sup>	3.00	
C-9, -9A, -9B, -9C	Generator Set	A/M32A-86D	6.00
	Start Cart	A/M32A-95	0.50
	Air Conditioner	MA-3D	6.00
	Heater	H1	6.00
	Light Cart	NF-2	12.00
	Air Compressor	MC-2A (S)	2.00
		MC-1A	0.50
MC-7		2.00	
C-11A	<b>See Generic 1</b>		
C-12, -12A, -12C, -12D, -12F, -12J, -12L, -12R, -12S, -12T, -12U	Generator Set	A/M32A-86D	0.75
C-17A	Generator Set	A/M32A-86D	2.00
	Start Cart	A/M32A-95	2.00
	Air Conditioner	MA-3D	1.50
	Heater	BT400-46	1.50
		H1	1.50
	Light Cart	NF-2	1.50
	Air Compressor	MC-1A	0.66
		MC-2A (S)	0.66
		MC-7	0.66
Pumping Unit	AF/M27M-1	0.50	
Bomb Lift	MJ-1B	1.50	
C-18B	<b>See Generic 1</b>		
C-20A, -20B, -20C, -20D, -20E, -20F, -20G, -20H, -20J	Generator Set	A/M32A-86D	5.50
	Air Conditioner	Ace 802-329S <sup>(a)</sup>	1.00
		MA-3D	1.00
	Heater	1H1	3.00
	Light Cart	FL-1D (S)	6.00
	Air Compressor	MC-2A (S)	0.50
		MC-5	0.50
MC-7		2.00	
	MC-8	3.00	
C-21A	<b>See Generic 1</b>		
C-22A, -22B	Generator Set	A/M32A-86D	1.50
	Start Cart	A/M32A-60A <sup>(a)</sup>	0.25
	Heater	H1	0.25
	Light Cart	NF-2	0.25
	Air Compressor	MC-1A	0.25
		MC-7	0.25
Pumping Unit	AF/M27M-1	0.25	
C-23A, -23B, -23C	<b>See Generic 1</b>		
C-26A, -26B, -26C	<b>See Generic 1</b>		

**Table 3-2. Military Aircraft and GSE Assignments (continued)**

Aircraft	GSE Type	GSE Model	Operating Time Per Sortie or LTO (hr)
C-27J	See Generic 1		
C-28A	See Generic 1		
C-32A	Generator Set	A/M32A-86D	6.00
C-37A	See Generic 1		
C-38	See Generic 1		
C-40A, -40B, -40C	See Generic 1		
C-123K	See Generic 1		
C-130A, -130B, -130D, -130E, -130F, -130H, -130J, -130T	Generator Set	A/M32A-86D	4.00 - 11.00
		Trielectron D200T 400	3.00
	Start Cart	MA-1A (S)	0.25
		A/M32A-60A	0.25
	Air Conditioner	Ace 802-993 (S)	1.00
		MA-3D	1.00
	Heater	H1	1.00
	Hydraulic Test Stand	MJ-2A <sup>(a)</sup>	3.00
Light Cart	NF-2	2.00 - 10.00	
Air Compressor	MC-1A	0.50 - 10.00	
	MC-2A (S)	0.50 - 10.00	
C-135A, -135B, -135C, -135E	Generator Set	A/M32A-86D	10.00
	Start Cart	A/M32A-60A	1.00
		A/M32A-95	0.10
	Air Conditioner	Ace 802-993 (S)	10.00
		MA-3C (S)	2.00
	Heater	H1	4.00
		1H1	5.00
Light Cart	NF-2	2.00	
Air Compressor	MC-1A	0.33	
C-137B, -137C	See Generic 1		
C-140A, -140B	See Generic 1		
C-141, -141A, -141B, -141C	Generator Set	A/M32A-86D	0.50
	Start Cart	MD-3 (S)	0.10
		A/M32A-60A	0.50
	Heater	H1	0.40
	Hydraulic Test Stand	TTU-228E (S)	0.10
		M32T1 (S)	0.10
	Light Cart	NF-2	0.50
Air Compressor	MC-1A	0.10	
	MC-2A (S)	0.10	
CH-3B, -3E	See Generic 4		
CH-46, -46A, -46E	See Generic 4		
CH-53A, -53D	See Generic 4		
CT-1B	See Generic 1		
CT-39A, -39E, -39G	See Generic 1		
CT-43A	See T-43A		
CT-49A	See Generic 1		
CV-22, -22A	See Generic 1		
DC-130A	See C-130A		
E-1B	See Generic 1		
E-2, -2B, -2C, -2D	See Generic 1		
E-3A, -3B, -3C	See Generic 1		
E-4A, -4B	See Generic 1		
E-6B	See Generic 1		
E-8C	See Generic 1		
EA-3B	See Generic 1		

**Table 3-2. Military Aircraft and GSE Assignments (continued)**

Aircraft	GSE Type	GSE Model	Operating Time Per Sortie or LTO (hr)
EA-4F		See Generic 1	
EA-6A, -6B		See Generic 1	
EA-7L		See Generic 1	
EB-57B		See Generic 1	
EC-18B, -18D		See Generic 1	
EC-24A		See Generic 1	
EC-130E, -130H, -130J, -130SJ, -130V		See C-130A	
EC-135A, -135B, -135C, -135E, -135G, -135H, -135J, -135K, -135L, -135N, -135P, -135Y		See C-135A	
EC-137D		See Generic 1	
EF-4J		See Generic 2	
EF-111A		See Generic 2	
EH-1H, -1X		See Generic 4	
EH-60A		See Generic 4	
EKA-3B		See Generic 1	
EP-3B, -3J		See Generic 1	
ERA-3B		See Generic 2	
ES-2D		See Generic 1	
F-4, -4B, -4C, -4D, -4E, -4G, -4J, -4N, -4S		See Generic 2	
F-5A, -5B, -5E, -5F		See Generic 2	
F-8, -8J		See Generic 2	
F-14A, -14B, -14C, -14D		See Generic 2	
F-15A, -15B, -15C, -15D, -15E	Generator Set	A/M32A-86D	0.33
	Start Cart	A/M32A-60A	0.33
		A/M32A-95	0.33
	Heater	H1	0.50
	Hydraulic Test Stand	MJ-1-1	0.50
		MJ-2/TTU-228	0.50
	Light Cart	NF-2	1.00 - 8.00
	Air Compressor	MC-1A	0.33
MC-2A (S)		0.25	
MC-11 (S)		2.00	
Bomb Lift	MJ-1B	1.00	
F-16, -16A, -16B, -16C, -16D, -16N	Generator Set	A/M32A-86D	0.33
	Start Cart	A/M32A-60A	0.33
		A/M32A-95	0.33
	Heater	H1	0.50
	Hydraulic Test Stand	MJ-1-1	0.50
		MJ-2/TTU-228	0.50
	Light Cart	NF-2	1.00 - 8.00
	Air Compressor	MC-1A	0.33
MC-2A (S)		0.25	
MC-11 (S)		2.00	
Bomb Lift	MJ-1B	1.00	
F-22A, -22B		See Generic 2	
F-35A, -35B, -35C		See Generic 2	
F-100		See Generic 2	
F-106A, -106B		See Generic 2	
F-111, -111A, -111D, -111E, -111F		See Generic 2	

**Table 3-2. Military Aircraft and GSE Assignments (continued)**

Aircraft	GSE Type	GSE Model	Operating Time Per Sortie or LTO (hr)
F-117A	Generator Set	A/M32A-86D	2.00
	Start Cart	A/M32A-60A	2.00
		A/M32A-95	0.50
	Air Conditioner	Ace 802-329S <sup>(a)</sup>	2.00
	Heater	H1	1.00
	Hydraulic Test Stand	MJ-1-1	1.00
	Light Cart	NF-2	1.00
	Air Compressor	MC-1A	0.33
MC-2A (S)		0.33	
Bomb Lift	MJ-1B	1.00 <sup>(b)</sup>	
F/A-18A, -18B, -18C, -18D, -18E, -18F	See Generic 2		
FA-22A	See Generic 2		
FB-22A	See Generic 2		
FB-111A	See Generic 2		
HC-130H, -130J, -130N, -130P	See C-130A		
HH-1H, -1K, -1N	Generator Set	A/M32A-86D	1.00 - 16.00
	Start Cart	M24A-9 (S)	0.25
	Heater	H1	8.00
	Hydraulic Test Stand	MJ-2/TTU-229	1.00
	Light Cart	NF-2D (S)	2.00
		TF-1	2.00
Air Compressor	MC-1A	1.00	
	MC-2A (S)	1.00	
HH-2D	See Generic 4		
HH-3A, -3E, -3F	See Generic 4		
HH-43	See Generic 4		
HH-46A	See Generic 4		
HH-52, -52A	See Generic 4		
HH-53	See Generic 4		
HH-60G	See Generic 4		
HV-22A, -22B	See Generic 1		
JA-6A	See Generic 2		
KA-3B	See Generic 2		
KA-6D	See Generic 2		
KC-10, -10A	Generator Set	A/M32A-86D	12.00
		90CU24P5 (S)	12.00
	Hydraulic Test Stand	9780-0023D (S)	2.00
		05-7056-3600 (S)	2.00
	Generator Light Cart	Generator Light Cart	6.00
Air Compressor	MODP160WJDACJF (S)	6.00	
KC-46A	See Generic 1		
KC-130F, -130R, -130T	See C-130A		
KC-135, -135A, -135D, -135E, -135Q, -135R, -135T	See C-135A		
KC-767A	See Generic 1		
LC-130F, -130H, -130R	See C-130A		
MC-12W	See C-12		
MC-130E, -130H, -130J, -130P, -130W	See C-130A		
MH-53J, -53M	Generator Set	A/M32A-86D	3.00
	Heater	H1	8.00
	Hydraulic Test Stand	MJ-2/TTU-228	2.00
	Light Cart	NF-2D (S)	2.00
		FL-1D (S)	2.00
Air Compressor	MC-2A (S)	4.00	
MH-60A, -60G	See Generic 4		

**Table 3-2. Military Aircraft and GSE Assignments (continued)**

Aircraft	GSE Type	GSE Model	Operating Time Per Sortie or LTO (hr)
MV-22A, -22B		See Generic 1	
NA-3B		See Generic 2	
NA-4E, -4F, -4M		See Generic 2	
NA-6A, -6E		See Generic 2	
NA-7A, -7C, -7E		See Generic 2	
NB-52B		See B-52D	
NC-12B		See C-12	
NC-21A		See Generic 1	
NC-130A, -130B, -130E, -130H		See C-130A	
NC-135A, -135W		See C-135A	
NC-141A		See C-141	
NCH-46A		See Generic 4	
NF-4D		See Generic 2	
NF-16A, -16D		See F-16	
NF-106B		See Generic 2	
NF/A-18A, -18B, -18C		See Generic 2	
NKC-135A, -135E		See C-135A	
NPC-3C, -3D		See Generic 1	
NRA-3B		See Generic 2	
NRH-53D		See Generic 4	
NSH-3A		See Generic 4	
NT-33A		See Generic 1	
NT-39A		See Generic 1	
NTA-4F, -4J		See Generic 1	
NUH-1E, -1N		See Generic 4	
NUP-3A		See Generic 1	
NVH-3A		See Generic 4	
O-1		See Generic 1	
O-2A, -2B		See Generic 1	
OA-4M		See Generic 2	
OA-10A		See A-10	
OA-37B		See Generic 2	
OC-135B		See C-135A	
OH-6A		See Generic 4	
OH-58A		See Generic 4	
OT-47B		See Generic 1	
OV-10A		See Generic 1	
P-3B, -3C		See Generic 1	
QF-4B, -4E, -4G		See Generic 2	
QF-106A, -106B		See Generic 2	
QRF-4C		See Generic 2	
QT-33A		See Generic 1	
RA-3B		See Generic 2	
RA-5C		See Generic 2	
RC-12D, -12G, -12H		See C-12	
RC-135M, -135S, -135T, -135U, -135V, -135W, -135X		See C-135A	
RF-4B, -4C		See Generic 2	
RF-8G		See Generic 2	
RF/A-18A		See Generic 2	
RH-53D		See Generic 4	

**Table 3-2. Military Aircraft and GSE Assignments (continued)**

Aircraft	GSE Type	GSE Model	Operating Time Per Sortie or LTO (hr)
RP-3D	See Generic 1		
RQ-1A, -4, -4A, -4B <sup>(d)</sup>	Generator Set	805 (S) 806 (S)	24.00 24.00
	Air Conditioner	MA-3D	2.00
	Heater	H1	4.00
	Light Cart	FL-1D (S)	6.00
RU-21J	See Generic 1		
S-2, -2D, -2E, -2G	See Generic 1		
S-3A	See Generic 2		
SH-2D, -2F	See Generic 4		
SH-3A, -3G	See Generic 4		
SH-60	See Generic 4		
SV-22A	See Generic 1		
T-1A	Generator Set	Jetex (S)	0.33
	Hydraulic Test Stand	Airton (S)	0.10
T-2	See Generic 3		
T-6A	Generator Set	Jettex-40 (S)	0.50
	Start Cart	Jet Series 703D (S) MA-1A (S)	0.50 0.50
	Air Conditioner	MA-3D	0.75
	Hydraulic Test Stand	6X620-RDF (S)	1.00
	Light Cart	FL-2D (S)	1.00
	Tug	(See "Tug" in Table 3-4 and select appropriate size)	0.33
T-28	See Generic 3		
T-33A	See Generic 3		
T-34, -34C	See Generic 3		
T-37, -37B	Generator Set	A/M32A-86D <sup>(a)</sup>	0.17
	Heater	H1	0.17
	Hydraulic Test Stand	MJ-1-1	0.50
	Light Cart	TL-1D (S)	1.00
	Air Compressor	MC-1A	0.50
		MC-2A (S)	0.50
Tug	(See "Tug" in Table 3-4 and select appropriate size)	0.33	
T-38, -38A, -38C, -38N	Generator Set	A/M32A-86D	0.25
	Hydraulic Test Stand	MK1 (S)	0.75
		MK3A (S)	0.75
T-39A, -39B, -39D	See Generic 3		
T-41, -41B, -41C, -41D	See Generic 3		
T-43A	Generator Set	A/M32A-86D	2.00
		Essex B8098 (S)	2.00
	Air Conditioner	MA-3D	12.00
	Hydraulic Test Stand	HPE-45 (S)	2.00
	Light Cart	FL-1D (S)	2.00
	Air Compressor	MC-1A	1.00
T-44	See Generic 3		
T-47A	See Generic 3		
TA-3B	See Generic 2		
TA-4B, -4F	See Generic 2		
TA-7C	See Generic 2		
TC-18E, -18F	See Generic 1		
TC-130H	See C-130A		
TC-135S, -135W	See C-135A		
TE-2A, -2C	See Generic 1		
TE-8A	See Generic 1		
TF-16N	See F-16		

**Table 3-2. Military Aircraft and GSE Assignments (continued)**

Aircraft	GSE Type	GSE Model	Operating Time Per Sortie or LTO (hr)
TF-18A		See Generic 2	
TF/A-18A		See Generic 2	
TH-1L		See Generic 4	
TH-53A		See Generic 4	
TS-2A		See Generic 2	
TU-2S		See Generic 2	
U-2S		See Generic 2	
U-21, -21J		See Generic 1	
U-28A		See Generic 1	
UA-3B		See Generic 2	
UC-12B		See C-12	
UC-35A, -35C		See Generic 1	
UC-123K		See Generic 1	
UH-1E, -1H, -1L, -1N, -1V		See Generic 4	
UH-2C		See Generic 4	
UH-3A		See Generic 4	
UH-46A		See Generic 4	
UH-60A, -60C, -60Q	Generator Set	A/M32A-86D	1.00 - 5.00
	Start Cart	A/M32A-95	0.50
	Air Conditioner	MA-3D	2.00
	Heater	H1 <sup>(a)</sup>	2.00
	Hydraulic Test Stand	MJ-1-1	2.50
		MJ-2/TTU-228	1.00
	Light Cart	FL-1D (S)	0.50 - 4.00
Air Compressor	MC-1A	1.00	
	MC-2A (S)	2.50	
UP-3B		See Generic 1	
US-2A, -2B, -2C, -2D		See Generic 1	
UV-18B		See Generic 1	
UV-20A		See Generic 1	
VC-25A		See C-5A	
VC-137B, -137C		See Generic 1	
VC-140B		See Generic 1	
WC-130E, -130H, -130J		See C-130A	
WC-135B, -135C, -135W		See C-135A	
X-29A		See Generic 2	
X-31A		See Generic 2	
X-44A		See Generic 2	
YA-7D		See Generic 2	
YC-14A		See Generic 1	
YE-2C		See Generic 1	
YF-4J		See Generic 2	
YF-15A, -15B		See F-15A	
YF-16A, -16B		See F-16	
YOV-10D		See Generic 2	
YP-3C		See Generic 1	
YS-2G		See Generic 2	
YSH-2E		See Generic 4	

**Table 3-2. Military Aircraft and GSE Assignments (continued)**

Aircraft	GSE Type	GSE Model	Operating Time Per Sortie or LTO (hr)
Generic 1 Cargo/Bomber (C-130)	Generator Set	A/M32A-86D	4.00 - 11.00
		Trielectron D200T 400	3.00
	Start Cart	MA-1A (S)	0.25
		A/M32A-60A	0.25
	Air Conditioner	A/M32A-95	0.25
		Ace 802-993 (S)	1.00
	Heater	MA-3D	1.00
Hydraulic Test Stand	H1	1.00	
Light Cart	MJ-2A <sup>a</sup>	3.00	
Air Compressor	NF-2	2.00 - 10.00	
	MC-1A	0.50 - 10.00	
	MC-2A (S)	0.50 - 10.00	
Generic 2 Fighter/Fighter Bomber (F-15)	Generator Set	A/M32A-86D	0.33
	Start Cart	A/M32A-60A	0.33
		A/M32A-95	0.33
	Heater	H1	0.50
	Hydraulic Test Stand	MJ-1-1	0.50
		MJ-2/TTU-228	0.50
	Light Cart	NF-2	1.00 - 8.00
Air Compressor	MC-1A	0.33	
	MC-2A (S)	0.25	
	MC-11 (S)	2.00	
Bomb Lift	MJ-1B	1.00	
Generic 3 Small Trainers (T-37, -37B)	Generator Set	A/M32A-86D <sup>a</sup>	0.17
	Heater	H1	0.17
	Hydraulic Test Stand	MJ-1-1	0.50
	Light Cart	TL-1D (S)	1.00
	Air Compressor	MC-1A	0.50
		MC-2A (S)	0.50
Tug	(See "Tug" in Table 3-4 and select appropriate size)	0.33	
Generic 4 Helicopter (UH-60A)	Generator Set	A/M32A-86D	1.00 - 5.00
	Start Cart	A/M32A-95	0.50
	Air Conditioner	MA-3D	2.00
	Heater	H1	2.00
	Hydraulic Test Stand	MJ-1-1	2.50
		MJ-2/TTU-228	1.00
	Light Cart	FL-1D (S)	0.50 - 4.00
Air Compressor	MC-1A	1.00	
	MC-2A (S)	2.50	
Generic (Not otherwise specified)	Aircraft Tug	(See "Tug" in Table 3-4 and select appropriate size)	0.10
	Package Tug	(See "Tug" in Table 3-4 and select appropriate size)	1.30
	Cargo Loader	Cargo Loader	1.50
	Fuel Truck	Fuel Truck	0.60
	Deicer Truck <sup>c</sup>	Deicer Truck	0.15

Notes for Table 3-3 are provided on the following page.



## Notes for Table 3-2:

SOURCE (unless otherwise noted): data obtained from USAF, IERA-RS-BR-SR-2005-0001, *Flightline Emission Factors – Aircraft/Auxiliary Power Units/Aerospace Ground Support Equipment December 2004*. Data provided by USAF flight squadrons and associated AGE shops. When calculating GSE emissions, use the data available at the installation. These aircraft/GSE combinations should be used only in the absence of current, more accurate, data.

- a. Operating time estimated based on operating time of GSE on similar aircraft.
- b. GSE model changed from what was stated in the source document because of suspected error in source.
- c. Cold weather months and cold weather bases only.
- d. Uses GSE assignments for similar, surrogate engine provided in source document.

“(S)” – Indicates that emission factors for this GSE are not found in this document. In the absence of available data, it is recommended that a similar GSE and its associated emission factors are used as a surrogate.

Table 3-3. Military Aircraft GSE Emission Factors

GSE Model	GSE Type	Source of Data <sup>a</sup>	Engine Manufacturer	Model Number	Rated Hp	Fuel	Operational Mode	Fuel Flow Rate (gal/hr)	Emission Factors (lb/hr)						
									NO <sub>x</sub>	SO <sub>x</sub> <sup>b</sup>	CO	VOC <sup>c</sup>	PM <sub>10</sub>	PM <sub>2.5</sub> <sup>d</sup>	CO <sub>2e</sub> <sup>e</sup>
IH1	Heater	(5)	---	---	6.5	Diesel/JP-8	All Loads	0.39	0.160	0.003	0.180	0.105	0.006	0.006	8.81
A/M27T-13	Hydraulic Test Stand	(5)	---	---	30	Diesel/JP-8	All Loads	---	0.180	0.051	12.250	0.295	0.167 <sup>g</sup>	0.162 <sup>g</sup>	39.70
A/M32A-60A	Start Cart	(5)	Garrett	---	180	Diesel/JP-8	All Loads	---	1.820	0.306	5.480	0.284	0.211	0.205	238.22
A/M32A-86D	Generator Set	(2)	Detroit Diesel	4-71N	148	Diesel/JP-8	All Loads	6.47	6.102	0.047	0.457	0.294	0.091	0.089	146.08
A/M32A-95	Start Cart	(5)	Garrett	---	155	Diesel/JP-8	All Loads	---	1.470	0.264	5.860	0.074	0.110	0.107	205.14
A/M32C-18	Air Compressor	(1)	Detroit Diesel	6V71T	290	Diesel/JP-8	100% Load	16.57	7.973	0.120	1.522	0.205	0.211	0.205	374.13
Ace 401	Air Conditioner	(5)	Detroit Diesel	---	---	Diesel/JP-8	All Loads	---	7.970	0.408	1.520	0.211	0.211	0.205	337.48
Ace 802-329S	Air Conditioner	(3)	Detroit Diesel	6V71N	272	Diesel/JP-8	All Loads	6.8	2.938	0.049	0.150	0.204	0.198	0.192	153.53
AF/M27M-1	Pumping Unit	(1)	Wisconsin	VH4D	30	Gasoline	100% Load	1.78	0.177	0.004	12.262	0.276	0.167 <sup>g</sup>	0.162 <sup>g</sup>	34.57
AF/M32T-1	Cabin Pressure Tester	(7)	Hatz	4M40	---	Diesel/JP-8	All Loads	---	0.118	0.238	0.203	0.095	0.167 <sup>g</sup>	0.162 <sup>g</sup>	185.29
B-1B Heater/Air Conditioner	Heater/Air Conditioner	(1)	Detroit Diesel	6V-92TA	300	Diesel/JP-8	100% Load	17.14	7.659	0.124	1.409	0.258	0.152	0.148	387.00
BAK-13	Arresting Barrier	(1)	Wisconsin	MV-465D	64	Gasoline	100% Load	3.9	0.377	0.010	29.207	0.319	0.167 <sup>g</sup>	0.162 <sup>g</sup>	75.74
BT400-46	Heater	(1)	Lister-Petter	AC1-389548	6.5	Diesel/JP-8	All Loads	0.39	0.158	0.003	0.181	0.100	0.167 <sup>g</sup>	0.162 <sup>g</sup>	8.81
Cargo Loader	Cargo Loader	(6)	---	---	133	Diesel/JP-8	All Loads	7.28	2.554	0.053	1.862	0.420	0.279	0.271	164.37
Deicer Truck	Deicer Truck	(6)	---	---	270	Gasoline	All Loads	14.78	5.940	0.036	73.170	2.519	0.027	0.024	287.04
Elevator Loader	Elevator Loader	(1)	Detroit Diesel	3-53 Series	110	Diesel/JP-8	100% Load	6.29	3.128	0.046	1.048	0.129	0.063	0.061	142.02
EMU-15	Generator Set	(1)	Detroit Diesel	3-71	100	Diesel/JP-8	100% Load	5.71	3.505	0.041	4.905	0.095	0.115	0.111	128.92
EMU-17	Generator Set	(1)	Detroit Diesel	12V-71N	300	Diesel/JP-8	100% Load	17.14	8.863	0.124	11.078	0.337	0.185	0.180	387.00
EMU-19U	Generator Set	(1)	Lister	ST-3	30	Diesel/JP-8	All Loads	1.78	0.743	0.013	0.351	0.266	0.167 <sup>g</sup>	0.162 <sup>g</sup>	40.19
FL-1D	Light Cart	(7)	Kubota	D905	10.5	Diesel/JP-8	All Loads	---	0.030	0.018	0.025	0.008	0.167 <sup>g</sup>	0.162 <sup>g</sup>	13.90
Fuel Truck	Fuel Truck	(6)	---	---	300	Diesel/JP-8	All Loads	16.42	3.300	0.119	0.900	0.316	0.210	0.204	370.74
Generator Light Cart	Generator Light Cart	(4)	Onan	P218G-V10876C	10.5	Diesel/JP-8	All Loads	0.62	0.181	0.004	0.139	0.022 <sup>f</sup>	0.167 <sup>g</sup>	0.162 <sup>g</sup>	14.00
Generator Set	Generator Set	(1)	Caterpillar	D3333T	214	Diesel/JP-8	100% Load	17.5	3.170	0.127	0.689	0.547	0.071	0.069	395.13
							62% Load	10.46	3.067	0.026	0.618	0.745	0.080	0.078	236.17
Ground Mobile Terminal Generator Set	Ground Mobile Terminal Generator Set	(1)	Detroit Diesel	4-71-T	150	Diesel/JP-8	100% Load	8.57	6.855	0.062	1.114	0.155	0.109	0.106	193.50
H1	Heater	(5)	---	---	6.5	Diesel/JP-8	All Loads	0.39	0.160	0.003	0.180	0.105	0.006	0.006	8.81
MA-3	Air Conditioner	(1)	Onan	L643T*1/1C178-C	65	Diesel/JP-8	All Loads	3.79	0.497	0.027	0.133	0.011	0.167 <sup>g</sup>	0.162 <sup>g</sup>	85.57
MA-3D	Air Conditioner	(1)	John Deere	4045T	120	Diesel/JP-8	All Loads	7.12	4.167	0.052	0.317	0.053	0.167 <sup>g</sup>	0.162 <sup>g</sup>	160.76
MA-3D	Air Conditioner	(3)	John Deere	4039T	110	Diesel/JP-8	All Loads	4.57	0.640	0.033	0.058	0.284	0.063	0.061	103.18

**Table 3-3. Military Aircraft GSE Emission Factors (continued)**

GSE Model	GSE Type	Source of Data <sup>a</sup>	Engine Manufacturer	Model Number	Rated Hp	Fuel	Operational Mode	Fuel Flow Rate (gal/hr)	Emission Factors (lb/hr)						
									NO <sub>x</sub>	SO <sub>x</sub> <sup>b</sup>	CO	VOC <sup>c</sup>	PM <sub>10</sub>	PM <sub>2.5</sub> <sup>d</sup>	CO <sub>2e</sub> <sup>e</sup>
MC-1A	Air Compressor	(1)	Hatz	Z790-193	18.4	Diesel/JP-8	All Loads	1.09	0.419	0.008	0.267	0.267	0.071	0.068	24.61
MC-1A	Air Compressor	(1)	Lister Engineering Co.	ST2A/MC1A	20	Diesel/JP-8	All Loads	1.19	0.496	0.009	0.234	0.177	0.167 <sup>g</sup>	0.162 <sup>g</sup>	26.87
MC-5	Air Compressor	(3)	Deutz	F4L912 4CYL	100	Diesel/JP-8	All Loads	2.38	0.547	0.017	0.333	0.110	0.167 <sup>g</sup>	0.162 <sup>g</sup>	53.74
MC-5	Air Compressor	(1)	GMC	Series 4-53	130	Diesel/JP-8	100% Load	7.43	3.396	0.054	0.794	0.195	0.089	0.086	167.76
MC-5	Air Compressor	(1)	John Deere	4039	110	Diesel/JP-8	All Loads	6.52	2.425	0.047	0.485	0.073	0.167 <sup>g</sup>	0.162 <sup>g</sup>	147.21
MC-7	Air Compressor	(1)	John Deere	3164D	52	Diesel/JP-8	100% Load	3.3	1.285	0.024	0.642	0.057	0.167 <sup>g</sup>	0.162 <sup>g</sup>	74.51
MC-7	Air Compressor	(3)	John Deere	3179 SPEC FD16694J	48	Diesel/JP-8	All Loads	1.8	0.414	0.013	0.018	0.053	0.167 <sup>g</sup>	0.162 <sup>g</sup>	40.64
MC-8	Air Compressor	(1)	Deutz	F6L912	110	Diesel/JP-8	All Loads	6.52	2.983	0.047	0.752	0.121	0.167 <sup>g</sup>	0.162 <sup>g</sup>	147.21
MC-20	Air Compressor	(7)	Hatz	1B50	11	Diesel/JP-8	All Loads	---	0.025	0.019	0.045	0.016	0.012	0.012	14.56
Miller Concrete Cutter	Miller Concrete Cutter	(1)	Deutz	BF4D-1011T	75	Diesel/JP-8	All Loads	4.45	1.042	0.032	0.198	0.083	0.167 <sup>g</sup>	0.162 <sup>g</sup>	100.47
MJ-1-1	Hydraulic Test Stand	(1)	Detroit Diesel	3-53 N	97	Diesel/JP-8	All Loads	2.52	0.757	0.018	0.043	0.026	0.167 <sup>g</sup>	0.162 <sup>g</sup>	56.90
MJ-1B	Bomb Lift	(5)	Detroit Diesel	---	---	Diesel/JP-8	All Loads	---	4.780	0.219	3.040	3.201	0.800	0.776	152.20
MJ-1B/C	Bomb Lift	(7)	Deutz	F21011F	26	Diesel/JP-8	All Loads	---	0.009	0.050	0.023	0.006	0.167 <sup>g</sup>	0.162 <sup>g</sup>	34.54
MJ-2/TTU-228	Hydraulic Test Stand	(3)	Detroit Diesel	6V-53N	125	Diesel/JP-8	All Loads	4.92	0.937	0.036	0.083	0.292	0.083	0.080	111.09
MJ-2/TTU-228	Hydraulic Test Stand	(1)	Detroit Diesel	4-53	130	Diesel/JP-8	100% Load	7.43	3.396	0.054	0.794	0.195	0.089	0.086	167.76
MJ-2/TTU-229	Hydraulic Test Stand	(1)	Detroit Diesel	6V-53N	125	Diesel/JP-8	100% Load	10.86	3.858	0.079	2.466	0.193	0.083	0.080	245.20
MJ-2A	Hydraulic Test Stand	(5)	Detroit Diesel	---	---	Diesel/JP-8	All Loads	---	3.850	0.238	2.460	0.200	0.083	0.076	185.29
MJ-40	Bomb Lift	(5)	Detroit Diesel	---	---	Diesel/JP-8	All Loads	---	0.340	0.219	0.210	0.221	0.060	0.055	152.20
NF-2	Light Cart	(5)	---	---	18	Diesel/JP-8	All Loads	---	0.110	0.031	0.080	0.011	0.010	0.010	23.82
Nitrogen Cart	Nitrogen Generating Cart	(7)	Isuzu	4LE1PW14	52	Diesel/JP-8	All Loads	---	0.147	0.089	0.050	0.006	0.016	0.015	69.22
PD501	Air Conditioner	(5)	---	---	---	Diesel/JP-8	All Loads	---	7.650	0.408	1.410	0.274	0.167 <sup>g</sup>	0.162 <sup>g</sup>	337.48
PMU 27/M	Pumping Unit	(1)	Petter Diesel Engine	AC-1	6.5	Diesel/JP-8	All Loads	0.39	0.158	0.003	0.181	0.100	0.167 <sup>g</sup>	0.162 <sup>g</sup>	8.81
R-22	Pumping Unit	(1)	Detroit Diesel	3-53 Series	110	Diesel/JP-8	100% Load	6.29	3.128	0.046	1.048	0.129	0.063	0.061	142.02
TF-1	Light Cart	(5)	---	---	---	Diesel/JP-8	All Loads	---	0.170	0.043	0.130	0.026 <sup>f</sup>	0.160	0.155	33.09
Trilectron D200T 400	Generator Set	(3)	Detroit Diesel	8V-71T	236	Diesel/JP-8	All Loads	10.9	8.621	0.079	0.219	0.271	0.208	0.202	246.11
Tug - Large	Tug	(6)	---	---	617	Diesel/JP-8	All Loads	33.4	10.489	0.242	4.936	0.650	0.864	0.839	754.13
Tug - Medium	Tug	(6)	---	---	475	Diesel/JP-8	All Loads	25.7	8.075	0.186	3.800	0.500	0.665	0.646	580.27
Tug - Small	Tug	(6)	---	---	190	Diesel/JP-8	All Loads	10.3	3.230	0.075	1.520	0.200	0.266	0.258	232.56

Notes for Table 3-3 are provided on the following page.

## Notes for Table 3-3:

- a. Sources of data include the following:
    - (1) Emission factors were obtained from the manufacturer. any documents? Fuel usage rates were based on 7,500 Btu/hp-hr.
    - (2) Emission factors were obtained from the Southwest Research Institute report titled *Exhaust Emissions from a USAF A/M32-86D Generator*.
    - (3) Emission factors were obtained from the Pacific Environmental Services report titled *Aerospace Ground Support Equipment Emissions Characterization for Edwards AFB, California*.
    - (4) Emission factors are EPA tier I Non-road engine factors.
    - (5) Emission factors were obtained from *Aircraft/Auxiliary Power Units/Ground Support Equipment Emission Factors*, December 2002
    - (6) Emission factors calculated using the emission factors in Table 3-6 using the hp stated in the table above. If no hp was given, then the average hp for that equipment type was used (Table 3-5). Fuel usage rates were based on 7,500 Btu/hp-hr.
    - (7) Emission factors calculated from on-site emissions testing.
  - b. SO<sub>x</sub> emission factor assumes that all sulfur in the fuel reacts to form SO<sub>2</sub>. Emission factors calculated using Equation 3-7. Sulfur content and density of the fuels taken from Table 3-1. Where the fuel flow rate was not provided, the appropriate EF was selected from Table 3-6 and multiplied by the horsepower (hp). If no hp was provided, the appropriate value was selected from Table 3-5. For equipment capable of using "Diesel/JP-8", the density and sulfur content of JP-8 were used.
  - c. Emission factors from reference (5) were converted from total hydrocarbons (THC) to VOC by multiplying by a factor of 1.053. Emission factors from reference (7) were converted from total organic gas (TOG) to VOC by multiplying by a factor 1.053 and dividing the result by 1.07. These hydrocarbon conversion factors come from "Conversion Factors for Hydrocarbon Emission Components", U.S. Environmental Protection Agency (EPA), Office of Transportation and Air Quality, July 2010.
  - d. PM<sub>2.5</sub> conservatively estimated at 97% of PM<sub>10</sub> for JP-8 or diesel and 92% of PM<sub>10</sub> for gasoline (per *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-Compression-Ignition*, EPA420-P-04-009, April 2004).
  - e. CO<sub>2e</sub> emission factor calculated by taking the product of the default CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emission factors from Tables C-1 and C-2 of 40 Code of Federal Regulations (CFR) part 98, subpart C and their respective global warming potentials (GWP). The GWP for CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O are 1, 25, and 298 respectively. These values were multiplied by the high heat value of the fuel from Table C-1 of 40 CFR part 98 and the fuel flow rate. In cases where the fuel flow rate was not provided, the product of the EF and GWP were multiplied by the engine hp and brake specific fuel consumption (BSFC). A BSFC value of 8089 Btu/hp-hr was used for the diesel/JP-8 equipment.
  - f. These values were not provided from test data but calculated using the hp (or hp from Table 3-5) and the appropriate emission factor from Table 3-6.
  - g. The source did not provide an EF for this pollutant. The value provided is the average of EF for this pollutant for all ground support equipment.
- “---” Indicates No Data Available.

**Table 3-4. Typical Commercial Aircraft GSE Assignments**

Long Haul Turbine Powered Aircraft	Short Haul/Regional Turbine Powered Aircraft	Turbo-prop Powered Aircraft	Piston Powered Aircraft
Air Conditioner (Diesel/Electric)	Aircraft Tractor (Diesel)	Aircraft Tractor (Diesel)	Fuel Truck (Diesel)
Air Start (Diesel)	Baggage Tractor (Gasoline)	Baggage Tractor (Gasoline)	X
Aircraft Tractor/Tug (Diesel)	Belt Loader (Gasoline)	Belt Loader (Gasoline)	
Baggage Tractor (Gasoline)	Catering Truck (Diesel)	Catering Truck (Diesel)	
Belt Loader (Gasoline)	Fuel Truck (Diesel)	Cabin Service Truck (Diesel)	
Cabin Service Truck (Diesel)	Lavatory Truck (Diesel)	Fuel Truck (Diesel)	
Catering Truck (Diesel)	Service Truck (Diesel)	Service Truck (Diesel)	
Hydrant Truck (Diesel)	X	Cabin Service Truck (Diesel)	
Lavatory Truck (Diesel)		X	
Service Truck (Diesel)			
Water Service Truck (Diesel)			

SOURCE: FAA Emissions and Dispersion Modeling System, Version 5.02

**Table 3-5. Common GSE Operating Parameters**

GSE Type	Fuel Type	Average Rated Power (hp)	Average Operating Load (% Max Power)	Operating Time Per LTO (hr)
Air Conditioner	Diesel	255	75	0.50
Air Start	Diesel	613	90	0.12
	Gasoline	---	---	0.12
Aircraft Tractor/Tug	Diesel	617	80	0.13
	Diesel	475	80	0.13
	Diesel	190	80	0.13
	Diesel	88	80	0.13
	Gasoline	110	80	0.13
	CNG/LPG	124	80	0.13
Baggage Tractor	Diesel	83	55	1.20
	Gasoline	107	55	1.20
	CNG	83	55	1.20
	LPG	107	55	1.20
Belt Loader	Diesel	71	50	0.80
	Gasoline	107	50	0.80
	CNG	83	50	0.80
	LPG	107	50	0.80
Bobtail	Diesel	225	55	---
	Gasoline	124	55	---
	CNG	110	55	---
	LPG	124	55	---
Cabin Service Truck	Diesel	210	53	0.33
	Diesel	71	53	0.33
	Gasoline	260	53	0.33
	Gasoline	107	53	0.33
	CNG	360	53	0.33
	CNG	83	53	0.33
	LPG	260	53	0.33
	LPG	107	53	0.33
Cargo Loader	Diesel	133	50	1.33
	Diesel	80	50	1.33
	Gasoline	107	50	1.33
	CNG	83	50	1.33
	LPG	107	50	1.33
Cargo Tractor	Diesel	88	54	---
	Gasoline	107	54	---
	CNG	83	54	---
	LPG	88	54	---

**Table 3-5. Common GSE Operating Parameters (continued)**

GSE Type	Fuel Type	Average Rated Power (hp)	Average Operating Load (% Max Power)	Operating Time Per LTO (hr)
Cart (Light Cart)	Diesel	25	50	0.17
	Gasoline	25	50	0.17
	CNG/LPG	25	50	0.17
Catering Truck	Diesel	210	53	25.00
	Diesel	71	53	0.25
	Gasoline	260	53	0.25
	Gasoline	107	53	0.25
	CNG	360	53	25.00
	CNG	83	53	0.25
	LPG	260	53	0.25
	LPG	107	53	0.25
Deicer	Diesel	263	95	---
	Diesel	165	95	---
	Gasoline	270	95	---
	Gasoline	107	95	---
	CNG	83	95	---
	CNG	54	95	---
	LPG	270	95	---
	LPG	107	95	---
Forklift	Diesel	55	30	---
	Gasoline	54	30	---
	CNG/LPG	54	30	---
Fuel Truck	Diesel	300	25	0.75
	Diesel	235	25	0.54
	Diesel	175	25	0.33
	Gasoline	420	25	0.75
	Gasoline	260	25	0.54
	CNG	420	25	0.75
	CNG	360	25	0.54
	LPG	420	25	0.75
	LPG	260	25	0.54
Generator Sets	Diesel	158	82	2.00
	Gasoline	107	82	2.00
	CNG/LPG	107	82	2.00
Ground Power Unit	Diesel	194	75	0.67
	Diesel	71	75	0.67
	Gasoline	107	75	0.67
	CNG	83	75	0.67
	LPG	107	75	0.67

**Table 3-5. Common GSE Operating Parameters (continued)**

GSE Type	Fuel Type	Average Rated Power (hp)	Average Operating Load (% Max Power)	Operating Time Per LTO (hr)
Hydrant Truck	Diesel	235	70	0.20
	Gasoline	260	70	0.20
	CNG	360	70	0.20
	LPG	260	70	0.20
Lavatory Truck	Diesel	235	25	25.00
	Diesel	56	25	0.25
	Gasoline	260	25	0.25
	Gasoline	97	25	0.25
	CNG	360	25	25.00
	CNG	82	25	0.25
	LPG	260	25	0.25
	LPG	89	25	0.25
Lift	Diesel	115	50	0.17
	Gasoline	105	50	0.17
	CNG/LPG	132	50	0.17
Passenger Stand	Diesel	65	57	---
	Gasoline	107	57	---
	CNG	107	57	---
	LPG	83	57	---
Service Truck	Diesel	235	20	25.00
	Gasoline	260	20	0.25
	CNG	360	20	0.25
	LPG	260	20	0.25
Sweeper	Diesel	53	51	---
	Gasoline	53	51	---
	CNG/LPG	45	51	---
Water Service	Diesel	235	20	0.20
	Gasoline	260	20	0.20
	CNG	360	20	0.20
	LPG	260	20	0.20
Other	Diesel	140	50	---
	Gasoline	126	50	---
	CNG/LPG	173	50	---

SOURCE: FAA Emissions and Dispersion Modeling System, Version 5.02

“---” Indicates No Data Available



**Table 3-6. Common GSE Emission Factors**

GSE Type	Fuel Type	Emission Factors (lb/1000hp-hr)						
		CO	VOC <sup>a</sup>	NO <sub>x</sub>	SO <sub>x</sub>	PM <sub>10</sub> <sup>b</sup>	PM <sub>2.5</sub> <sup>c</sup>	CO <sub>2e</sub> <sup>d</sup>
Air Conditioner	Diesel	5.00	1.05	16.40	1.60	1.00	0.97	1330.83
Air Start	Diesel	6.00	1.05	19.30	1.60	1.20	1.16	1330.83
	Gasoline	271.00	9.33	22.00	0.40	0.10	0.09	1093.30
Aircraft Tractor/Tug	Diesel	8.00	1.05	17.00	1.70	1.40	1.36	1330.83
	Gasoline	393.00	12.13	23.20	0.40	0.10	0.09	1093.30
	CNG/LPG	---	---	---	---	---	---	1458.76
Baggage Tractor	Diesel	11.00	2.11	13.70	1.80	2.10	2.04	1330.83
	Gasoline	395.00	12.13	22.30	0.40	0.20	0.18	1093.30
	CNG/LPG	107.00	6.00	26.90	0.00	0.10	0.10	1458.76
Belt Loader	Diesel	8.00	2.11	14.80	1.80	1.70	1.65	1330.83
	Gasoline	275.00	9.33	22.30	0.40	0.20	0.18	1093.30
	CNG	275.00	10.00	22.30	0.00	0.10	0.10	2229.82
	LPG	74.00	4.00	26.90	0.00	0.00	0.00	1453.67
Bobtail	Diesel	8.00	1.05	16.70	1.70	1.30	1.26	1330.83
	Gasoline	398.00	12.13	22.30	0.40	0.20	0.18	1093.30
	CNG/LPG	---	---	---	---	---	---	1458.76
Cabin Service Truck	Diesel	2.00	1.05	10.30	1.60	0.30	0.29	1330.83
	Gasoline	24.00	3.73	10.70	0.30	0.10	0.09	1093.30
	CNG/LPG	107.00	6.00	26.90	0.00	0.10	0.10	1062.84
Cargo Loader	Diesel	14.00	3.16	19.20	1.90	2.10	2.04	1330.83
	Gasoline	400.00	12.13	22.30	0.40	0.20	0.18	1093.30
	CNG/LPG	106.00	5.00	26.80	0.00	0.10	0.10	1062.84
Cargo Tractor	Diesel	12.00	2.11	17.00	1.80	2.40	2.33	1330.83
	Gasoline	404.00	12.13	22.40	0.40	0.20	0.18	1093.30
	CNG/LPG	107.00	6.00	26.90	0.00	0.10	0.10	1062.84
Cart (Light Cart)	Diesel	---	---	---	---	---	---	1330.83
	Gasoline	392.00	12.13	22.30	0.40	0.10	0.09	1093.30
	CNG/LPG	---	---	---	---	---	---	1458.76
Catering Truck	Diesel	2.00	1.05	10.30	1.60	0.30	0.29	1330.83
	Gasoline	24.00	3.73	10.70	0.30	0.10	0.09	1093.30
	CNG/LPG	107.00	6.00	27.00	0.00	0.10	0.10	1062.84
Deicer	Diesel	---	---	---	---	---	---	1330.83
	Gasoline	271.00	9.33	22.00	0.40	0.10	0.09	1093.30
	CNG/LPG	---	---	---	---	---	---	1458.76
Forklift	Diesel	15.00	4.21	22.00	1.90	2.70	2.62	1330.83
	Gasoline	392.00	12.13	22.00	0.40	0.10	0.09	1093.30
	CNG/LPG	108.00	6.00	27.00	0.00	0.10	0.10	1062.84

**Table 3-6. Common GSE Emission Factors (continued)**

GSE Type	Fuel Type	Emission Factors (lb/1000hp-hr)						
		CO	VOC <sup>a</sup>	NO <sub>x</sub>	SO <sub>x</sub>	PM <sub>10</sub> <sup>b</sup>	PM <sub>2.5</sub> <sup>c</sup>	CO <sub>2e</sub> <sup>d</sup>
Fuel Truck	Diesel	3.00	1.05	11.00	1.60	0.70	0.68	1330.83
	Gasoline	37.00	4.67	11.00	0.30	0.10	0.09	1093.30
	CNG/LPG	106.00	5.00	27.00	0.00	0.10	0.10	1062.84
Generator	Diesel	6.00	2.11	20.00	1.60	1.40	1.36	1330.83
	Gasoline	271.00	9.33	22.00	0.40	0.10	0.09	1093.30
	CNG/LPG	---	---	---	---	---	---	1458.76
Ground Power Unit	Diesel	5.00	1.05	17.00	1.60	1.00	0.97	1330.83
	Gasoline	271.00	9.33	22.00	0.40	0.10	0.09	1093.30
	CNG/LPG	---	---	---	---	---	---	---
Hydrant Truck	Diesel	4.00	1.05	12.00	1.60	1.60	1.55	1330.83
	Gasoline	26.00	3.73	11.00	0.30	0.10	0.09	1093.30
	CNG/LPG	---	---	---	---	---	---	1458.76
Lavatory Truck	Diesel	4.00	1.05	12.00	1.60	1.30	1.26	1330.83
	Gasoline	18.00	3.73	11.00	0.30	0.10	0.09	1093.30
	CNG/LPG	106.00	5.00	27.00	0.00	0.10	0.10	1062.84
Lift	Diesel	15.00	4.21	22.00	1.90	2.70	2.62	1330.83
	Gasoline	397.00	12.13	22.00	0.40	0.20	0.18	1093.30
	CNG/LPG	106.00	5.00	27.00	0.00	0.10	0.10	1062.84
Passenger Stand	Diesel	4.00	1.05	12.00	1.60	1.60	1.55	1330.83
	Gasoline	46.00	4.67	11.00	0.30	0.10	0.09	1093.30
	CNG/LPG	106.00	5.00	27.00	0.00	0.10	0.10	1062.84
Service Truck	Diesel	3.00	1.05	11.00	1.60	0.90	0.87	1330.83
	Gasoline	46.00	4.67	11.00	0.30	0.10	0.09	1093.30
Sweeper	Diesel	12.00	2.11	17.00	1.80	2.40	2.33	1330.83
	Gasoline	393.00	12.13	22.00	0.40	0.10	0.09	1093.30
	CNG/LPG	108.00	6.00	27.00	0.00	0.10	0.10	1062.84
Water Service	Diesel	---	---	---	---	---	---	1330.83
	Gasoline	46.00	4.67	11.00	0.30	0.10	0.09	1093.30
	CNG/LPG	---	---	---	---	---	---	1458.76
Other	Diesel	8.00	1.05	17.00	1.70	1.30	1.26	1330.83
	Gasoline	396.00	12.13	22.00	0.40	0.20	0.18	1093.30
	CNG/LPG	106.00	5.00	27.00	0.00	0.10	0.10	1062.84

SOURCE: FAA Emission and Dispersion Modeling System, Version 5.02 for model year 2000 GSE and converted from g/hp-hr to lb/10<sup>3</sup> hp-hr.

- Reported as HC in EDMS. All values assumed to be equal to total hydrocarbons (THC) and converted into VOC. For diesel engines, THC was converted to VOC by multiplying THC value by 1.053. All gasoline engines were assumed to be 4-stroke. For gasoline engines, THC was converted to VOC by multiplying the THC value by 0.933. THC values were assumed to equal VOC emissions for CNG and LPG-fired engines. Hydrocarbon conversion factors come from *Conversion Factors for Hydrocarbon Emission Components*, U.S. Environmental Protection Agency (EPA), July 2010.
- Reported as PM in EDMS. All PM assumed to be PM<sub>10</sub>.
- Using assumptions and factors applied by EPA in its NONROAD model, PM<sub>2.5</sub> emissions conservatively estimated as 97% of JP-8 or diesel PM<sub>10</sub> emissions, 92% of gasoline PM<sub>10</sub> emissions, and 100% of CNG or LPG PM<sub>10</sub> emissions.
- CO<sub>2e</sub> is the sum of emission factors for CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O. The emission factors are presented in equivalent CO<sub>2</sub> (CO<sub>2e</sub>) using global warming potentials of 25 and 298 for CH<sub>4</sub> and N<sub>2</sub>O respectively. The emission factors were provided by the EPA's Emission Factors for Greenhouse Gas Inventories. When "CNG/LPG" is provided as the fuel used, then the greenhouse gas emission factor provided was calculated using the more conservative estimate from LPG. The emission factors for N<sub>2</sub>O and CH<sub>4</sub> for CNG and LPG were assumed to be equal to those for gasoline. Calculations were made using the heating values and fuel usage rates provided in Table 3-1.

“---” Indicates No Data Available.

**Table 3-7. Speciated HAP Emission Factors for Uncontrolled Diesel Reciprocating Internal Combustion Engines**

Compound	Emission Factors	
	lb/10 <sup>3</sup> gal	lb/10 <sup>3</sup> hp-hr
1,3-Butadiene	5.40E-03	3.16E-04
Acenaphthene	1.96E-04	1.15E-05
Acenaphthylene	6.98E-04	4.09E-05
Acetaldehyde	1.06E-01	6.20E-03
Acrolein	1.28E-02	7.48E-04
Anthracene	2.58E-04	1.51E-05
Benz(a)anthracene	2.32E-04	1.36E-05
Benzene	1.29E-01	7.55E-03
Benzo(a)pyrene	2.59E-05	1.52E-06
Benzo(b)fluoranthene	1.37E-05	8.02E-07
Benzo(g,h,i)perylene	6.75E-05	3.96E-06
Benzo(k)fluoranthene	2.14E-05	1.25E-06
Chrysene	4.87E-05	2.86E-06
Dibenz(a,h)anthracene	8.05E-05	4.72E-06
Fluoranthene	1.05E-03	6.16E-05
Fluorene	4.03E-03	2.36E-04
Formaldehyde	1.63E-01	9.55E-03
Indeno(1,2,3-c,d)pyrene	5.18E-05	3.03E-06
Naphthalene	1.17E-03	6.86E-05
Phenanthrene	4.06E-03	2.38E-04
Pyrene	6.60E-04	3.87E-05
Toluene	5.64E-02	3.31E-03
Xylenes	3.93E-02	2.31E-03

SOURCE: *Compilation of Air Pollutant Emission Factors Volume I: Stationary Point and Area Sources fifth edition*, January 1995. Section 3.3. Where necessary, the average brake specific fuel consumption (BSFC) and heating value from Table 3-1 were used for unit conversion.



### 3.6 References

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40 CFR 1039, "Title 40-Protection of the Environment, Chapter I-Environmental Protection Agency, Subchapter U-Air Pollution Controls, Part 1039-CONTROL OF EMISSIONS FROM NEW AND IN-USE NONROAD COMPRESSION-IGNITION ENGINES," U.S. Environmental Protection Agency

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## 4.0 NONROAD ENGINES AND EQUIPMENT (NRDE)

### 4.1 Introduction

Air emissions at USAF installations result not only from military operations, but also from day to day activities involving nonroad engines and equipment (NRDE). The full federal definition of a nonroad engine can be found in 40 CFR 1068.30. Examples of NRDE that are commonly operated on USAF installations include: industrial equipment (e.g., forklifts, aerial lifts, sweepers, etc.); lawn and garden equipment (e.g., lawn mowers, trimmers, leaf blowers, snow blowers, etc.); agricultural equipment (e.g., sprayers, agricultural tractors, agricultural mowers, etc.); commercial equipment (e.g., pumps, air compressors, etc.); recreational vehicles (e.g., off-road motorcycles, all-terrain vehicles, including utility vehicles, snowmobiles, golf carts, etc.); and logging equipment (e.g., shredders). Portable generators are nonroad engines but as internal combustion (ICOM) units, their emissions are covered in the appropriate sections of either the *Air Emissions Guide for Air Force Stationary Sources* or *Transitory Sources*. Similarly, AGE and GSE are also nonroad engines that are widely used on USAF installations, but are addressed separately in the “Flightline Ground Support Equipment” section of this Guide. Emissions of concern from the operation of NRDE include criteria pollutants and HAPs associated with fuel combustion processes.

NRDE are typically powered by either a reciprocating internal combustion engine or a small gas turbine. For reciprocating engines, a piston moves inside a cylinder to compress an air/fuel mixture. The air/fuel mixture combusts and expands, pushing the piston through the cylinder. The piston returns, pushing out the exhaust gases, and the cycle is repeated. For gas turbines, ambient air is pressurized with a compressor. Fuel is introduced to this compressed air and is ignited. The high temperature, high pressure air flows through a turbine where it expands, producing shaft energy that is used to drive both the compressor and the electric generator.

Reciprocating engines may differ in design by the diameter of the cylinders in the engine, known as the bore, and the length of the linear movement of the piston in each cylinder, known as the stroke. The size of the engine is related to its displacement per cylinder, which is a measure of the volume of the cylinder multiplied by the length of the stroke. A reciprocating engine may be classified as either 4-stroke or 2-stroke. For a 4-stroke engine, the combustion cycle involves two revolutions of the crankshaft, to which the pistons are connected, and the cycle consists of four stages. The induction stroke occurs when the piston moves down within the cylinder, creating a vacuum and drawing in air or an air/fuel mixture. During the compression stroke, the piston moves up to pressurize the air or air/fuel mixture which then ignites. The heated air expands generating a force on the piston such that it is forced downward again in what is called the power stroke. Finally, the piston moves upward again to force the exhaust gas out of the cylinder during the exhaust stroke and returns to the starting position of the induction stroke so

the cycle may be repeated. 2-stroke engines can operate with just one revolution of the crankshaft because induction of the air or air/fuel mixture occurs concurrently with the release of the exhaust gas.

Detonation of the air/fuel mixture during the compression stroke may occur through either compression or spark ignition (CI or SI). In a CI engine, air is first compressed by the piston in the cylinder, which causes the temperature of the air to rise. Fuel is added to the heated air and combusts due to the temperature of the air is above the auto-ignition temperature of the fuel. Reciprocating CI engines are powered either by diesel fuel or JP-8. SI engines, which use gasoline, natural gas, or LPG differ from CI engines in that the fuel/air mixture does not ignite spontaneously, but rather by a spark. Emissions from nonroad engines will vary due to operating conditions such as temperature, humidity, torque, ignition timing, or even air/fuel mixture. Even slight variations in the air/fuel mixture will dramatically affect pollutant emissions.

While most NRDE are powered by either diesel or gasoline fuel, engines fueled with JP-8 are becoming increasingly more common. Presently, there are few EPA-approved NRDE EFs developed specifically for JP-8. However, since the combustion characteristics between JP-8 and diesel fuel are similar, **emissions from JP-8 fueled NRDE are typically calculated using diesel EFs.**

Gas turbines are composed of three major components: a compressor, a combustor, and a power turbine. In a gas turbine, ambient air is drawn in at the front of the engine with a fan, and the pressure is raised up to 30 times the ambient pressure via a compressor. The compressed air is directed into the combustor section where it is sprayed with fuel and ignited with an electric spark. The burning gases expand, and the high-pressure, high-velocity gas stream passes through a turbine area, driving the movement of an output shaft that converts the energy to useful power. Typically, more than half of the shaft energy produced is needed to drive the internal compressor, with the balance available to drive an external load such as an electric generator or water pump. Gas turbines may be more advantageous than reciprocating engines because of their lower operational cost, lower levels of CO and VOC emissions, and potential for use in cogeneration systems. However, the large initial cost of a gas turbine engine means that they are not likely to be part of NRDE.

## 4.2 Emission Factors

Emission factors for NRDE are provided at the end of this section. They have been developed for specific equipment and are in units of  $\text{lb}/10^3 \text{ hp-hr}$ . The appropriate EF should be selected based on the fuel the engine uses and whether the equipment is a 2-stroke or 4-stroke engine, if applicable. The tables also provide typical load factors and calculated BSFC values which may be needed for emissions calculations as described later in this chapter.

### 4.2.1 Alternative Fuels and Emissions Reduction

Increasingly stringent regulatory requirements mean that some USAF installations may be encouraged to operate non-road engines and equipment on alternative fuels such as ethanol based E85 (a blend of 85% ethanol and 15% gasoline) or B20 (a blend of 20% biodiesel and 80% petroleum diesel). While there are currently no NRDE that use these alternative fuels, there are on-highway flexible fuel vehicles (FFVs) that can operate on E85 and are required to meet EPA's Tier II vehicle emission standards regardless of the fuel type. Some research suggests evidence of potential emission reduction benefits from the use of E85, although testing has been limited and emissions impacts have not been fully characterized. While some reduction in evaporative emissions is expected due to the displacement of gasoline, emissions are believed to be generally similar to gasoline emissions. Note, however, that data does indicate that some HAP emissions are reduced while others are increased. Accordingly, EPA does not support the use of emission reduction factors for engines using E85 fuels.

A somewhat similar situation exists regarding information on the emissions impact of B20 fuels. In October 2002, the EPA issued its technical report on biodiesel emissions (USEPA 2002). This report was developed using various statistical analysis tools to compile and assess the results of 39 studies regarding the impact of B20 use on vehicle emissions. Relative to conventional on-highway diesel fuel (i.e., conventional low sulfur diesel with sulfur content < 500 ppm), B20 showed a +2% impact on NO<sub>x</sub> emissions, a -10% impact on PM emissions, a -21% impact on HC emissions, and a -11% impact on CO emissions. Since the time of the study, however, ultra-low sulfur diesel (ULSD) regulations limiting the sulfur content of on-highway diesel fuel to 15 ppm have been enacted. Since June 2007, the sulfur content of nonroad diesel fuel has been limited to 500 ppm which was then further reduced to 15 ppm effective June 2010. Another study was conducted under the auspices of the DoD Environmental Security Technology Certification Program (ESTCP). This study sought to measure the impact of B20 on CO, NO<sub>x</sub>, PM, HC, and HAP emissions from engines used in on-road and portable power generation applications (Environmental Security Technology Certification Program 2006). Using primarily a B20 biodiesel/ULSD blend, the study showed no significant differences in emissions between the B20 biodiesel blended with ULSD and the ULSD by itself. No consistent trend was observed with regards to HAP emissions.

These examples indicate that efforts to apply emission reduction factors to estimate emissions from alternatively fueled NRDE should be attempted only after careful review of the most current, validated information available. Information can be obtained from either the EPA, the Department of Energy (DOE), the DoD, and Service Engineering and Research Organizations. Application of the B20 EFs developed by the EPA should only be considered if an installation is confident that the nonroad diesel fuel it is replacing has a sulfur concentration of 500 ppm or less. It is important to note that should the sulfur content exceed 500 ppm, potential emissions

benefits of B20 may be underreported because, to date, emission impacts studies have generally not focused on nonroad engines and fuels.

### 4.3 Emissions Calculation

This section describes several methodologies available for calculating emissions from nonroad engines and equipment using either the EPA's NONROAD emissions estimating software model, or the underlying EFs in the NONROAD model and manual calculation procedures. Regardless of which approach is chosen, the methodology is applied to each individual piece of NRDE for each pollutant for which emissions are being calculated. The methodologies are briefly described in the following paragraphs.

#### 4.3.1 Emissions Estimation Using the EPA NONROAD Model

The EPA recommends use of its NONROAD modeling software for estimating emissions from the operation of nonroad vehicles and equipment. The software was developed to provide a consistent means of generating emissions data required by the CAA. The current NONROAD model predicts emissions of six exhaust pollutants (HC, NO<sub>x</sub>, CO, CO<sub>2</sub>, SO<sub>x</sub>, and PM) for more than 80 basic and 260 specific types of NRDE across a variety of model years that use gasoline, diesel, CNG or LPG. The model allows PM to be reported as PM<sub>10</sub> or PM<sub>2.5</sub>. **As of June 2014, the NONROAD model was integrated into the Motor Vehicle Emissions Simulator (MOVES2014) model as an additional module and can now be run within MOVES2014b, therefore, is no longer a separate software.**

One advantage of the NONROAD model is that it recognizes that an engine's performance degrades over time due to normal operation and use. Engine deterioration not only increases exhaust emissions, but usually leads to a loss of combustion efficiency, and may increase non-exhaust emissions. EPA believes there is insufficient information to justify the use of adjustment factors for small SI engines. Therefore, the NONROAD model uses EFs based on unadjusted steady-state test results, and applies an adjustment factor only to SI engines with a power rating greater than 25 hp. In terms of CI engines, the NONROAD model addresses the effects of deterioration by multiplying a zero-hour EF for each category of engine by a deterioration factor to reflect degraded performance as the engine ages.

While the core model for NONROAD is written in FORTRAN and can be operated as a stand-alone application in a DOS environment, the graphical user interface will generate scenarios for only one specified set of conditions. If the user wishes to run multiple scenarios in a single model run, the scenarios must be generated in a DOS environment. The NONROAD reporting utility is written in Microsoft Access and operated similar to the graphical user interface. The

reporting utility is a stand-alone application and knowledge of Access is not required to generate reports.

EFs for NRDE manufactured prior to Model Year 1998 have been derived from the NONROAD model and its underlying data sets by the EPA Office of Transportation Air Quality. EFs are provided in Table 4-1 through Table 4-6 and serve as the basis for estimating emissions manually using the methodologies discussed in the following subsections.

### 4.3.2 Horsepower/Load Factor Method

The most common approach for calculating emissions from NRDE is essentially the same as the method incorporated into the NONROAD model and the horsepower/load factor method used in the “FLIGHTLINE GROUND SUPPORT EQUIPMENT (AGE)” section. Emissions are estimated based on the engine's rated power output, a load factor, and annual operating time. Generally, for calculating emissions from non-road engines, a load factor of 100% is assumed. The following equation is used:

$$E(Pol) = OT \times \frac{LF}{100} \times hp_{rtd} \times \frac{1}{1000} \times EF(Pol) \times N$$

**Equation 4-1**

Where,

- E(Pol)** = Annual emissions of each individual pollutant (lb/yr)
- OT** = Operating time (hr/unit)
- LF** = Load factor (%). Typically assumed to be 100%, though it may be calculated using Equation 3-3
- 100** = Factor for converting percent to a fraction (%)
- hp<sub>rtd</sub>** = Engine rated horsepower (hp)
- 1000** = Factor converting from hp to 10<sup>3</sup> hp (hp/10<sup>3</sup> hp)
- EF(Pol)** = Emission factor of each pollutant (lb/10<sup>3</sup> hp-hr)
- N** = Number of nonroad engines and equipment used each year (units/yr)

The data required for calculating emissions using the horsepower/load factor method may be found in Table 4-1 through Table 4-5.

### 4.3.3 Fuel Consumption Method

Estimating emissions based on fuel consumption can be accomplished in instances when the fuel consumption is known but the operating time of the NRDE is not. The annual fuel consumption, fuel density, BSFC values for the piece of equipment, and EF must be known to calculate emissions using this method as shown:

$$E(\text{Pol}) = \frac{(\text{FC} \times \rho)}{\text{BSFC}} \times \text{EF}(\text{Pol}) \times N$$

Equation 4-2

Where,

- E(Pol)** = Annual emissions of each individual pollutant (lb/yr)  
**FC** = Annual fuel consumption (gal/unit). If the total fuel consumed is unknown, the fuel consumed may be calculated using Equation 3-5 or Equation 3-6  
**ρ** = Fuel density (lb/gal)  
**BSFC** = Brake-specific fuel consumption for the engine (lb/10<sup>3</sup> hp-hr)  
**EF(Pol)** = Emission factor for each pollutant (lb/10<sup>3</sup> hp-hr)  
**N** = Number of equipment used each year (units/yr)

When performing emissions calculations using the fuel consumption method, enhanced accuracy may be achieved by using the density of the fuel as provided by the fuel supplier, and the BSFC for the engine provided directly from the engine manufacturer. If this data is unavailable, then suggested values for these variables may be found in the following tables:

- Table 3-1 provides the average density for nonroad fuels.
- Table 4-1 through Table 4-6 provide the EFs and BSFC for specific equipment types in a lb/10<sup>3</sup> hp-hr basis.

#### 4.3.4 VOC and HAP Speciation

There is very little data available for the speciation of VOCs for nonroad engines. Whenever the quantity of speciated compounds is required to be calculated, the average percentage of each species within the total VOC may be used as a gross estimate of the emissions of that compound. This section should only be used if no acceptable speciated EFs are available for the engine in question. Speciated VOCs are calculated by taking the product of the total VOCs and the weighted percentage of the individual VOC as follows:

$$E(\text{Pol}) = E(\text{VOC}) \times \frac{P(\text{Pol})}{100}$$

Equation 4-3

Where,

- E(Pol)** = Emissions of speciated VOC (lb/yr)  
**E(VOC)** = Emissions of total VOC (lb/yr)  
**P(Pol)** = Weight percent of a given pollutant (%). These are provided in Table 4-7  
**100** = Factor for converting percent to a fraction (%)

The weight percent of individual pollutants were calculated for engines combusting diesel, gasoline, natural gas (which is further subdivided into 2 and 4 stroke lean burn and 4-stroke rich burn), and LPG. The values, provided in Table 4-7, were calculated using the equation below. The EF data used in these calculations came from several sources including *Compilation of Air Pollutant Emission Factors* (AP-42), the Mojave Desert Air Quality Management District, and the EPAs *SPECIATE* database. Since there is limited data available regarding mobile NRDE EFs, those factors presented in these sources were assumed to be representative of all non-road engines.

$$P_{(Pol)} = \frac{EF(Pol)}{EF(VOC)_{Total}}$$

Where,

- P(Pol) = Weight percent of a given pollutant (%)
- EF(Pol) = Individual pollutant emission factor (lb/10<sup>3</sup> hp-hr)
- EF(VOC)<sub>Total</sub> = Total VOC emission factor (lb/10<sup>3</sup> hp-hr)

In addition to the weight percent pollutant speciation values provided in Table 4-7, most equipment manufacturers have data on emissions specific to their product, and many are willing to provide it upon request. HAPs emissions may be calculated using the following tables:

- Table 3-7 provides EFs for uncontrolled diesel reciprocating internal combustion engines in a lb/1,000 hp-hr format and may be used to calculate HAPs directly using Equation 4-1.
- Table 4-7 gives the weight percent VOC and HAP speciation of emissions for estimating specific VOCs/HAPs using Equation 4-3 above.

#### 4.4 Information Resources

The primary source of information for most NRDE is the Transportation Squadron. The Transportation Vehicle Operations Flight and/or the Transportation Vehicle Maintenance Flight typically maintain records on most USAF-owned NRDE. Records include information such as the identity of the shops/organizations operating the vehicles/equipment, hp rating of the vehicles/equipment, and hours of operation. In some cases, it may be necessary to contact the actual organizations/shops using the vehicles/equipment to obtain information that Transportation does not have. For example, for construction equipment and lawn/garden equipment, it will probably be necessary to contact the Civil Engineering (CE) Operations Flight, the CE Flight, and the CE Housing Flight, or a similar organization if base housing has been privatized.

It is important to note that many of the construction and lawn care activities at USAF installations are performed by contractors, and therefore may be necessary to contact the contractors directly

to obtain the necessary information on their equipment. The contracts section of the CE Engineering Flight should be able to provide information on what equipment was used to perform construction and lawn care activities on base during the year.

In addition, some NRDE (such as leaf blowers, trimmers/edgers, snow blowers, etc.) operated on USAF installations may be owned by personnel who live on base. Since this equipment is privately owned, obtaining this information is usually more difficult than for USAF-owned equipment. One approach to obtaining the necessary information is to work with the CE Housing Flight to identify the types of NRDE used in base housing, estimate the number of each different equipment type, estimate the average hp of each equipment type, and estimate the average operating time (hours per year) for each equipment type. If adequate resources and time are available, a more comprehensive approach would be to survey a representative number of housing units to determine the type/size of equipment used and the estimated usage. For NRDE in which emissions are calculated using EFs based on fuel usage (i.e., using "g/gal" EFs), Fuels Supply may be a source of information regarding fuel consumption. An example of a data collection form which can be used to collect data necessary to estimate emissions from NRDE is provided in Figure 4-1.

## 4.5 Example Calculations

The following section provides examples of how the equations and methodologies discussed earlier are applied to calculate emissions from non-road vehicle and equipment operations. The procedures are applied to each individual NRDE, and for each pollutant for which emissions must be calculated. Emissions for all NRDE and pollutants are then summed to obtain pollutant-specific, base-wide totals. Load factors, BSFCs, and EFs necessary for calculating emissions are obtained from Table 4-1 through Table 4-7.

### 4.5.1 Problem 1 - Estimating Emissions Using the Horsepower/Load Factor Method

As part of its requirement to conduct an annual mobile source emissions inventory for CY2020, a USAF base has collected information on the NRDE operating on the base. Calculate the CO emissions associated with the operation of diesel-powered forklifts on base. The following information was obtained from the base:

Equipment Type – Diesel powered forklift (SCC-2270003020)	
# of pieces	6
Power Rating	85 hp
Operating Time	200 hr/unit



**Step 1 – Record the CO emission factor and load factor.** The EF and typical load factor are given in Table 4-1 as **0.534 lb/10<sup>3</sup> hp-hr** and **59%** respectively.

**Step 2 – Calculate the annual emissions for the six forklifts.** Using the information in the table above and the values recorded in Step 1, the annual CO emissions for the six forklifts are calculated using Equation 4-1:

$$E(Pol) = OT \times \frac{LF}{100} \times hp \times \frac{1}{1000} \times EF(Pol) \times N$$

$$E(CO) = 200 \frac{hr}{unit} \times \frac{59\%}{100\%} \times 85(\cancel{hp}) \times \frac{1}{1000} \left( \frac{10^3 \cancel{hp}}{hp} \right) \times 0.534 \frac{lb}{10^3 \cancel{hp-hr}} \times 6 \frac{units}{yr}$$

$$E(CO) = 32.14 \frac{lb}{yr}$$

#### 4.5.2 Problem 2 - Estimating Emissions Using Fuel Consumption

A USAF base operates gasoline fueled commercial lawn mowers to maintain the appearance of public areas on base. Calculate the VOC and formaldehyde emissions associated with operation of the lawnmowers on base for CY2020. The following information was obtained from the base:

Equipment Type – 4-stroke gasoline lawnmower (SCC 2265004011)	
# of pieces	25
Power rating	5 hp
Fuel Consumption	40 gal each

**Step 1 – Record the fuel density, VOC emission factor, and appropriate BSFC.** The fuel density is provided in Table 3-1 and the VOC EF and BSFC value for gas powered commercial lawn mowers are provided in Table 4-1. The fuel density is given as **6.15 lb/gal** while the VOC EF and BSFC (for 2020) are given as **27.858** and **880 lb/10<sup>3</sup> hp-hr**, respectively.

**Step 2 - Calculate annual VOC emissions.** Using the data from Step 1 and Equation 4-2:

$$E(Pol) = \frac{(FC \times D)}{BSFC} \times EF(Pol) \times N$$

$$E(VOC) = \frac{\left( 40 \frac{gal}{unit} \times 6.15 \frac{lb}{gal} \right)}{880 \frac{lb}{10^3 \cancel{hp-hr}}} \times 27.858 \frac{lb}{10^3 \cancel{hp-hr}} \times 25 \frac{units}{yr}$$

$$E(VOC) = 0.2795 \frac{10^3 \cancel{hp-hr}}{unit} \times 27.858 \frac{lb}{10^3 \cancel{hp-hr}} \times 25 \frac{units}{yr}$$

$$E(VOC) = 194.69 \frac{lb}{yr}$$

Next, calculate formaldehyde emissions.

**Step 3 – Record formaldehyde weight percent VOC emissions for 4-stroke gasoline engines.**

Table 4-7 states this value is **1.32%**.

**Step 4 - Calculate annual formaldehyde emissions.** Using the formaldehyde weight percent recorded in Step 3 and Equation 4-3:

$$E(Pol) = E(VOC) \times \frac{P(Pol)}{100}$$

$$E(Formaldehyde) = 194.69 \frac{lb}{yr} \times \frac{1.32\%}{100\%}$$

$$E(Formaldehyde) = 194.69 \frac{lb}{yr} \times 0.0132$$

$$E(Formaldehyde) = 2.57 \frac{lb}{yr}$$

#### 4.5.3 Problem 3 - Estimating SO<sub>x</sub> Emissions

A USAF base needs to estimate SO<sub>x</sub> emissions from the operation of rough terrain forklifts. The following information was obtained from the base:

Equipment Data – Rough terrain forklifts (SCC 2270002057)	
# of pieces	5
Fuel	Diesel
Power rating	80 hp
Model year	1997
Fuel Consumption	200 gal (each); 1,000 gal (total)
Hours of operation	250 hr/unit (each)

Since the model year of the forklifts are pre-1998, then the EFs applicable to these engines are found in Table 4-6. The preferred method of using the horsepower and load factor is used for the calculation of emissions.

**Step 1 – Record the load factor and SO<sub>x</sub> emission factor.** According to Table 4-1, for diesel-powered rough terrain forklifts the typical load factor is **59%** and Table 4-6 states the SO<sub>x</sub> EF as **0.21 lb/10<sup>3</sup> hp-hr**.

**Step 2 –Calculate the total SO<sub>x</sub> emissions.** Using these values and the data in the table above, the SO<sub>x</sub> emissions are calculated using Equation 4-1:

$$E(Pol) = OT \times \frac{LF}{100} \times hp \times \frac{1}{1000} \times EF(Pol) \times N$$

$$E(SO_x) = 250 \frac{hr}{unit} \times \frac{59\%}{100\%} \times 80hp \times \frac{1}{1000} \left( \frac{10^3 hp}{hr} \right) \times 0.21 \frac{lb}{10^3 hp-hr} \times 5 \frac{units}{yr}$$

$$E(SO_x) = 12.39 \frac{lb}{yr}$$

#### 4.5.4 Problem 4 - Estimating Emissions from the Use of B20

A USAF base has been blending B20 biodiesel into the non-road diesel fuel used to power its off- highway trucks. The normal sulfur content of the non-road diesel is 500 ppm. The following information was obtained from the base:

Equipment Data – Off-Highway Trucks (SCC 2270002051)	
# of pieces	10
Fuel	B20/nonroad diesel (500 ppm blend)
Power rating	250 hp
Model year	2001
Hours of operation	200 hours (each); 2,000 hours (total)

Estimate the NO<sub>x</sub> and PM<sub>10</sub> emissions from the operation of the vehicles.

**Step 1 – Record the NO<sub>x</sub> emission factor and load factor.** Table 4-1 gives the EF and load factor (for 2020) as **3.728 lb/10<sup>3</sup> hp-hr** and **59%** respectively.

**Step 2 - Calculate annual NO<sub>x</sub> emissions.** Use the EF and load factor recorded in Step 1, the data provided in the table, and Equation 4-1 as follows:

$$E(Pol) = OT \times \frac{LF}{100} \times hp \times \frac{1}{1000} \times EF(Pol) \times N$$

$$E(NO_X) = 200 \frac{hr}{unit} \times \frac{59\%}{100\%} \times 250hp \times \frac{1}{1000} \left( \frac{10^3 hp}{hp} \right) \times 3.728 \frac{lb}{10^3 hp-hr} \times 10 \frac{units}{yr} = 1,099.76 \frac{lb}{yr}$$

**Step 3 - Adjust the estimated emissions to reflect the expected 2% increase in NO<sub>x</sub> attributable to the use of B20.**

$$E(NO_X) = 1,099.76 \frac{lb}{yr} \times \left( 1 + \frac{2\%}{100\%} \right)$$

$$E(NO_X) = 1,099.76 \frac{lb}{yr} \times (1.02)$$

$$E(NO_X) = 1,121.76 \frac{lb}{yr}$$

**Step 4 – Record the PM<sub>10</sub> emission factor.** Table 4-1 lists this value as **0.096 lb/10<sup>3</sup> hp-hr.**

**Step 5 - Calculate annual PM<sub>10</sub> emissions.** Use Equation 4-1, the EF recorded in Step 4 and the data provided in the table above as follows:

$$E(PM_{10}) = OT \times \frac{LF}{100} \times hp \times \frac{1}{1000} \times EF(PM_{10}) \times N$$

$$E(PM_{10}) = 200 \frac{hr}{unit} \times \frac{59\%}{100\%} \times 250hp \times \frac{1}{1000} \left( \frac{10^3 hp}{hp} \right) \times 0.096 \frac{lb}{10^3 hp-hr} \times 10 \frac{units}{yr} = 28.32 \frac{lb}{yr}$$

**Step 6 - Adjust the estimated emissions to reflect the expected 10% decrease in PM emissions attributable to the use of B20 fuel:**

$$E(PM_{10}) = 28.32 \frac{lb}{yr} \times \left( 1 - \frac{10\%}{100\%} \right)$$

$$E(PM_{10}) = 28.32 \frac{lb}{yr} \times (0.9)$$

$$E(PM_{10}) = 25.49 \frac{lb}{yr}$$

**Table 4-1. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2020**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>ef</sup>	CO <sub>2e</sub> <sup>g</sup>
2260001010	2 Stroke Motorcycles: Off-Road <sup>c</sup>	100	260	79.787	73.289	0.907	0.003	2.673	2.459	569.044
2260001020	2 Stroke Snowmobiles	34	1640	144.556	173.537	5.446	0.013	1.857	1.708	2140.433
2260001030	2 Stroke ATVs <sup>c</sup>	100	210	83.462	22.911	0.921	0.003	0.699	0.643	489.892
2260001060	2 Stroke Specialty Vehicles/Carts	58	1000	576.484	20.213	4.691	0.014	0.296	0.272	2348.711
2260002006	2 Stroke Tampers/Rammers	55	680	559.477	135.201	3.369	0.009	20.383	18.752	1596.505
2260002009	2 Stroke Plate Compactors	55	830	489.951	110.618	5.250	0.014	16.823	15.477	2440.576
2260002021	2 Stroke Paving Equipment	59	830	493.802	110.203	5.250	0.014	16.940	15.585	2437.760
2260002027	2 Stroke Signal Boards/Light Plants	72	830	512.609	129.693	5.250	0.014	17.574	16.168	2422.453
2260002039	2 Stroke Concrete/Industrial Saws	78	630	580.558	137.223	3.520	0.009	21.176	19.482	1645.698
2260002054	2 Stroke Crushing/Proc. Equipment	85	830	512.608	113.759	5.250	0.014	17.574	16.168	2422.454
2260003030	2 Stroke Sweepers/Scrubbers	71	820	512.608	122.930	5.250	0.014	17.574	16.168	2422.454
2260003040	2 Stroke Other General Industrial Equipment	54	830	512.608	118.565	5.250	0.014	17.574	16.168	2422.454
2260004015	2 Stroke Rotary Tillers < 6 HP (Residential)	40	940	454.720	123.608	5.264	0.014	16.268	14.966	2454.556
2260004016	2 Stroke Rotary Tillers < 6 HP (Commercial)	40	900	459.368	110.838	5.264	0.014	16.401	15.089	2451.351
2260004020	2 Stroke Chain Saws < 6 HP (Residential)	70	900	470.031	167.454	5.250	0.014	16.249	14.949	2454.293
2260004021	2 Stroke Chain Saws < 6 HP (Commercial)	70	650	576.681	161.819	3.619	0.010	20.971	19.293	1690.018
2260004025	2 Stroke Trimmers/Edgers/Brush Cutter (Residential)	91	890	433.961	133.245	5.300	0.014	16.887	15.536	2441.540
2260004026	2 Stroke Trimmers/Edgers/Brush Cutter (Commercial)	91	810	494.275	127.044	4.981	0.013	17.170	15.796	2323.479
2260004030	2 Stroke Leaf blowers/Vacuums (Residential)	94	890	460.250	132.838	5.264	0.014	16.426	15.112	2450.739
2260004031	2 Stroke Leaf blowers/Vacuums (Commercial)	94	760	519.763	119.899	4.357	0.012	18.424	16.950	2042.132
2260004035	2 Stroke Snow blowers (Residential)	35	870	530.444	381.514	1.774	0.006	5.896	5.425	1239.629
2260004036	2 Stroke Snow blowers (Commercial)	35	870	618.686	241.792	2.069	0.007	6.878	6.328	1446.312

**Table 4-1. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2020 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>ef</sup>	CO <sub>2e</sub> <sup>g</sup>
2260004071	2 Stroke Commercial Turf Equipment	60	840	481.401	100.085	5.250	0.014	16.571	15.245	2446.603
2260005035	2 Stroke Sprayers	65	840	424.025	107.021	5.323	0.014	17.379	15.989	2430.649
2260006005	2 Stroke Generator Sets	68	830	483.283	137.242	5.255	0.014	16.813	15.468	2441.020
2260006010	2 Stroke Pumps	69	830	461.507	142.240	5.282	0.014	18.335	16.868	2396.546
2260006015	2 Stroke Air Compressors	56	830	512.608	139.006	5.250	0.014	17.574	16.168	2422.453
2260006035	2 Stroke Hydro Power Units	56	830	512.608	146.272	5.250	0.014	17.574	16.168	2422.457
2260007005	2 Stroke Chain Saws > 6 HP	70	620	586.492	150.576	3.369	0.009	21.491	19.772	1577.852
2265001010	4 Stroke Motorcycles: Off- Road	100	160	59.866	7.218	1.255	0.003	0.147	0.135	504.399
2265001030	4 Stroke ATVs	100	170	81.146	8.300	0.991	0.003	0.147	0.135	533.103
2265001050	4 Stroke Golf Carts	46	740	586.284	13.534	4.945	0.014	0.301	0.277	2345.393
2265001060	4 Stroke Specialty Vehicles/Carts	58	820	626.505	22.617	8.216	0.014	0.246	0.226	2342.512
2265002003	4 Stroke Pavers	66	700	435.196	9.889	4.460	0.013	0.256	0.235	2158.582
2265002006	4 Stroke Tampers/Rammers	55	760	571.537	13.503	4.578	0.014	0.250	0.230	2345.352
2265002009	4 Stroke Plate Compactors	55	830	487.534	15.974	5.150	0.015	0.515	0.473	2584.992
2265002015	4 Stroke Rollers	62	690	447.736	9.910	4.326	0.013	0.253	0.233	2152.882
2265002021	4 Stroke Paving Equipment	59	780	530.690	14.146	4.881	0.014	0.343	0.315	2416.694
2265002024	4 Stroke Surfacing Equipment	49	750	534.804	13.540	4.868	0.014	0.358	0.329	2389.675
2265002027	4 Stroke Signal Boards/Light Plants	72	780	524.578	13.745	5.117	0.015	0.463	0.426	2495.257
2265002030	4 Stroke Trenchers	66	710	417.899	10.531	4.616	0.013	0.322	0.297	2205.276
2265002033	4 Stroke Bore/Drill Rigs	79	790	374.020	15.164	7.826	0.014	0.487	0.448	2418.612
2265002039	4 Stroke Concrete/Industrial Saws	78	710	518.670	11.442	4.650	0.013	0.279	0.256	2250.936
2265002042	4 Stroke Cement & Mortar Mixers	59	820	536.686	18.089	5.055	0.014	0.347	0.319	2452.625

**Table 4-1. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2020 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265002045	4 Stroke Cranes	47	590	122.956	4.529	6.292	0.010	0.161	0.148	1667.420
2265002054	4 Stroke Crushing/Proc. Equipment	85	740	497.544	12.153	4.979	0.014	0.326	0.299	2314.156
2265002057	4 Stroke Rough Terrain Forklifts	63	570	45.069	2.140	3.955	0.009	0.151	0.139	1567.229
2265002060	4 Stroke Rubber Tire Loaders	71	550	25.047	1.374	2.795	0.009	0.152	0.140	1544.028
2265002066	4 Stroke Tractors/Loaders/ Backhoes	48	730	541.768	11.271	4.586	0.014	0.263	0.242	2293.844
2265002072	4 Stroke Skid Steer Loaders	58	640	260.049	6.753	5.583	0.011	0.190	0.174	1875.710
2265002078	4 Stroke Dumpers/Tenders	41	800	555.843	17.985	5.434	0.014	0.275	0.253	2372.900
2265002081	4 Stroke Other Construction Equipment	48	580	86.390	4.307	7.770	0.010	0.150	0.138	1605.098
2265003010	4 Stroke Aerial Lifts	46	630	192.224	5.820	6.120	0.011	0.175	0.161	1774.929
2265003020	4 Stroke Forklifts	30	560	25.048	1.361	2.794	0.009	0.152	0.140	1544.028
2265003030	4 Stroke Sweepers/Scrubbers	71	610	202.535	5.408	3.492	0.011	0.220	0.202	1822.919
2265003040	4 Stroke Other General Industrial Equipment	54	760	440.712	14.894	5.091	0.014	0.533	0.491	2400.499
2265003050	4 Stroke Other Material Handling Equipment	53	640	213.325	5.669	4.883	0.011	0.182	0.168	1811.832
2265003060	4 Stroke AC/Refrigeration	46	740	574.254	12.502	4.635	0.014	0.260	0.239	2345.307
2265003070	4 Stroke Terminal Tractors	78	520	24.468	1.323	2.748	0.009	0.154	0.142	1544.029
2265004010	4 Stroke Lawn mowers (Residential)	33	900	424.789	37.291	5.485	0.016	0.652	0.600	2760.075
2265004011	4 Stroke Lawn mowers (Commercial)	33	880	426.530	27.858	5.590	0.016	0.717	0.659	2760.006
2265004015	4 Stroke Rotary Tillers < 6 HP (Residential)	40	910	424.572	38.651	5.481	0.016	0.653	0.600	2760.202
2265004016	4 Stroke Rotary Tillers < 6 HP (Commercial)	40	890	423.041	30.845	5.430	0.016	0.658	0.605	2760.165
2265004025	4 Stroke Trimmers/Edgers/Brush Cutter HP (Residential)	91	900	423.157	45.809	5.435	0.016	0.660	0.607	2760.168
2265004026	4 Stroke Trimmers/Edgers/Brush Cutter (Commercial)	91	820	495.883	29.938	5.146	0.015	0.499	0.460	2566.435
2265004030	4 Stroke Leaf blowers/Vacuums (Residential)	94	900	423.170	33.158	5.436	0.016	0.660	0.607	2760.169

**Table 4-1. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2020 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>ef</sup>	CO <sub>2e</sub> <sup>g</sup>
2265004031	4 Stroke Leaf blowers/Vacuums (Commercial)	94	700	436.238	14.363	4.475	0.013	0.249	0.229	2157.366
2265004035	4 Stroke Snow blowers (Residential)	35	940	604.859	205.549	4.759	0.009	0.126	0.116	1506.753
2265004036	4 Stroke Snow blowers (Commercial)	35	940	708.803	37.093	5.415	0.010	0.147	0.135	1757.368
2265004040	4 Stroke Rear Engine Riding Mowers (Residential)	38	760	571.895	23.162	4.663	0.014	0.247	0.227	2346.961
2265004041	4 Stroke Rear Engine Riding Mowers (Commercial)	38	740	573.370	13.077	4.621	0.014	0.259	0.238	2346.083
2265004046	4 Stroke Front Mowers	65	790	581.917	15.196	5.388	0.014	0.243	0.224	2346.697
2265004051	4 Stroke Shredders < 6 HP	80	890	423.305	30.931	5.436	0.016	0.654	0.601	2760.178
2265004055	4 Stroke Lawn & Garden Tractors (Residential)	44	760	571.504	18.027	4.649	0.014	0.247	0.227	2345.959
2265004056	4 Stroke Lawn & Garden Tractors (Commercial)	44	740	573.538	12.416	4.620	0.014	0.258	0.238	2345.602
2265004066	4 Stroke Chippers/Stump Grinders	78	640	292.194	6.505	3.739	0.011	0.213	0.196	1930.398
2265004071	4 Stroke Commercial Turf Equipment	60	730	486.239	11.178	4.563	0.014	0.315	0.290	2309.816
2265004075	4 Stroke Other Lawn & Garden Equipment	58	850	509.221	25.706	5.705	0.015	0.451	0.415	2561.702
2265004076	4 Stroke Other Lawn & Garden Equipment	58	850	506.413	23.838	5.691	0.015	0.448	0.412	2556.277
2265005010	4 Stroke 2-Wheel Tractors	62	740	576.318	12.026	4.688	0.014	0.267	0.246	2345.321
2265005015	4 Stroke Agricultural Tractors	62	580	108.218	2.929	3.217	0.010	0.171	0.157	1662.562
2265005020	4 Stroke Combines	74	580	164.782	11.951	15.175	0.010	0.153	0.141	1698.908
2265005025	4 Stroke Balers	62	580	164.589	14.357	15.156	0.010	0.153	0.141	1698.571
2265005030	4 Stroke Agricultural Mowers	48	770	573.283	12.910	4.824	0.014	0.251	0.231	2348.731
2265005035	4 Stroke Sprayers	65	740	410.933	16.436	9.032	0.013	0.300	0.276	2211.867
2265005040	4 Stroke Tillers > 6 HP	71	870	799.614	29.496	9.176	0.015	0.255	0.235	2518.070
2265005045	4 Stroke Swathers	52	580	164.589	11.995	15.156	0.010	0.153	0.141	1698.570
2265005055	4 Stroke Other Agricultural Equipment	55	620	247.658	10.331	13.092	0.011	0.175	0.161	1833.521



**Table 4-1. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2020 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>ef</sup>	CO <sub>2e</sub> <sup>g</sup>
2265005060	4 Stroke Irrigation Sets	60	550	36.073	1.754	2.814	0.009	0.167	0.154	1571.229
2265006005	4 Stroke Generator Sets	68	780	559.899	15.839	4.869	0.014	0.287	0.264	2384.956
2265006010	4 Stroke Pumps	69	760	440.094	15.007	5.214	0.014	0.415	0.381	2363.691
2265006015	4 Stroke Air Compressors	56	700	361.061	10.800	4.477	0.013	0.335	0.309	2146.145
2265006025	4 Stroke Welders	68	710	473.239	11.732	4.509	0.013	0.259	0.238	2200.497
2265006030	4 Stroke Pressure Washers	85	800	520.134	16.740	4.960	0.015	0.416	0.383	2489.984
2265006035	4 Stroke Hydro Power Units	56	750	539.142	12.848	4.795	0.014	0.334	0.308	2370.817
2265007010	4 Stroke Shredders > 6 HP	80	800	596.111	17.819	5.346	0.014	0.250	0.230	2358.739
2265007015	4 Stroke Forest Equipment - Feller/Bunch/Skidder	70	810	491.163	16.171	5.416	0.015	0.598	0.550	2593.365
2265008005	4 Stroke Airport Ground Support Equipment	56	600	129.637	4.225	3.313	0.010	0.232	0.214	1744.061
2265010010	4 Stroke Other Oil Field Equipment	90	740	592.904	12.584	5.115	0.014	0.323	0.297	2345.442
2267001060	LPG Specialty Vehicle Carts	58	490	56.175	2.456	11.261	0.006	0.126	0.126	1327.937
2267002003	LPG Pavers	66	460	16.218	0.444	2.839	0.006	0.126	0.126	1224.723
2267002015	LPG Rollers	62	450	10.904	0.248	2.066	0.006	0.127	0.127	1216.740
2267002021	LPG Paving Equipment	59	480	34.537	1.212	5.952	0.006	0.124	0.124	1259.519
2267002024	LPG Surfacing Equipment	49	460	15.246	0.419	2.746	0.006	0.126	0.126	1224.098
2267002030	LPG Trenchers	66	460	16.516	0.451	2.864	0.006	0.126	0.126	1224.847
2267002033	LPG Bore/Drill Rigs	79	490	65.089	2.753	12.482	0.007	0.125	0.125	1339.385
2267002039	LPG Concrete/Industrial Saws	78	430	10.657	0.246	2.056	0.006	0.129	0.129	1216.736
2267002045	LPG Cranes	47	480	34.243	1.101	5.410	0.006	0.124	0.124	1250.712
2267002054	LPG Crushing/Proc. Equipment	85	480	29.692	0.958	4.870	0.006	0.123	0.123	1246.086
2267002057	LPG Rough Terrain Forklifts	63	470	18.378	0.520	3.137	0.006	0.125	0.125	1227.679

**Table 4-1. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2020(cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>ef</sup>	CO <sub>2e</sub> <sup>g</sup>
2267002060	LPG Rubber Tire Loaders	71	460	11.594	0.260	2.106	0.006	0.126	0.126	1216.761
2267002066	LPG Tractors/Loaders/ Backhoes	48	450	10.542	0.241	2.043	0.006	0.127	0.127	1216.725
2267002072	LPG Skid Steer Loaders	58	470	32.367	1.035	5.154	0.006	0.125	0.125	1248.106
2267002081	LPG Other Construction Equipment	48	480	41.658	1.392	6.567	0.006	0.124	0.124	1262.979
2267003010	LPG Aerial Lifts	46	480	32.432	1.110	5.505	0.006	0.125	0.125	1254.013
2267003020	LPG Forklifts	30	460	11.532	0.259	2.104	0.006	0.127	0.127	1216.761
2267003030	LPG Sweepers/Scrubbers	71	440	11.008	0.252	2.076	0.006	0.128	0.128	1216.746
2267003040	LPG Other General Industrial Equipment	54	450	10.919	0.248	2.067	0.006	0.127	0.127	1216.742
2267003050	LPG Other Material Handling Equipment	53	480	24.984	0.764	4.092	0.006	0.125	0.125	1237.420
2267003070	LPG Terminal Tractors	78	430	10.628	0.245	2.053	0.006	0.129	0.129	1216.734
2267004066	LPG Chippers/Stump Grinders	78	450	11.213	0.255	2.087	0.006	0.128	0.128	1216.752
2267005055	LPG Other Agricultural Equipment	55	490	73.628	2.915	13.067	0.007	0.127	0.127	1340.068
2267005060	LPG Irrigation Sets	60	450	10.539	0.242	2.045	0.006	0.128	0.128	1216.728
2267006005	LPG Generator Sets	68	480	38.165	1.558	9.451	0.006	0.125	0.125	1305.122
2267006010	LPG Pumps	69	470	23.137	0.730	4.815	0.006	0.126	0.126	1248.212
2267006015	LPG Air Compressors	56	460	14.032	0.331	2.580	0.006	0.126	0.126	1222.095
2267006025	LPG Welders	68	460	15.919	0.403	2.655	0.006	0.126	0.126	1221.801
2267006030	LPG Pressure Washers	85	470	33.724	1.098	5.427	0.006	0.125	0.125	1251.302
2267006035	LPG Hydro Power Units	56	460	13.240	0.322	2.513	0.006	0.127	0.127	1221.686
2267008005	LPG Airport Ground Support Equipment	56	450	11.084	0.251	2.077	0.006	0.127	0.127	1216.747
2268002081	CNG Other Construction Equipment	48	480	41.469	4.968	6.598	0.006	0.124	0.124	1622.291
2268003020	CNG Forklifts	30	460	11.532	0.981	2.198	0.006	0.127	0.127	1167.361

**Table 4-1. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2020 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2268003030	CNG Sweepers/Scrubbers	71	460	11.318	0.967	2.186	0.006	0.127	0.127	1165.961
2268003040	CNG Other General Industrial Equipment	54	460	10.956	0.941	2.163	0.006	0.127	0.127	1163.352
2268003060	CNG AC\Refrigeration	46	450	12.143	1.100	2.334	0.006	0.127	0.127	1181.362
2268003070	CNG Terminal Tractors	78	430	10.627	0.934	2.150	0.006	0.129	0.129	1162.546
2268005055	CNG Other Agricultural Equipment	55	510	73.545	10.404	13.101	0.006	0.127	0.127	2258.513
2268005060	CNG Irrigation Sets	60	510	10.544	0.922	2.142	0.006	0.128	0.128	1161.389
2268006005	CNG Generator Sets	68	490	40.407	6.135	10.395	0.006	0.125	0.125	1795.033
2268006010	CNG Pumps	69	480	28.212	3.415	6.114	0.006	0.125	0.125	1462.537
2268006015	CNG Air Compressors	56	470	14.265	1.255	2.706	0.006	0.126	0.126	1201.152
2268006020	CNG Gas Compressors	85	410	11.753	1.087	2.256	0.006	0.139	0.139	1178.200
2268006035	CNG Hydro Power Units	56	470	15.428	1.399	2.945	0.006	0.125	0.125	1218.717
2268010010	CNG Other Oil Field Equipment	90	410	11.082	0.996	2.193	0.006	0.133	0.133	1168.864
2270001060	Diesel Specialty Vehicle Carts	21	450	8.006	2.068	9.521	0.012	1.200	1.164	1438.229
2270002003	Diesel Pavers	59	380	0.941	0.147	2.852	0.009	0.165	0.160	1214.297
2270002006	Diesel Tampers/Rammers	43	1000	5.928	1.826	9.634	0.012	0.640	0.621	1299.980
2270002009	Diesel Plate Compactors	43	410	5.122	1.509	9.246	0.012	0.559	0.543	1300.277
2270002015	Diesel Rollers	59	390	1.298	0.194	3.466	0.009	0.217	0.211	1233.861
2270002018	Diesel Scrapers	59	370	0.974	0.121	2.206	0.009	0.134	0.130	1183.420
2270002021	Diesel Paving Equipment	59	390	1.457	0.273	3.807	0.009	0.246	0.239	1227.168
2270002024	Diesel Surfacing Equipment	59	380	2.499	0.377	6.102	0.010	0.346	0.336	1224.112
2270002027	Diesel Signal Boards/Light Plants	43	410	3.009	0.756	7.988	0.011	0.389	0.378	1293.579
2270002030	Diesel Trenchers	59	400	1.903	0.300	5.277	0.009	0.277	0.269	1273.550

**Table 4-1. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2020 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>ef</sup>	CO <sub>2e</sub> <sup>g</sup>
2270002033	Diesel Bore/Drill Rigs	43	370	2.182	0.553	7.806	0.010	0.402	0.390	1190.172
2270002036	Diesel Excavators	59	380	0.582	0.091	1.838	0.008	0.112	0.108	1194.756
2270002039	Diesel Concrete/Industrial Saws	59	410	2.095	0.340	5.543	0.010	0.303	0.294	1304.922
2270002042	Diesel Cement & Mortar Mixers	43	390	3.799	0.953	9.008	0.010	0.623	0.604	1244.256
2270002045	Diesel Cranes	43	370	0.764	0.173	3.079	0.009	0.135	0.131	1175.652
2270002048	Diesel Graders	59	370	0.565	0.093	1.646	0.008	0.112	0.108	1185.394
2270002051	Diesel Off-highway Trucks	59	370	0.584	0.117	3.728	0.008	0.096	0.093	1183.432
2270002054	Diesel Crushing/Proc. Equipment	43	380	1.090	0.223	4.312	0.009	0.173	0.168	1203.154
2270002057	Diesel Rough Terrain Forklifts	59	390	1.755	0.219	3.857	0.009	0.291	0.282	1255.743
2270002060	Diesel Rubber Tire Loaders	59	370	1.147	0.183	3.369	0.009	0.188	0.182	1190.384
2270002066	Diesel Tractors/Loaders/ Backhoes	21	460	5.866	1.282	7.389	0.012	0.976	0.947	1465.938
2270002069	Diesel Crawler Tractor/Dozers	59	370	0.874	0.128	2.646	0.008	0.143	0.138	1190.000
2270002072	Diesel Skid Steer Loaders	21	480	8.989	1.943	9.707	0.012	1.420	1.378	1528.150
2270002075	Diesel Off-Highway Tractors	59	370	1.272	0.198	4.475	0.009	0.175	0.170	1183.252
2270002078	Diesel Dumpers/Tenders	21	470	9.251	2.188	9.977	0.013	1.426	1.384	1507.136
2270002081	Diesel Other Construction Equipment	59	370	1.970	0.277	4.790	0.009	0.272	0.263	1185.308
2270003010	Diesel Aerial Lifts	21	480	8.506	1.916	9.873	0.013	1.210	1.174	1529.787
2270003020	Diesel Forklifts	59	400	0.534	0.073	2.696	0.009	0.085	0.083	1265.575
2270003030	Diesel Sweepers/Scrubbers	43	380	0.768	0.139	2.997	0.009	0.141	0.137	1219.296
2270003040	Diesel Other General Industrial Equipment	43	380	1.040	0.210	3.530	0.009	0.200	0.194	1205.452
2270003050	Diesel Other Material Handling Equipment	21	440	4.895	1.282	8.073	0.011	0.831	0.806	1413.073
2270003060	Diesel AC/Refrigeration	43	410	1.283	0.278	6.274	0.009	0.156	0.151	1301.529

**Table 4-1. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2020 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>ef</sup>	CO <sub>2e</sub> <sup>g</sup>
2270003070	Diesel Terminal Tractors	59	380	0.450	0.070	1.398	0.008	0.091	0.088	1199.653
2270004031	Diesel Leaf blowers/Vacuums	43	410	6.440	1.845	11.659	0.011	1.002	0.972	1297.679
2270004036	Diesel Snow blowers	43	370	1.233	0.304	4.597	0.006	0.205	0.199	682.349
2270004046	Diesel Front Mowers	43	410	3.192	0.777	8.348	0.011	0.478	0.464	1300.680
2270004056	Diesel Lawn & Garden Tractors	43	410	3.584	0.857	8.448	0.012	0.438	0.425	1300.840
2270004066	Diesel Chippers/Stump Grinders	43	380	2.858	0.653	8.228	0.010	0.521	0.506	1215.369
2270004071	Diesel Commercial Turf Equipment	43	400	1.299	0.267	4.852	0.009	0.203	0.197	1263.241
2270004076	Diesel Other Lawn & Garden Equipment	43	410	4.305	0.997	9.620	0.011	0.748	0.726	1292.684
2270005010	Diesel 2-Wheel Tractors	59	410	5.749	1.811	9.206	0.012	0.575	0.557	1313.095
2270005015	Diesel Agricultural Tractors	59	380	2.904	0.516	6.611	0.010	0.484	0.470	1211.056
2270005020	Diesel Combines	59	370	2.989	0.704	8.479	0.010	0.652	0.632	1185.088
2270005025	Diesel Balers	59	400	5.655	1.110	9.310	0.011	0.871	0.845	1269.197
2270005030	Diesel Agricultural Mowers	59	410	6.785	0.936	8.752	0.011	1.049	1.018	1312.491
2270005035	Diesel Sprayers	59	380	3.564	0.857	8.177	0.010	0.614	0.596	1195.340
2270005040	Diesel Tillers > 6 HP	59	370	3.915	0.618	8.077	0.010	0.501	0.486	1186.298
2270005045	Diesel Swathers	59	400	5.886	0.968	9.510	0.011	0.949	0.920	1283.938
2270005055	Diesel Other Agricultural Equipment	59	380	3.303	0.656	7.608	0.010	0.609	0.590	1195.985
2270005060	Diesel Irrigation Sets	43	390	1.885	0.382	5.358	0.010	0.341	0.331	1234.996
2270006005	Diesel Generator Sets	43	390	3.160	0.760	7.935	0.010	0.543	0.527	1253.757
2270006010	Diesel Pumps	43	390	3.237	0.762	7.918	0.010	0.566	0.549	1252.846
2270006015	Diesel Air Compressors	43	400	1.736	0.306	5.139	0.010	0.281	0.273	1265.984
2270006020	Diesel Gas Compressors	43	410	0.205	0.044	2.965	0.009	0.033	0.032	1301.566

**Table 4-1. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2020 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>ef</sup>	CO <sub>2e</sub> <sup>g</sup>
2270006025	Diesel Welders	21	480	8.265	1.756	9.431	0.013	1.219	1.183	1528.439
2270006030	Diesel Pressure Washers	43	380	2.981	0.817	7.894	0.010	0.473	0.459	1223.939
2270006035	Diesel Hydro Power Units	43	400	1.840	0.350	5.519	0.010	0.295	0.286	1272.207
2270007015	Diesel Forest Equipment - Feller/Bunch/Skidder	59	370	0.480	0.074	1.306	0.008	0.095	0.092	1186.532
2270008005	Diesel Airport Ground Support Equipment	59	380	1.352	0.195	3.232	0.009	0.225	0.218	1195.393
2270009010	Diesel Other Underground Mining Equipment	21	450	9.037	2.140	11.532	0.013	1.117	1.083	1428.234
2270010010	Diesel Other Oil Field Equipment	43	370	0.954	0.198	4.306	0.009	0.144	0.140	1174.702
2282005010	2 Stroke Outboard	21	850	223.736	90.967	13.111	0.013	0.781	0.719	2238.849
2282005015	2 Stroke Personal Water Craft	21	820	253.991	24.235	13.817	0.013	0.252	0.232	2151.588
2282010005	4 Stroke Inboard/Sterndrive	21	630	150.713	25.379	15.259	0.011	0.151	0.139	1875.996
2282020005	Diesel Inboard/Sterndrive	35	370	2.286	0.619	10.780	0.011	0.243	0.236	1173.130
2282020010	Diesel Outboards	35	410	4.600	1.430	7.981	0.012	0.755	0.732	1299.358
2285002015	Diesel Railway Maintenance	21	440	5.483	1.351	8.629	0.012	0.964	0.935	1400.859
2285004015	4 Stroke Railway Maintenance	62	750	530.191	13.607	4.703	0.014	0.293	0.269	2344.573
2285006015	LPG Railway Maintenance	62	480	22.761	0.686	3.785	0.006	0.126	0.126	1234.321

Notes for Table 4-1 follows Table 4-5

**Table 4-2. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2021**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2260001010	2 Stroke Motorcycles: Off-Road <sup>c</sup>	100	260	79.334	71.939	0.913	0.003	2.623	2.413	570.662
2260001020	2 Stroke Snowmobiles	34	1640	139.999	166.123	5.647	0.013	1.765	1.624	2127.630
2260001030	2 Stroke ATVs <sup>c</sup>	100	210	82.877	19.517	0.931	0.003	0.571	0.525	495.061
2260001060	2 Stroke Specialty Vehicles/Carts	58	1000	575.965	20.043	4.655	0.014	0.296	0.272	2348.507
2260002006	2 Stroke Tampers/Rammers	55	680	561.048	135.608	3.369	0.009	20.447	18.811	1595.423
2260002009	2 Stroke Plate Compactors	55	830	490.514	110.822	5.250	0.014	16.842	15.494	2440.119
2260002021	2 Stroke Paving Equipment	59	830	494.216	110.354	5.250	0.014	16.954	15.598	2437.424
2260002027	2 Stroke Signal Boards/Light Plants	72	830	512.609	129.694	5.250	0.014	17.574	16.168	2422.455
2260002039	2 Stroke Concrete/Industrial Saws	78	630	580.558	137.223	3.520	0.009	21.176	19.482	1645.698
2260002054	2 Stroke Crushing/Proc. Equipment	85	830	512.608	113.759	5.250	0.014	17.574	16.168	2422.453
2260003030	2 Stroke Sweepers/Scrubbers	71	820	512.608	122.930	5.250	0.014	17.574	16.168	2422.454
2260003040	2 Stroke Other General Industrial Equipment	54	830	512.608	118.565	5.250	0.014	17.574	16.168	2422.454
2260004015	2 Stroke Rotary Tillers < 6 HP (Residential)	40	940	454.788	123.444	5.264	0.014	16.270	14.968	2454.509
2260004016	2 Stroke Rotary Tillers < 6 HP (Commercial)	40	900	459.600	110.915	5.264	0.014	16.408	15.095	2451.188
2260004020	2 Stroke Chain Saws < 6 HP (Residential)	70	900	470.045	167.458	5.250	0.014	16.249	14.949	2454.286
2260004021	2 Stroke Chain Saws < 6 HP (Commercial)	70	650	576.681	161.819	3.619	0.010	20.971	19.293	1690.016
2260004025	2 Stroke Trimmers/Edgers/Brush Cutter (Residential)	91	890	433.973	133.249	5.300	0.014	16.887	15.536	2441.532
2260004026	2 Stroke Trimmers/Edgers/Brush Cutter (Commercial)	91	810	494.343	127.067	4.981	0.013	17.172	15.799	2323.426
2260004030	2 Stroke Leaf blowers/Vacuums (Residential)	94	890	460.262	132.842	5.264	0.014	16.427	15.113	2450.732
2260004031	2 Stroke Leaf blowers/Vacuums (Commercial)	94	760	519.829	119.920	4.357	0.012	18.426	16.952	2042.085
2260004035	2 Stroke Snow blowers (Residential)	35	870	530.542	381.540	1.774	0.006	5.897	5.425	1239.581
2260004036	2 Stroke Snow blowers (Commercial)	35	870	619.049	241.891	2.069	0.007	6.881	6.330	1446.130

**Table 4-2. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2021 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2260004071	2 Stroke Commercial Turf Equipment	60	840	481.480	100.112	5.250	0.014	16.574	15.248	2446.545
2260005035	2 Stroke Sprayers	65	840	424.007	107.014	5.323	0.014	17.379	15.988	2430.668
2260006005	2 Stroke Generator Sets	68	830	483.112	137.181	5.255	0.014	16.807	15.463	2441.154
2260006010	2 Stroke Pumps	69	830	461.363	142.167	5.282	0.014	18.336	16.869	2396.478
2260006015	2 Stroke Air Compressors	56	830	512.607	139.006	5.250	0.014	17.574	16.168	2422.449
2260006035	2 Stroke Hydro Power Units	56	830	512.608	146.271	5.250	0.014	17.574	16.168	2422.451
2260007005	2 Stroke Chain Saws > 6 HP	70	620	586.492	150.576	3.369	0.009	21.491	19.772	1577.848
2265001010	4 Stroke Motorcycles: Off-Road	100	160	59.265	7.152	1.251	0.003	0.147	0.135	504.362
2265001030	4 Stroke ATVs	100	170	80.955	8.215	0.981	0.003	0.147	0.135	533.055
2265001050	4 Stroke Golf Carts	46	740	586.285	13.534	4.945	0.014	0.301	0.277	2345.391
2265001060	4 Stroke Specialty Vehicles/Carts	58	820	609.793	21.450	7.806	0.014	0.243	0.224	2329.876
2265002003	4 Stroke Pavers	66	700	434.726	9.877	4.407	0.013	0.257	0.236	2157.865
2265002006	4 Stroke Tampers/Rammers	55	760	571.541	13.499	4.570	0.014	0.251	0.230	2345.315
2265002009	4 Stroke Plate Compactors	55	830	487.684	16.002	5.155	0.015	0.517	0.476	2584.983
2265002015	4 Stroke Rollers	62	690	447.821	9.923	4.326	0.013	0.253	0.233	2152.881
2265002021	4 Stroke Paving Equipment	59	780	530.399	14.108	4.845	0.014	0.344	0.316	2416.454
2265002024	4 Stroke Surfacing Equipment	49	750	534.874	13.551	4.866	0.014	0.359	0.330	2389.607
2265002027	4 Stroke Signal Boards/Light Plants	72	780	524.706	13.760	5.120	0.015	0.464	0.427	2495.259
2265002030	4 Stroke Trenchers	66	710	417.341	10.515	4.558	0.013	0.323	0.297	2204.515
2265002033	4 Stroke Bore/Drill Rigs	79	790	371.290	15.018	7.556	0.014	0.490	0.451	2414.866
2265002039	4 Stroke Concrete/Industrial Saws	78	710	518.754	11.450	4.653	0.013	0.279	0.257	2250.938
2265002042	4 Stroke Cement & Mortar Mixers	59	820	535.551	17.837	4.957	0.014	0.348	0.320	2452.045



**Table 4-2. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2021 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265002045	4 Stroke Cranes	47	590	114.468	4.138	5.607	0.010	0.161	0.148	1660.960
2265002054	4 Stroke Crushing/Proc. Equipment	85	740	496.799	12.129	4.909	0.014	0.326	0.300	2313.410
2265002057	4 Stroke Rough Terrain Forklifts	63	570	41.387	1.971	3.636	0.009	0.152	0.140	1563.317
2265002060	4 Stroke Rubber Tire Loaders	71	550	24.507	1.357	2.757	0.009	0.152	0.140	1544.027
2265002066	4 Stroke Tractors/Loaders/ Backhoes	48	730	541.957	11.290	4.591	0.014	0.263	0.242	2293.847
2265002072	4 Stroke Skid Steer Loaders	58	640	255.160	6.519	5.176	0.011	0.189	0.174	1871.422
2265002078	4 Stroke Dumpers/Tenders	41	800	552.861	17.577	5.275	0.014	0.276	0.254	2370.916
2265002081	4 Stroke Other Construction Equipment	48	580	74.902	3.758	6.807	0.010	0.149	0.137	1594.357
2265003010	4 Stroke Aerial Lifts	46	630	185.293	5.471	5.510	0.011	0.175	0.161	1766.927
2265003020	4 Stroke Forklifts	30	560	24.451	1.344	2.754	0.009	0.152	0.140	1544.028
2265003030	4 Stroke Sweepers/Scrubbers	71	610	202.353	5.401	3.481	0.011	0.220	0.202	1822.919
2265003040	4 Stroke Other General Industrial Equipment	54	760	440.643	14.890	5.087	0.014	0.533	0.490	2400.498
2265003050	4 Stroke Other Material Handling Equipment	53	640	208.592	5.439	4.501	0.011	0.182	0.168	1808.204
2265003060	4 Stroke AC/Refrigeration	46	740	574.149	12.491	4.632	0.014	0.260	0.239	2345.302
2265003070	4 Stroke Terminal Tractors	78	520	24.496	1.325	2.750	0.009	0.154	0.142	1544.028
2265004010	4 Stroke Lawn mowers (Residential)	33	900	423.388	36.658	5.431	0.016	0.647	0.595	2760.040
2265004011	4 Stroke Lawn mowers (Commercial)	33	880	426.536	27.859	5.591	0.016	0.717	0.659	2760.004
2265004015	4 Stroke Rotary Tillers < 6 HP (Residential)	40	910	423.256	38.091	5.430	0.016	0.647	0.596	2760.178
2265004016	4 Stroke Rotary Tillers < 6 HP (Commercial)	40	890	423.001	30.829	5.429	0.016	0.658	0.605	2760.166
2265004025	4 Stroke Trimmers/Edgers/Brush Cutter HP (Residential)	91	900	423.092	45.790	5.433	0.016	0.660	0.607	2760.166
2265004026	4 Stroke Trimmers/Edgers/Brush Cutter (Commercial)	91	820	495.899	29.940	5.147	0.015	0.500	0.460	2566.437
2265004030	4 Stroke Leaf blowers/Vacuums (Residential)	94	900	423.104	33.138	5.434	0.016	0.660	0.607	2760.167

**Table 4-2. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2021 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265004031	4 Stroke Leaf blowers/Vacuums (Commercial)	94	700	435.418	14.329	4.404	0.013	0.249	0.229	2156.537
2265004035	4 Stroke Snow blowers (Residential)	35	940	605.010	204.772	4.759	0.009	0.126	0.116	1506.754
2265004036	4 Stroke Snow blowers (Commercial)	35	940	709.379	37.042	5.415	0.010	0.147	0.135	1757.377
2265004040	4 Stroke Rear Engine Riding Mowers (Residential)	38	760	571.141	22.928	4.600	0.014	0.247	0.228	2346.694
2265004041	4 Stroke Rear Engine Riding Mowers (Commercial)	38	740	573.397	13.079	4.622	0.014	0.259	0.238	2346.080
2265004046	4 Stroke Front Mowers	65	790	577.929	14.738	5.184	0.014	0.243	0.223	2344.822
2265004051	4 Stroke Shredders < 6 HP	80	890	422.654	30.707	5.412	0.016	0.651	0.599	2760.162
2265004055	4 Stroke Lawn & Garden Tractors (Residential)	44	760	570.804	17.868	4.586	0.014	0.247	0.227	2345.751
2265004056	4 Stroke Lawn & Garden Tractors (Commercial)	44	740	573.566	12.419	4.621	0.014	0.258	0.238	2345.603
2265004066	4 Stroke Chippers/Stump Grinders	78	640	291.953	6.498	3.722	0.011	0.213	0.196	1930.398
2265004071	4 Stroke Commercial Turf Equipment	60	730	486.257	11.180	4.564	0.014	0.315	0.290	2309.818
2265004075	4 Stroke Other Lawn & Garden Equipment	58	850	504.772	24.895	5.501	0.015	0.448	0.412	2559.983
2265004076	4 Stroke Other Lawn & Garden Equipment	58	850	502.585	23.162	5.521	0.015	0.447	0.411	2554.638
2265005010	4 Stroke 2-Wheel Tractors	62	740	576.333	12.027	4.689	0.014	0.267	0.246	2345.320
2265005015	4 Stroke Agricultural Tractors	62	580	106.846	2.879	3.114	0.010	0.170	0.157	1661.922
2265005020	4 Stroke Combines	74	580	156.801	11.385	14.384	0.010	0.153	0.141	1687.787
2265005025	4 Stroke Balers	62	580	156.786	13.704	14.380	0.010	0.153	0.141	1687.648
2265005030	4 Stroke Agricultural Mowers	48	770	572.139	12.756	4.739	0.014	0.251	0.231	2348.311
2265005035	4 Stroke Sprayers	65	740	405.255	15.821	8.632	0.013	0.300	0.276	2206.561
2265005040	4 Stroke Tillers > 6 HP	71	870	782.683	28.472	9.012	0.015	0.255	0.235	2501.641
2265005045	4 Stroke Swathers	52	580	156.786	11.440	14.380	0.010	0.153	0.141	1687.645
2265005055	4 Stroke Other Agricultural Equipment	55	620	240.899	9.917	12.442	0.011	0.175	0.161	1824.564

**Table 4-2. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2021 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265005060	4 Stroke Irrigation Sets	60	550	36.038	1.752	2.812	0.009	0.167	0.154	1571.230
2265006005	4 Stroke Generator Sets	68	780	558.909	15.680	4.796	0.014	0.288	0.265	2384.563
2265006010	4 Stroke Pumps	69	760	439.498	14.967	5.137	0.014	0.414	0.381	2362.689
2265006015	4 Stroke Air Compressors	56	700	360.533	10.770	4.410	0.013	0.336	0.309	2145.321
2265006025	4 Stroke Welders	68	710	472.708	11.706	4.467	0.013	0.259	0.238	2200.050
2265006030	4 Stroke Pressure Washers	85	800	519.984	16.716	4.948	0.015	0.416	0.382	2489.939
2265006035	4 Stroke Hydro Power Units	56	750	539.065	12.842	4.789	0.014	0.334	0.307	2370.754
2265007010	4 Stroke Shredders > 6 HP	80	800	589.987	17.398	5.173	0.014	0.251	0.231	2355.209
2265007015	4 Stroke Forest Equipment - Feller/Bunch/Skidder	70	810	491.151	16.169	5.416	0.015	0.598	0.550	2593.366
2265008005	4 Stroke Airport Ground Support Equipment	56	600	129.309	4.214	3.291	0.010	0.232	0.214	1744.062
2265010010	4 Stroke Other Oil Field Equipment	90	740	592.913	12.585	5.116	0.014	0.323	0.297	2345.444
2267001060	LPG Specialty Vehicle Carts	58	490	52.763	2.269	10.444	0.006	0.126	0.126	1317.594
2267002003	LPG Pavers	66	460	14.947	0.394	2.635	0.006	0.126	0.126	1222.450
2267002015	LPG Rollers	62	450	10.614	0.243	2.049	0.006	0.127	0.127	1216.730
2267002021	LPG Paving Equipment	59	480	29.958	1.053	5.331	0.006	0.124	0.124	1253.555
2267002024	LPG Surfacing Equipment	49	460	14.333	0.382	2.595	0.006	0.127	0.127	1222.384
2267002030	LPG Trenchers	66	460	15.109	0.396	2.644	0.006	0.126	0.126	1222.449
2267002033	LPG Bore/Drill Rigs	79	490	61.304	2.552	11.594	0.006	0.125	0.125	1328.300
2267002039	LPG Concrete/Industrial Saws	78	430	10.708	0.248	2.061	0.006	0.129	0.129	1216.739
2267002045	LPG Cranes	47	480	28.288	0.917	4.714	0.006	0.123	0.123	1244.839
2267002054	LPG Crushing/Proc. Equipment	85	480	24.846	0.802	4.275	0.006	0.123	0.123	1240.789
2267002057	LPG Rough Terrain Forklifts	63	470	16.571	0.448	2.849	0.006	0.126	0.126	1224.518

**Table 4-2. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2021 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2267002060	LPG Rubber Tire Loaders	71	460	10.952	0.248	2.068	0.006	0.127	0.127	1216.740
2267002066	LPG Tractors/Loaders/ Backhoes	48	450	10.497	0.241	2.042	0.006	0.127	0.127	1216.726
2267002072	LPG Skid Steer Loaders	58	470	27.935	0.883	4.563	0.006	0.125	0.125	1242.506
2267002081	LPG Other Construction Equipment	48	480	35.659	1.173	5.704	0.006	0.124	0.124	1254.337
2267003010	LPG Aerial Lifts	46	480	28.810	0.938	4.798	0.006	0.125	0.125	1245.599
2267003020	LPG Forklifts	30	460	10.908	0.247	2.065	0.006	0.127	0.127	1216.738
2267003030	LPG Sweepers/Scrubbers	71	440	10.756	0.247	2.060	0.006	0.128	0.128	1216.736
2267003040	LPG Other General Industrial Equipment	54	450	10.581	0.242	2.046	0.006	0.127	0.127	1216.727
2267003050	LPG Other Material Handling Equipment	53	480	20.725	0.632	3.591	0.006	0.125	0.125	1233.146
2267003070	LPG Terminal Tractors	78	430	10.639	0.246	2.054	0.006	0.129	0.129	1216.734
2267004066	LPG Chippers/Stump Grinders	78	450	10.723	0.246	2.056	0.006	0.128	0.128	1216.734
2267005055	LPG Other Agricultural Equipment	55	490	70.944	2.764	12.376	0.006	0.128	0.128	1331.283
2267005060	LPG Irrigation Sets	60	450	10.522	0.242	2.044	0.006	0.128	0.128	1216.726
2267006005	LPG Generator Sets	68	480	35.709	1.412	8.624	0.006	0.125	0.125	1294.862
2267006010	LPG Pumps	69	470	21.680	0.658	4.408	0.006	0.126	0.126	1243.332
2267006015	LPG Air Compressors	56	460	13.168	0.303	2.412	0.006	0.127	0.127	1220.240
2267006025	LPG Welders	68	460	14.454	0.352	2.457	0.006	0.126	0.126	1219.890
2267006030	LPG Pressure Washers	85	470	29.142	0.945	4.833	0.006	0.125	0.125	1245.799
2267006035	LPG Hydro Power Units	56	460	12.634	0.300	2.384	0.006	0.127	0.127	1220.209
2267008005	LPG Airport Ground Support Equipment	56	450	10.636	0.243	2.049	0.006	0.127	0.127	1216.728
2268002081	CNG Other Construction Equipment	48	480	35.495	4.194	5.746	0.006	0.124	0.124	1534.350
2268003020	CNG Forklifts	30	460	10.908	0.938	2.160	0.006	0.127	0.127	1163.031

**Table 4-2. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2021 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2268003030	CNG Sweepers/Scrubbers	71	460	10.786	0.930	2.153	0.006	0.127	0.127	1162.231
2268003040	CNG Other General Industrial Equipment	54	460	10.560	0.915	2.139	0.006	0.127	0.127	1160.616
2268003060	CNG AC/Refrigeration	46	450	11.698	1.044	2.271	0.006	0.127	0.127	1174.935
2268003070	CNG Terminal Tractors	78	430	10.638	0.935	2.151	0.006	0.129	0.129	1162.704
2268005055	CNG Other Agricultural Equipment	55	510	70.917	9.875	12.422	0.006	0.128	0.128	2195.423
2268005060	CNG Irrigation Sets	60	510	10.527	0.920	2.140	0.006	0.128	0.128	1161.153
2268006005	CNG Generator Sets	68	490	37.822	5.583	9.511	0.006	0.125	0.125	1727.457
2268006010	CNG Pumps	69	480	26.380	3.071	5.566	0.006	0.125	0.125	1420.498
2268006015	CNG Air Compressors	56	470	13.340	1.147	2.528	0.006	0.127	0.127	1188.167
2268006020	CNG Gas Compressors	85	410	11.753	1.087	2.256	0.006	0.139	0.139	1178.199
2268006035	CNG Hydro Power Units	56	470	14.305	1.263	2.721	0.006	0.126	0.126	1202.199
2268010010	CNG Other Oil Field Equipment	90	410	11.075	0.995	2.192	0.006	0.133	0.133	1168.779
2270001060	Diesel Specialty Vehicle Carts	21	450	7.338	1.888	9.000	0.012	1.105	1.072	1438.736
2270002003	Diesel Pavers	59	380	0.786	0.123	2.513	0.009	0.138	0.134	1214.318
2270002006	Diesel Tampers/Rammers	43	1000	5.823	1.824	9.530	0.012	0.616	0.597	1300.061
2270002009	Diesel Plate Compactors	43	410	5.034	1.500	9.156	0.012	0.541	0.524	1300.352
2270002015	Diesel Rollers	59	390	1.080	0.164	3.110	0.009	0.180	0.175	1233.892
2270002018	Diesel Scrapers	59	370	0.830	0.104	1.886	0.008	0.116	0.112	1183.435
2270002021	Diesel Paving Equipment	59	390	1.299	0.245	3.513	0.009	0.219	0.212	1227.207
2270002024	Diesel Surfacing Equipment	59	380	2.214	0.337	5.632	0.009	0.307	0.297	1224.192
2270002027	Diesel Signal Boards/Light Plants	43	410	2.886	0.722	7.829	0.011	0.368	0.356	1293.650
2270002030	Diesel Trenchers	59	400	1.633	0.260	4.966	0.009	0.235	0.228	1273.618

**Table 4-2. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2021 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2270002033	Diesel Bore/Drill Rigs	43	370	1.997	0.506	7.272	0.009	0.368	0.357	1190.292
2270002036	Diesel Excavators	59	380	0.464	0.076	1.516	0.008	0.091	0.088	1194.759
2270002039	Diesel Concrete/Industrial Saws	59	410	1.801	0.298	5.261	0.009	0.256	0.248	1304.985
2270002042	Diesel Cement & Mortar Mixers	43	390	3.560	0.893	8.516	0.010	0.577	0.559	1244.445
2270002045	Diesel Cranes	43	370	0.638	0.144	2.594	0.008	0.114	0.110	1175.688
2270002048	Diesel Graders	59	370	0.451	0.075	1.316	0.008	0.091	0.089	1185.399
2270002051	Diesel Off-highway Trucks	59	370	0.462	0.100	3.526	0.008	0.081	0.079	1183.438
2270002054	Diesel Crushing/Proc. Equipment	43	380	0.938	0.192	3.823	0.009	0.149	0.144	1203.199
2270002057	Diesel Rough Terrain Forklifts	59	390	1.522	0.187	3.530	0.009	0.254	0.247	1255.790
2270002060	Diesel Rubber Tire Loaders	59	370	0.937	0.150	2.880	0.009	0.155	0.150	1190.427
2270002066	Diesel Tractors/Loaders/ Backhoes	21	460	5.230	1.131	6.704	0.011	0.864	0.838	1466.293
2270002069	Diesel Crawler Tractor/Dozers	59	370	0.731	0.108	2.319	0.008	0.121	0.117	1190.018
2270002072	Diesel Skid Steer Loaders	21	480	8.260	1.768	9.255	0.012	1.300	1.261	1528.609
2270002075	Diesel Off-Highway Tractors	59	370	1.089	0.173	4.126	0.009	0.152	0.148	1183.297
2270002078	Diesel Dumpers/Tenders	21	470	8.511	1.997	9.496	0.013	1.307	1.268	1507.678
2270002081	Diesel Other Construction Equipment	59	370	1.733	0.244	4.245	0.009	0.240	0.232	1185.371
2270003010	Diesel Aerial Lifts	21	480	7.767	1.726	9.395	0.012	1.097	1.064	1530.292
2270003020	Diesel Forklifts	59	400	0.350	0.058	2.492	0.008	0.055	0.053	1265.582
2270003030	Diesel Sweepers/Scrubbers	43	380	0.621	0.114	2.609	0.008	0.113	0.110	1219.312
2270003040	Diesel Other General Industrial Equipment	43	380	0.888	0.177	3.116	0.009	0.170	0.165	1205.494
2270003050	Diesel Other Material Handling Equipment	21	440	4.415	1.153	7.417	0.011	0.751	0.729	1413.391
2270003060	Diesel AC/Refrigeration	43	410	1.089	0.246	6.127	0.009	0.124	0.121	1301.563

**Table 4-2. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2021 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2270003070	Diesel Terminal Tractors	59	380	0.326	0.053	1.106	0.008	0.067	0.065	1199.656
2270004031	Diesel Leaf blowers/Vacuums	43	410	6.118	1.744	11.262	0.011	0.938	0.910	1298.041
2270004036	Diesel Snow blowers	43	370	1.131	0.279	4.272	0.006	0.190	0.184	682.413
2270004046	Diesel Front Mowers	43	410	3.002	0.726	8.124	0.011	0.442	0.428	1300.791
2270004056	Diesel Lawn & Garden Tractors	43	410	3.449	0.818	8.337	0.012	0.417	0.405	1300.906
2270004066	Diesel Chippers/Stump Grinders	43	380	2.629	0.594	7.662	0.010	0.478	0.464	1215.519
2270004071	Diesel Commercial Turf Equipment	43	400	1.136	0.239	4.560	0.009	0.171	0.166	1263.266
2270004076	Diesel Other Lawn & Garden Equipment	43	410	4.032	0.926	9.261	0.011	0.693	0.672	1292.880
2270005010	Diesel 2-Wheel Tractors	59	410	5.583	1.822	9.209	0.012	0.550	0.534	1313.088
2270005015	Diesel Agricultural Tractors	59	380	2.591	0.453	6.018	0.010	0.434	0.421	1211.164
2270005020	Diesel Combines	59	370	2.795	0.662	8.014	0.010	0.607	0.588	1185.203
2270005025	Diesel Balers	59	400	5.353	1.036	8.974	0.011	0.815	0.791	1269.408
2270005030	Diesel Agricultural Mowers	59	410	6.433	0.872	8.347	0.011	0.987	0.958	1312.656
2270005035	Diesel Sprayers	59	380	3.330	0.796	7.764	0.010	0.571	0.554	1195.508
2270005040	Diesel Tillers > 6 HP	59	370	3.658	0.577	7.657	0.010	0.468	0.454	1186.412
2270005045	Diesel Swathers	59	400	5.606	0.910	9.103	0.011	0.889	0.863	1284.099
2270005055	Diesel Other Agricultural Equipment	59	380	3.081	0.606	7.152	0.010	0.563	0.546	1196.113
2270005060	Diesel Irrigation Sets	43	390	1.600	0.314	4.701	0.009	0.294	0.285	1235.087
2270006005	Diesel Generator Sets	43	390	2.919	0.700	7.526	0.010	0.497	0.482	1253.924
2270006010	Diesel Pumps	43	390	2.993	0.705	7.503	0.010	0.518	0.502	1252.996
2270006015	Diesel Air Compressors	43	400	1.480	0.257	4.707	0.009	0.241	0.233	1266.055
2270006020	Diesel Gas Compressors	43	410	0.205	0.044	2.965	0.009	0.033	0.032	1301.568

**Table 4-2. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2021 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2270006025	Diesel Welders	21	480	7.561	1.592	9.054	0.013	1.111	1.078	1528.873
2270006030	Diesel Pressure Washers	43	380	2.769	0.756	7.476	0.010	0.436	0.423	1224.108
2270006035	Diesel Hydro Power Units	43	400	1.585	0.300	5.095	0.009	0.253	0.245	1272.276
2270007015	Diesel Forest Equipment - Feller/Bunch/Skidder	59	370	0.363	0.058	1.009	0.008	0.074	0.071	1186.534
2270008005	Diesel Airport Ground Support Equipment	59	380	1.127	0.163	2.757	0.009	0.190	0.184	1195.432
2270009010	Diesel Other Underground Mining Equipment	21	450	8.812	2.091	11.358	0.013	1.074	1.042	1428.446
2270010010	Diesel Other Oil Field Equipment	43	370	0.828	0.173	3.926	0.009	0.126	0.122	1174.725
2282005010	2 Stroke Outboard	21	850	220.637	82.309	13.085	0.013	0.671	0.617	2239.409
2282005015	2 Stroke Personal Water Craft	21	820	253.420	22.300	13.905	0.013	0.217	0.199	2151.530
2282010005	4 Stroke Inboard/Stern-drive	21	630	143.069	24.139	14.305	0.011	0.151	0.139	1868.469
2282020005	Diesel Inboard/Stern-drive	35	370	2.279	0.621	10.509	0.011	0.240	0.233	1173.179
2282020010	Diesel Outboards	35	410	4.451	1.379	7.662	0.012	0.719	0.697	1299.572
2285002015	Diesel Railway Maintenance	21	440	5.000	1.231	7.983	0.011	0.882	0.856	1401.149
2285004015	4 Stroke Railway Maintenance	62	750	530.126	13.604	4.677	0.014	0.294	0.270	2344.279
2285006015	LPG Railway Maintenance	62	480	20.160	0.588	3.402	0.006	0.125	0.125	1230.388

Notes for Table 4-2 follow Table 4-5



**Table 4-3. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2022**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2260001010	2 Stroke Motorcycles: Off-Road <sup>c</sup>	100	260	78.972	70.870	0.919	0.003	2.583	2.377	571.948
2260001020	2 Stroke Snowmobiles	34	1640	135.938	161.027	5.833	0.012	1.679	1.545	2115.499
2260001030	2 Stroke ATVs <sup>c</sup>	100	210	82.459	17.099	0.938	0.003	0.480	0.441	498.742
2260001060	2 Stroke Specialty Vehicles/Carts	58	1000	575.700	19.947	4.641	0.014	0.296	0.272	2348.394
2260002006	2 Stroke Tampers/Rammers	55	680	561.089	135.619	3.369	0.009	20.449	18.813	1595.396
2260002009	2 Stroke Plate Compactors	55	830	490.341	110.759	5.250	0.014	16.836	15.489	2440.263
2260002021	2 Stroke Paving Equipment	59	830	494.068	110.301	5.250	0.014	16.949	15.593	2437.547
2260002027	2 Stroke Signal Boards/Light Plants	72	830	512.608	129.693	5.250	0.014	17.574	16.168	2422.454
2260002039	2 Stroke Concrete/Industrial Saws	78	630	580.558	137.223	3.520	0.009	21.176	19.482	1645.696
2260002054	2 Stroke Crushing/Proc. Equipment	85	830	512.609	113.760	5.250	0.014	17.574	16.168	2422.453
2260003030	2 Stroke Sweepers/Scrubbers	71	820	512.608	122.930	5.250	0.014	17.574	16.168	2422.454
2260003040	2 Stroke Other General Industrial Equipment	54	830	512.608	118.565	5.250	0.014	17.574	16.168	2422.454
2260004015	2 Stroke Rotary Tillers < 6 HP (Residential)	40	940	454.774	123.345	5.264	0.014	16.269	14.968	2454.515
2260004016	2 Stroke Rotary Tillers < 6 HP (Commercial)	40	900	459.534	110.896	5.264	0.014	16.406	15.094	2451.226
2260004020	2 Stroke Chain Saws < 6 HP (Residential)	70	900	470.071	167.467	5.250	0.014	16.250	14.950	2454.264
2260004021	2 Stroke Chain Saws < 6 HP (Commercial)	70	650	576.681	161.819	3.619	0.010	20.971	19.293	1690.014
2260004025	2 Stroke Trimmers/Edgers/Brush Cutter (Residential)	91	890	433.997	133.258	5.300	0.014	16.888	15.537	2441.512
2260004026	2 Stroke Trimmers/Edgers/Brush Cutter (Commercial)	91	810	494.308	127.055	4.981	0.013	17.171	15.798	2323.453
2260004030	2 Stroke Leaf blowers/Vacuums (Residential)	94	890	460.288	132.851	5.264	0.014	16.428	15.113	2450.709
2260004031	2 Stroke Leaf blowers/Vacuums (Commercial)	94	760	519.794	119.909	4.357	0.012	18.425	16.951	2042.108
2260004035	2 Stroke Snow blowers (Residential)	35	870	530.541	381.541	1.774	0.006	5.897	5.425	1239.577
2260004036	2 Stroke Snow blowers (Commercial)	35	870	619.048	241.893	2.069	0.007	6.881	6.330	1446.123

**Table 4-3. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2022 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2260004071	2 Stroke Commercial Turf Equipment	60	840	481.400	100.085	5.250	0.014	16.571	15.245	2446.603
2260005035	2 Stroke Sprayers	65	840	423.924	106.981	5.323	0.014	17.376	15.986	2430.740
2260006005	2 Stroke Generator Sets	68	830	483.070	137.166	5.255	0.014	16.806	15.462	2441.188
2260006010	2 Stroke Pumps	69	830	461.227	142.098	5.281	0.014	18.336	16.869	2396.409
2260006015	2 Stroke Air Compressors	56	830	512.608	139.006	5.250	0.014	17.574	16.168	2422.453
2260006035	2 Stroke Hydro Power Units	56	830	512.609	146.271	5.250	0.014	17.574	16.168	2422.456
2260007005	2 Stroke Chain Saws > 6 HP	70	620	586.493	150.577	3.369	0.009	21.491	19.772	1577.854
2265001010	4 Stroke Motorcycles: Off-Road	100	160	58.790	7.101	1.247	0.003	0.147	0.135	504.335
2265001030	4 Stroke ATVs	100	170	80.797	8.148	0.973	0.003	0.147	0.135	533.018
2265001050	4 Stroke Golf Carts	46	740	586.285	13.534	4.945	0.014	0.301	0.277	2345.394
2265001060	4 Stroke Specialty Vehicles/Carts	58	820	595.491	20.393	7.436	0.014	0.241	0.222	2319.113
2265002003	4 Stroke Pavers	66	700	434.242	9.858	4.362	0.013	0.257	0.236	2157.302
2265002006	4 Stroke Tampers/Rammers	55	760	571.360	13.479	4.562	0.014	0.250	0.230	2345.300
2265002009	4 Stroke Plate Compactors	55	830	487.663	16.004	5.154	0.015	0.518	0.477	2584.977
2265002015	4 Stroke Rollers	62	690	447.825	9.923	4.326	0.013	0.254	0.233	2152.885
2265002021	4 Stroke Paving Equipment	59	780	530.439	14.106	4.826	0.014	0.345	0.317	2416.272
2265002024	4 Stroke Surfacing Equipment	49	750	534.857	13.551	4.862	0.014	0.359	0.330	2389.551
2265002027	4 Stroke Signal Boards/Light Plants	72	780	524.728	13.762	5.121	0.015	0.464	0.427	2495.262
2265002030	4 Stroke Trenchers	66	710	416.771	10.490	4.507	0.013	0.323	0.298	2203.885
2265002033	4 Stroke Bore/Drill Rigs	79	790	368.931	14.881	7.327	0.014	0.491	0.452	2411.773
2265002039	4 Stroke Concrete/Industrial Saws	78	710	518.774	11.451	4.654	0.013	0.279	0.257	2250.937
2265002042	4 Stroke Cement & Mortar Mixers	59	820	534.985	17.690	4.898	0.014	0.349	0.321	2451.645

**Table 4-3. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2022 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265002045	4 Stroke Cranes	47	590	108.215	3.847	5.095	0.010	0.161	0.148	1655.789
2265002054	4 Stroke Crushing/Proc. Equipment	85	740	496.238	12.104	4.859	0.014	0.326	0.300	2312.810
2265002057	4 Stroke Rough Terrain Forklifts	63	570	38.488	1.838	3.387	0.009	0.153	0.141	1560.290
2265002060	4 Stroke Rubber Tire Loaders	71	550	24.279	1.350	2.740	0.009	0.153	0.140	1544.027
2265002066	4 Stroke Tractors/Loaders/ Backhoes	48	730	541.980	11.291	4.592	0.014	0.263	0.242	2293.849
2265002072	4 Stroke Skid Steer Loaders	58	640	251.122	6.325	4.852	0.011	0.189	0.174	1868.338
2265002078	4 Stroke Dumpers/Tenders	41	800	551.011	17.344	5.172	0.014	0.279	0.257	2369.349
2265002081	4 Stroke Other Construction Equipment	48	580	65.750	3.328	6.065	0.009	0.149	0.137	1587.080
2265003010	4 Stroke Aerial Lifts	46	630	178.647	5.137	4.939	0.010	0.174	0.160	1759.726
2265003020	4 Stroke Forklifts	30	560	24.086	1.333	2.730	0.009	0.152	0.140	1544.028
2265003030	4 Stroke Sweepers/Scrubbers	71	610	202.236	5.396	3.474	0.011	0.220	0.202	1822.920
2265003040	4 Stroke Other General Industrial Equipment	54	760	440.614	14.888	5.086	0.014	0.533	0.490	2400.498
2265003050	4 Stroke Other Material Handling Equipment	53	640	205.398	5.277	4.238	0.011	0.182	0.168	1805.193
2265003060	4 Stroke AC/Refrigeration	46	740	574.097	12.486	4.631	0.014	0.259	0.239	2345.302
2265003070	4 Stroke Terminal Tractors	78	520	24.449	1.323	2.747	0.009	0.154	0.142	1544.028
2265004010	4 Stroke Lawn mowers (Residential)	33	900	422.563	36.281	5.400	0.016	0.644	0.592	2760.017
2265004011	4 Stroke Lawn mowers (Commercial)	33	880	426.536	27.859	5.591	0.016	0.717	0.659	2760.004
2265004015	4 Stroke Rotary Tillers < 6 HP (Residential)	40	910	422.434	37.737	5.399	0.016	0.644	0.593	2760.160
2265004016	4 Stroke Rotary Tillers < 6 HP (Commercial)	40	890	422.958	30.818	5.427	0.016	0.658	0.605	2760.163
2265004025	4 Stroke Trimmers/Edgers/Brush Cutter HP (Residential)	91	900	423.069	45.782	5.432	0.016	0.660	0.607	2760.167
2265004026	4 Stroke Trimmers/Edgers/Brush Cutter (Commercial)	91	820	495.894	29.939	5.147	0.015	0.500	0.460	2566.439
2265004030	4 Stroke Leaf blowers/Vacuums (Residential)	94	900	423.086	33.132	5.433	0.016	0.660	0.607	2760.168

**Table 4-3. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2022 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265004031	4 Stroke Leaf blowers/Vacuums (Commercial)	94	700	434.725	14.300	4.346	0.013	0.249	0.229	2155.862
2265004035	4 Stroke Snow blowers (Residential)	35	940	605.003	204.451	4.759	0.009	0.126	0.116	1506.755
2265004036	4 Stroke Snow blowers (Commercial)	35	940	709.362	37.012	5.415	0.010	0.147	0.135	1757.376
2265004040	4 Stroke Rear Engine Riding Mowers (Residential)	38	760	570.742	22.810	4.568	0.014	0.247	0.228	2346.543
2265004041	4 Stroke Rear Engine Riding Mowers (Commercial)	38	740	573.385	13.078	4.622	0.014	0.259	0.238	2346.083
2265004046	4 Stroke Front Mowers	65	790	574.835	14.437	5.032	0.014	0.242	0.223	2343.304
2265004051	4 Stroke Shredders < 6 HP	80	890	422.580	30.686	5.409	0.016	0.651	0.599	2760.159
2265004055	4 Stroke Lawn & Garden Tractors (Residential)	44	760	570.458	17.790	4.556	0.014	0.247	0.227	2345.651
2265004056	4 Stroke Lawn & Garden Tractors (Commercial)	44	740	573.554	12.417	4.620	0.014	0.258	0.238	2345.602
2265004066	4 Stroke Chippers/Stump Grinders	78	640	291.827	6.493	3.714	0.011	0.213	0.196	1930.396
2265004071	4 Stroke Commercial Turf Equipment	60	730	486.241	11.178	4.563	0.014	0.315	0.290	2309.816
2265004075	4 Stroke Other Lawn & Garden Equipment	58	850	501.268	24.266	5.330	0.015	0.446	0.410	2558.611
2265004076	4 Stroke Other Lawn & Garden Equipment	58	850	499.282	22.593	5.362	0.015	0.445	0.410	2553.248
2265005010	4 Stroke 2-Wheel Tractors	62	740	576.321	12.026	4.688	0.014	0.267	0.246	2345.321
2265005015	4 Stroke Agricultural Tractors	62	580	106.085	2.855	3.064	0.010	0.170	0.156	1661.923
2265005020	4 Stroke Combines	74	580	148.523	10.802	13.575	0.010	0.153	0.141	1676.472
2265005025	4 Stroke Balers	62	580	148.555	13.020	13.576	0.010	0.153	0.141	1676.395
2265005030	4 Stroke Agricultural Mowers	48	770	571.229	12.625	4.673	0.014	0.250	0.230	2348.052
2265005035	4 Stroke Sprayers	65	740	400.101	15.335	8.261	0.013	0.299	0.275	2201.416
2265005040	4 Stroke Tillers > 6 HP	71	870	765.741	27.504	8.787	0.015	0.254	0.234	2486.460
2265005045	4 Stroke Swathers	52	580	148.555	10.857	13.576	0.010	0.153	0.141	1676.394
2265005055	4 Stroke Other Agricultural Equipment	55	620	233.909	9.502	11.778	0.011	0.175	0.161	1815.405

**Table 4-3. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2022 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265005060	4 Stroke Irrigation Sets	60	550	36.064	1.753	2.813	0.009	0.167	0.154	1571.229
2265006005	4 Stroke Generator Sets	68	780	558.002	15.543	4.737	0.014	0.287	0.264	2384.291
2265006010	4 Stroke Pumps	69	760	438.882	14.928	5.059	0.014	0.414	0.381	2361.676
2265006015	4 Stroke Air Compressors	56	700	360.086	10.746	4.357	0.013	0.336	0.309	2144.694
2265006025	4 Stroke Welders	68	710	472.317	11.687	4.436	0.013	0.259	0.238	2199.739
2265006030	4 Stroke Pressure Washers	85	800	519.797	16.691	4.937	0.015	0.415	0.382	2489.906
2265006035	4 Stroke Hydro Power Units	56	750	539.005	12.837	4.785	0.014	0.334	0.307	2370.703
2265007010	4 Stroke Shredders > 6 HP	80	800	583.819	16.896	4.975	0.014	0.249	0.230	2352.247
2265007015	4 Stroke Forest Equipment - Feller/Bunch/Skidder	70	810	491.167	16.171	5.416	0.015	0.598	0.551	2593.368
2265008005	4 Stroke Airport Ground Support Equipment	56	600	129.157	4.209	3.281	0.010	0.232	0.214	1744.060
2265010010	4 Stroke Other Oil Field Equipment	90	740	592.910	12.585	5.116	0.014	0.323	0.297	2345.444
2267001060	LPG Specialty Vehicle Carts	58	490	49.397	2.086	9.646	0.006	0.126	0.126	1307.505
2267002003	LPG Pavers	66	460	13.893	0.352	2.470	0.006	0.127	0.127	1220.666
2267002015	LPG Rollers	62	450	10.572	0.243	2.048	0.006	0.128	0.128	1216.730
2267002021	LPG Paving Equipment	59	480	27.390	0.947	4.897	0.006	0.124	0.124	1248.702
2267002024	LPG Surfacing Equipment	49	460	13.631	0.353	2.475	0.006	0.127	0.127	1220.986
2267002030	LPG Trenchers	66	460	13.954	0.351	2.462	0.006	0.127	0.127	1220.470
2267002033	LPG Bore/Drill Rigs	79	490	58.002	2.383	10.851	0.006	0.125	0.125	1319.177
2267002039	LPG Concrete/Industrial Saws	78	430	10.774	0.251	2.067	0.006	0.130	0.130	1216.746
2267002045	LPG Cranes	47	480	24.108	0.781	4.195	0.006	0.124	0.124	1240.158
2267002054	LPG Crushing/Proc. Equipment	85	480	22.272	0.703	3.881	0.006	0.124	0.124	1236.595
2267002057	LPG Rough Terrain Forklifts	63	470	15.109	0.391	2.622	0.006	0.126	0.126	1222.066

**Table 4-3. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2022 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2267002060	LPG Rubber Tire Loaders	71	460	10.628	0.243	2.049	0.006	0.127	0.127	1216.730
2267002066	LPG Tractors/Loaders/ Backhoes	48	450	10.589	0.244	2.050	0.006	0.128	0.128	1216.732
2267002072	LPG Skid Steer Loaders	58	470	23.901	0.757	4.086	0.006	0.125	0.125	1238.434
2267002081	LPG Other Construction Equipment	48	480	30.104	0.996	5.029	0.006	0.124	0.124	1248.408
2267003010	LPG Aerial Lifts	46	480	25.061	0.773	4.132	0.006	0.125	0.125	1238.005
2267003020	LPG Forklifts	30	460	10.538	0.240	2.042	0.006	0.127	0.127	1216.724
2267003030	LPG Sweepers/Scrubbers	71	440	10.608	0.244	2.050	0.006	0.128	0.128	1216.732
2267003040	LPG Other General Industrial Equipment	54	450	10.450	0.239	2.037	0.006	0.127	0.127	1216.722
2267003050	LPG Other Material Handling Equipment	53	480	18.437	0.545	3.252	0.006	0.124	0.124	1229.641
2267003070	LPG Terminal Tractors	78	430	10.619	0.245	2.053	0.006	0.128	0.128	1216.733
2267004066	LPG Chippers/Stump Grinders	78	450	10.514	0.241	2.043	0.006	0.127	0.127	1216.725
2267005055	LPG Other Agricultural Equipment	55	490	68.126	2.607	11.671	0.006	0.128	0.128	1322.349
2267005060	LPG Irrigation Sets	60	450	10.532	0.242	2.045	0.006	0.128	0.128	1216.729
2267006005	LPG Generator Sets	68	480	33.128	1.263	7.783	0.006	0.125	0.125	1284.472
2267006010	LPG Pumps	69	470	20.164	0.585	3.998	0.006	0.126	0.126	1238.435
2267006015	LPG Air Compressors	56	460	12.407	0.279	2.277	0.006	0.127	0.127	1218.811
2267006025	LPG Welders	68	460	13.287	0.314	2.311	0.006	0.126	0.126	1218.554
2267006030	LPG Pressure Washers	85	470	24.646	0.800	4.278	0.006	0.125	0.125	1240.883
2267006035	LPG Hydro Power Units	56	460	12.103	0.282	2.282	0.006	0.127	0.127	1219.091
2267008005	LPG Airport Ground Support Equipment	56	450	10.450	0.239	2.037	0.006	0.127	0.127	1216.718
2268002081	CNG Other Construction Equipment	48	480	29.975	3.570	5.080	0.006	0.124	0.124	1464.530
2268003020	CNG Forklifts	30	460	10.538	0.913	2.137	0.006	0.127	0.127	1160.402

**Table 4-3. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2022 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2268003030	CNG Sweepers/Scrubbers	71	460	10.505	0.911	2.135	0.006	0.127	0.127	1160.230
2268003040	CNG Other General Industrial Equipment	54	460	10.411	0.904	2.129	0.006	0.127	0.127	1159.541
2268003060	CNG AC\Refrigeration	46	450	11.337	0.999	2.223	0.006	0.127	0.127	1169.901
2268003070	CNG Terminal Tractors	78	430	10.618	0.932	2.149	0.006	0.128	0.128	1162.423
2268005055	CNG Other Agricultural Equipment	55	510	68.038	9.310	11.710	0.006	0.128	0.128	2128.298
2268005060	CNG Irrigation Sets	60	510	10.538	0.921	2.141	0.006	0.128	0.128	1161.310
2268006005	CNG Generator Sets	68	490	35.185	5.027	8.629	0.006	0.124	0.124	1659.490
2268006010	CNG Pumps	69	480	24.419	2.710	4.999	0.006	0.125	0.125	1376.628
2268006015	CNG Air Compressors	56	470	12.528	1.057	2.385	0.006	0.127	0.127	1177.454
2268006020	CNG Gas Compressors	85	410	11.753	1.087	2.256	0.006	0.139	0.139	1178.202
2268006035	CNG Hydro Power Units	56	470	13.352	1.154	2.544	0.006	0.126	0.126	1189.163
2268010010	CNG Other Oil Field Equipment	90	410	11.062	0.993	2.191	0.006	0.133	0.133	1168.584
2270001060	Diesel Specialty Vehicle Carts	21	450	6.732	1.722	8.517	0.012	1.016	0.985	1439.197
2270002003	Diesel Pavers	59	380	0.648	0.102	2.229	0.008	0.114	0.111	1214.333
2270002006	Diesel Tampers/Rammers	43	1000	5.751	1.824	9.450	0.012	0.598	0.580	1300.125
2270002009	Diesel Plate Compactors	43	410	4.969	1.495	9.090	0.012	0.527	0.511	1300.408
2270002015	Diesel Rollers	59	390	0.931	0.142	2.818	0.009	0.155	0.150	1233.913
2270002018	Diesel Scrapers	59	370	0.713	0.091	1.622	0.008	0.101	0.098	1183.443
2270002021	Diesel Paving Equipment	59	390	1.166	0.221	3.266	0.009	0.195	0.189	1227.241
2270002024	Diesel Surfacing Equipment	59	380	1.993	0.306	5.232	0.009	0.276	0.268	1224.255
2270002027	Diesel Signal Boards/Light Plants	43	410	2.787	0.695	7.687	0.011	0.349	0.339	1293.708
2270002030	Diesel Trenchers	59	400	1.445	0.232	4.735	0.009	0.206	0.200	1273.667

**Table 4-3. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2022 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2270002033	Diesel Bore/Drill Rigs	43	370	1.843	0.468	6.805	0.009	0.340	0.330	1190.388
2270002036	Diesel Excavators	59	380	0.374	0.064	1.277	0.008	0.074	0.072	1194.763
2270002039	Diesel Concrete/Industrial Saws	59	410	1.609	0.270	5.072	0.009	0.225	0.218	1305.031
2270002042	Diesel Cement & Mortar Mixers	43	390	3.357	0.845	8.100	0.010	0.538	0.522	1244.600
2270002045	Diesel Cranes	43	370	0.533	0.119	2.164	0.008	0.096	0.093	1175.714
2270002048	Diesel Graders	59	370	0.361	0.062	1.043	0.008	0.076	0.073	1185.401
2270002051	Diesel Off-highway Trucks	59	370	0.372	0.088	3.390	0.008	0.070	0.068	1183.444
2270002054	Diesel Crushing/Proc. Equipment	43	380	0.798	0.163	3.386	0.009	0.126	0.122	1203.239
2270002057	Diesel Rough Terrain Forklifts	59	390	1.288	0.158	3.221	0.009	0.216	0.210	1255.829
2270002060	Diesel Rubber Tire Loaders	59	370	0.786	0.127	2.525	0.008	0.132	0.128	1190.457
2270002066	Diesel Tractors/Loaders/ Backhoes	21	460	4.649	0.992	6.081	0.011	0.760	0.737	1466.610
2270002069	Diesel Crawler Tractor/Dozers	59	370	0.616	0.093	2.045	0.008	0.104	0.101	1190.028
2270002072	Diesel Skid Steer Loaders	21	480	7.638	1.617	8.869	0.012	1.198	1.162	1529.015
2270002075	Diesel Off-Highway Tractors	59	370	0.957	0.155	3.868	0.008	0.137	0.132	1183.329
2270002078	Diesel Dumpers/Tenders	21	470	7.871	1.837	9.084	0.012	1.204	1.168	1508.132
2270002081	Diesel Other Construction Equipment	59	370	1.525	0.215	3.769	0.009	0.212	0.206	1185.420
2270003010	Diesel Aerial Lifts	21	480	7.042	1.543	8.930	0.012	0.987	0.957	1530.771
2270003020	Diesel Forklifts	59	400	0.269	0.051	2.394	0.008	0.042	0.041	1265.583
2270003030	Diesel Sweepers/Scrubbers	43	380	0.507	0.094	2.274	0.008	0.092	0.089	1219.320
2270003040	Diesel Other General Industrial Equipment	43	380	0.770	0.151	2.785	0.009	0.148	0.143	1205.521
2270003050	Diesel Other Material Handling Equipment	21	440	3.977	1.034	6.795	0.011	0.676	0.656	1413.676
2270003060	Diesel AC/Refrigeration	43	410	0.914	0.219	5.981	0.009	0.101	0.098	1301.590



**Table 4-3. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2022 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2270003070	Diesel Terminal Tractors	59	380	0.222	0.041	0.914	0.008	0.047	0.045	1199.660
2270004031	Diesel Leafblowers/Vacuums	43	410	5.797	1.645	10.867	0.011	0.874	0.847	1298.400
2270004036	Diesel Snow blowers	43	370	1.047	0.259	3.969	0.006	0.177	0.171	682.462
2270004046	Diesel Front Mowers	43	410	2.826	0.678	7.917	0.011	0.408	0.396	1300.887
2270004056	Diesel Lawn & Garden Tractors	43	410	3.369	0.796	8.258	0.012	0.404	0.392	1300.946
2270004066	Diesel Chippers/Stump Grinders	43	380	2.427	0.545	7.129	0.010	0.440	0.427	1215.642
2270004071	Diesel Commercial Turf Equipment	43	400	1.030	0.220	4.319	0.009	0.150	0.146	1263.281
2270004076	Diesel Other Lawn & Garden Equipment	43	410	3.775	0.858	8.920	0.011	0.640	0.621	1293.068
2270005010	Diesel 2-Wheel Tractors	59	410	5.481	1.830	9.213	0.012	0.534	0.518	1313.083
2270005015	Diesel Agricultural Tractors	59	380	2.291	0.394	5.453	0.009	0.386	0.375	1211.256
2270005020	Diesel Combines	59	370	2.626	0.622	7.555	0.010	0.563	0.546	1185.305
2270005025	Diesel Balers	59	400	5.048	0.962	8.630	0.011	0.759	0.736	1269.614
2270005030	Diesel Agricultural Mowers	59	410	6.070	0.808	7.931	0.011	0.924	0.897	1312.815
2270005035	Diesel Sprayers	59	380	3.118	0.738	7.353	0.010	0.529	0.513	1195.662
2270005040	Diesel Tillers > 6 HP	59	370	3.425	0.541	7.246	0.010	0.438	0.424	1186.511
2270005045	Diesel Swathers	59	400	5.314	0.850	8.685	0.011	0.829	0.804	1284.260
2270005055	Diesel Other Agricultural Equipment	59	380	2.854	0.556	6.657	0.010	0.516	0.501	1196.235
2270005060	Diesel Irrigation Sets	43	390	1.401	0.269	4.256	0.009	0.259	0.251	1235.152
2270006005	Diesel Generator Sets	43	390	2.688	0.644	7.130	0.010	0.451	0.438	1254.072
2270006010	Diesel Pumps	43	390	2.768	0.652	7.109	0.010	0.473	0.459	1253.128
2270006015	Diesel Air Compressors	43	400	1.289	0.223	4.390	0.009	0.209	0.203	1266.105
2270006020	Diesel Gas Compressors	43	410	0.205	0.044	2.965	0.009	0.033	0.032	1301.564

**Table 4-3. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2022 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2270006025	Diesel Welders	21	480	6.845	1.429	8.668	0.012	0.999	0.969	1529.293
2270006030	Diesel Pressure Washers	43	380	2.572	0.698	7.077	0.010	0.401	0.389	1224.271
2270006035	Diesel Hydro Power Units	43	400	1.397	0.264	4.791	0.009	0.220	0.213	1272.329
2270007015	Diesel Forest Equipment - Feller/Bunch/Skidder	59	370	0.252	0.044	0.760	0.008	0.052	0.051	1186.536
2270008005	Diesel Airport Ground Support Equipment	59	380	0.932	0.135	2.309	0.009	0.160	0.155	1195.460
2270009010	Diesel Other Underground Mining Equipment	21	450	8.618	2.048	11.204	0.013	1.038	1.007	1428.632
2270010010	Diesel Other Oil Field Equipment	43	370	0.712	0.151	3.581	0.008	0.110	0.107	1174.742
2282005010	2 Stroke Outboard	21	850	218.109	74.684	13.052	0.013	0.576	0.530	2240.114
2282005015	2 Stroke Personal Water Craft	21	820	253.058	20.940	13.965	0.013	0.192	0.177	2151.745
2282010005	4 Stroke Inboard/Sterndrive	21	630	136.001	22.957	13.363	0.011	0.151	0.139	1861.767
2282020005	Diesel Inboard/Sterndrive	35	370	2.271	0.623	10.248	0.011	0.237	0.230	1173.225
2282020010	Diesel Outboards	35	410	4.318	1.335	7.361	0.012	0.687	0.666	1299.765
2285002015	Diesel Railway Maintenance	21	440	4.546	1.118	7.343	0.011	0.803	0.779	1401.410
2285004015	4 Stroke Railway Maintenance	62	750	529.897	13.587	4.655	0.014	0.294	0.270	2344.041
2285006015	LPG Railway Maintenance	62	480	18.077	0.506	3.078	0.006	0.126	0.126	1226.934

Notes for Table 4-3 follow Table 4-5

**Table 4-4. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2023**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2260001010	2 Stroke Motorcycles: Off-Road <sup>c</sup>	100	260	78.679	69.997	0.923	0.003	2.551	2.347	572.994
2260001020	2 Stroke Snowmobiles	34	1640	132.446	156.784	5.989	0.012	1.607	1.479	2105.578
2260001030	2 Stroke ATVs <sup>c</sup>	100	210	82.122	15.146	0.943	0.003	0.406	0.373	501.715
2260001060	2 Stroke Specialty Vehicles/Carts	58	1000	575.526	19.872	4.634	0.014	0.296	0.272	2348.307
2260002006	2 Stroke Tampers/Rammers	55	680	560.193	135.386	3.369	0.009	20.412	18.779	1596.014
2260002009	2 Stroke Plate Compactors	55	830	490.327	110.754	5.250	0.014	16.835	15.489	2440.272
2260002021	2 Stroke Paving Equipment	59	830	494.062	110.298	5.250	0.014	16.949	15.593	2437.554
2260002027	2 Stroke Signal Boards/Light Plants	72	830	512.608	129.693	5.250	0.014	17.574	16.168	2422.455
2260002039	2 Stroke Concrete/Industrial Saws	78	630	580.558	137.223	3.520	0.009	21.176	19.482	1645.699
2260002054	2 Stroke Crushing/Proc. Equipment	85	830	512.608	113.760	5.250	0.014	17.574	16.168	2422.454
2260003030	2 Stroke Sweepers/Scrubbers	71	820	512.608	122.930	5.250	0.014	17.574	16.168	2422.453
2260003040	2 Stroke Other General Industrial Equipment	54	830	512.608	118.565	5.250	0.014	17.574	16.168	2422.453
2260004015	2 Stroke Rotary Tillers < 6 HP (Residential)	40	940	454.814	123.324	5.264	0.014	16.271	14.969	2454.488
2260004016	2 Stroke Rotary Tillers < 6 HP (Commercial)	40	900	459.586	110.914	5.264	0.014	16.408	15.095	2451.185
2260004020	2 Stroke Chain Saws < 6 HP (Residential)	70	900	470.078	167.470	5.250	0.014	16.250	14.950	2454.264
2260004021	2 Stroke Chain Saws < 6 HP (Commercial)	70	650	576.681	161.819	3.619	0.010	20.971	19.293	1690.018
2260004025	2 Stroke Trimmers/Edgers/Brush Cutter (Residential)	91	890	434.003	133.261	5.300	0.014	16.888	15.537	2441.507
2260004026	2 Stroke Trimmers/Edgers/Brush Cutter (Commercial)	91	810	494.279	127.045	4.981	0.013	17.170	15.797	2323.474
2260004030	2 Stroke Leaf blowers/Vacuums (Residential)	94	890	460.294	132.853	5.264	0.014	16.428	15.114	2450.705
2260004031	2 Stroke Leaf blowers/Vacuums (Commercial)	94	760	519.767	119.901	4.357	0.012	18.424	16.950	2042.130
2260004035	2 Stroke Snow blowers (Residential)	35	870	530.538	381.541	1.774	0.006	5.897	5.425	1239.575
2260004036	2 Stroke Snow blowers (Commercial)	35	870	619.096	241.908	2.069	0.007	6.881	6.331	1446.094

**Table 4-4. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2023 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2260004071	2 Stroke Commercial Turf Equipment	60	840	481.417	100.090	5.250	0.014	16.571	15.246	2446.591
2260005035	2 Stroke Sprayers	65	840	423.684	106.886	5.323	0.014	17.367	15.978	2430.960
2260006005	2 Stroke Generator Sets	68	830	483.138	137.190	5.255	0.014	16.808	15.464	2441.133
2260006010	2 Stroke Pumps	69	830	461.101	142.034	5.281	0.014	18.336	16.869	2396.353
2260006015	2 Stroke Air Compressors	56	830	512.608	139.006	5.250	0.014	17.574	16.168	2422.455
2260006035	2 Stroke Hydro Power Units	56	830	512.608	146.271	5.250	0.014	17.574	16.168	2422.454
2260007005	2 Stroke Chain Saws > 6 HP	70	620	586.493	150.576	3.369	0.009	21.491	19.772	1577.850
2265001010	4 Stroke Motorcycles: Off-Road	100	160	58.402	7.060	1.244	0.003	0.147	0.135	504.317
2265001030	4 Stroke ATVs	100	170	80.666	8.095	0.967	0.003	0.147	0.135	532.991
2265001050	4 Stroke Golf Carts	46	740	586.285	13.534	4.945	0.014	0.301	0.277	2345.391
2265001060	4 Stroke Specialty Vehicles/Carts	58	820	583.070	19.418	7.093	0.014	0.240	0.221	2309.850
2265002003	4 Stroke Pavers	66	700	433.709	9.830	4.321	0.013	0.257	0.236	2156.851
2265002006	4 Stroke Tampers/Rammers	55	760	571.395	13.481	4.561	0.014	0.250	0.230	2345.295
2265002009	4 Stroke Plate Compactors	55	830	487.584	15.986	5.149	0.015	0.516	0.475	2584.976
2265002015	4 Stroke Rollers	62	690	447.841	9.922	4.327	0.013	0.254	0.233	2152.882
2265002021	4 Stroke Paving Equipment	59	780	530.456	14.105	4.812	0.014	0.346	0.318	2416.120
2265002024	4 Stroke Surfacing Equipment	49	750	534.802	13.548	4.858	0.014	0.359	0.330	2389.505
2265002027	4 Stroke Signal Boards/Light Plants	72	780	524.714	13.760	5.120	0.015	0.464	0.427	2495.258
2265002030	4 Stroke Trenchers	66	710	416.202	10.461	4.462	0.013	0.323	0.297	2203.373
2265002033	4 Stroke Bore/Drill Rigs	79	790	366.331	14.712	7.085	0.014	0.490	0.450	2408.613
2265002039	4 Stroke Concrete/Industrial Saws	78	710	518.760	11.449	4.653	0.013	0.279	0.257	2250.935
2265002042	4 Stroke Cement & Mortar Mixers	59	820	534.644	17.598	4.858	0.014	0.351	0.323	2451.331

**Table 4-4. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2023 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265002045	4 Stroke Cranes	47	590	103.842	3.636	4.721	0.010	0.161	0.149	1651.206
2265002054	4 Stroke Crushing/Proc. Equipment	85	740	495.698	12.076	4.815	0.014	0.326	0.300	2312.272
2265002057	4 Stroke Rough Terrain Forklifts	63	570	36.008	1.725	3.175	0.009	0.153	0.141	1557.783
2265002060	4 Stroke Rubber Tire Loaders	71	550	24.284	1.351	2.739	0.009	0.153	0.141	1544.027
2265002066	4 Stroke Tractors/Loaders/ Backhoes	48	730	541.962	11.289	4.592	0.014	0.263	0.242	2293.844
2265002072	4 Stroke Skid Steer Loaders	58	640	247.977	6.177	4.593	0.011	0.190	0.174	1865.685
2265002078	4 Stroke Dumpers/Tenders	41	800	549.446	17.180	5.092	0.014	0.281	0.259	2367.973
2265002081	4 Stroke Other Construction Equipment	48	580	58.369	2.980	5.462	0.009	0.149	0.137	1580.970
2265003010	4 Stroke Aerial Lifts	46	630	174.358	4.926	4.589	0.010	0.174	0.160	1756.150
2265003020	4 Stroke Forklifts	30	560	23.959	1.329	2.721	0.009	0.152	0.140	1544.026
2265003030	4 Stroke Sweepers/Scrubbers	71	610	202.203	5.395	3.471	0.011	0.219	0.202	1822.919
2265003040	4 Stroke Other General Industrial Equipment	54	760	440.621	14.889	5.086	0.014	0.533	0.490	2400.500
2265003050	4 Stroke Other Material Handling Equipment	53	640	202.944	5.156	4.029	0.011	0.182	0.168	1802.687
2265003060	4 Stroke AC/Refrigeration	46	740	574.126	12.489	4.632	0.014	0.260	0.239	2345.301
2265003070	4 Stroke Terminal Tractors	78	520	24.404	1.321	2.745	0.009	0.154	0.142	1544.028
2265004010	4 Stroke Lawn mowers (Residential)	33	900	422.230	36.133	5.387	0.016	0.642	0.591	2760.001
2265004011	4 Stroke Lawn mowers (Commercial)	33	880	426.531	27.858	5.591	0.016	0.717	0.659	2760.003
2265004015	4 Stroke Rotary Tillers < 6 HP (Residential)	40	910	422.118	37.601	5.387	0.016	0.643	0.591	2760.155
2265004016	4 Stroke Rotary Tillers < 6 HP (Commercial)	40	890	422.967	30.820	5.427	0.016	0.658	0.605	2760.162
2265004025	4 Stroke Trimmers/Edgers/Brush Cutter HP (Residential)	91	900	423.071	45.783	5.432	0.016	0.660	0.607	2760.167
2265004026	4 Stroke Trimmers/Edgers/Brush Cutter (Commercial)	91	820	495.886	29.938	5.147	0.015	0.500	0.460	2566.434
2265004030	4 Stroke Leaf blowers/Vacuums (Residential)	94	900	423.087	33.132	5.433	0.016	0.660	0.607	2760.166

**Table 4-4. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2023 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265004031	4 Stroke Leaf blowers/Vacuums (Commercial)	94	700	434.144	14.275	4.297	0.013	0.249	0.229	2155.301
2265004035	4 Stroke Snow blowers (Residential)	35	940	604.997	204.312	4.759	0.009	0.126	0.116	1506.755
2265004036	4 Stroke Snow blowers (Commercial)	35	940	709.430	37.002	5.415	0.010	0.147	0.135	1757.375
2265004040	4 Stroke Rear Engine Riding Mowers (Residential)	38	760	570.571	22.761	4.556	0.014	0.247	0.228	2346.455
2265004041	4 Stroke Rear Engine Riding Mowers (Commercial)	38	740	573.381	13.078	4.621	0.014	0.259	0.238	2346.082
2265004046	4 Stroke Front Mowers	65	790	572.474	14.223	4.916	0.014	0.243	0.223	2342.097
2265004051	4 Stroke Shredders < 6 HP	80	890	422.545	30.676	5.407	0.016	0.651	0.599	2760.161
2265004055	4 Stroke Lawn & Garden Tractors (Residential)	44	760	570.337	17.760	4.544	0.014	0.247	0.227	2345.615
2265004056	4 Stroke Lawn & Garden Tractors (Commercial)	44	740	573.549	12.417	4.620	0.014	0.258	0.238	2345.603
2265004066	4 Stroke Chippers/Stump Grinders	78	640	291.825	6.493	3.714	0.011	0.213	0.196	1930.397
2265004071	4 Stroke Commercial Turf Equipment	60	730	486.242	11.178	4.563	0.014	0.315	0.290	2309.817
2265004075	4 Stroke Other Lawn & Garden Equipment	58	850	499.259	23.943	5.237	0.015	0.446	0.410	2557.757
2265004076	4 Stroke Other Lawn & Garden Equipment	58	850	497.206	22.287	5.270	0.015	0.445	0.409	2552.271
2265005010	4 Stroke 2-Wheel Tractors	62	740	576.247	12.019	4.686	0.014	0.267	0.245	2345.320
2265005015	4 Stroke Agricultural Tractors	62	580	105.578	2.839	3.031	0.010	0.170	0.156	1661.922
2265005020	4 Stroke Combines	74	580	139.571	10.173	12.719	0.010	0.153	0.141	1664.638
2265005025	4 Stroke Balers	62	580	139.647	12.280	12.724	0.010	0.153	0.141	1664.617
2265005030	4 Stroke Agricultural Mowers	48	770	570.515	12.519	4.623	0.014	0.250	0.230	2347.907
2265005035	4 Stroke Sprayers	65	740	395.040	14.892	7.885	0.013	0.299	0.275	2196.259
2265005040	4 Stroke Tillers > 6 HP	71	870	748.254	26.522	8.510	0.014	0.253	0.233	2471.838
2265005045	4 Stroke Swathers	52	580	139.647	10.229	12.724	0.010	0.153	0.141	1664.615
2265005055	4 Stroke Other Agricultural Equipment	55	620	226.489	9.072	11.081	0.011	0.175	0.161	1805.887

**Table 4-4. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2023 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265005060	4 Stroke Irrigation Sets	60	550	36.154	1.757	2.818	0.009	0.168	0.154	1571.230
2265006005	4 Stroke Generator Sets	68	780	557.370	15.441	4.696	0.014	0.287	0.264	2384.128
2265006010	4 Stroke Pumps	69	760	438.275	14.892	4.980	0.014	0.414	0.381	2360.628
2265006015	4 Stroke Air Compressors	56	700	359.786	10.730	4.319	0.013	0.336	0.309	2144.274
2265006025	4 Stroke Welders	68	710	472.063	11.676	4.415	0.013	0.259	0.238	2199.533
2265006030	4 Stroke Pressure Washers	85	800	519.734	16.684	4.933	0.015	0.415	0.382	2489.887
2265006035	4 Stroke Hydro Power Units	56	750	538.990	12.837	4.782	0.014	0.334	0.307	2370.667
2265007010	4 Stroke Shredders > 6 HP	80	800	578.720	16.418	4.795	0.014	0.246	0.226	2350.217
2265007015	4 Stroke Forest Equipment - Feller/Bunch/Skidder	70	810	491.152	16.169	5.416	0.015	0.598	0.550	2593.370
2265008005	4 Stroke Airport Ground Support Equipment	56	600	129.132	4.209	3.279	0.010	0.232	0.213	1744.060
2265010010	4 Stroke Other Oil Field Equipment	90	740	592.906	12.584	5.115	0.014	0.323	0.297	2345.442
2267001060	LPG Specialty Vehicle Carts	58	490	46.060	1.904	8.867	0.006	0.126	0.126	1297.670
2267002003	LPG Pavers	66	460	12.972	0.318	2.333	0.006	0.127	0.127	1219.229
2267002015	LPG Rollers	62	450	10.633	0.246	2.054	0.006	0.129	0.129	1216.734
2267002021	LPG Paving Equipment	59	480	25.208	0.851	4.504	0.006	0.125	0.125	1244.159
2267002024	LPG Surfacing Equipment	49	460	12.956	0.326	2.367	0.006	0.128	0.128	1219.810
2267002030	LPG Trenchers	66	460	12.959	0.313	2.311	0.006	0.127	0.127	1218.865
2267002033	LPG Bore/Drill Rigs	79	490	54.451	2.206	10.082	0.006	0.125	0.125	1309.824
2267002039	LPG Concrete/Industrial Saws	78	430	10.772	0.251	2.066	0.006	0.130	0.130	1216.745
2267002045	LPG Cranes	47	480	21.781	0.687	3.822	0.006	0.124	0.124	1236.060
2267002054	LPG Crushing/Proc. Equipment	85	480	20.247	0.619	3.546	0.006	0.125	0.125	1232.842
2267002057	LPG Rough Terrain Forklifts	63	470	13.839	0.343	2.430	0.006	0.127	0.127	1220.032

**Table 4-4. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2023 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2267002060	LPG Rubber Tire Loaders	71	460	10.548	0.243	2.046	0.006	0.128	0.128	1216.729
2267002066	LPG Tractors/Loaders/ Backhoes	48	450	10.655	0.246	2.056	0.006	0.129	0.129	1216.735
2267002072	LPG Skid Steer Loaders	58	470	20.879	0.658	3.707	0.006	0.125	0.125	1234.969
2267002081	LPG Other Construction Equipment	48	480	25.716	0.852	4.480	0.006	0.124	0.124	1243.422
2267003010	LPG Aerial Lifts	46	480	21.820	0.665	3.716	0.006	0.124	0.124	1234.183
2267003020	LPG Forklifts	30	460	10.406	0.237	2.033	0.006	0.126	0.126	1216.719
2267003030	LPG Sweepers/Scrubbers	71	440	10.557	0.243	2.047	0.006	0.128	0.128	1216.728
2267003040	LPG Other General Industrial Equipment	54	450	10.456	0.239	2.038	0.006	0.127	0.127	1216.722
2267003050	LPG Other Material Handling Equipment	53	480	16.733	0.477	2.983	0.006	0.125	0.125	1226.729
2267003070	LPG Terminal Tractors	78	430	10.599	0.244	2.051	0.006	0.128	0.128	1216.732
2267004066	LPG Chippers/Stump Grinders	78	450	10.508	0.241	2.043	0.006	0.127	0.127	1216.725
2267005055	LPG Other Agricultural Equipment	55	490	64.969	2.438	10.922	0.006	0.128	0.128	1312.994
2267005060	LPG Irrigation Sets	60	450	10.572	0.243	2.048	0.006	0.128	0.128	1216.731
2267006005	LPG Generator Sets	68	480	30.540	1.117	6.968	0.006	0.124	0.124	1274.449
2267006010	LPG Pumps	69	470	18.532	0.507	3.569	0.006	0.126	0.126	1233.343
2267006015	LPG Air Compressors	56	460	11.828	0.263	2.182	0.006	0.127	0.127	1217.848
2267006025	LPG Welders	68	460	12.398	0.287	2.208	0.006	0.127	0.127	1217.676
2267006030	LPG Pressure Washers	85	470	22.284	0.704	3.891	0.006	0.125	0.125	1236.640
2267006035	LPG Hydro Power Units	56	460	11.683	0.268	2.203	0.006	0.127	0.127	1218.245
2267008005	LPG Airport Ground Support Equipment	56	450	10.429	0.238	2.035	0.006	0.127	0.127	1216.719
2268002081	CNG Other Construction Equipment	48	480	25.623	3.065	4.541	0.006	0.124	0.124	1407.887
2268003020	CNG Forklifts	30	460	10.406	0.903	2.129	0.006	0.126	0.126	1159.473



**Table 4-4. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2023 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2268003030	CNG Sweepers/Scrubbers	71	460	10.416	0.905	2.130	0.006	0.127	0.127	1159.609
2268003040	CNG Other General Industrial Equipment	54	460	10.418	0.905	2.130	0.006	0.127	0.127	1159.637
2268003060	CNG AC/Refrigeration	46	450	11.040	0.965	2.187	0.006	0.127	0.127	1166.049
2268003070	CNG Terminal Tractors	78	430	10.598	0.930	2.147	0.006	0.128	0.128	1162.146
2268005055	CNG Other Agricultural Equipment	55	510	64.879	8.710	10.963	0.006	0.128	0.128	2057.224
2268005060	CNG Irrigation Sets	60	510	10.577	0.927	2.145	0.006	0.128	0.128	1161.855
2268006005	CNG Generator Sets	68	490	32.632	4.493	7.789	0.006	0.124	0.124	1594.412
2268006010	CNG Pumps	69	480	22.217	2.314	4.386	0.006	0.125	0.125	1328.749
2268006015	CNG Air Compressors	56	470	11.912	0.996	2.285	0.006	0.127	0.127	1170.139
2268006020	CNG Gas Compressors	85	410	11.753	1.087	2.256	0.006	0.139	0.139	1178.201
2268006035	CNG Hydro Power Units	56	470	12.619	1.072	2.410	0.006	0.126	0.126	1179.292
2268010010	CNG Other Oil Field Equipment	90	410	11.075	0.995	2.192	0.006	0.133	0.133	1168.773
2270001060	Diesel Specialty Vehicle Carts	21	450	6.160	1.564	8.053	0.012	0.930	0.902	1439.633
2270002003	Diesel Pavers	59	380	0.526	0.086	1.968	0.008	0.095	0.092	1214.343
2270002006	Diesel Tampers/Rammers	43	1000	5.691	1.829	9.387	0.012	0.583	0.565	1300.175
2270002009	Diesel Plate Compactors	43	410	4.911	1.492	9.039	0.012	0.515	0.500	1300.452
2270002015	Diesel Rollers	59	390	0.783	0.123	2.555	0.009	0.130	0.126	1233.930
2270002018	Diesel Scrapers	59	370	0.587	0.077	1.366	0.008	0.085	0.082	1183.453
2270002021	Diesel Paving Equipment	59	390	1.021	0.198	3.008	0.009	0.168	0.163	1227.270
2270002024	Diesel Surfacing Equipment	59	380	1.787	0.277	4.840	0.009	0.247	0.240	1224.315
2270002027	Diesel Signal Boards/Light Plants	43	410	2.695	0.670	7.553	0.011	0.332	0.322	1293.755
2270002030	Diesel Trenchers	59	400	1.274	0.207	4.522	0.009	0.180	0.174	1273.708

**Table 4-4. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2023 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2270002033	Diesel Bore/Drill Rigs	43	370	1.688	0.429	6.324	0.009	0.311	0.302	1190.483
2270002036	Diesel Excavators	59	380	0.292	0.053	1.101	0.008	0.058	0.056	1194.766
2270002039	Diesel Concrete/Industrial Saws	59	410	1.442	0.247	4.910	0.009	0.199	0.193	1305.066
2270002042	Diesel Cement & Mortar Mixers	43	390	3.155	0.799	7.680	0.010	0.499	0.484	1244.747
2270002045	Diesel Cranes	43	370	0.446	0.100	1.830	0.008	0.081	0.079	1175.737
2270002048	Diesel Graders	59	370	0.281	0.051	0.832	0.008	0.060	0.059	1185.404
2270002051	Diesel Off-highway Trucks	59	370	0.299	0.079	3.282	0.008	0.062	0.060	1183.448
2270002054	Diesel Crushing/Proc. Equipment	43	380	0.674	0.138	2.996	0.009	0.106	0.103	1203.272
2270002057	Diesel Rough Terrain Forklifts	59	390	1.098	0.133	2.926	0.009	0.185	0.180	1255.859
2270002060	Diesel Rubber Tire Loaders	59	370	0.664	0.109	2.239	0.008	0.113	0.110	1190.479
2270002066	Diesel Tractors/Loaders/ Backhoes	21	460	3.987	0.836	5.401	0.011	0.644	0.625	1466.931
2270002069	Diesel Crawler Tractor/Dozers	59	370	0.502	0.079	1.796	0.008	0.086	0.084	1190.039
2270002072	Diesel Skid Steer Loaders	21	480	7.050	1.478	8.492	0.012	1.101	1.068	1529.380
2270002075	Diesel Off-Highway Tractors	59	370	0.836	0.139	3.637	0.008	0.122	0.118	1183.358
2270002078	Diesel Dumpers/Tenders	21	470	7.227	1.682	8.664	0.012	1.100	1.067	1508.566
2270002081	Diesel Other Construction Equipment	59	370	1.301	0.185	3.251	0.009	0.183	0.177	1185.468
2270003010	Diesel Aerial Lifts	21	480	6.395	1.382	8.515	0.012	0.889	0.862	1531.187
2270003020	Diesel Forklifts	59	400	0.225	0.047	2.341	0.008	0.035	0.034	1265.585
2270003030	Diesel Sweepers/Scrubbers	43	380	0.423	0.081	2.006	0.008	0.076	0.074	1219.327
2270003040	Diesel Other General Industrial Equipment	43	380	0.625	0.123	2.423	0.008	0.119	0.116	1205.547
2270003050	Diesel Other Material Handling Equipment	21	440	3.598	0.929	6.237	0.011	0.609	0.591	1413.916
2270003060	Diesel AC/Refrigeration	43	410	0.818	0.204	5.908	0.009	0.087	0.085	1301.599

**Table 4-4. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2023 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2270003070	Diesel Terminal Tractors	59	380	0.156	0.033	0.784	0.008	0.034	0.033	1199.662
2270004031	Diesel Leaf blowers/Vacuums	43	410	5.481	1.550	10.479	0.011	0.810	0.786	1298.746
2270004036	Diesel Snow blowers	43	370	0.966	0.240	3.670	0.006	0.164	0.159	682.508
2270004046	Diesel Front Mowers	43	410	2.657	0.634	7.720	0.011	0.376	0.365	1300.972
2270004056	Diesel Lawn & Garden Tractors	43	410	3.299	0.778	8.188	0.012	0.392	0.380	1300.979
2270004066	Diesel Chippers/Stump Grinders	43	380	2.232	0.497	6.605	0.010	0.403	0.391	1215.756
2270004071	Diesel Commercial Turf Equipment	43	400	0.927	0.203	4.094	0.009	0.130	0.126	1263.295
2270004076	Diesel Other Lawn & Garden Equipment	43	410	3.542	0.798	8.604	0.011	0.593	0.575	1293.227
2270005010	Diesel 2-Wheel Tractors	59	410	5.454	1.836	9.216	0.012	0.530	0.514	1313.078
2270005015	Diesel Agricultural Tractors	59	380	2.005	0.343	4.931	0.009	0.339	0.329	1211.338
2270005020	Diesel Combines	59	370	2.468	0.583	7.094	0.010	0.521	0.505	1185.399
2270005025	Diesel Balers	59	400	4.756	0.892	8.291	0.011	0.704	0.683	1269.802
2270005030	Diesel Agricultural Mowers	59	410	5.649	0.737	7.455	0.011	0.852	0.826	1312.984
2270005035	Diesel Sprayers	59	380	2.915	0.682	6.937	0.010	0.489	0.474	1195.805
2270005040	Diesel Tillers > 6 HP	59	370	3.188	0.505	6.811	0.010	0.407	0.394	1186.605
2270005045	Diesel Swathers	59	400	5.031	0.794	8.269	0.011	0.771	0.748	1284.404
2270005055	Diesel Other Agricultural Equipment	59	380	2.615	0.504	6.121	0.010	0.467	0.453	1196.357
2270005060	Diesel Irrigation Sets	43	390	1.209	0.230	3.857	0.009	0.223	0.217	1235.210
2270006005	Diesel Generator Sets	43	390	2.488	0.595	6.777	0.010	0.411	0.399	1254.191
2270006010	Diesel Pumps	43	390	2.576	0.606	6.760	0.010	0.436	0.423	1253.247
2270006015	Diesel Air Compressors	43	400	1.144	0.196	4.140	0.009	0.185	0.179	1266.143
2270006020	Diesel Gas Compressors	43	410	0.205	0.044	2.965	0.009	0.033	0.032	1301.571

**Table 4-4. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2023 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2270006025	Diesel Welders	21	480	6.170	1.279	8.302	0.012	0.892	0.865	1529.656
2270006030	Diesel Pressure Washers	43	380	2.396	0.647	6.714	0.010	0.369	0.358	1224.410
2270006035	Diesel Hydro Power Units	43	400	1.263	0.239	4.567	0.009	0.197	0.191	1272.367
2270007015	Diesel Forest Equipment - Feller/Bunch/Skidder	59	370	0.174	0.034	0.576	0.008	0.037	0.036	1186.536
2270008005	Diesel Airport Ground Support Equipment	59	380	0.776	0.114	1.981	0.008	0.135	0.131	1195.481
2270009010	Diesel Other Underground Mining Equipment	21	450	8.454	2.012	11.074	0.013	1.008	0.978	1428.787
2270010010	Diesel Other Oil Field Equipment	43	370	0.612	0.133	3.287	0.008	0.096	0.093	1174.751
2282005010	2 Stroke Outboard	21	850	215.846	67.760	13.011	0.013	0.491	0.451	2241.025
2282005015	2 Stroke Personal Water Craft	21	820	252.797	19.938	14.008	0.013	0.174	0.160	2152.122
2282010005	4 Stroke Inboard/Stern-drive	21	630	129.409	21.820	12.429	0.011	0.151	0.139	1855.784
2282020005	Diesel Inboard/Stern-drive	35	370	2.264	0.625	9.997	0.011	0.234	0.227	1173.268
2282020010	Diesel Outboards	35	410	4.199	1.295	7.078	0.012	0.656	0.637	1299.940
2285002015	Diesel Railway Maintenance	21	440	4.146	1.018	6.770	0.011	0.733	0.711	1401.641
2285004015	4 Stroke Railway Maintenance	62	750	529.553	13.557	4.634	0.014	0.294	0.270	2343.848
2285006015	LPG Railway Maintenance	62	480	16.512	0.444	2.832	0.006	0.126	0.126	1224.263

Notes for Table 4-4 follow Table 4-5

**Table 4-5. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2024**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2260001010	2 Stroke Motorcycles: Off-Road <sup>c</sup>	100	260	78.442	69.285	0.926	0.003	2.524	2.322	573.844
2260001020	2 Stroke Snowmobiles	34	1640	129.563	153.318	6.107	0.012	1.554	1.429	2098.723
2260001030	2 Stroke ATVs <sup>c</sup>	100	210	81.846	13.531	0.948	0.003	0.345	0.317	504.172
2260001060	2 Stroke Specialty Vehicles/Carts	58	1000	575.383	19.809	4.630	0.014	0.296	0.273	2348.243
2260002006	2 Stroke Tampers/Rammers	55	680	560.798	135.543	3.369	0.009	20.437	18.802	1595.592
2260002009	2 Stroke Plate Compactors	55	830	490.384	110.775	5.250	0.014	16.837	15.490	2440.228
2260002021	2 Stroke Paving Equipment	59	830	494.132	110.324	5.250	0.014	16.951	15.595	2437.490
2260002027	2 Stroke Signal Boards/Light Plants	72	830	512.608	129.694	5.250	0.014	17.574	16.168	2422.455
2260002039	2 Stroke Concrete/Industrial Saws	78	630	580.557	137.223	3.520	0.009	21.176	19.482	1645.699
2260002054	2 Stroke Crushing/Proc. Equipment	85	830	512.608	113.760	5.250	0.014	17.574	16.168	2422.453
2260003030	2 Stroke Sweepers/Scrubbers	71	820	512.609	122.930	5.250	0.014	17.574	16.168	2422.455
2260003040	2 Stroke Other General Industrial Equipment	54	830	512.608	118.565	5.250	0.014	17.574	16.168	2422.453
2260004015	2 Stroke Rotary Tillers < 6 HP (Residential)	40	940	454.796	123.319	5.264	0.014	16.270	14.968	2454.498
2260004016	2 Stroke Rotary Tillers < 6 HP (Commercial)	40	900	459.458	110.871	5.264	0.014	16.404	15.092	2451.282
2260004020	2 Stroke Chain Saws < 6 HP (Residential)	70	900	470.104	167.478	5.250	0.014	16.251	14.951	2454.244
2260004021	2 Stroke Chain Saws < 6 HP (Commercial)	70	650	576.681	161.819	3.619	0.010	20.971	19.293	1690.014
2260004025	2 Stroke Trimmers/Edgers/Brush Cutter (Residential)	91	890	434.026	133.269	5.300	0.014	16.889	15.538	2441.488
2260004026	2 Stroke Trimmers/Edgers/Brush Cutter (Commercial)	91	810	494.333	127.063	4.981	0.013	17.172	15.798	2323.436
2260004030	2 Stroke Leaf blowers/Vacuums (Residential)	94	890	460.319	132.861	5.264	0.014	16.428	15.114	2450.688
2260004031	2 Stroke Leaf blowers/Vacuums (Commercial)	94	760	519.819	119.917	4.357	0.012	18.426	16.952	2042.092
2260004035	2 Stroke Snow blowers (Residential)	35	870	530.589	381.555	1.774	0.006	5.897	5.426	1239.550
2260004036	2 Stroke Snow blowers (Commercial)	35	870	618.924	241.861	2.069	0.007	6.880	6.329	1446.179

**Table 4-5. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2024 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2260004071	2 Stroke Commercial Turf Equipment	60	840	481.441	100.099	5.250	0.014	16.572	15.247	2446.571
2260005035	2 Stroke Sprayers	65	840	423.797	106.928	5.323	0.014	17.371	15.981	2430.866
2260006005	2 Stroke Generator Sets	68	830	483.166	137.200	5.255	0.014	16.809	15.464	2441.112
2260006010	2 Stroke Pumps	69	830	461.035	142.002	5.280	0.014	18.336	16.869	2396.326
2260006015	2 Stroke Air Compressors	56	830	512.608	139.006	5.250	0.014	17.574	16.168	2422.455
2260006035	2 Stroke Hydro Power Units	56	830	512.608	146.271	5.250	0.014	17.574	16.168	2422.455
2260007005	2 Stroke Chain Saws > 6 HP	70	620	586.493	150.576	3.369	0.009	21.491	19.772	1577.852
2265001010	4 Stroke Motorcycles: Off-Road	100	160	58.086	7.027	1.242	0.003	0.147	0.135	504.306
2265001030	4 Stroke ATVs	100	170	80.559	8.051	0.961	0.003	0.147	0.135	532.971
2265001050	4 Stroke Golf Carts	46	740	586.285	13.534	4.945	0.014	0.301	0.277	2345.391
2265001060	4 Stroke Specialty Vehicles/Carts	58	820	572.223	18.500	6.770	0.014	0.239	0.220	2301.875
2265002003	4 Stroke Pavers	66	700	433.366	9.815	4.291	0.013	0.257	0.236	2156.480
2265002006	4 Stroke Tampers/Rammers	55	760	571.582	13.500	4.566	0.014	0.251	0.231	2345.294
2265002009	4 Stroke Plate Compactors	55	830	487.704	16.003	5.153	0.015	0.518	0.476	2584.974
2265002015	4 Stroke Rollers	62	690	447.857	9.924	4.328	0.013	0.254	0.233	2152.881
2265002021	4 Stroke Paving Equipment	59	780	530.211	14.080	4.796	0.014	0.345	0.318	2415.992
2265002024	4 Stroke Surfacing Equipment	49	750	534.764	13.547	4.855	0.014	0.359	0.330	2389.462
2265002027	4 Stroke Signal Boards/Light Plants	72	780	524.721	13.761	5.120	0.015	0.464	0.427	2495.258
2265002030	4 Stroke Trenchers	66	710	415.880	10.448	4.433	0.013	0.324	0.298	2203.031
2265002033	4 Stroke Bore/Drill Rigs	79	790	364.007	14.583	6.862	0.014	0.491	0.451	2405.578
2265002039	4 Stroke Concrete/Industrial Saws	78	710	518.761	11.450	4.653	0.013	0.279	0.257	2250.935
2265002042	4 Stroke Cement & Mortar Mixers	59	820	534.443	17.545	4.835	0.014	0.352	0.324	2451.095

**Table 4-5. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2024 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265002045	4 Stroke Cranes	47	590	100.266	3.464	4.409	0.010	0.162	0.149	1647.239
2265002054	4 Stroke Crushing/Proc. Equipment	85	740	495.298	12.058	4.779	0.014	0.327	0.300	2311.813
2265002057	4 Stroke Rough Terrain Forklifts	63	570	34.164	1.641	3.018	0.009	0.154	0.142	1555.983
2265002060	4 Stroke Rubber Tire Loaders	71	550	24.406	1.356	2.745	0.009	0.154	0.142	1544.026
2265002066	4 Stroke Tractors/Loaders/ Backhoes	48	730	541.975	11.290	4.592	0.014	0.263	0.242	2293.843
2265002072	4 Stroke Skid Steer Loaders	58	640	245.940	6.081	4.415	0.011	0.190	0.175	1863.514
2265002078	4 Stroke Dumpers/Tenders	41	800	547.761	17.010	5.012	0.014	0.282	0.259	2366.803
2265002081	4 Stroke Other Construction Equipment	48	580	53.286	2.736	5.030	0.009	0.149	0.137	1575.879
2265003010	4 Stroke Aerial Lifts	46	630	170.895	4.759	4.305	0.010	0.174	0.160	1753.277
2265003020	4 Stroke Forklifts	30	560	23.978	1.330	2.722	0.009	0.152	0.140	1544.027
2265003030	4 Stroke Sweepers/Scrubbers	71	610	202.225	5.396	3.472	0.011	0.220	0.202	1822.919
2265003040	4 Stroke Other General Industrial Equipment	54	760	440.635	14.890	5.087	0.014	0.533	0.491	2400.495
2265003050	4 Stroke Other Material Handling Equipment	53	640	201.088	5.066	3.866	0.011	0.183	0.168	1800.657
2265003060	4 Stroke AC/Refrigeration	46	740	574.141	12.490	4.632	0.014	0.260	0.239	2345.306
2265003070	4 Stroke Terminal Tractors	78	520	24.419	1.321	2.746	0.009	0.154	0.142	1544.028
2265004010	4 Stroke Lawn mowers (Residential)	33	900	422.196	36.123	5.386	0.016	0.642	0.591	2759.991
2265004011	4 Stroke Lawn mowers (Commercial)	33	880	426.537	27.859	5.591	0.016	0.717	0.659	2760.003
2265004015	4 Stroke Rotary Tillers < 6 HP (Residential)	40	910	422.077	37.589	5.385	0.016	0.643	0.591	2760.153
2265004016	4 Stroke Rotary Tillers < 6 HP (Commercial)	40	890	422.951	30.816	5.427	0.016	0.658	0.605	2760.165
2265004025	4 Stroke Trimmers/Edgers/Brush Cutter HP (Residential)	91	900	423.075	45.784	5.432	0.016	0.660	0.607	2760.167
2265004026	4 Stroke Trimmers/Edgers/Brush Cutter (Commercial)	91	820	495.896	29.939	5.147	0.015	0.500	0.460	2566.436
2265004030	4 Stroke Leaf blowers/Vacuums (Residential)	94	900	423.092	33.133	5.433	0.016	0.660	0.607	2760.170

**Table 4-5. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2024 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265004031	4 Stroke Leaf blowers/Vacuums (Commercial)	94	700	433.728	14.259	4.262	0.013	0.249	0.229	2154.928
2265004035	4 Stroke Snow blowers (Residential)	35	940	605.076	204.314	4.759	0.009	0.126	0.116	1506.756
2265004036	4 Stroke Snow blowers (Commercial)	35	940	709.157	36.994	5.415	0.010	0.147	0.135	1757.374
2265004040	4 Stroke Rear Engine Riding Mowers (Residential)	38	760	570.446	22.732	4.549	0.014	0.247	0.228	2346.388
2265004041	4 Stroke Rear Engine Riding Mowers (Commercial)	38	740	573.386	13.078	4.622	0.014	0.259	0.238	2346.081
2265004046	4 Stroke Front Mowers	65	790	570.460	14.036	4.812	0.014	0.243	0.224	2341.098
2265004051	4 Stroke Shredders < 6 HP	80	890	422.532	30.673	5.407	0.016	0.651	0.598	2760.159
2265004055	4 Stroke Lawn & Garden Tractors (Residential)	44	760	570.262	17.743	4.538	0.014	0.247	0.227	2345.593
2265004056	4 Stroke Lawn & Garden Tractors (Commercial)	44	740	573.555	12.417	4.620	0.014	0.258	0.238	2345.601
2265004066	4 Stroke Chippers/Stump Grinders	78	640	291.831	6.493	3.715	0.011	0.213	0.196	1930.399
2265004071	4 Stroke Commercial Turf Equipment	60	730	486.248	11.179	4.564	0.014	0.315	0.290	2309.818
2265004075	4 Stroke Other Lawn & Garden Equipment	58	850	497.892	23.708	5.166	0.015	0.445	0.410	2557.181
2265004076	4 Stroke Other Lawn & Garden Equipment	58	850	495.664	22.045	5.193	0.015	0.444	0.409	2551.595
2265005010	4 Stroke 2-Wheel Tractors	62	740	576.284	12.023	4.687	0.014	0.267	0.245	2345.321
2265005015	4 Stroke Agricultural Tractors	62	580	105.376	2.832	3.018	0.010	0.169	0.156	1661.921
2265005020	4 Stroke Combines	74	580	130.832	9.561	11.890	0.010	0.153	0.141	1653.219
2265005025	4 Stroke Balers	62	580	130.960	11.560	11.900	0.010	0.153	0.141	1653.264
2265005030	4 Stroke Agricultural Mowers	48	770	570.083	12.453	4.591	0.014	0.249	0.229	2347.815
2265005035	4 Stroke Sprayers	65	740	390.659	14.540	7.546	0.013	0.300	0.276	2191.491
2265005040	4 Stroke Tillers > 6 HP	71	870	731.417	25.592	8.236	0.014	0.251	0.231	2458.105
2265005045	4 Stroke Swathers	52	580	130.960	9.619	11.900	0.010	0.153	0.141	1653.262
2265005055	4 Stroke Other Agricultural Equipment	55	620	219.303	8.661	10.410	0.011	0.175	0.161	1796.735



**Table 4-5. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2024 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2265005060	4 Stroke Irrigation Sets	60	550	36.208	1.759	2.821	0.009	0.168	0.155	1571.230
2265006005	4 Stroke Generator Sets	68	780	556.966	15.368	4.665	0.014	0.287	0.264	2384.029
2265006010	4 Stroke Pumps	69	760	437.888	14.869	4.931	0.014	0.414	0.381	2360.075
2265006015	4 Stroke Air Compressors	56	700	359.578	10.719	4.294	0.013	0.336	0.309	2144.002
2265006025	4 Stroke Welders	68	710	471.864	11.668	4.398	0.013	0.259	0.238	2199.375
2265006030	4 Stroke Pressure Washers	85	800	519.772	16.687	4.933	0.015	0.415	0.382	2489.875
2265006035	4 Stroke Hydro Power Units	56	750	538.987	12.837	4.780	0.014	0.334	0.307	2370.641
2265007010	4 Stroke Shredders > 6 HP	80	800	575.556	16.091	4.676	0.014	0.242	0.223	2349.118
2265007015	4 Stroke Forest Equipment - Feller/Bunch/Skidder	70	810	491.162	16.171	5.416	0.015	0.598	0.551	2593.365
2265008005	4 Stroke Airport Ground Support Equipment	56	600	129.124	4.209	3.279	0.010	0.232	0.213	1744.059
2265010010	4 Stroke Other Oil Field Equipment	90	740	592.908	12.585	5.115	0.014	0.323	0.297	2345.444
2267001060	LPG Specialty Vehicle Carts	58	490	42.798	1.728	8.115	0.006	0.126	0.126	1288.198
2267002003	LPG Pavers	66	460	12.229	0.289	2.221	0.006	0.127	0.127	1218.056
2267002015	LPG Rollers	62	450	10.643	0.246	2.055	0.006	0.129	0.129	1216.734
2267002021	LPG Paving Equipment	59	480	23.358	0.769	4.164	0.006	0.126	0.126	1240.186
2267002024	LPG Surfacing Equipment	49	460	12.351	0.302	2.275	0.006	0.128	0.128	1218.847
2267002030	LPG Trenchers	66	460	12.193	0.286	2.204	0.006	0.127	0.127	1217.788
2267002033	LPG Bore/Drill Rigs	79	490	51.124	2.038	9.353	0.006	0.125	0.125	1300.875
2267002039	LPG Concrete/Industrial Saws	78	430	10.730	0.249	2.063	0.006	0.129	0.129	1216.741
2267002045	LPG Cranes	47	480	19.950	0.610	3.510	0.006	0.125	0.125	1232.517
2267002054	LPG Crushing/Proc. Equipment	85	480	18.586	0.550	3.265	0.006	0.126	0.126	1229.660
2267002057	LPG Rough Terrain Forklifts	63	470	12.831	0.307	2.286	0.006	0.127	0.127	1218.567

**Table 4-5. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2024 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2267002060	LPG Rubber Tire Loaders	71	460	10.601	0.244	2.051	0.006	0.128	0.128	1216.730
2267002066	LPG Tractors/Loaders/ Backhoes	48	450	10.647	0.246	2.055	0.006	0.129	0.129	1216.736
2267002072	LPG Skid Steer Loaders	58	470	19.208	0.593	3.446	0.006	0.125	0.125	1232.147
2267002081	LPG Other Construction Equipment	48	480	23.155	0.754	4.092	0.006	0.124	0.124	1239.326
2267003010	LPG Aerial Lifts	46	480	19.103	0.576	3.377	0.006	0.124	0.124	1231.108
2267003020	LPG Forklifts	30	460	10.415	0.238	2.034	0.006	0.127	0.127	1216.719
2267003030	LPG Sweepers/Scrubbers	71	440	10.568	0.243	2.048	0.006	0.128	0.128	1216.728
2267003040	LPG Other General Industrial Equipment	54	450	10.475	0.240	2.040	0.006	0.127	0.127	1216.723
2267003050	LPG Other Material Handling Equipment	53	480	15.431	0.424	2.771	0.006	0.125	0.125	1224.376
2267003070	LPG Terminal Tractors	78	430	10.607	0.245	2.051	0.006	0.128	0.128	1216.733
2267004066	LPG Chippers/Stump Grinders	78	450	10.517	0.241	2.043	0.006	0.128	0.128	1216.727
2267005055	LPG Other Agricultural Equipment	55	490	61.876	2.274	10.199	0.006	0.128	0.128	1303.976
2267005060	LPG Irrigation Sets	60	450	10.597	0.244	2.051	0.006	0.128	0.128	1216.733
2267006005	LPG Generator Sets	68	480	28.065	0.992	6.269	0.006	0.124	0.124	1266.048
2267006010	LPG Pumps	69	470	16.943	0.461	3.305	0.006	0.126	0.126	1230.655
2267006015	LPG Air Compressors	56	460	11.374	0.252	2.118	0.006	0.127	0.127	1217.233
2267006025	LPG Welders	68	460	11.685	0.265	2.126	0.006	0.127	0.127	1216.999
2267006030	LPG Pressure Washers	85	470	20.411	0.625	3.572	0.006	0.125	0.125	1233.048
2267006035	LPG Hydro Power Units	56	460	11.345	0.257	2.142	0.006	0.127	0.127	1217.592
2267008005	LPG Airport Ground Support Equipment	56	450	10.422	0.238	2.035	0.006	0.127	0.127	1216.717
2268002081	CNG Other Construction Equipment	48	480	23.066	2.718	4.157	0.006	0.124	0.124	1368.202
2268003020	CNG Forklifts	30	460	10.415	0.905	2.130	0.006	0.127	0.127	1159.598

**Table 4-5. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2024 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2268003030	CNG Sweepers/Scrubbers	71	460	10.427	0.906	2.131	0.006	0.127	0.127	1159.761
2268003040	CNG Other General Industrial Equipment	54	460	10.439	0.908	2.132	0.006	0.127	0.127	1159.933
2268003060	CNG AC/Refrigeration	46	450	10.812	0.939	2.160	0.006	0.127	0.127	1163.165
2268003070	CNG Terminal Tractors	78	430	10.605	0.931	2.148	0.006	0.128	0.128	1162.248
2268005055	CNG Other Agricultural Equipment	55	510	61.785	8.126	10.243	0.006	0.128	0.128	1988.150
2268005060	CNG Irrigation Sets	60	510	10.601	0.930	2.147	0.006	0.128	0.128	1162.183
2268006005	CNG Generator Sets	68	490	30.211	3.995	7.009	0.006	0.124	0.124	1533.727
2268006010	CNG Pumps	69	480	20.018	2.076	4.006	0.006	0.125	0.125	1300.382
2268006015	CNG Air Compressors	56	470	11.428	0.955	2.217	0.006	0.127	0.127	1165.292
2268006020	CNG Gas Compressors	85	410	11.753	1.087	2.256	0.006	0.139	0.139	1178.201
2268006035	CNG Hydro Power Units	56	470	12.012	1.007	2.305	0.006	0.126	0.126	1171.469
2268010010	CNG Other Oil Field Equipment	90	410	11.071	0.994	2.192	0.006	0.133	0.133	1168.723
2270001060	Diesel Specialty Vehicle Carts	21	450	5.638	1.422	7.614	0.012	0.850	0.825	1440.020
2270002003	Diesel Pavers	59	380	0.433	0.073	1.763	0.008	0.079	0.077	1214.350
2270002006	Diesel Tampers/Rammers	43	1000	5.637	1.831	9.337	0.012	0.571	0.554	1300.218
2270002009	Diesel Plate Compactors	43	410	4.867	1.490	9.002	0.012	0.507	0.492	1300.485
2270002015	Diesel Rollers	59	390	0.667	0.108	2.328	0.008	0.111	0.107	1233.940
2270002018	Diesel Scrapers	59	370	0.483	0.066	1.145	0.008	0.071	0.069	1183.458
2270002021	Diesel Paving Equipment	59	390	0.913	0.180	2.776	0.009	0.148	0.144	1227.292
2270002024	Diesel Surfacing Equipment	59	380	1.593	0.251	4.477	0.009	0.220	0.214	1224.364
2270002027	Diesel Signal Boards/Light Plants	43	410	2.614	0.650	7.425	0.011	0.315	0.306	1293.794
2270002030	Diesel Trenchers	59	400	1.105	0.184	4.312	0.009	0.153	0.148	1273.741

**Table 4-5. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2024 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2270002033	Diesel Bore/Drill Rigs	43	370	1.538	0.392	5.849	0.009	0.282	0.274	1190.574
2270002036	Diesel Excavators	59	380	0.226	0.045	0.957	0.008	0.045	0.044	1194.769
2270002039	Diesel Concrete/Industrial Saws	59	410	1.272	0.226	4.755	0.009	0.172	0.167	1305.098
2270002042	Diesel Cement & Mortar Mixers	43	390	2.971	0.758	7.291	0.010	0.464	0.450	1244.880
2270002045	Diesel Cranes	43	370	0.380	0.085	1.565	0.008	0.070	0.068	1175.751
2270002048	Diesel Graders	59	370	0.218	0.042	0.685	0.008	0.048	0.046	1185.407
2270002051	Diesel Off-highway Trucks	59	370	0.230	0.070	3.183	0.008	0.053	0.051	1183.453
2270002054	Diesel Crushing/Proc. Equipment	43	380	0.573	0.119	2.716	0.008	0.089	0.087	1203.298
2270002057	Diesel Rough Terrain Forklifts	59	390	0.922	0.112	2.661	0.009	0.156	0.151	1255.885
2270002060	Diesel Rubber Tire Loaders	59	370	0.570	0.095	2.006	0.008	0.099	0.096	1190.494
2270002066	Diesel Tractors/Loaders/ Backhoes	21	460	3.369	0.699	4.797	0.011	0.549	0.533	1467.169
2270002069	Diesel Crawler Tractor/Dozers	59	370	0.410	0.068	1.607	0.008	0.072	0.070	1190.046
2270002072	Diesel Skid Steer Loaders	21	480	6.530	1.357	8.149	0.012	1.016	0.985	1529.685
2270002075	Diesel Off-Highway Tractors	59	370	0.711	0.123	3.411	0.008	0.107	0.104	1183.380
2270002078	Diesel Dumpers/Tenders	21	470	6.628	1.541	8.274	0.012	1.003	0.973	1508.951
2270002081	Diesel Other Construction Equipment	59	370	1.093	0.157	2.771	0.009	0.156	0.151	1185.510
2270003010	Diesel Aerial Lifts	21	480	5.828	1.246	8.146	0.012	0.803	0.779	1531.533
2270003020	Diesel Forklifts	59	400	0.198	0.045	2.312	0.008	0.031	0.030	1265.586
2270003030	Diesel Sweepers/Scrubbers	43	380	0.341	0.068	1.819	0.008	0.060	0.058	1219.331
2270003040	Diesel Other General Industrial Equipment	43	380	0.534	0.105	2.134	0.008	0.102	0.099	1205.563
2270003050	Diesel Other Material Handling Equipment	21	440	3.265	0.837	5.740	0.011	0.550	0.534	1414.122
2270003060	Diesel AC/Refrigeration	43	410	0.763	0.195	5.868	0.009	0.079	0.077	1301.607

**Table 4-5. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2024 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2270003070	Diesel Terminal Tractors	59	380	0.123	0.029	0.710	0.008	0.028	0.027	1199.663
2270004031	Diesel Leaf blowers/Vacuums	43	410	5.197	1.468	10.116	0.011	0.751	0.729	1299.052
2270004036	Diesel Snow blowers	43	370	0.888	0.221	3.372	0.005	0.151	0.146	682.553
2270004046	Diesel Front Mowers	43	410	2.511	0.597	7.540	0.011	0.348	0.337	1301.043
2270004056	Diesel Lawn & Garden Tractors	43	410	3.237	0.764	8.123	0.012	0.381	0.370	1301.003
2270004066	Diesel Chippers/Stump Grinders	43	380	2.042	0.452	6.089	0.010	0.367	0.356	1215.866
2270004071	Diesel Commercial Turf Equipment	43	400	0.856	0.192	3.904	0.009	0.116	0.113	1263.302
2270004076	Diesel Other Lawn & Garden Equipment	43	410	3.329	0.744	8.308	0.011	0.549	0.533	1293.361
2270005010	Diesel 2-Wheel Tractors	59	410	5.453	1.841	9.219	0.012	0.530	0.515	1313.074
2270005015	Diesel Agricultural Tractors	59	380	1.794	0.306	4.542	0.009	0.304	0.295	1211.403
2270005020	Diesel Combines	59	370	2.318	0.546	6.648	0.010	0.481	0.466	1185.487
2270005025	Diesel Balers	59	400	4.484	0.829	7.966	0.010	0.655	0.635	1269.967
2270005030	Diesel Agricultural Mowers	59	410	5.202	0.664	6.952	0.011	0.775	0.752	1313.158
2270005035	Diesel Sprayers	59	380	2.724	0.630	6.531	0.010	0.451	0.438	1195.936
2270005040	Diesel Tillers > 6 HP	59	370	2.968	0.472	6.399	0.010	0.378	0.367	1186.691
2270005045	Diesel Swathers	59	400	4.766	0.744	7.874	0.011	0.719	0.697	1284.529
2270005055	Diesel Other Agricultural Equipment	59	380	2.370	0.450	5.586	0.010	0.420	0.408	1196.464
2270005060	Diesel Irrigation Sets	43	390	1.072	0.201	3.556	0.009	0.198	0.192	1235.252
2270006005	Diesel Generator Sets	43	390	2.308	0.553	6.454	0.010	0.375	0.364	1254.291
2270006010	Diesel Pumps	43	390	2.410	0.566	6.443	0.010	0.403	0.391	1253.341
2270006015	Diesel Air Compressors	43	400	0.962	0.168	3.863	0.009	0.154	0.150	1266.179
2270006020	Diesel Gas Compressors	43	410	0.205	0.044	2.965	0.009	0.033	0.032	1301.567

**Table 4-5. Criteria Pollutant Emission Factors for Non-Road Engines and Equipment - 2024 (cont.)**

SCC	Equipment Description	Load Factor <sup>a</sup> (% Max Power)	BSFC <sup>b</sup> (lb/1000 hp-hr)	Emission Factors (lb/1000 hp-hr)						
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub> <sup>d</sup>	PM <sub>2.5</sub> <sup>e,f</sup>	CO <sub>2e</sub> <sup>g</sup>
2270006025	Diesel Welders	21	480	5.595	1.154	7.982	0.012	0.799	0.775	1529.934
2270006030	Diesel Pressure Washers	43	380	2.240	0.602	6.381	0.010	0.341	0.331	1224.531
2270006035	Diesel Hydro Power Units	43	400	1.100	0.213	4.324	0.009	0.169	0.164	1272.398
2270007015	Diesel Forest Equipment - Feller/Bunch/Skidder	59	370	0.129	0.028	0.475	0.008	0.029	0.028	1186.536
2270008005	Diesel Airport Ground Support Equipment	59	380	0.644	0.096	1.708	0.008	0.113	0.110	1195.493
2270009010	Diesel Other Underground Mining Equipment	21	450	8.335	1.984	10.976	0.013	0.987	0.957	1428.911
2270010010	Diesel Other Oil Field Equipment	43	370	0.505	0.113	3.003	0.008	0.082	0.079	1174.765
2282005010	2 Stroke Outboard	21	850	214.142	62.119	13.003	0.013	0.424	0.390	2241.257
2282005015	2 Stroke Personal Water Craft	21	820	252.586	19.168	14.044	0.013	0.160	0.147	2152.547
2282010005	4 Stroke Inboard/Stern-drive	21	630	123.306	20.740	11.519	0.011	0.151	0.139	1850.453
2282020005	Diesel Inboard/Stern-drive	35	370	2.257	0.627	9.763	0.011	0.231	0.224	1173.310
2282020010	Diesel Outboards	35	410	4.091	1.255	6.826	0.012	0.630	0.611	1300.093
2285002015	Diesel Railway Maintenance	21	440	3.805	0.931	6.272	0.011	0.672	0.652	1401.841
2285004015	4 Stroke Railway Maintenance	62	750	529.588	13.566	4.626	0.014	0.294	0.271	2343.704
2285006015	LPG Railway Maintenance	62	480	15.237	0.394	2.631	0.006	0.126	0.126	1222.092

- a. Load factor and activity data obtained from EPA Office of Transportation Air Quality and were derived from *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling*, EPA 420-R-10-016, NR-005d, July 2010.
- b. BSFC and emission factors obtained from EPA Office of Transportation Air Quality and were derived from *Exhaust Emission Factors for Nonroad Engine Modeling: Spark-Ignition*, EPA 420-R-019, NR-010e, December 2005, and *Exhaust Emission Factors for Nonroad Engine Modeling: Compression-Ignition*, EPA 420-P-04-009, NR-009c, April 2004. The emission factors are composite emission factors that represent the national mix of model years and technology types believed to be in existence in 2007. They represent in-use emissions and consider NONROAD model deterioration and transient adjustment factors across the model years.
- c. Activities for off-road motorcycles and all-terrain vehicles are in units of miles per year instead of hours per year.
- d. PM<sub>10</sub> is assumed to be equivalent to total PM for gasoline engines.
- e. For gasoline engines, PM<sub>2.5</sub> is assumed to be 92% of the PM<sub>10</sub> value.
- f. For LPG and CNG engines, all PM is assumed to be PM<sub>2.5</sub>.
- g. The Carbon Dioxide Equivalent (CO<sub>2e</sub>) emission factors are the total of CO<sub>2</sub> and CH<sub>4</sub> converted to equivalent CO<sub>2</sub> (CO<sub>2e</sub>) using a global warming potential (GWP) value of 25 for CH<sub>4</sub>. The converted CH<sub>4</sub> value was added to the CO<sub>2</sub> emission factor and presented as a CO<sub>2e</sub> emission factor in units of lb/1000lb. Calculations were made using the stated BSFC, the fuel density in Table 3-1, and if the fuel was not stated, it was assumed to be gasoline. N<sub>2</sub>O is not included in these calculations because there is no N<sub>2</sub>O pollutant output for the Nonroad module within MOVES2014b.

**Table 4-6. Pre-1998 Non-Road CI Engine Criteria Pollutant Emission Factors  
(Power Rating >50 hp)**

Equipment Description	Emission Factors (lb/1000 hp-hr)						
	CO	VOC <sup>a</sup>	NO <sub>x</sub>	SO <sub>x</sub>	PM <sub>10</sub> <sup>b</sup>	PM <sub>2.5</sub> <sup>c</sup>	CO <sub>2e</sub> <sup>d</sup>
<b>Construction Equipment</b>							
Asphalt Pavers	7.05	1.39	22.71	0.42	1.98	1.92	1323.47
Plate Compactors	6.83	1.86	20.50	0.42	1.98	1.92	1323.47
Concrete Pavers	10.08	2.55	22.09	0.42	1.98	1.92	1323.47
Rollers	6.83	1.86	20.50	0.42	1.72	1.67	1323.47
Scrapers	11.02	1.63	19.18	0.42	2.78	2.69	1323.47
Paving Equipment	10.14	2.34	24.27	0.42	1.98	1.92	1323.47
Signal Boards	11.02	2.79	17.64	0.42	2.20	2.14	1323.47
Trenchers	20.15	3.58	22.09	0.42	3.17	3.08	1323.47
Bore/Drill Rigs	20.28	3.27	24.27	0.42	3.17	3.08	1323.47
Excavators	11.46	1.63	23.70	0.42	3.17	3.08	1323.47
Concrete/Industrial Saws	20.28	3.27	24.27	0.42	3.17	3.08	1323.47
Cement and Mortar Mixers	10.14	2.34	24.27	0.42	1.98	1.92	1323.47
Cranes	9.26	2.93	22.71	0.42	3.17	3.08	1323.47
Graders	8.38	3.58	21.16	0.42	2.20	2.14	1323.47
Off-Highway Trucks	6.17	1.95	21.16	0.42	1.76	1.71	1323.47
Crushing/Processing Equipment	20.28	3.27	24.27	0.42	3.17	3.08	1323.47
Rough Terrain Forklifts	22.05	3.90	17.64	0.42	3.53	3.42	1323.47
Rubber Tired Dozers	6.17	1.95	22.71	0.42	1.46	1.41	1323.47
Tractors/Loaders/Backhoes	14.99	3.25	22.27	0.42	2.31	2.25	1323.47
Crawler Tractors	10.58	2.93	22.71	0.42	2.45	2.37	1323.47
Skid Steer Loaders	19.84	4.88	21.16	0.42	3.17	3.08	1323.47
Off-Highway Tractors	32.36	4.78	26.26	0.42	4.48	4.34	1323.47
Dumpers/Tenders	6.17	1.95	21.16	0.42	3.17	3.08	1323.47
Other Construction Equipment	20.28	3.27	24.27	0.42	3.17	3.08	1323.47
<b>Industrial Equipment</b>							
Aerial Lifts	13.36	3.64	30.86	0.42	3.53	3.42	1323.47
Forklifts	13.36	3.64	30.86	0.42	3.53	3.42	1323.47
Sweepers/Scrubbers	13.36	3.64	30.86	0.42	3.53	3.42	1323.47
Other General Equipment	13.36	3.64	30.86	0.42	3.53	3.42	1323.47
Other Material Handling Equipment	13.36	3.64	30.86	0.42	3.53	3.42	1323.47
<b>Lawn and Garden Equipment</b>							
Rear Engine Riding Mowers	11.02	2.79	17.64	0.42	2.20	2.14	1323.47
Lawn and Garden Tractors	11.02	2.79	17.64	0.42	2.20	2.14	1323.47
Wood Splitters	11.02	2.79	17.64	0.42	2.20	2.14	1323.47
Chippers/Stump Grinders	11.02	2.79	17.64	0.42	2.20	2.14	1323.47
Other Equipment	11.02	2.79	17.64	0.42	2.20	2.14	1323.47

**Table 4-6. Pre-1998 Non-Road CI Engine Criteria Pollutant Emission Factors (continued)**

Equipment Description	Emission Factors (lb/1000 hp-hr)						
	CO	VOC <sup>a</sup>	NO <sub>x</sub>	SO <sub>x</sub>	PM <sub>10</sub> <sup>b</sup>	PM <sub>2.5</sub> <sup>c</sup>	CO <sub>2e</sub> <sup>d</sup>
<b>Agricultural Equipment</b>							
Tractors	19.71	5.32	24.71	0.42	4.52	4.38	1323.47
Sprayers	8.33	5.18	17.15	0.42	3.33	3.23	1323.47
Tillers	11.02	2.79	17.64	0.42	2.20	2.14	1323.47
Hydro Power Units	8.33	5.18	17.15	0.42	3.33	3.23	1323.47
Other Equipment	9.63	4.23	24.52	0.42	3.33	3.23	1323.47
<b>Logging Equipment</b>							
Skidders	11.46	1.95	24.91	0.42	3.17	3.08	1323.47
Fellers/Bunchers	11.46	1.95	24.91	0.42	3.17	3.08	1323.47
<b>Recreational Equipment</b>							
Specialty Vehicles/Carts	11.02	2.79	17.64	0.42	2.20	2.14	1323.47

SOURCE: *Nonroad Engine and Vehicle Emission Study – Report*, EPA 460/3-91-02, 21A-2001, November 1991.

- Reported as hydrocarbon (HC) and converted to VOC by multiplying value by a conversion factor (1.053). This value recommended by the document "Conversion Factors for Hydrocarbon Emission Components", U.S. Environmental Protection Agency (EPA), Office of Transportation and Air Quality, July 2010.
- Reported as particulate matter (PM) in the source document and assumed to be equal to PM<sub>10</sub>.
- Assumed to be 97% of PM<sub>10</sub> per *Exhaust and Crankshaft Emission Factors for Nonroad Engine Modeling-Compression-Ignition*, EPA420-P-04-009, April 2004.
- The Greenhouse gas (GHG) emission factors calculated by summing the product of the emission factors for CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O and their respective global warming potentials (GWP). The GWP for CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O are 1, 25, and 298 respectively. Emission factors for individual GHG calculated by taking the product of the default emission factor provided in Tables C-1 and C-2 of Title 40 Code of Federal Regulations (CFR) Part 98 and the brake-specific fuel consumption (BSFC) for diesel engines provided in Table 3-1.



**Table 4-7. Weight Percent Speciation of VOC Emissions Non-Road Engines**

Compound	HAP	Gasoline <sup>a</sup>	Diesel <sup>b</sup>	Natural Gas <sup>c</sup>			LPG <sup>d</sup>
				2-Stroke LB	4-Stroke LB	4-Stroke RB	
Acenaphthene	X	---	0.02%	0.00%	0.00%	---	---
Acenaphthylene	X	---	0.08%	0.00%	0.01%	---	---
Acetaldehyde	X	0.30%	11.88%	6.49%	7.00%	8.63%	0.88%
Acetylene		15.47%	---	---	---	---	---
Acrolein	X	---	1.43%	6.51%	4.31%	8.14%	---
Anthracene	X	---	0.03%	0.00%	---	---	---
Benz(a)anthracene	X	---	0.03%	0.00%	---	---	---
Benzaldehyde		0.26%	---	---	---	---	---
Benzene	X	5.83%	14.46%	1.62%	0.37%	4.89%	3.23%
Benzo(a)pyrene	X	---	0.00%	0.00%	---	---	---
Benzo(b)fluoranthene	X	---	0.00%	0.00%	0.00%	---	---
Benzo(k)fluoranthene	X	---	0.00%	0.00%	---	---	---
Benzo(g,h,i)perylene	X	---	0.01%	0.00%	0.00%	---	---
Benzo(c)pyrene		---	---	0.00%	0.00%	---	---
Biphenyl	X	---	---	0.00%	0.18%	---	---
1,3-Butadiene	X	0.99%	0.61%	0.69%	0.22%	2.05%	---
Butane		---	---	3.97%	0.45%	---	---
n-Butane		2.19%	---	---	---	---	---
1-Butene		0.40%	---	---	---	---	---
cis-2-Butene		0.22%	---	---	---	---	---
trans-2-Butene		0.28%	---	---	---	---	---
Butyl isobutyraldehyde		---	---	0.37%	0.09%	0.15%	0.59%
Carbon Tetrachloride	X	---	---	0.05%	0.03%	0.05%	---
Chlorobenzene		---	---	0.04%	0.03%	0.04%	---
Chloroethane	X	---	---	---	0.00%	---	---
Chloroform	X	---	---	0.04%	0.02%	0.04%	---
Chrysene	X	---	0.00%	0.00%	0.00%	---	---
Cyclohexane		---	---	0.26%	---	---	---
Cyclopentane		---	---	0.08%	0.19%	---	---
1,3-Cyclopentadiene		0.26%	---	---	---	---	---
Dibenz(a,h)anthracene	X	---	0.01%	---	---	---	---
1,1-Dichloroethane	X	---	---	0.03%	0.02%	0.03%	---
1,2-Dichloroethane	X	---	---	0.04%	0.02%	0.03%	---
1,2-Dichloropropane	X	---	---	0.04%	0.02%	0.04%	---
1,3-Dichloropropane	X	---	---	0.04%	0.02%	0.04%	---
Dicyclopentadiene		0.27%	---	---	---	---	---
1,2-Diethylbenzene		0.56%	---	---	---	---	---
1,3-Diethylbenzene		0.45%	---	---	---	---	---
2,2-Dimethylbutane		0.30%	---	---	---	---	---
2,3-Dimethylbutane		0.62%	---	---	---	---	---
trans-1,3-Dimethylcyclopentane		0.28%	---	---	---	---	---
2,3-Dimethylhexane		0.32%	---	---	---	---	---
2,4-Dimethylhexane		0.45%	---	---	---	---	---
2,5-Dimethylhexane		0.24%	---	---	---	---	---
2,3-Dimethylpentane		1.16%	---	---	---	---	---
2,4-Dimethylpentane		0.71%	---	---	---	---	---
1,2-Dimethyl-4-Ethylbenzene		0.17%	---	---	---	---	---
1,3-Dimethyl-2-Ethylbenzene		0.34%	---	---	---	---	---
1,3-Dimethyl-4-Ethylbenzene		0.20%	---	---	---	---	---
Ethylbenzene	X	2.00%	---	0.09%	0.03%	0.08%	0.29%
Ethylene		11.39%	---	---	---	---	18.53%
Ethylene Dibromide	X	---	---	0.06%	0.04%	0.07%	---
Fluoranthene	X	---	0.12%	0.00%	0.00%	---	---
Fluorene	X	---	0.45%	0.00%	0.01%	---	---
Formaldehyde	X	1.32%	18.28%	46.17%	44.24%	63.43%	23.82%
n-Heptane		0.78%	---	---	---	---	---
1-Hexene		0.20%	---	---	---	---	---
n-Hexane	X	0.45%	---	0.37%	0.93%	---	0.59%
trans-2-Hexene		0.16%	---	---	---	---	---
Indan		---	---	---	---	---	---
Indeno(1,2,3-c)pyrene	X	0.24%	0.01%	0.00%	---	---	---
Isobutane		---	---	---	3.14%	---	---
Isobutene		2.02%	---	---	---	---	---
Isopentane		5.50%	---	---	---	---	---
Isoprene		0.32%	---	---	---	---	---
Methanol	X	---	---	0.15%	2.07%	2.10%	9.47%
2-Methyl-1-Butene		0.35%	---	---	---	---	---
2-Methyl-2-Butene		0.37%	---	---	---	---	---
Methylcyclohexane		0.24%	---	0.28%	1.03%	---	---
Methylcyclopentane		0.40%	---	---	---	---	---
1-Methylcyclopentene		0.16%	---	---	---	---	---
1-Methyl-2-Ethylbenzene		0.50%	---	---	---	---	---
1-Methyl-3-Ethylbenzene		1.52%	---	---	---	---	---
1-Methyl-4-Ethylbenzene		0.71%	---	---	---	---	---
2-Methylheptane		0.37%	---	---	---	---	---
3-Methylheptane		0.40%	---	---	---	---	---
4-Methylheptane		0.17%	---	---	---	---	---
2-Methylhexane		1.02%	---	---	---	---	---
3-Methylhexane		1.18%	---	---	---	---	---
3-Methyl-cis-3-Hexene		0.18%	---	---	---	---	---
2-Methylnaphthalene		---	---	0.02%	0.03%	---	---
3-Methyloctane		0.20%	---	---	---	---	---
2-Methyl-2-Pentene		0.18%	---	---	---	---	---
2-Methylpentane		1.73%	---	---	---	---	---
3-Methylpentane		0.99%	---	---	---	---	---
1-Methyl-3-Propylbenzene		0.26%	---	---	---	---	---
Methyl t-butyl ether	X	0.30%	---	---	---	---	---
Naphthalene	X	0.35%	1.31%	0.08%	0.06%	0.30%	---
n-Nonane		---	---	0.03%	0.09%	---	---
1-Nonene		0.61%	---	---	---	---	---
n-Octane		0.30%	---	0.06%	0.29%	---	---
1-Octene		0.22%	---	---	---	---	---
n-Pentane		0.71%	---	1.28%	2.18%	---	---
1-Pentene		0.27%	---	---	---	---	---
cis-2-Pentene		0.21%	---	---	---	---	---
trans-2-Pentene		0.34%	---	---	---	---	---
Perylene		---	---	0.00%	---	---	---
Phenanthrene	X	---	0.46%	0.00%	0.01%	---	---
Phenol	X	---	---	0.03%	0.02%	---	---
1,2-Propadiene		0.29%	---	---	---	---	---
Propane		---	---	24.01%	35.11%	---	---
n-Propylbenzene		0.38%	---	---	---	---	---
Propylene		4.72%	39.98%	---	---	---	49.71%
1-Propyne		0.48%	---	---	---	---	---
Pyrene	X	---	0.07%	0.00%	0.00%	---	---
Styrene	X	---	---	0.05%	0.02%	0.04%	---
Tetrachloroethane		---	---	---	0.06%	---	---
1,1,2,2-Tetrachloroethane	X	---	---	0.06%	0.03%	0.08%	---
1,2,3,5-Tetramethylbenzene		0.22%	---	---	---	---	---
Tolualdehyde		0.16%	---	---	---	---	---
Toluene	X	8.21%	6.34%	0.81%	0.34%	1.73%	1.18%
1,1,2-Trichloroethane	X	---	---	0.04%	0.03%	0.05%	---
1,2,3-Trimethylbenzene		0.40%	---	0.03%	0.02%	---	---
1,2,4-Trimethylbenzene		2.18%	---	0.09%	0.01%	---	---
1,3,5-Trimethylbenzene		0.77%	---	0.01%	0.03%	---	---
2,2,5-Trimethylhexane		0.30%	---	---	---	---	---
2,2,4-Trimethylpentane	X	2.37%	---	0.71%	0.21%	---	---
2,3,4-Trimethylpentane		0.52%	---	---	---	---	---
Vinyl Chloride	X	---	---	0.02%	0.01%	0.02%	---
Vinylacetylene		0.23%	---	---	---	---	---
o-Vinyltoluene		0.26%	---	---	---	---	---
Xylenes	X	7.47%	4.42%	0.22%	0.15%	0.60%	1.18%

a. SOURCE: Emission factors used to calculate weight percent taken from EPA's SPECIATE profile #4738.

b. SOURCE: Emission factors used to calculate weight percent taken from Section 3.3 of AP-42

c. SOURCE: Emission factors used to calculate weight percent taken from Section 3.2 of AP-42.

d. SOURCE: Emission factors used to calculate weight percent taken from Mojave Desert AQMD.

“X” Indicates the compound is a HAP.

“---” Indicates No Data Available.

<b>Installation Name:</b>				<b>Inventory Year (CY):</b>				
<b>Responsible Organization (Name &amp; Office Symbol):</b>								
<b>POC (Name, Phone # and e-mail address):</b>								
Equipment Type	Equipment ID	Equipment Manufacturer	Equipment Model Number	Fuel Type	Power Rating (hp)	Load Factor (% of max) <sup>1</sup>	Estimated Operating Time (hr/yr)	Estimated Fuel Usage (gal/yr) <sup>2</sup>

**Figure 4-1. Example Data Collection Form for Non-Road Vehicles and Equipment**

- a. Load factor is the highest % of maximum power which the equipment was operated at during the inventory year. If this is unknown, a default EPA value should be used. While the quantity of fuel is generally needed only if the power rating and operating hours are unknown, fuel consumption data may also be needed to estimate CO<sub>2</sub> emissions.

## 4.6 References

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## 5.0 ON-ROAD VEHICLES (VEHE)

**\*Air Force policy considers the dispensing of fuel into on-road vehicles a mobile source of emissions. However, if the regulator insists this category be included as a stationary source, subtract those emissions from the Mobile AEI and add them to the Stationary AEI to avoid duplicate reporting. This is accomplished by manually calculating emissions generated from on-road vehicle refueling using the procedures given in the “Fuel Dispensing” section of this document, then subtracting those values from the emissions generated by on-road vehicles described in this section. \***

### 5.1 Introduction

On-road vehicles encompass the full range of passenger cars, light duty trucks, heavy duty trucks, buses, and motorcycles that are specifically designed to operate on highways and other road systems. On-road vehicles in use on USAF installations are *classified* either as Government Owned Vehicles (GOVs) or Privately-Owned Vehicles (POVs). GOVs include all on-road vehicles that are owned or leased and operated by government organizations on the base (e.g., Air Force, Guard, Reserve, etc.). Such vehicles are typically referred to as "fleet vehicles" and range from small passenger cars to large vehicles such as refueling or fire trucks. This classification also includes Tactical Vehicles. Tactical vehicles are defined as any motor vehicle designed to military specifications or a commercially designed motor vehicle modified to military specifications to meet direct transportation support of combat, tactical or relief operations, or for training of personnel for such purposes. POVs are those on-road vehicles that travel on an USAF installation, but are owned or leased and operated by base employees, and visitors. Both GOVs and POVs typically operate on conventional gasoline and diesel motor fuels, but may also operate on alternative, non-petroleum-based fuels.

**The emissions of concern from the operation of on-road vehicles include the criteria pollutants: NO<sub>x</sub>, VOC, CO, SO<sub>2</sub>, PM<sub>2.5</sub> and PM<sub>10</sub>, as well as HAPs.** HAPs include: 1,3-butadiene, benzene, acetaldehyde, formaldehyde, acrolein and methyl tert-butyl ether (MTBE). Some of these direct pollutant emissions also participate in atmospheric reactions that contribute to the formation of ground level ozone and fine PM pollution. Factors which impact the volume of pollutants emitted include the vehicle make and model, the Vehicle Miles Traveled (VMT), the average operating speed, vehicle age, climate, altitude, fuel type and quality, and maintenance procedures. To control vehicle emissions, the EPA has adopted an integrated approach to controlling on-road vehicle emissions. This approach has resulted in the establishment of regulatory standards that consider changes in vehicle and engine design, advanced emission controls, and the mandated use of reformulated and cleaner burning fuels.

Emissions from the operation of on-road vehicles are designated as exhaust, evaporative, or fugitive in nature. Exhaust emissions result from the combustion (sometimes incomplete) of the motor fuel while evaporative emissions result from the volatilization of the fuel in engine components during the different stages of a vehicle's operating cycle. Additionally, fugitive particulate emissions, in the form of road dust, brake wear dust, and tire wear dust, can be attributed to the operation of on-road vehicles.

The EPA is currently proposing to regulate greenhouse gases (GHGs) for both mobile and stationary sources. As a matter of USAF policy, GHG emissions are to be reported as part of the mobile AEI. Specifically, CO<sub>2</sub> and CH<sub>4</sub> emissions should be estimated for all mobile sources when EFs are available. Since CO<sub>2</sub> and CH<sub>4</sub> EFs are attainable for on-road vehicles, emissions should be estimated for a mobile AEI as part of USAF policy. Additionally, although not currently regulated under the CAA, many regulatory agencies may request installations to include GHG emissions from motor vehicles in mobile source emissions inventories. Specific requests to calculate and provide CO<sub>2</sub> and/or CH<sub>4</sub> emissions data to regulatory agencies as part of the AEI process should be reported through the appropriate Air Force Civil Engineer Center (AFCEC) channels and coordinated through the chain-of-command. Such coordination should be accomplished prior to responding to the request to ensure a consistent USAF response.

Since 1978, the EPA has used computer models to estimate emissions from cars, trucks and other mobile sources. The EPA's initial on-road vehicle emissions modeling software, known as the MOBILE model, was expanded many times over the years to incorporate new data. The updates included new data on vehicle emissions and new vehicle emission standards, and better addressed new policy questions, while keeping the basic structure of the model. MOBILE uses average gram per mile emission rates and a series of correction factors to estimate emissions over a wide range of driving conditions. MOBILE6.2, finalized in 2004, was the EPA's official model for highway vehicle emissions. Several analysts have critiqued the MOBILE series of models and suggested that the EPA develop a modeling "toolkit" that would better serve the range of uses for highway vehicle modeling, including consistent modeling at the aggregate scale, mesoscale, and microscale analysis.

In response to these and other concerns, the EPA developed the Motor Vehicle Emissions Simulator (MOVES) model. MOVES incorporates extensive new data and advanced algorithms to estimate highway vehicle emissions of GHGs, criteria pollutants, and selected air toxics at the national, regional and project level. In July of 2014, the EPA released MOVES2014, which included Tier 3 rule benefit considerations for new EPA rules released since the last version of MOVES, as well as new emissions data and new user-requested features. MOVES2014 is used for EPA internal policy analyses and is required for use (outside California) in the evaluation of State Implementation Plans (SIPs) and transportation conformity determinations. On the official EPA website, use of other models, such as the MOBILE model and previous versions of

MOVES, is being discouraged as they contain outdated or otherwise inaccurate data. In October 2014, the EPA published an announcement in the Federal Register approving the MOVES2014 model for official use (outside of California). This announcement marks a two-year grace period for switching to MOVES2014 for SIP and transportation conformity analyses. In November of 2015, MOVES2014a was released with minimal changes to the model. The update did not significantly change the criteria pollutant emissions results of MOVES2014; therefore, it is not considered a new model for SIP and transportation conformity purposes. The most recent update, MOVES2014b released in December of 2018, is another minor update which primarily improves emissions estimates for nonroad mobile sources. MOVES2014b was used to derive the on-road emission factors for each state (excluding California) in this guide. California does not use the MOVES model for on-road vehicle use emissions estimates but has its own model that it uses known as the Emission FACTor (EMFAC) Model. The most recent EMFAC model approved by the U.S. EPA is EMFAC2014, which was used to derive emission factors for each county in the state.

The EPA has historically classified on-road vehicles into eight broad *categories* based on the motor fuel type and Gross Vehicle Weight (GVW). MOVES was designed to reflect the general fleet distribution or fleet characterization (i.e., fractional vehicle category distribution by year) for a specific location. MOVES can also estimate emission rates (e.g., grams/mile, grams/vehicle) or input VMT and vehicle populations to output total emissions for any year from 1990 and 1999-2050. **The MOVES model incorporates emissions from on-road vehicle refueling. Therefore, these emissions are not addressed in the “Fuel Dispensing” section of this document since they are already integrated in the EFs presented in this section.**

### 5.1.1 Vehicle Categories

The 28 vehicle *categories* from MOVES have been grouped into seven major aggregate *categories* based on vehicle type and Gross Vehicle Weight Rating (GVWR). Table 5-1 provides the seven major aggregate *categories* based upon available MOBILE6 EF outputs and readily identifiable general vehicle groupings. The seven aggregate vehicle *categories* are:

- ***Light-Duty Gasoline Vehicles (LDGV)*** – All gasoline-powered passenger cars
- ***Light-Duty Diesel Vehicles (LDDV)*** – All diesel-powered passenger cars
- ***Light-Duty Gasoline Trucks (LDGT)*** – All smaller gasoline-powered trucks (0 to 8,500 lbs. GVWR)
- ***Light-Duty Diesel Trucks (LDDT)*** – All smaller diesel-powered trucks (0 to 8,500 lbs. GVWR)
- ***Heavy-Duty Gasoline Vehicles (HDGV)*** – All larger gasoline-powered vehicles (8,501lbs. to >60,000 lbs. GVWR)

- **Heavy-Duty Diesel Vehicles (HDDV)** – All larger diesel-powered vehicles (10,001 lbs. to >60,000 lbs. GVWR)
- **Motorcycles (MC)** – All motorcycles (assumed to be gasoline powered)

### 5.1.2 Vehicle Fleet Characterization

Based upon a review of recent USAF mobile source emission inventories, the vehicle categories that are most representative of the types of GOVs and POVs expected to be encountered on a typical USAF installation have been identified. The seven Air Force vehicle categories provide the most readily identifiable and discernible vehicle classes for vehicle mix identification and characterization. It is recognized that some vehicles encountered may not fit within the specific weight parameters of the categories chosen. In such instances, personnel conducting the AEI should use professional judgment to assign the vehicles to the listed category which most closely approximates the vehicles in question. This approximation should be based on fuel type and vehicle weight. Table 5-2, provides a breakdown of the fleet characterization for the typical POV and GOV vehicle mix at a USAF installation. **The vehicle mix provided in this table is to be used for estimating vehicle emissions unless specific vehicle mix data is available from a recent traffic study.**

### 5.1.3 Tactical Vehicles

Tactical vehicles are defined as any motor vehicle designed to military specifications to meet direct transportation support of combat, tactical or relief operations, or for training of personnel for such purposes. This also includes a commercially designed motor vehicle modified to military specifications. Tactical vehicles are a subset of GOVs, and Table 5-3 provides vehicle mix percentages for Tactical Vehicles as well as Non-Tactical Vehicles out of the total GOV Vehicle Mix. This supplemental information is provided if the need to calculate emissions specific to tactical or non-tactical vehicles arises.



**Table 5-1. Air Force On-Road Vehicle Categories**

CATEGORY		VEHICLE CLASS DESCRIPTION
Air Force	MOVES	
<b>Gas/Diesel</b>		
LDGV	LDGV	Light-Duty Gasoline Vehicles (Passenger Cars)
LDDV	LDDV	Light-Duty Diesel Vehicles (Passenger Cars)
LDGT	LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
	LDGT2	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
	LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW)
	LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, greater than 5,751 lbs. ALVW)
LDDT	LDDT1/2	Light-Duty Diesel Trucks 1 and 2 (0-6,000 lbs. GVWR)
	LDDT3/4	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)
HDGV	HDGV2a	Class 2b Heavy-Duty Gasoline Vehicles (8,501-10,000 lbs. GVWR)
	HDDV2b	Class 2b Heavy-Duty Diesel Vehicles (8,501-10,000 lbs. GVWR)
	HDGV3	Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)
	HDGV4	Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)
	HDGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)
	HDGV6	Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)
	HDGV7	Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)
	HDGV8a	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)
	HDGV8b	Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)
	HDGB	Gasoline Buses (School, Transit and Urban)
HDDV	HDDV3	Class 3 Heavy-Duty Diesel Vehicles (10,001-14,000 lbs. GVWR)
	HDDV4	Class 4 Heavy-Duty Diesel Vehicles (14,001-16,000 lbs. GVWR)
	HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs. GVWR)
	HDDV6	Class 6 Heavy-Duty Diesel Vehicles (19,501-26,000 lbs. GVWR)
	HDDV7	Class 7 Heavy-Duty Diesel Vehicles (26,001-33,000 lbs. GVWR)
	HDDV8a	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs. GVWR)
	HDDV8b	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs. GVWR)
		HDDBT
	HDDBS	Diesel School Buses
MC	MC	Motorcycles (Gasoline)
<b>HYBRID</b>		
LDGV (H)	---	---
LDGT (H)	---	---
<b>CNG</b>		
LDGV (C)	---	---
LDGT (C)	---	---
HDGV (C)	---	---

Table 5-2. Typical Air Force POV &amp; GOV Mix

CATEGORY		2012 to 2020 Avg. National Vehicle Mix (%)		POV Vehicle Mix (%) <sup>a</sup>	GOV Vehicle Mix (%) <sup>b</sup>
Air Force	MOVES				
<b>Gas/Diesel</b>					
LDGV	LDGV	34.86	34.86	47.11	9.48
LDDV	LDDV	0.03	0.03	0.89	0.59
LDGT	LDGT1	9.57	56.00	39.23	46.58
	LDGT2	31.86			
	LDGT3	9.98			
	LDGT4	4.59			
LDDT	LDDT1/2	0.00	0.19	0.35	16.43
	LDDT3/4	0.19			
HDGV	HDGV2a	2.88	3.46	4.22	4.60
	HDGV2b				
	HDGV3	0.10			
	HDGV4	0.03			
	HDGV5	0.11			
	HDGV6	0.24			
	HDGV7	0.10			
	HDGV8a	0.00			
	HDGV8b	0.00			
	HDGB	0.00			
HDDV	HDDV2b	0.72	3.70	3.06	21.23
	HDDV3	0.22			
	HDDV4	0.21			
	HDDV5	0.10			
	HDDV6	0.41			
	HDDV7	0.59			
	HDDV8a	0.35			
	HDDV8b	0.82			
	HDDBT	0.03			
	HDDBS	0.25			
MC	MC	1.76	1.76	3.40	0.00
<b>HYBRID</b>					
LDGV (H)	---	---	---	1.54	0.85
LDGT (H)	---	---	---	0.14	0.11
<b>CNG</b>					
LDGV (C)	---	---	---	0.04	0.00
LDGT (C)	---	---	---	0.01	0.11
HDGV (C)	---	---	---	0.00	0.03

a. SOURCE: POV vehicle mix was based on available Employee-Certification and Reporting System (ECARS) data collected on 3/2020.

b. SOURCE: GOV vehicle mix was based on information provided by the Air Force Vehicle and Equipment Management Office (VEMSO).

“---” Indicates No Data Available

**Table 5-3. GOV Tactical and Non-Tactical Vehicle Mix**

CATEGORY		GOV Tactical Vehicle Mix (%)	GOV Non-Tactical Vehicle Mix (%)
Air Force	MOVES		
<b>Gas/Diesel</b>			
LDGV	LDGV	0.00	9.83
LDDV	LDDV	0.00	0.61
LDGT	LDGT1	0.05	48.25
	LDGT2		
	LDGT3		
	LDGT4		
LDDT	LDDT1/2	0.19	16.84
	LDDT3/4		
HDGV	HDGV2a	0.11	4.65
	HDGV2b		
	HDGV3		
	HDGV4		
	HDGV5		
	HDGV6		
	HDGV7		
	HDGV8a		
	HDGV8b		
HDGB			
HDDV	HDDV2b	3.21	18.68
	HDDV3		
	HDDV4		
	HDDV5		
	HDDV6		
	HDDV7		
	HDDV8a		
	HDDV8b		
	HDDBT		
	HDDBS		
MC	MC	0.00	0.00
<b>HYBRID</b>			
LDGV (H)	---	0.00	0.88
LDGT (H)	---	0.00	0.11
HDGV(H)	---	0.00	0.00
<b>CNG</b>			
LDGV (C)	---	0.00	0.00
LDGT (C)	---	0.00	0.11
HDGV (C)	---	0.00	0.03

SOURCE: GOV vehicle mix was based on information provided by the Air Force Vehicle and Equipment Management Office (VEMSO).

## 5.2 Emission Factors

Emissions from on-road vehicles include exhaust emissions, which occurs both when the vehicle is in motion and while idling, as well as fugitive particulate emissions from road dust. The methodology for estimating emissions from each of these contributing sources is described in the following sections.

### 5.2.1 Vehicle Exhaust Emissions

The operation of on-road vehicles results in the generation of vehicle exhaust, which emits criteria pollutants, HAPs, and GHGs. Estimating emissions from vehicle exhaust is made more challenging because the amount of pollutants emitted is different for a vehicle in normal operation versus when the vehicle is idling. The total emissions from vehicle exhaust is quantified by taking the sum of both the idling and normal operating exhaust emissions.

**MOVES accounts for idling in proportion to normal driving, therefore calculation of idling emissions is not required for an AEI.** Particulate emissions estimation is made more complex by the fact that particulate is emitted from vehicle exhaust, from both idle and normal vehicle use, as well as from the suspension of road dust. The EFs for each contributing source are described in more detail below.

#### 5.2.1.1 Vehicle Exhaust Emissions – Normal Vehicle Operation

EFs for the Air Force vehicle categories were obtained directly from MOVES2014b. The MOVES2014b model was used to generate estimations of on-road vehicle emissions for each state (except California), the District of Columbia, and relevant US territories. This model requires various inputs such as population of personnel and VMT by vehicle type, age distribution and average speed distribution, ambient meteorological conditions, and elevation among other inputs. The “default” input database for MOVES2014b was used for all calculations and derivations. The MOVES2014b model was run for each state for calendar years 2019 through 2023 using the national estimates contained within the default database for all vehicle types listed in Table 5-1. The vehicle types selected for the run were gasoline and diesel vehicles available in the MOVES database. The vehicle model years used for each run include a 30-year span from the calendar year of the run to 30 years prior. The output emission rates were averaged using an activity- (mileage) weighted average over all vehicle model years for each calendar year to estimate a representative emission factor for each pollutant for each vehicle type. The resultant EFs are provided in a **gram/mile format** and are presented in Table 5-19 through Table 5-23 for all states other than California. The State of California uses EMFAC2014 Model to calculate emissions data. Like the MOVES2014 model, EMFAC2014 calculates emissions for all motor vehicles in the state using data stored in its default database. County and vehicle-specific EFs for California are presented in Table 5-34 through Table 5-38.

Additionally, there are composite EFs that are state- and year-specific. These values account for emissions reductions resulting in the use of alternative fuels and are calculated using Air Force-specific vehicle mix data (refer to Section 1.2.1.3 regarding alternative fuels). The composite EFs are provided in Table 5-9 through Table 5-18 depending on the calendar year. Furthermore, since the calculation of composite EFs account for Air Force vehicle mix data, the tables are further subdivided into POV and GOV categories. The composite EFs for the state of California were derived from EMFAC and are provided in Table 5-24 through Table 5-33. The model input and default values used to calculate the EFs in MOVES and EMFAC are provided in Table 5-4 and Table 5-5, respectively.

**Table 5-4. MOVES2014b Inputs Used to Generate On-Road Vehicle Emission Factors**

Model Input	Input Value
Scale	National
Calculation Type	Inventory
Model Years	30-year range from calendar year back
Years	2020-2024
Months	All
Days	Weekend and Weekdays
Hours	All
Geographic Bounds	State/Territory Specific
Fuels	Diesel Fuel and Gasoline
Source Use Types	All
Road Types	All
Pollutants and Processes	NO <sub>x</sub> , SO <sub>x</sub> , CO, VOC, PM <sub>10</sub> , PM <sub>2.5</sub> , CO <sub>2</sub> , NH <sub>3</sub> , and all required additional processes
Activity	Distance Traveled, Populations, Starts

There is not a universally accepted set of EFs for installations located Outside of the Continental United States (OCONUS). Additionally, determining the vehicle mix or classifying vehicles may be more difficult in a foreign country. Calculating emissions for on-road vehicles at OCONUS facilities can be approximated by calculating the average of all state-specific composite EFs. The EFs for vehicle emissions at OCONUS installations are provided in Table 5-39 and Table 5-40 and are to be used with the same methodology as calculating on-road vehicle emissions within the United States.

**Table 5-5. EMFAC2014 Inputs Used to Generate On-Road Vehicle Emission Factors**

<b>Model Input</b>	<b>Input Value</b>
Run Mode	Emissions
Run Type	Default Activity
Area	County Specific
Years	2020-2024
Season	Annual
Aggregation Level	Day
Vehicle Class	ALL
Model Year	30-year range from calendar year back
Fuel	By Fuel
Speed	Aggregated
Pollutants and Processes	NO <sub>x</sub> , SO <sub>x</sub> , CO, ROG, PM <sub>10</sub> , PM <sub>2.5</sub> , CO <sub>2</sub> , CH <sub>4</sub>
Activities	VMT, Population

### 5.2.1.2 Vehicle Exhaust Emissions - Idling

An idling vehicle wastes fuel, increases the cost of maintenance, and creates air pollution. Several states have adopted anti-idling restrictions with some including these restrictions in their SIPs. EFs for emissions from idling vehicles were developed and are provided in a **gram/hour format**. An idling vehicle is not in motion; therefore, emissions may not be calculated on miles driven, but rather time in the idle mode. For this reason, the total amount of time that a vehicle spends in idle mode must be known or closely approximated. **Note that MOVES, EFs already include vehicle idling in proportion to normal driving. For this reason, the EFs given here are presented for calculating theoretical emissions for NEPA, or for intersection modeling.** Idling EFs for each vehicle category are provided in Table 5-6.

**Table 5-6. Idling Emission Factors for On-Road Vehicles**

Vehicle Category	Emission Factors (g/hr)				
	CO	NO <sub>x</sub>	VOC	PM <sub>10</sub> <sup>a</sup>	PM <sub>2.5</sub> <sup>b</sup>
LDGV (Passenger Cars)	71.225	3.515	2.683	---	---
LDGT (0-8,500 lb GVWR)	72.725	4.065	4.043	---	---
HDGV (>8,500 lb GVWR)	151.900	5.330	6.495	---	---
LDDV (Passenger Cars)	7.018	2.690	1.373	---	---
LDDT (Light-Duty Trucks)	5.853	3.705	2.720	---	---
HDDV (>8,500 lb GVWR)	25.628	33.763	3.455	1.196	1.100
MC (Motorcycles)	301.075	1.625	19.153	---	---

SOURCE: *Idling Vehicle Emissions for Passenger Cars, Light-Duty Trucks, and Heavy-Duty Trucks*, United States Environmental Protection Agency, Office of Transportation and Air Quality, EPA420-F-08-025, October 2008

a. PM<sub>10</sub> is an average of HDDV particulate emissions.

b. PM<sub>2.5</sub> value is assumed to be 92% of the PM<sub>10</sub> value per *Air Emissions Factor Guide to Air Force Mobile Sources*, December 2009.

“---” Indicates No Data Available.

### 5.2.1.3 Alternative Fuel Emission Reduction Factors

Progressively stringent requirements resulting from the EPA Act, Presidential Executive Orders, DoD, and Air Force pollution prevention and energy conservation initiatives will result in an increasing number of GOVs and POVs powered by alternative fuels such as E85, CNG, or B20, and advanced hybrid electric vehicles (HEVs). Regardless of fuel type, all vehicles operating on alternative fuels are currently required to meet existing EPA emission standards established for gasoline and/or diesel-powered vehicles. However, some fuels offer potential emission reductions beyond those standards.

Relative to conventional gasoline, the higher-octane value and oxygen content of E85 fuel should lead to reduced vehicle emissions. The EPA's Office of Transportation Air Quality (OTAQ) notes that while potential reductions will vary with engine design, E85 fuel should lead to reductions in VOCs, CO, PM, and NO<sub>x</sub> relative to conventional gasoline (USEPA 2002a). The case with HAP emissions is not as clear since some data indicates a reduction in benzene and fewer total toxics, but an increase in ethanol and acetaldehyde emissions (USEPA 2006a). Adding to the complexity, some studies have shown that with the use of a catalytic converter, there is virtually no difference in exhaust emissions from on-road vehicles powered by gasoline. Due to these inconsistencies and the lack of clear data trends, **the application of E85 emission reduction factors is not recommended.**

CNG is recognized as one of the cleanest burning alternative fuels available and offers several advantages over gasoline (USDOE 2002). There is limited data for emissions reductions that CNG offers over conventional gasoline, especially since emissions will vary with engine design and performance. However, the EPA suggests that, relative to conventional gasoline-powered

vehicle applications, emissions from CNG-powered vehicles are estimated to be substantially lower for CO, PM, NO<sub>x</sub>, and non-methane hydrocarbons.

There have been a few studies on the impact of B20 fuel on vehicle emissions. In October 2002, the EPA issued a draft technical report on biodiesel emissions (USEPA 2002b). The EPA used the results from 39 studies to compare the difference in emissions between vehicles using B20 versus diesel fuel. Relative to low sulfur diesel (sulfur content of 500 ppm), B20 use resulted in notable reduction of NO<sub>x</sub>, PM, HC, and CO emissions. Since the publication of the study, Ultra-Low Sulfur Diesel (ULSD) regulations that limit the sulfur content of on-highway diesel fuel to 15 ppm have been enacted and are in place across the country. Another study conducted under the auspices of the DoD Environmental Security Technology Certification Program (ESTCP) sought to measure the impact of B20 on emissions from engines used in on-road and portable power generation applications (DoD 2006). Whereas the EPA study used a B20/low sulfur diesel blend, the ESTCP study used a B20 biodiesel/ULSD blend to reflect the fact that conventional low sulfur diesel is no longer available for use in on-road vehicles. The ESTCP study concluded there were **no statistically significant differences in criteria pollutant emissions between the B20 biodiesel blended with ULSD and the ULSD by itself**. Likewise, no consistent trend was observed regarding HAP emissions.

Hybrid Electric Vehicles (HEVs) produce fewer criteria pollutant, HAP, and CO<sub>2</sub> emissions than comparable dedicated gasoline-powered vehicles. This is because HEVs utilize an electric motor in conjunction with a traditional, and often smaller, internal combustion engine. The electric motor decreases the frequency in which the combustion engine is used, which reduces fuel consumption and, therefore, emissions. Overall emissions will vary depending on several factors, including the vehicle's electrical storage capacity and how long it can operate in "electric-only" mode. Additional factors include how advanced the engine controls are, which emission standards the vehicles have been produced to meet, vehicle size, and model year. For these reasons, the emission profile of HEVs must be judged individually based on the miles traveled under each power mode, complicating attempts to estimate vehicle emission reductions. To estimate the potential emission reduction benefits from the use of HEVs, two sources were utilized. These include vehicle family application and emission certification data contained in the EPA OTAQ Certification and Fuel Economy Information System, and the California Air Resources Board (CARB) On-Road Vehicle and Engine Certification website. The assessment of representative certification data indicated NO<sub>x</sub>, CO, HC (assumed to be equal to VOCs), and CO<sub>2</sub> were substantially reduced on average (U.S. Environmental Protection Agency, Office of Transportation Air Quality, Certification and Fuel Economy Information System).

Based upon this data, reduction factors for alternative fuels were calculated for on-road vehicles and are provided in Table 5-7. To estimate potential emission reductions from the use of these alternative fuels and advanced vehicle technologies, calculate vehicle emissions using the



MOVES2014 gasoline or diesel fuel emission factors provided, and apply an appropriate percent impact based upon the values listed in the table.

**Table 5-7. Alternative Fuel Emission Reduction Factors (FERFs)**

Alternative Fuel (Original fuel type)	Vehicle Category	Fuel Reduction Emission Factor (%)					
		CO	NO <sub>x</sub>	VOC <sup>a</sup>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
CNG (Gasoline) <sup>b</sup>	LDGV, LDGT, HDGV	90	35	50	90 <sup>c</sup>	90 <sup>c</sup>	25
B20 (Diesel) <sup>d</sup>	LDDV, LDDT, HDDV	0	0	0	0	0	0
HEVs (Gasoline) <sup>e</sup>	LDGV, LDGT	50	75	35	---	---	30

- a. Source provided emission factors (EFs) for hydrocarbons (HC) or non-methane HCs which are assumed to be equivalent to VOC emissions reduction.
- b. SOURCE: “Clean Alternative Fuels: Compressed Natural Gas (EPA 420- F-00-033),” U.S. Environmental Protection Agency, March 2002.
- c. SOURCE: Arkansas Gas Association, Natural Gas Vehicles
- d. Based on EFs using a default of 15 parts per million (ppm) sulfur for diesel, and results of the Department of Defense Environmental Security Technology Certification Program study, *Effect of Biodiesel on Diesel Engine Nitrogen Oxide and Other Regulated Emissions*, Project number WP-0308, May 2006, indicating no statistically significant difference in B20/Ultra Low Sulfur Diesel (ULSD) vs. ULSD emissions.
- e. EFs represent the difference in CO<sub>2</sub> emissions associated with the combustion of one gallon of gasoline and one-gallon gasoline equivalent of Compressed Natural Gas (CNG). Source: California Climate Action Registry, General Reporting Protocol Version 2.2, Table C-3, March 2007.
- “---” Indicates No Data Available.

### 5.2.2 Fugitive Particulate Matter (PM) Emissions

Though roads are themselves stationary, the generation of airborne road dust is the result of the turbulent wake created by on-road vehicles, which are mobile sources. Therefore, road dust emissions are provided in this section. **Note that this section does not describe emissions from asphalt paving since those operations are considered transitory and are addressed in the *Air Emissions Guide for Air Force Transitory Sources*.** Since fugitive PM emissions are the result of road dust suspended as the vehicle moves across a road surface, the extent of the emitted PM is dependent on whether the road surface is paved or unpaved. These surfaces are subjected to strong air currents from the turbulent wake that follows behind a vehicle as it passes. The currents disturb the loose material pulverized under the weight of the vehicle and PM is cast into the air. PM emissions will fluctuate for several reasons, including construction activities in the area, road degradation due to vehicular traffic, and the application of granular materials for snow and ice control. Typically, the most important factors regarding road PM emissions are the number and weight of the vehicles that travel the road, and the VMT. Paved and unpaved road EFs are already derived and may be found in Table 5-8.

Table 5-8. Fugitive PM Emission Factors

	POV		GOV	
	PM <sub>10</sub> (g/mi)	PM <sub>2.5</sub> (g/mi)	PM <sub>10</sub> (g/mi)	PM <sub>2.5</sub> (g/mi)
Paved Road	0.058	0.014	0.069	0.017
Unpaved Road	466.206	46.621	505.981	50.598

The EFs for suspension of loose material on paved and unpaved road surfaces due to vehicle travel were derived from the following empirical equations from AP-42 Chapter 13.2.1 (Jan 2011) and AP-42 Chapter 13.2.2 (Nov 2006):

$$EF(Pol)_P = k(Pol) \times (sL)^{0.91} \times W^{1.02} \quad \text{AP-42 Chapter 13.2.1.3}$$

Where,

- EF(Pol)<sub>P</sub> = Particulate emission factor for **paved** roads (g/mi)
- k(Pol) = Particle size multiplier (g/mi). **PM<sub>2.5</sub> = 0.25 and PM<sub>10</sub> = 1.00**
- sL = Road surface silt loading (g/m<sup>2</sup>). **AP-42 Chapter 13.2.1 recommends a default value of 0.015 for limited access roadways (such as Air Force roads)**
- W = Average weight of the vehicles traveling the road (tons). **POVs = 2.581 and GOVs = 3.096**

$$EF(Pol)_U = k(Pol) \times \left(\frac{s}{12}\right)^a \times \left(\frac{W}{3}\right)^b \times 453.6 \quad \text{AP-42 Chapter 13.2.2.2}$$

Where,

- EF(Pol)<sub>U</sub> = Particulate emission factor for **unpaved** roads (g/mi)
- k(Pol) = Particle size multiplier (lb/mi). **PM<sub>2.5</sub> = 0.15 and PM<sub>10</sub> = 1.5**
- s = Surface material silt content (%). **AP-42 Chapter 13.2.2 value for construction site road value of 8.5**
- a, b = Empirical constants for industrial roads from AP-42 Table 13.2.2-2. **a=0.9 and b=0.45**
- 453.6 = Factor converting lb to grams (g/lb)

**\*Note:** the equation above calls for the average weight of all vehicles traveling the road and is **not** intended to be used to calculate a separate EF for each vehicle weight class. Rather, one EF should be calculated to represent the “fleet” average weight of all vehicles.

### 5.2.2.1 Corrected Emission Factors Accounting for Precipitation

Average fugitive PM emissions are inversely proportional to the frequency of measurable precipitation (>0.01 inch). The total fugitive PM emissions are calculated using the appropriate EF listed above, the total vehicle miles traveled, and a precipitation correction term. When accounting for precipitation, the fugitive PM EFs must be corrected. The corrected EFs for both paved ( $EF(Pol)_{CP}$ ) and unpaved ( $EF(Pol)_{CU}$ ) roads are calculated as follows:

$$EF(Pol)_{CP} = EF(Pol)_P \times \left(1 - \frac{P}{4N}\right)$$

Equation 5-1

$$EF(Pol)_{CU} = EF(Pol)_U \times \left(1 - \frac{P}{N}\right)$$

Equation 5-2

Where,

- $EF(Pol)_{CP/CU}$  = Corrected emission factor for paved or unpaved roads (g/mi)-specify
- $P$  = Number of days in the inventory period in which at least 0.01 inches of precipitation was measured (days). See Figure 5-1 to determine this value based on the installation's geographic location.
- $N$  = Number of days in the inventory period (days). 1 year = 365 Days

**\*Note** – The paved road precipitation factor differs from the unpaved precipitation factor since it incorporates a factor of “4” in the denominator to account for the fact that paved roads dry more quickly than unpaved roads.

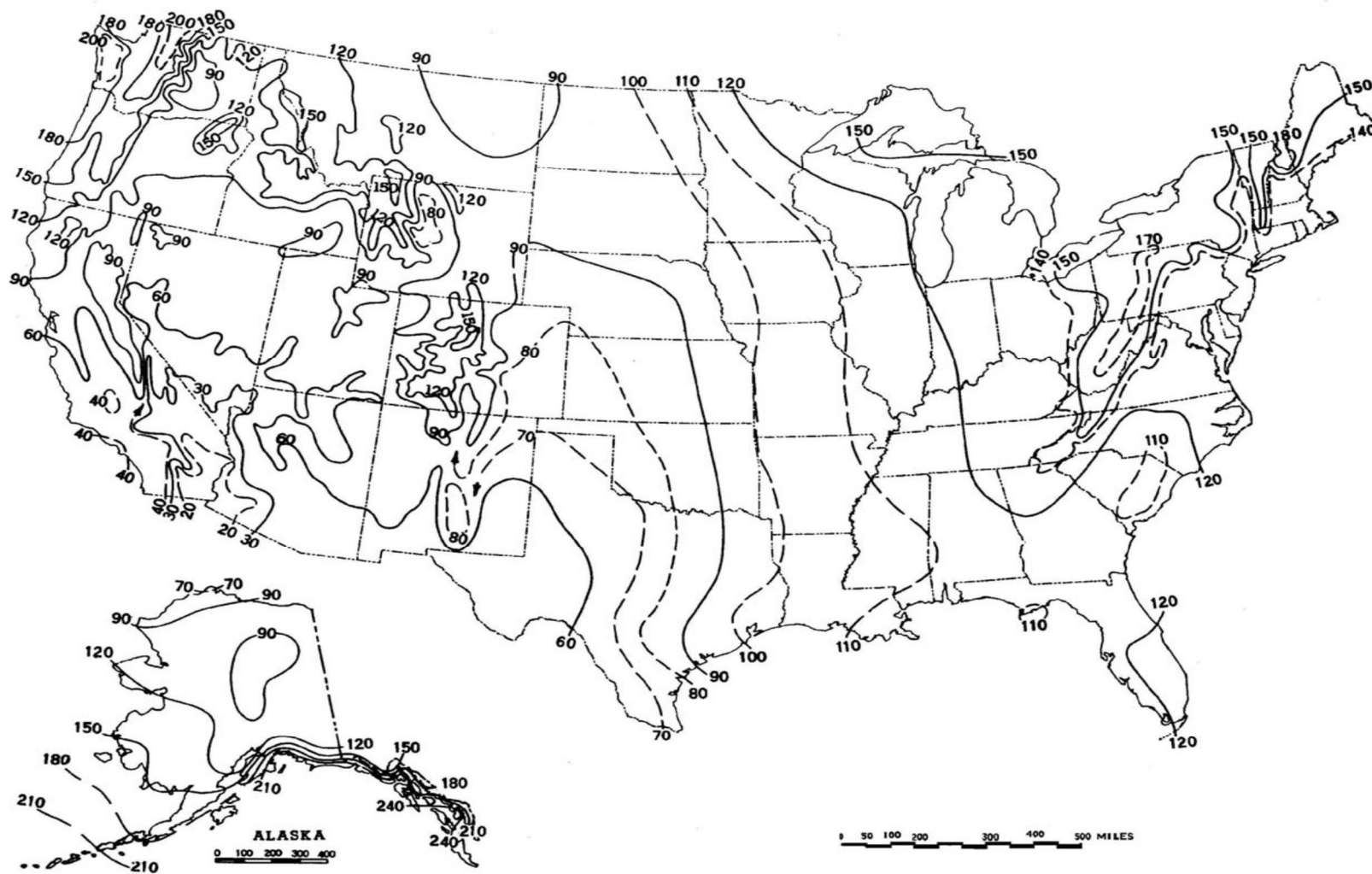


Figure 5-1. Mean Number of Days in the Year with Precipitation of 0.01 Inches or More

### 5.3 Emissions Calculation

The total emissions from the operation of on-road vehicles are the sum of the emissions from the vehicle exhaust and fugitive PM from road dust. There are three accepted methods for estimating vehicle emissions. Method 1, which is the simplest and preferred method, uses Air Force/State/Territory composite EFs. Method 2 uses POV and GOV fleet mix from recent traffic studies. Method 3 uses the typical USAF POV and GOV fleet mix from Table 5-2. No matter the method used for estimation, **POV and GOV emissions are calculated independently.**

#### 5.3.1 Vehicle Exhaust Emissions – Typical Vehicle Operation

Calculating emissions from vehicle exhaust is dependent on the VMT and appropriate EF. Vehicle exhaust emissions are directly dependent on the vehicle mix at the installation. There are two circumstances that determine the method for calculating vehicle exhaust emissions – when the specific vehicle mix is known, or when it is unknown. If the vehicle mix is known, that data may be used for emissions calculations. If the vehicle mix is unknown, the mix from Table 5-2 may be assumed. Calculating these emissions is discussed below.

##### 5.3.1.1 Method 1: Using Air Force/State/Territory Composite Emission Factors (Preferred Method)

This is the preferred method for emissions estimates because it is the simplest method to use. The EFs used for this method are selected based on: (1) the emission inventory year, and (2) the state/territory in which the installation is located. The Air Force/State/Territory composite EFs ( $EF(Pol)_{Comp}$ ) were derived using the assumed vehicle mix as provided in Table 5-2, and Table 5-9 through Table 5-18 for most states. For the State of California, the composite values are provided in Table 5-24 through Table 5-33. Use Table 5-39 and Table 5-40 for OCONUS installations. Note that the tables are separated into POV and GOV since the EFs account for the vehicle mix which differ between these two classifications. Also note that these EFs **have already been adjusted** to reflect the reduction in emissions because of vehicles that operate on alternative fuels. Therefore, no additional calculation is needed to account for the reduction in emissions from the use of alternative fuels. Emissions calculation using the adjusted EFs is estimated as follows:

$$E(Pol)_{Total} = VMT_{Total} \times EF(Pol)_{Comp} \times 0.002205$$

Equation 5-3

Where,

- E(Pol)<sub>Total</sub>** = Total annual emissions of specific pollutant from vehicle exhaust (lb/yr)
- VMT<sub>Total</sub>** = Total annual vehicle miles traveled for all POV or GOV (mi/yr). This should be available for GOVs through records or estimated for GOVs and POVs using Equation 5-4 and Equation 5-5 respectively. **Note that this includes both paved and unpaved roads, if applicable.**
- EF(Pol)<sub>Comp</sub>** = Air Force/State/Territory composite EF for specific pollutant (g/mi) from Table 5-9 through Table 5-18 and for California, Table 5-24 through Table 5-33.
- 0.002205** = Factor for converting grams to pounds (lb/g)

Emissions from GOVs or POVs are calculated using the general formula provided in Equation 5-3. **These steps must be completed independently for each pollutant of concern.** Note GOVs and POVs should not be combined, **GOV and POV emissions must be calculated independently.** Due to the complexity of calculating on-road vehicle emissions, the following steps are recommended for use as a guideline for data collection and emissions calculations:

**Step 1 – Gather fleet data.** The first step is to determine the number of POVs (N) and GOVs (N) operating on base. Also, the total vehicle miles traveled (VMT<sub>Total</sub>) or average vehicle miles traveled (AVM) for GOVs should be recorded. This data often can be provided or estimated by the Security Forces Squadron (from the Pass & Registration section) and/or the Military Personnel Flight (MPF). For POVs, VMT<sub>Total</sub> is calculated using Equation 5-5 while Equation 5-4 may be used, if necessary, to calculate VMT<sub>Total</sub> for GOVs.

#### Vehicle Miles Traveled for GOVs:

The total vehicle miles traveled (VMT<sub>Total</sub>) for GOVs is the sum of all the miles put on GOVs during the inventory period. These values should be available through records kept by the base transportation organization or directly from the organizations that operate and/or maintain the vehicles. Alternatively, VMT<sub>Total</sub> may be estimated if it is assumed that each vehicle category traveled the same distance per year, as shown:

$$VMT_{Total} = AVM \times N$$

**Equation 5-4**

Where,

- VMT<sub>Total</sub>** = The total vehicle miles travelled for all GOV vehicles (mi/yr)
- AVM** = The annual average miles travelled per vehicle (mi/yr)
- N** = The number of vehicles – specifically GOV in this case - at the installation

Vehicle Miles Traveled for POVs:

For POVs, the suggested method for estimating  $VMT_{Total}$  is to assume that each POV in operation on an installation travels twice the distance from the main gate to the population centroid of the installation. Not every person will operate their vehicle every day of the year. It is assumed that the majority of POVs will be driven during the workweek. Additionally, a statistical analysis of available Employee-Certification and Reporting System ECARS data revealed that typically only 70% of the installation population operates their vehicles on the installation during the week. Using this information, the  $VMT_{Total}$  for POVs is estimated as follows:

$$VMT_{Total} = D \times 520 \times 0.7 \times P$$

Equation 5-5

Where,

- D** = One-way distance from the main gate to the population centroid of the installation (miles/trip)
- 520** = Factor for converting the number of miles per trip to miles per year (trips/year)
- 0.7** = Fraction of the installation population that operate their vehicle during the week
- P** = Installation population

In Equation 5-5, the “520” multiplying factor was derived as follows:

$$2 \frac{\text{trips}}{\text{day}} \times 5 \frac{\text{days}}{\text{week}} \times 52 \frac{\text{weeks}}{\text{yr}} = 520 \frac{\text{trips}}{\text{yr}}$$

**Step 2 – Select emission factors.** These are provided in Table 5-9 through Table 5-18 for all states but California, Table 5-24 through Table 5-33 for California, or Table 5-39 and Table 5-40 for OCONUS installations.

**Step 3 – Calculate emissions.** Emissions of each pollutant (and *classification*) are calculated *independently* using Equation 5-3.

### 5.3.1.2 Method 2: Using Specific Vehicle Mix Data

This method is more intensive than the preferred method given above. However, it may be desirable if a recent traffic study conflicts with the typical vehicle mix provided, or if emissions from each vehicle category are required. The EFs used for this method are selected based on: (1) the emission inventory year, (2) the state in which the installation is located, and (3) the vehicle category (LDGV, LDDV, etc.). The EFs used for this method, labeled as the term  $EF(Pol)_i$ , are provided in Table 5-19 through Table 5-23 for most states, or Table 5-34 through Table 5-38 for California. To account for the reduction in emissions due to the use of alternative fuels, the

appropriate emissions reduction factor, as given in Table 5-7, is employed. Emissions are estimated using the VMT for each vehicle category and summed as follows:

$$E(\text{Pol})_{\text{Total}} = \sum_{i=1}^n \left\{ VMT_i \times EF(\text{Pol})_i \times \left[ 1 - \frac{FERF(\text{Pol})}{100} \right] \times 0.002205 \right\}$$

Equation 5-6

Where,

- E(Pol)<sub>Total</sub>** = Total annual emissions of specific pollutant from vehicle exhaust (lb/yr)  
**VMT<sub>i</sub>** = Total annual vehicle miles traveled for each vehicle class (mi/yr). This should be available for GOVs through records and estimated for POVs using Equation 5-5. **Note that this includes both paved and unpaved roads, if applicable.**  
**EF(Pol)<sub>i</sub>** = Air Force/State/Territory emission factor for specific pollutant (g/mi)  
**FERF(Pol)** = Pollutant-specific fuel emission reduction factor, as applicable (%). This is given in Table 5-7.  
**100** = Factor converting percent to fraction  
**0.002205** = Factor for converting grams to pounds (lb/g)

To accurately account for the reduction of emissions using alternative fuels, the VMT<sub>i</sub> for each hybrid and CNG vehicle should be known and treated as a separate vehicle category. If the annual VMT for each vehicle category is not known, the following equation may be used to approximate VMT for each specific vehicle category (VMT<sub>i</sub>):

$$VMT_i = AVM_i \times n_i = AVM_i \times N \times \frac{MIX_i}{100}$$

Equation 5-7

Where,

- AVM<sub>i</sub>** = Average annual vehicle miles traveled by each vehicle category (mi/yr)  
**n<sub>i</sub>** = Number of vehicles in a specific vehicle category  
**N** = Total number of vehicles, POV or GOV  
**MIX<sub>i</sub>** = Vehicle mix for a specific vehicle category (%)

To quantify the emissions from on-road vehicles using this method, the following process is recommended:

**Step 1 – Gather fleet data.** Data required to calculate vehicle emissions typically includes vehicle category, model year, and vehicle miles traveled (VMT<sub>i</sub>) during the year in question.

- a. GOV Fleet MIX Data:** If a GOV is driven both on and off base during the inventory year,



an estimate must be made to apportion the number of miles driven between off and on installation miles. Figure 5-2 provides a sample form that can be used to collect and organize GOV data by vehicle category for use in emission calculations. The best way to collect GOV information is to provide blank forms for each vehicle category to the installation organization(s) responsible for managing GOVs.

- b. POV Fleet MIX Data:** Prior to conducting an AEI that includes POVs, it is recommended that the individual responsible for preparing the mobile source emission inventory contacts the Base Development and/or Community Planning sections of the Civil Engineering Squadron. This is to determine if a traffic survey has been conducted recently at the installation, which may contain information that will be useful in calculating POV emissions.

If a recent traffic survey is not available, and resources do not allow the conduct of a new traffic survey, data provided by the Security Forces Squadron (from the Pass & Registration section) and/or the Military Personnel Flight (MPF) can be used to estimate POV fleet data. Types of data that can usually be obtained from the Security Forces Squadron and/or MPF include:

- 1) The estimated average number of registered POVs at the installation during the applicable inventory year;
- 2) The estimated percentage of registered vehicles that fall under the seven vehicle categories;
- 3) The estimated distance (in miles) of the average POV travels on the installation during a typical weekday and weekend day; and
- 4) The estimated number of non-registered vehicles that travel on the installation during a typical weekday and weekend day.

Figure 5-3 at the end of this chapter provides a sample form that can be used to collect and organize POV data for use in emission calculations.

An alternative approach to obtaining vehicle registration information may be available at some installations. Some installations may be able to provide a listing of the vehicles contained in their databases.

**Step 2 – Group vehicle categories.** Upon gathering fleet data, group together all vehicles based on the USAF vehicle categories (i.e., LDGV, LDDV, LGDT, LDDT, HDGV, HDDV, MC, LDGV (H), LDGT(H), LDGV(C), LDGT(C), and HDGV(C)). Record the number of vehicles ( $n_i$ ) and total annual miles traveled ( $VMT_i$ ) for each vehicle category.

- a.** If  $VMT_i$  is unknown, it may be estimated using **Equation 5-7**.

$$VMT_i = AVM_i \times n_i$$

- b. If there is insufficient fleet data to provide the number of vehicles ( $n_i$ ) for each vehicle category yet the total number of vehicles and the relative vehicle mix ( $MIX_i$ ) for each specific vehicle category is known, use **Equation 5-7** to approximate  $n_i$ :

$$n_i = N \times \frac{MIX_i}{100}$$

**Step 3 – Select emission factors.** The appropriate EFs are selected based on the vehicle category, the calendar year you are performing the emissions calculation, and the installation's location. Vehicle exhaust EFs ( $EF(Pol)_i$ ) are selected from Table 5-19 through Table 5-23 for most states, Table 5-34 through Table 5-38 for California, or Table 5-41 through 5-42 for OCONUS.

**Step 4 – Calculate emissions.** For vehicle exhaust emissions, calculate the emissions for each individual vehicle category ( $EP(Pol)_i$ ) and sum these values for the total vehicle emissions for that pollutant. Pollutant emissions for each vehicle category are calculated using Equation 5-6.

### 5.3.1.3 Method 3: Using USAF Typical Vehicle Mix Data

Another method for calculating on-road vehicle emissions is to calculate the emissions from each vehicle category using the typical USAF vehicle mix. The method of calculation is like that of calculating emissions using specific vehicle mix data. The EFs used for this method are selected based on: (1) the emission inventory year, (2) the state in which the installation is located, and (3) the vehicle category (LDGV, LDDV, etc.). Emissions are estimated via this method using a slightly modified Equation 5-3 by substituting the correct EF as shown:

$$E(Pol)_{Total} = VMT_{Total} \times EF(Pol)_{Total} \times 0.002205$$

**Equation 5-8**

Where,

$EF(Pol)_{Total}$  = Total adjusted on-road vehicle exhaust emission (lb/yr). This is calculated using Equation 5-9

The total adjusted on-road vehicle EF considers any reduction in emissions because of alternative fuel use. This is calculated as follows:

$$EF(Pol)_{Total} = \sum_{i=1}^n \left\{ \left( \frac{MIX_i}{100} \right) \times EF(Pol)_i \times \left[ 1 - \frac{FERF(Pol)}{100} \right] \right\}$$

**Equation 5-9**

The total vehicle miles traveled ( $VMT_{Total}$ ) is the sum of the average miles traveled for all vehicle categories as shown:

$$VMT_{Total} = \sum_{i=1}^n \left( AVM_i \times N \times \frac{MIX_i}{100} \right)$$

**Equation 5-10**

Emissions from vehicles are calculated by applying the equations in Method 2 using the typical POV or GOV vehicle mix data from Table 5-2. **These steps must be completed independently for each pollutant of concern.** GOVs and POVs should not be combined; **GOV and POV emissions must be calculated independently.** Due to the complexity of calculating on-road vehicle emissions, the following steps are recommended for use as a guideline for data collection and emissions calculations:

**Step 1- Gather fleet data.** In this case fleet data or a traffic survey for the base is not available. Therefore, obtain the total number (N) of vehicles (POV or GOV) driving on base and the overall average annual vehicle miles traveled (AVM) for all vehicle categories. The data can often be provided or estimated by the Security Forces Squadron (from the Pass & Registration section) and/or the Military Personnel Flight (MPF) can be used to estimate POV fleet data. Types of data that can usually be obtained from the Security Forces Squadron and/or MPF include: 1) The estimated average number of registered POVs and/or GOVs at the installation during the applicable inventory year; 2) the estimated distance (in miles) of the average POV travels on the installation during a typical weekday and weekend day; and 3) the estimated number of non-registered vehicles that travel on the installation during a typical weekday and weekend day.

An alternative approach to obtaining vehicle registration information may be available at some installations. Some installations may be able to provide a listing (preferably in both electronic and hardcopy format) of the vehicles contained in their databases. At a minimum, the listing should provide the number of registered vehicles.

**Step 2 - Group vehicle categories.** Upon gathering fleet data on the total number (N) of vehicles (POV or GOV) driving on base and overall average AVM, obtain and record the typical vehicle mix values ( $MIX_i$ ) from Table 5-2 for each vehicle category. Then, assuming all vehicle categories traveled the same distance per year, calculate the total annual vehicle miles traveled ( $VMT_{Total}$ ) for all vehicle categories combined with Equation 5-4.

**Step 3 - Select emission factors.** Selection of the appropriate EF is based on the vehicle category, the calendar year you are performing the emissions calculation, the installation's location (i.e., the

state it is in), and the installation's altitude. The EFs are selected from Table 5-19 through Table 5-23 (Table 5-34 through Table 5-38 for California or Table 5-41 through 5-42 for OCONUS).

Once the appropriate pollutant-specific EFs ( $EF(\text{Pol})_i$ ) for each vehicle category are obtained, calculate the total composite EF using Equation 5-9.

**Step 4 - Calculate emissions.** The total pollutant emissions from all vehicle categories ( $EP(\text{Pol})_{\text{Total}}$ ) for on-road emissions are each calculated using Equation 5-8.

### 5.3.2 Vehicle Exhaust Emissions (Idling)

Calculating idling emissions is like the calculation of on-road vehicle emissions provided above with slight modifications to the equations supplied. The primary difference is that the EFs for idling vehicles are presented in a g/hr format, which means the time spent in idle mode must be known (or estimated). Idling emissions from typical on-road vehicle operation are already addressed in the previous section above. Estimating the emissions from vehicle idling is performed using one of two methods: where the vehicle mix is known, and where the typical USAF vehicle mix is used. **This section describes the calculation of theoretical emissions from idling vehicles for NEPA and intersection modeling, not for a mobile AEI.**

#### 5.3.2.1 Method A: Using Specific Vehicle Mix Data

If necessary, emissions may be calculated using a specific vehicle mix different from the one provided in Table 5-2. This method may be desirable if a recent traffic study conflicts with the typical vehicle mix provided. The EFs used for this method are selected based on the vehicle category (LDGV, LDDV, etc.). The EFs used for this method ( $EF(\text{Pol})_i$ ) are provided in Table 5-6. Idling emissions are estimated as follows:

$$E(\text{Pol})_{\text{Total}} = \sum_{i=1}^n \left\{ VIT_i \times EF(\text{Pol})_i \times \left[ 1 - \frac{FERF(\text{Pol})}{100} \right] \times 0.002205 \right\}$$

Equation 5-11

Where,

- $E(\text{Pol})_{\text{Total}}$  = Total theoretical emissions of specific pollutant from vehicle idling (lb/yr)
- $VIT_i$  = Annual vehicle idling time (hr/yr)
- $EF(\text{Pol})_i$  = Idling emission factor for a specific pollutant (g/hr). This is provided in Table 5-6.

The vehicle idling time is the most difficult parameter to determine. Depending on the proposed action, idling times of varying lengths may be recommended for each vehicle *category* and/or

*classification*. The idling time for each vehicle category may be estimated using an average idling time as shown:

$$VIT_i = AVIT_i \times n_i = AVIT_i \times N \times \frac{MIX_i}{100}$$

**Equation 5-12**

Where,

**AVIT<sub>i</sub>** = Average annual vehicle idling time (hr/yr)

### 5.3.2.2 Method B: Using Air Force Typical Vehicle Mix Data

If the specific vehicle mix data is not available from a recent traffic study, the typical vehicle mix from Table 5-2 may be assumed. The EFs used for this method are selected based on the vehicle category (LDGV, LDDV, etc.). The EFs used for this method ( $EF_{Idle}(Pol)_i$ ) are provided in Table 5-6. Theoretical emissions from vehicle idling is estimated as follows:

$$E(Pol)_{Total} = VIT_{Total} \times EF(Pol)_{Total} \times 0.002205$$

**Equation 5-13**

Where,

**VIT<sub>Total</sub>** = Total annual vehicle idling time for all POV or GOV (hr/yr)

**EF(Pol)<sub>Total</sub>** = Total adjusted idling emission factor (g/hr). This is calculated by Equation 5-14.

The total adjusted idling EF considers any reduction in emissions because of alternative fuel use. This is calculated as shown:

$$EF(Pol)_{Total} = \sum_{i=1}^n \left\{ EF(Pol)_i \times \frac{MIX_i}{100} \times \left[ 1 - \frac{FERF(Pol)}{100} \right] \right\}$$

**Equation 5-14**

The total vehicle idling time ( $VIT_{Total}$ ) is the sum of the average idling time for all vehicle categories as shown:

$$VIT_{Total} = \sum_{i=1}^n \left( AVIT_i \times N \times \frac{MIX_i}{100} \right)$$

**Equation 5-15**

Equation 5-15 may be simplified if it is assumed that each vehicle category will idle for the same amount of time per year, as shown below:

$$VIT_{Total} = AVIT \times N$$

Equation 5-16

In the absence of average vehicle idling time (AVIT) data, contact Base CE for assistance in estimating this value.

### 5.3.3 Fugitive PM Emissions

Particulate emissions are generated from vehicle exhaust and are described in the previous sections. Fugitive particulate emissions, however, are generated from the operation of on-road vehicles across a paved or unpaved road surface. The amount of particulate generated is a function of the road surface (paved or unpaved) and the total vehicle miles traveled ( $VMT_{Total}$ ). The EFs are selected from Table 5-8 based on: (1) the road surface (paved or unpaved); and (2) vehicle classification (POV or GOV). The selected EFs must be corrected based on the amount of days in the year with precipitation of 0.01 inches or more using the appropriate equation (either Equation 5-1 or Equation 5-2) and on the road surface. Using the corrected EF for paved ( $EF(Pol)_{CP}$ ) and unpaved ( $EF(Pol)_{CU}$ ) roads, fugitive PM emissions are calculated as follows:

$$E(Pol)_{Total} = VMT_{Total} \times \left\{ \left[ \frac{\%VMT_P}{100} \times EF(Pol)_{CP} \right] + \left[ \frac{\%VMT_U}{100} \times EF(Pol)_{CU} \right] \right\} \times 0.002205$$

Equation 5-17

Where,

- $E(Pol)_{Total}$  = Total annual emissions of fugitive PM from on-road vehicles (lb/yr)
- $\%VMT_P$  = Percent of total miles driven on paved roads (%)
- $\%VMT_U$  = Percent of total miles driven on unpaved roads (%)

### 5.3.4 VOC Speciation

On-road vehicles have the potential to produce a significant amount of air pollutants released to the atmosphere. The amount of pollution is a function of the number of on-road vehicles, the average number of miles driven, the time of year, the content of the fuel used, and even the average idling time. The large number of variables impacting air emissions from on-road vehicles increases the complexity of quantifying their emissions. However, measurements are continually being taken to develop more accurate air emission estimates. Individual VOCs may be estimated using the weight fractions of each chemical to the total emitted VOC.

The weight fractions provided in this document were determined using test data from a variety of sources, including the EPA's *SPECIATE* database. The emission profiles used to determine the VOC weight percent are assumed to be representative of the vehicle category's emissions.

However, this information should only be used when no alternative emission profiles are available. The average weight percent of individual pollutants were calculated as follows:

$$P_{Pol} = \frac{A_{Pol}}{AVOC_{Total}}$$

Equation 5-18

Where,

- $P_{Pol}$  = Weight percent of a given pollutant (%)
- $A_{Pol}$  = Individual pollutant emission factor (mg/mi)
- $AVOC_{Total}$  = Total VOC emission factor (mg/mi)

Speciated VOCs are calculated by taking the product of the total VOCs and the weighted percentage of the individual VOC as follows:

$$E_{Pol} = E_{VOC} \times \frac{P_{Pol}}{100}$$

Equation 5-19

Where,

- $E_{Pol}$  = Emissions of speciated VOC (lb/yr)
- $100$  = Factor for converting percent to a fraction (%)
- $E_{VOC}$  = Emissions of total VOC (lb/yr)

The percentages of each VOC to total VOC are provided in Table 5-41. Note that the light duty gas vehicles, trucks, and heavy-duty gas vehicles (LDGV, LDGT, and HDGV) are not further subdivided into hybrid and CNG fueled vehicles. To calculate the emissions specific to these vehicles, apply the vehicle mix (use the default values if no onsite data is available).

## 5.4 Information Resources

Information required for calculating emissions from GOVs can usually be obtained from the installation transportation organization as it typically maintains records on most, if not all, GOVs assigned to the installation. At some installations, it may also be necessary to obtain information directly from the organizations that use and/or maintain the vehicles. For example, the Fire Department may need to be contacted to obtain information specific to fire trucks and rescue vehicles.

In some cases, it may be necessary to obtain and review data contained in the installation's vehicle maintenance index file (VMIF), on-line vehicle interactive management system (OLVIMS) report, or equivalent vehicle information management system to verify vehicle class/type as

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some installations do not use the same classification system used by the EPA. Some facilities may have a cross-reference tool with management codes that will assist in interpreting how vehicle usage is being tracked (e.g., miles, hours, and kilometers).

Most information required to calculate POV emissions may be obtained from the Security Forces Squadron. The Pass & Registration section of the base Security Forces Squadron usually maintains computer records on all POVs registered at the installation. Some installations perform vehicle registration at MPF. The office that handles vehicle registrations (Pass & Registration or MPF) is also in a good position to survey personnel on their vehicle usage. Since the Security Forces Squadron is responsible for staffing the installation gates, they are usually the best source of information on non-registered vehicles.

If the POV information needed to calculate vehicle emissions cannot be obtained from the Security Forces Squadron, it might be necessary to survey a representative number of installation personnel to obtain the required information. It is also highly recommended that personnel conducting the AEI check with the Base Development and/or Community Planning sections of the Civil Engineering Squadron to determine whether any recent traffic surveys have been conducted.

For purposes of estimating the length of typical on-installation POV trips, consider the trip length in terms of the mileage from the main gate to a common on-installation destination and back. For instance, if most POVs are believed to be traveling to the Base Exchange, the Commissary, or the Medical Clinic, estimate the distance from the main gate to those locations. In such instances, it may be assumed that a median round-trip distance of 3-4 miles is appropriate for use. However, it may also be necessary to estimate vehicle travel distances for individuals who travel on and off the installation more than once per day, such as personnel who leave during lunchtime. In the absence of installation-specific survey data, it can be **conservatively assumed that 5% of installation personnel will travel off installation during lunchtime**. Since this is a second trip through the gate, you should assume the daily on-installation mileage is doubled for those individuals. If installation organizations are unable to provide required data, it may be possible to obtain trip length and driver behavior data that can be extrapolated to on-installation conditions from the local metropolitan planning office (MPO).

## 5.5 Example Problems

### 5.5.1 Problem 1 – Calculating POV and GOV Emissions – Method 1

A USAF base is inventorying its calendar year (CY) 2020 CO emissions for their POVs and GOVs operated by the facility during the year. Data indicates that there is a total of 422 POVs and 38 GOVs and all vehicles traveled an average of 4,563 miles each. Calculate CO emissions for CY2020 if the Base is in Alabama.



**Step 1 – Gather fleet data.** The data required to calculate emissions is provided in the problem statement. This information includes the number of POVs ( $N_{POV} = 422$ ), the number of GOVs ( $N_{GOV} = 38$ ), and the average miles traveled for each vehicle ( $AVM = 4,563$  miles/yr).

Next, calculate total vehicle miles traveled ( $VMT_{Total}$ ). Using the number of POVs and GOVs, the average vehicle miles traveled (AVM) and Equation 5-4, the  $VMT_{Total}$  is calculated as follows:

$$VMT_{Total} = AVM \times N$$

For POVs

$$VMT_{Total-POV} = 4,563 \frac{\text{miles}}{\text{yr}} \times 422 = 1,925,586 \frac{\text{miles}}{\text{yr}}$$

For GOVs:

$$VMT_{Total-GOV} = 4,563 \frac{\text{miles}}{\text{yr}} \times 38 = 173,394 \frac{\text{miles}}{\text{yr}}$$

**Step 2 – Select emission factors.** According to Table 5-9, for CY2020 in Alabama, the CO EF ( $EF(CO)_{Alabama}$ ) for POVs is **4.534 g/mi**. Similarly, the CO EF ( $EF(CO)_{Alabama}$ ) for GOVs, according to Table 5-14, is **4.213 g/mi**.

**Step 3 – Calculate emissions.** Emissions are calculated using the adjusted EFs from Step 2, the  $VMT_{Total}$  calculated from Step 1, and Equation 5-3 as shown:

$$E(Pol)_{Total} = VMT_{Total} \times EF(Pol)_{Total} \times 0.002205$$

For POVs:

$$E(CO)_{Total} = 1,925,586 \frac{\text{miles}}{\text{yr}} \times 4.534 \frac{\text{g}}{\text{mi}} \times 0.002205 \frac{\text{lb}}{\text{g}}$$

$$E(CO)_{Total} = 19,251.00 \frac{\text{lb}}{\text{yr}}$$

For GOVs:

$$E(CO)_{Total} = 173,394 \frac{\text{miles}}{\text{yr}} \times 4.213 \frac{\text{g}}{\text{mi}} \times 0.002205 \frac{\text{lb}}{\text{g}}$$

$$E(CO)_{Total} = 1,610.77 \frac{\text{lb}}{\text{yr}}$$

### **5.5.2 Problem 2 – Calculating GOV Emissions – Method 2**

A USAF base is inventorying its CY2020 CO emissions for their 15 GOVs operated by the facility during the year. The Air Force Base is in Alabama. For this example, vehicle data was collected and organized by vehicle category using the form shown in Figure 5-2.

**Step 1 – Gather fleet data and Step 2 – Group vehicle categories.** Since the data was available from the Environmental manager, steps 1 and 2 are combined using the form from Figure 5-2.

Installation Name: Anytown AFB			Inventory Year: 2020	
Responsible Organization (Name and Office Symbol):				
POC (Name, Phone #, and email):				
Vehicle Category:				
Vehicle Identification Number (VIN)	Vehicle Description	Bldg. Number	Model Year	Miles Driven (mi/yr)
<b>LDGV</b>				
Vehicle #1	Sedan	Bldg. 45-2	1999	4,900
Vehicle #10	Sedan	Bldg. 45-2	1999	5,670
Vehicle #11	Sedan	Bldg. 15-1	2004	4,368
Vehicle #15	Sedan	Bldg. 23-6	2002	6,670
Vehicle #8	Sedan	Bldg. 15	1998	2,700
Vehicle #3	Sedan	Bldg. 1	2004	7,400
Vehicle #5	Sedan	Bldg. 10	1997	1,730
Vehicle #9	Sedan	Bldg. 10	1997	1,450
		<b>Average</b>	<b>2000</b>	<b>4,361</b>
		<b>Total</b>		<b>34,888</b>
<b>LDGT</b>				
Vehicle #6	Pickup	Bldg. 15	2000	4,600
Vehicle #7	Pickup	Bldg. 15	2000	5,200
Vehicle #13	Van	Bldg. 15	1999	6,500
Vehicle #14	SUV	Bldg. 15	2003	3,200
		<b>Average</b>	<b>2000</b>	<b>4,875</b>
		<b>Total</b>		<b>19,500</b>
<b>HDGV</b>				
Vehicle #2	Flatbed	Bldg. 15	1998	4,450
		<b>Average</b>	<b>1998</b>	<b>4,450</b>
		<b>Total</b>		<b>4,450</b>
<b>LDDT</b>				
Vehicle #4	Pickup	Bldg. 1	2004	4,300
		<b>Average</b>	<b>2004</b>	<b>4,300</b>
		<b>Total</b>		<b>4,300</b>
<b>HDDV</b>				
Vehicle #12	Fire Truck	Bldg. 45-2	2002	5,300
		<b>Average</b>	<b>2002</b>	<b>5,300</b>
		<b>Total</b>		<b>5,300</b>

**Step 3 – Select emission factors:** For vehicles in CY 2020 in Alabama, the CO EFs for each vehicle category are given in Table 5-19. The EFs are provided in the table below.

Vehicle Category	CO Emission Factor (g/mi)
LDGV	3.351
LDGT	4.515
HDGV	15.011
LDDV	2.584
LDDT	4.394
HDDV	1.678
MC	13.109

**Step 4 – Calculate emissions.** No information was provided regarding whether any of the vehicles operated on alternative fuel. Using the vehicle miles traveled for each vehicle category ( $VMT_i$ ) from the fleet data, the EFs recorded in Step 3, and Equation 5-6, the emissions are first calculated for each vehicle category as follows:

$$E(Pol)_{Total} = \sum_{i=1}^7 \left\{ VMT_i \times EF(Pol)_i \times \left[ 1 - \frac{FERF(Pol)}{100} \right] \times 0.002205 \right\}$$

$$E(CO)_{LDGV} = 34,888 \frac{mi}{yr} \times 3.351 \frac{g}{mi} \times \left[ 1 - \frac{0\%}{100\%} \right] \times 0.002205 \frac{lb}{g} = 257.79 \frac{lb}{yr}$$

$$E(CO)_{LDGT} = 19,500 \frac{mi}{yr} \times 4.515 \frac{g}{mi} \times \left[ 1 - \frac{0\%}{100\%} \right] \times 0.002205 \frac{lb}{g} = 194.13 \frac{lb}{yr}$$

$$E(CO)_{HDGV} = 4,450 \frac{mi}{yr} \times 15.011 \frac{g}{mi} \times \left[ 1 - \frac{0\%}{100\%} \right] \times 0.002205 \frac{lb}{g} = 147.29 \frac{lb}{yr}$$

$$E(CO)_{LDDV} = 0 \frac{mi}{yr} \times 2.584 \frac{g}{mi} \times \left[ 1 - \frac{0\%}{100\%} \right] \times 0.002205 \frac{lb}{g} = 0.0 \frac{lb}{yr}$$

$$E(CO)_{LDDT} = 4,300 \frac{mi}{yr} \times 4.394 \frac{g}{mi} \times \left[ 1 - \frac{0\%}{100\%} \right] \times 0.002205 \frac{lb}{g} = 41.66 \frac{lb}{yr}$$

$$E(CO)_{HDDV} = 5,300 \frac{mi}{yr} \times 1.678 \frac{g}{mi} \times \left[ 1 - \frac{0\%}{100\%} \right] \times 0.002205 \frac{lb}{g} = 19.61 \frac{lb}{yr}$$

$$E(CO)_{MC} = 0 \frac{mi}{yr} \times 13.109 \frac{g}{mi} \times \left[ 1 - \frac{0\%}{100\%} \right] \times 0.002205 \frac{lb}{g} = 0.0 \frac{lb}{yr}$$

Finally, the total CO emissions are calculated by summing the contributing CO emissions from each vehicle category.

$$E(Pol)_{Total} = \sum_{i=1}^7 E(Pol)_i$$

$$E(CO)_{TOTAL} = (257.79 + 194.13 + 147.29 + 0 + 41.66 + 19.61 + 0) \frac{lb}{yr}$$

$E(CO)_{TOTAL} = 660.48 \frac{lb}{yr}$
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### 5.5.3 Problem 3 – Calculating POV Emissions – Method 2

A USAF Base (located in Alabama) is conducting an emissions inventory to quantify CY 2020 emissions attributable to the operation of POVs. Using the information provided by the Security Forces Squadron, the following data was used to calculate the CY2020 emissions of CO from the operation of POVs. The collected POV data was organized by vehicle category using the form shown in Figure 5-3.

**Step 1 – Gather fleet data.** Fleet data information is provided in the figure following Step 2.

**Step 2 – Group vehicle categories.** The first step in grouping the vehicle categories is to calculate the estimated total number of vehicles (N) driving on base. Using the data provided in the form referenced in Step 1, the total number of POVs is estimated as follows:

$$N = Registered + Unregistered$$

$$N = 1,675 + 125 = \mathbf{1,800 vehicles}$$

<b>Installation Name:</b> Anytown AFB		<b>Inventory Year:</b> 2020
<b>Responsible Organization (Name and Office Symbol):</b> 58 CES/CD		
<b>POC (Name, Phone #, and email):</b> SSgt John Jones, DSN 234-5678		
<b>Question</b>	<b>Response</b>	
Can you provide the listing of all registered vehicles on base? (Y/N)? If so, be sure to include all specific information (make/model year, etc.) about the vehicles.	N	
What is the estimated average number of <u>registered</u> POVs at the installation during the inventory period?	1,675	
What is the estimated percentage of <u>registered</u> vehicles which travel on the installation during a typical weekday (Monday-Friday)?	75	
What is the estimated percentage of <u>registered</u> vehicles which travel on the installation during a typical weekend day (Saturday and Sunday)?	50	
What is the estimated distance the average POV travels on base during a typical weekday?	6 mi/day	
What is the estimated distance the average POV travels on base during a typical weekend day?	4 mi/day	
What is the estimated number of <u>non-registered</u> POVs which travel on base during a typical weekday?	125	
What is the estimated average model year of all POVs driven on base during the inventory year? (NOTE: This is not required if the average model years are listed below for each vehicle category)		
<b>Using registration information, provide an estimate of the percentage of <u>registered</u> POVs which fall under each of the 7 vehicle categories listed below.</b>		
<b>Vehicle Category</b>	<b>Category Description</b>	<b>Estimated % of Registered Vehicles</b>
LDGV	Light-Duty Gasoline Vehicles – All gasoline-powered passenger cars	36
LDDV	Light-Duty Diesel Vehicles – All diesel-powered passenger cars	1
LDGT	Light-Duty Gasoline Trucks – All smaller gasoline-powered trucks (0 to 8,500 lbs. GVWR)	54
LDDT	Light-Duty Diesel Trucks (LDDT) – All smaller diesel-powered trucks (0 to 8,500 lbs. GVWR)	1
HDGV	Heavy-Duty Gasoline Vehicles (HDGV) – All larger gasoline-powered vehicles (8,501 to >60,000 lbs. GVWR)	4
HDDV	Heavy-Duty Diesel Vehicles – All larger diesel-powered vehicles (10,001 to >60,000 lbs. GVWR)	3
MC	Motorcycles (MC) – All motorcycles (assumed to be gasoline powered)	1

Next, the number of vehicles which fall under each vehicle category are calculated under the assumption that the fleet mix for the unregistered vehicles is the same as for the registered

vehicles. By slightly modifying Equation 5-7, the number of vehicles for each category ( $n_i$ ) may be derived from the total number of vehicles ( $N$ ) and vehicle category mix ( $MIX_i$ ).

$$n_i = N \times \frac{MIX_i}{100}$$

$$n_{LDGV} = 1,800 \times \frac{36\%}{100\%} = \mathbf{648 \text{ Vehicles}}$$

$$n_{LDDV} = 1,800 \times \frac{1\%}{100\%} = \mathbf{18 \text{ Vehicles}}$$

$$n_{LDGT} = 1,800 \times \frac{54\%}{100\%} = \mathbf{972 \text{ Vehicles}}$$

$$n_{LDDT} = 1,800 \times \frac{1\%}{100\%} = \mathbf{18 \text{ Vehicles}}$$

$$n_{HDGV} = 1,800 \times \frac{4\%}{100\%} = \mathbf{72 \text{ Vehicles}}$$

$$n_{HDDV} = 1,800 \times \frac{3\%}{100\%} = \mathbf{54 \text{ Vehicles}}$$

$$n_{MC} = 1,800 \times \frac{1\%}{100\%} = \mathbf{18 \text{ Vehicles}}$$

Next, the average annual vehicle miles traveled ( $AVM_i$ ) is calculated. Using the data provided in the form above, the AVM traveled is calculated as follows:

$$AVM_i = \frac{52 \text{ weeks}}{\text{yr}} \times \left[ \left( \frac{75\%}{100\%} \times 6 \frac{\text{mi}}{\text{day}} \times 5 \frac{\text{day}}{\text{week}} \right) + \left( \frac{50\%}{100\%} \times 4 \frac{\text{mi}}{\text{day}} \times 2 \frac{\text{day}}{\text{week}} \right) \right]$$

$$AVM_i = \frac{52 \text{ weeks}}{\text{yr}} \times \left[ \left( 0.75 \times 6 \frac{\text{mi}}{\text{day}} \times 5 \frac{\text{day}}{\text{week}} \right) + \left( 0.5 \times 4 \frac{\text{mi}}{\text{day}} \times 2 \frac{\text{day}}{\text{week}} \right) \right]$$

$$AVM_i = \frac{52 \text{ weeks}}{\text{yr}} \times \left[ \left( 22.5 \frac{\text{mi}}{\text{week}} \right) + \left( 4 \frac{\text{mi}}{\text{week}} \right) \right]$$

$$AVM_i = \frac{52 \text{ weeks}}{\text{yr}} \times \left[ \left( 26.5 \frac{\text{mi}}{\text{week}} \right) \right] = \mathbf{1,378 \frac{\text{mi}}{\text{yr}}}$$

Finally, the total annual VMT for each category ( $VMT_i$ ) is calculated using Equation 5-7.

$$VMT_i = AVM_i \times n_i$$

$$VMT_{LDGV} = 1378 \frac{\text{mi}}{\text{yr}} \times 648 \text{ vehicles} = \mathbf{892,944 \frac{\text{mi}}{\text{yr}}}$$

$$VMT_{LDDV} = 1378 \frac{\text{mi}}{\text{yr}} \times 18 \text{ vehicles} = \mathbf{24,804 \frac{\text{mi}}{\text{yr}}}$$

$$VMT_{LDGT} = 1378 \frac{mi}{yr} \times 972 \text{ vehicles} = \mathbf{1,339,416} \frac{mi}{yr}$$

$$VMT_{LDDT} = 1378 \frac{mi}{yr} \times 18 \text{ vehicles} = \mathbf{24,804} \frac{mi}{yr}$$

$$VMT_{HDGV} = 1378 \frac{mi}{yr} \times 72 \text{ vehicles} = \mathbf{99,216} \frac{mi}{yr}$$

$$VMT_{HDDV} = 1378 \frac{mi}{yr} \times 54 \text{ vehicles} = \mathbf{74,412} \frac{mi}{yr}$$

$$VMT_{MC} = 1378 \frac{mi}{yr} \times 18 \text{ vehicles} = \mathbf{24,804} \frac{mi}{yr}$$

**Step 3 – Select emission factors.** EFs for vehicles in CY2020 are provided in Table 5-19. The CO EFs for a base in Alabama for 2020 are provided in the sub-table below.

Vehicle Category	CO Emission Factor (g/mi)
LDGV	3.351
LDGT	4.515
HDGV	15.011
LDDV	2.584
LDDT	4.394
HDDV	1.678
MC	13.109

**Step 4 – Calculate emissions.** Emissions are calculated using the vehicle miles traveled as calculated in Step 2, the EFs recorded in Step 3, and Equation 5-6. First the CO emissions from each vehicle category are individually calculated and then summed for total CO emissions. Also, since no information was provided regarding the use of alternative fuels, a FERF value of “0” is used.

$$E(Pol)_{Total} = \sum_{i=1}^n \left[ VMT_i \times EF(Pol)_i \times \frac{FERF(Pol)}{100} \times 0.002205 \right]$$

$$E(CO)_{LDGV} = 892,944 \frac{mi}{yr} \times 3.351 \frac{g}{mi} \times \left[ 1 - \frac{0\%}{100\%} \right] \times 0.002205 \frac{lb}{g} = \mathbf{6,597.92} \frac{lb}{yr}$$

$$E(CO)_{LDDV} = 24,804 \frac{mi}{yr} \times 2.584 \frac{g}{mi} \times \left[ 1 - \frac{0\%}{100\%} \right] \times 0.002205 \frac{lb}{g} = \mathbf{141.33} \frac{lb}{yr}$$

$$E(CO)_{LDGT} = 1,339,416 \frac{mi}{yr} \times 4.515 \frac{g}{mi} \times \left[ 1 - \frac{0\%}{100\%} \right] \times 0.002205 \frac{lb}{g} = \mathbf{13,334.66} \frac{lb}{yr}$$



$$E(\text{CO})_{LDDT} = 24,804 \frac{\text{mi}}{\text{yr}} \times 4.394 \frac{\text{g}}{\text{mi}} \times \left[1 - \frac{0\%}{100\%}\right] \times 0.002205 \frac{\text{lb}}{\text{g}} = \mathbf{240.32 \frac{\text{lb}}{\text{yr}}}$$

$$E(\text{CO})_{HDGV} = 99,216 \frac{\text{mi}}{\text{yr}} \times 15.011 \frac{\text{g}}{\text{mi}} \times \left[1 - \frac{0\%}{100\%}\right] \times 0.002205 \frac{\text{lb}}{\text{g}} = \mathbf{3,283.98 \frac{\text{lb}}{\text{yr}}}$$

$$E(\text{CO})_{HDDV} = 74,412 \frac{\text{mi}}{\text{yr}} \times 1.678 \frac{\text{g}}{\text{mi}} \times \left[1 - \frac{0\%}{100\%}\right] \times 0.002205 \frac{\text{lb}}{\text{g}} = \mathbf{275.32 \frac{\text{lb}}{\text{yr}}}$$

$$E(\text{CO})_{MC} = 24,804 \frac{\text{mi}}{\text{yr}} \times 13.109 \frac{\text{g}}{\text{mi}} \times \left[1 - \frac{0\%}{100\%}\right] \times 0.002205 \frac{\text{lb}}{\text{g}} = \mathbf{716.97 \frac{\text{lb}}{\text{yr}}}$$

The total CO emissions are calculated by summing the CO emissions from each contributing vehicle category:

$$E(\text{Pol})_{\text{Total}} = \sum_{i=1}^n E(\text{Pol})_i$$

$$E(\text{CO})_{\text{Total}} = (6,597.92 + 141.33 + 13,334.66 + 240.32 + 3,283.98 + 275.32 + 716.97) \frac{\text{lb}}{\text{yr}}$$

$$\boxed{E(\text{CO})_{\text{TOTAL}} = \mathbf{24,590.50 \frac{\text{lb}}{\text{yr}}}}$$

#### 5.5.4 Problem 4 – Calculating POV Emissions – Method 3

A USAF base is interested in determining the NO<sub>x</sub> generated by the operation of POVs driven on base. There are approximately 600 POVs that average 3,700 miles per year, but no vehicle studies have been performed to describe the vehicle mix. Using the typical USAF vehicle mix, determine the NO<sub>x</sub> generated by the operation of these vehicles on base for CY2020. The base is in Colorado.

**Step 1 – Gather fleet data.** The problem statement provided information regarding the number of POVs ( $N = 600$ ) and the average vehicle miles driven by each vehicle ( $AVM = 3,700$  miles per year).

**Step 2 – Group vehicle categories.** The first step is to determine the total annual vehicle miles traveled ( $VMT_{\text{Total}}$ ) for all vehicles. The problem statement provided information regarding the average vehicle miles travelled for all POVs ( $AVM$ ), but not the average miles travelled for each vehicle category ( $AVM_i$ ). Therefore, the appropriate method for calculating the total annual vehicle miles travelled for all vehicles utilizes Equation 5-4 as shown:

$$VMT_{\text{Total}} = AVM \times N$$

$$VMT_{Total} = 3,700 \frac{mi}{yr} \times 600 = 2,220,000 \frac{mi}{yr}$$

Since the typical vehicle mix is assumed for this example, the vehicle mix (MIX<sub>i</sub>) for each category for POVs has been extracted from Table 5-2 and presented in the following sub-table.

Vehicle Category	POV Vehicle Mix (%)
LDGV	47.11
LDDV	0.89
LDGT	39.23
LDDT	0.35
HDGV	4.22
HDDV	3.06
MC	3.40
LDGV (H)	1.54
LDGT (H)	0.14
LDGV (C)	0.04
LDGT (C)	0.01
HDGV (C)	0.00

**Step 3 – Select emission factors.** The EFs for CY2020 POVs are presented in Table 5-19. The EFs for NO<sub>x</sub> in Colorado have been extracted from the table and presented in the following sub-table.

Vehicle Category	NO <sub>x</sub> Emission Factor (g/mi)
LDGV	0.224
LDDV	0.135
LDGT	0.360
LDDT	0.389
HDGV	1.093
HDDV	5.051
MC	0.833

**Step 4 – Calculate emissions.** First, a total composite EF is calculated by taking the product of the EF for each vehicle category (EF(Pol)<sub>i</sub> – from the sub-table in Step 3), the vehicle mix value for the corresponding vehicle category (MIX<sub>i</sub> – from the sub-table in Step 2), and the appropriate FERF from Table 5-7. These values are calculated as follows:

$$EF(Pol)_{Total} = \sum_{i=1}^n \left\{ EF(Pol)_i \times \frac{MIX_i}{100} \times \left[ 1 - \frac{FERF(Pol)}{100} \right] \right\}$$

$$EF(NO_x)_{LDGV} = 0.224 \frac{g}{mi} \times \left( \frac{47.11\%}{100\%} \right) \times \left[ 1 - \frac{0\%}{100\%} \right] = \mathbf{0.106} \frac{g}{mi}$$

$$EF(NO_x)_{LDDV} = 0.135 \frac{g}{mi} \times \left( \frac{0.89\%}{100\%} \right) \times \left[ 1 - \frac{0\%}{100\%} \right] = \mathbf{0.0012} \frac{g}{mi}$$

$$EF(NO_x)_{LDGT} = 0.360 \frac{g}{mi} \times \left( \frac{39.23\%}{100\%} \right) \times \left[ 1 - \frac{0\%}{100\%} \right] = \mathbf{0.141} \frac{g}{mi}$$

$$EF(NO_x)_{LDDT} = 0.389 \frac{g}{mi} \times \left( \frac{0.35\%}{100\%} \right) \times \left[ 1 - \frac{0\%}{100\%} \right] = \mathbf{0.0014} \frac{g}{mi}$$

$$EF(NO_x)_{HDGV} = 1.093 \frac{g}{mi} \times \left( \frac{4.22\%}{100\%} \right) \times \left[ 1 - \frac{0\%}{100\%} \right] = \mathbf{0.0461} \frac{g}{mi}$$

$$EF(NO_x)_{HDDV} = 5.051 \frac{g}{mi} \times \left( \frac{3.06\%}{100\%} \right) \times \left[ 1 - \frac{0\%}{100\%} \right] = \mathbf{0.155} \frac{g}{mi}$$

$$EF(NO_x)_{MC} = 0.833 \frac{g}{mi} \times \left( \frac{3.40\%}{100\%} \right) \times \left[ 1 - \frac{0\%}{100\%} \right] = \mathbf{0.0283} \frac{g}{mi}$$

$$EF(NO_x)_{LDGV(H)} = 0.224 \frac{g}{mi} \times \left( \frac{1.54\%}{100\%} \right) \times \left[ 1 - \frac{75\%}{100\%} \right] = \mathbf{0.00086} \frac{g}{mi}$$

$$EF(NO_x)_{LDGT(H)} = 0.360 \frac{g}{mi} \times \left( \frac{0.14\%}{100\%} \right) \times \left[ 1 - \frac{75\%}{100\%} \right] = \mathbf{0.00013} \frac{g}{mi}$$

$$EF(NO_x)_{LDGV(C)} = 0.224 \frac{g}{mi} \times \left( \frac{0.04\%}{100\%} \right) \times \left[ 1 - \frac{35\%}{100\%} \right] = \mathbf{0.00006} \frac{g}{mi}$$

$$EF(NO_x)_{LDGT(C)} = 0.360 \frac{g}{mi} \times \left( \frac{0.01\%}{100\%} \right) \times \left[ 1 - \frac{35\%}{100\%} \right] = \mathbf{0.00002} \frac{g}{mi}$$

$$EF(NO_x)_{HDGV(C)} = 1.093 \frac{g}{mi} \times \left( \frac{0.00\%}{100\%} \right) \times \left[ 1 - \frac{35\%}{100\%} \right] = \mathbf{0.00} \frac{g}{mi}$$

Next, sum these values for a total composite emission factor ( $EF(Pol)_{Total}$ ) as shown:

$$EF(Pol)_{Total} = \sum_{i=1}^n EF(Pol)_i$$

$$EF(NO_x)_{Total} = (0.106 + 0.0012 + 0.141 + 0.0014 + 0.0461 + 0.155 + 0.0283 + 0.00086 + 0.00013 + 0.00006 + 0.00002 + 0.00) \frac{g}{mi} = \mathbf{0.4801} \frac{g}{mi}$$

Finally, using the total vehicle miles traveled ( $VMT_{Total}$ ) from Step 2 and the total composite EF, the total  $NO_X$  emissions are calculated using Equation 5-8 as shown:

$$E(Pol)_{Total} = VMT_{Total} \times EF(Pol)_{Total} \times 0.002205$$

$$E(NO_X)_{Total} = 2,220,000 \frac{mi}{yr} \times 0.4801 \frac{g}{mi} \times 0.002205 \frac{lb}{g}$$

$$E(NO_X)_{Total} = 2,350.14 \frac{lb}{yr}$$

### 5.5.5 Problem 5 – Calculating Fugitive PM Emissions

Determine the fugitive  $PM_{10}$  generated from the POVs and GOVs provided in Problem 1 given that the base is in central Alabama. It can be assumed that 100% of all miles traveled by POVs are on paved roads, whereas GOVs traveled 90% on paved roads and 10% on unpaved roads.

**Step 1 – Gather fleet data.** Calculation of fugitive  $PM_{10}$  emissions from on-road vehicle operation requires that the total vehicle miles driven ( $VMT_{Total}$ ) for POVs and GOVs is known. These values have been calculated in Step 1 of Problem 1:  $VMT_{Total-POV} = 1,925,586$  and  $VMT_{Total-GOV} = 173,394$  miles/year.

**Step 2 – Select emission factors.** Fugitive  $PM_{10}$  EFs are provided in Table 5-8. For POVs, the EFs for paved and unpaved roads are **0.058** and **466.206 g/mi**, respectively. Similarly, for GOVs, the EFs for paved and unpaved roads are **0.069** and **505.981 g/mi**, respectively.

Once selected, the EFs must be corrected to account for precipitation at the base. It is given that the base is in central Alabama. Based on this information, a review of Figure 5-1 reveals that the base is estimated to have 110 days in the year with precipitation of 0.01 inches or more. The EFs are corrected using this value and Equation 5-1 or Equation 5-2.

For POVs:

$$EF(Pol)_{CP} = EF(Pol)_P \times \left(1 - \frac{P}{4N}\right)$$

$$EF(PM_{10})_{CP} = 0.058 \frac{g}{mi} \times \left(1 - \frac{110}{4 \times 365}\right)$$

$$EF(PM_{10})_{CP} = 0.058 \frac{g}{mi} \times \left(1 - \frac{110}{1460}\right) = \mathbf{0.054 \frac{g}{mi}}$$

For GOVs:

$$EF(PM_{10})_{CP} = 0.069 \frac{g}{mi} \times \left(1 - \frac{110}{4 \times 365}\right)$$

$$EF(PM_{10})_{CP} = 0.069 \frac{g}{mi} \times \left(1 - \frac{110}{1460}\right) = \mathbf{0.064 \frac{g}{mi}}$$

$$EF(Pol)_{CU} = EF(Pol)_U \times \left(1 - \frac{P}{N}\right)$$

$$EF(PM_{10})_{CU} = 505.981 \frac{g}{mi} \times \left(1 - \frac{110}{365}\right) = \mathbf{353.494 \frac{g}{mi}}$$

**Step 3 – Calculate emissions.** Using the  $VMT_{Total}$  for POVs and GOVs as recorded in Step 1, the estimated percentage of driving on paved and unpaved roads (as given in the problem statement), and Equation 5-17, emissions are calculated as follows:

$$E(Pol)_{Total} = VMT_{Total} \times \left[ \left( \frac{\%VMT_P}{100} \times EF(Pol)_{CP} \right) + \left( \frac{\%VMT_U}{100} \times EF(Pol)_{CU} \right) \right] \times 0.002205$$

For POVs:

$$E(PM_{10})_{Total} = 1,925,586 \frac{mi}{yr} \times \left[ \left( \frac{100\%}{100\%} \times 0.054 \frac{g}{mi} \right) + (0) \right] \times 0.002205 \frac{lb}{g}$$

$$E(PM_{10})_{Total} = 1,925,586 \frac{mi}{yr} \times \left[ \left( 1 \times 0.054 \frac{g}{mi} \right) \right] \times 0.002205 \frac{lb}{g}$$

$E(PM_{10})_{Total} = \mathbf{229.28 \frac{lb}{yr}}$
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For GOVs:

$$E(PM_{10})_{Total} = 173,394 \frac{mi}{yr} \times \left[ \left( \frac{90\%}{100\%} \times 0.064 \frac{g}{mi} \right) + \left( \frac{10\%}{100\%} \times 353.494 \frac{g}{mi} \right) \right] \times 0.002205 \frac{lb}{g}$$

$$E(PM_{10})_{Total} = 173,394 \frac{mi}{yr} \times \left[ \left( 0.9 \times 0.064 \frac{g}{mi} \right) + \left( 0.1 \times 353.494 \frac{g}{mi} \right) \right] \times 0.002205 \frac{lb}{g}$$

$$E(PM_{10})_{Total} = 173,394 \frac{mi}{yr} \times \left[ \left( 0.0576 \frac{g}{mi} \right) + \left( 35.3494 \frac{g}{mi} \right) \right] \times 0.002205 \frac{lb}{g}$$

$$E(PM_{10})_{Total} = 173,394 \frac{mi}{yr} \times \left[ 35.407 \frac{g}{mi} \right] \times 0.002205 \frac{lb}{g}$$

$$\boxed{E(PM_{10})_{Total} = 13,537.29 \frac{lb}{yr}}$$

**Table 5-9. Air Force/State/Territory-Specific On-Road Vehicle Composite Emission Factors – 2020 POV**

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
ALABAMA	All Vehicles	4.534	0.404	0.450	0.003	0.013	0.012	415.514	0.025
ALASKA	All Vehicles	4.937	0.438	0.520	0.003	0.020	0.018	411.774	0.025
ARIZONA	All Vehicles	4.563	0.409	0.473	0.003	0.012	0.011	425.618	0.025
ARKANSAS	All Vehicles	4.737	0.402	0.479	0.003	0.013	0.012	409.150	0.025
COLORADO	All Vehicles	4.520	0.404	0.480	0.003	0.016	0.014	413.260	0.025
CONNECTICUT	All Vehicles	4.200	0.351	0.417	0.003	0.015	0.014	413.063	0.025
DELAWARE	All Vehicles	4.085	0.353	0.410	0.003	0.013	0.012	414.654	0.025
DISTRICT OF COLUMBIA	All Vehicles	4.161	0.356	0.398	0.003	0.014	0.013	432.645	0.024
FLORIDA	All Vehicles	4.800	0.420	0.421	0.003	0.012	0.011	435.549	0.025
GEORGIA	All Vehicles	4.322	0.383	0.447	0.003	0.013	0.012	411.422	0.025
HAWAII	All Vehicles	4.722	0.399	0.404	0.003	0.012	0.010	423.000	0.025
IDAHO	All Vehicles	4.612	0.409	0.504	0.003	0.016	0.014	408.954	0.025
ILLINOIS	All Vehicles	4.486	0.388	0.428	0.003	0.015	0.013	425.759	0.025
INDIANA	All Vehicles	4.611	0.401	0.473	0.003	0.015	0.013	416.973	0.025
IOWA	All Vehicles	4.795	0.419	0.499	0.003	0.016	0.014	408.301	0.025
KANSAS	All Vehicles	4.746	0.408	0.478	0.003	0.014	0.013	409.744	0.025
KENTUCKY	All Vehicles	4.651	0.397	0.494	0.003	0.014	0.013	408.063	0.025
LOUISIANA	All Vehicles	4.635	0.405	0.445	0.003	0.013	0.011	418.501	0.025
MAINE	All Vehicles	4.417	0.406	0.497	0.003	0.017	0.015	399.785	0.025
MARYLAND	All Vehicles	4.191	0.360	0.434	0.003	0.014	0.013	412.617	0.025
MASSACHUSETTS	All Vehicles	4.210	0.365	0.442	0.003	0.015	0.014	411.092	0.025
MICHIGAN	All Vehicles	4.760	0.410	0.485	0.003	0.016	0.014	414.686	0.025
MINNESOTA	All Vehicles	4.801	0.421	0.475	0.003	0.018	0.016	409.483	0.025
MISSISSIPPI	All Vehicles	4.515	0.401	0.446	0.003	0.013	0.011	409.929	0.025
MISSOURI	All Vehicles	4.594	0.387	0.470	0.003	0.014	0.013	404.362	0.025
MONTANA	All Vehicles	4.806	0.425	0.534	0.003	0.016	0.015	402.696	0.025

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
NEBRASKA	All Vehicles	4.843	0.422	0.513	0.003	0.016	0.014	409.168	0.025
NEVADA	All Vehicles	4.366	0.406	0.475	0.003	0.014	0.012	425.123	0.025
NEW HAMPSHIRE	All Vehicles	4.150	0.372	0.445	0.003	0.016	0.014	406.895	0.025
NEW JERSEY	All Vehicles	4.127	0.351	0.483	0.003	0.015	0.013	405.209	0.025
NEW MEXICO	All Vehicles	4.555	0.416	0.511	0.003	0.014	0.013	409.107	0.025
NEW YORK	All Vehicles	4.044	0.352	0.418	0.003	0.015	0.014	414.177	0.025
NORTH CAROLINA	All Vehicles	4.448	0.395	0.445	0.003	0.013	0.012	412.479	0.025
NORTH DAKOTA	All Vehicles	4.932	0.446	0.513	0.003	0.019	0.017	403.387	0.025
OHIO	All Vehicles	4.476	0.388	0.448	0.003	0.015	0.014	416.415	0.023
OKLAHOMA	All Vehicles	4.749	0.409	0.471	0.003	0.013	0.012	414.663	0.025
OREGON	All Vehicles	4.323	0.374	0.474	0.003	0.014	0.013	404.851	0.025
PACIFIC ISLANDS	All Vehicles	4.362	0.379	0.452	0.003	0.014	0.012	413.118	0.025
PENNSYLVANIA	All Vehicles	4.256	0.374	0.455	0.003	0.015	0.014	414.899	0.025
PUERTO RICO	All Vehicles	5.222	0.423	0.397	0.003	0.012	0.011	438.537	0.025
RHODE ISLAND	All Vehicles	4.194	0.357	0.430	0.003	0.015	0.014	417.402	0.025
SOUTH CAROLINA	All Vehicles	4.593	0.406	0.472	0.003	0.013	0.012	414.855	0.025
SOUTH DAKOTA	All Vehicles	4.827	0.428	0.522	0.003	0.017	0.015	403.590	0.025
TENNESSEE	All Vehicles	4.463	0.392	0.461	0.003	0.014	0.012	414.815	0.025
TEXAS	All Vehicles	4.387	0.378	0.425	0.003	0.012	0.011	417.485	0.025
UTAH	All Vehicles	4.573	0.403	0.474	0.003	0.016	0.014	419.051	0.025
VERMONT	All Vehicles	4.188	0.392	0.476	0.003	0.017	0.015	400.861	0.025
VIRGIN ISLANDS	All Vehicles	4.867	0.396	0.374	0.003	0.010	0.009	415.152	0.024
VIRGINIA	All Vehicles	4.429	0.384	0.462	0.003	0.014	0.013	413.734	0.025
WASHINGTON	All Vehicles	4.452	0.377	0.471	0.003	0.015	0.013	410.188	0.025
WEST VIRGINIA	All Vehicles	4.581	0.400	0.488	0.003	0.015	0.013	403.749	0.025
WISCONSIN	All Vehicles	4.622	0.406	0.479	0.003	0.016	0.015	407.776	0.025
WYOMING	All Vehicles	4.924	0.438	0.552	0.003	0.017	0.015	405.674	0.025

**Table 5-10. Air Force/State/Territory-Specific On-Road Vehicle Composite Emission Factors – 2021 POV**

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
ALABAMA	All Vehicles	4.274	0.374	0.402	0.003	0.012	0.011	405.234	0.024
ALASKA	All Vehicles	4.656	0.408	0.470	0.003	0.018	0.016	401.739	0.024
ARIZONA	All Vehicles	4.309	0.381	0.424	0.003	0.011	0.010	415.075	0.024
ARKANSAS	All Vehicles	4.471	0.372	0.430	0.003	0.012	0.011	399.071	0.024
COLORADO	All Vehicles	4.267	0.377	0.433	0.003	0.014	0.013	403.111	0.024
CONNECTICUT	All Vehicles	3.967	0.328	0.374	0.003	0.014	0.012	402.912	0.024
DELAWARE	All Vehicles	3.847	0.328	0.364	0.003	0.012	0.011	404.401	0.024
DISTRICT OF COLUMBIA	All Vehicles	3.926	0.332	0.355	0.003	0.013	0.012	421.942	0.023
FLORIDA	All Vehicles	4.525	0.388	0.375	0.003	0.011	0.010	424.718	0.024
GEORGIA	All Vehicles	4.074	0.355	0.401	0.003	0.012	0.011	401.270	0.024
HAWAII	All Vehicles	4.457	0.369	0.359	0.003	0.011	0.010	412.477	0.024
IDAHO	All Vehicles	4.345	0.379	0.453	0.003	0.014	0.013	398.917	0.024
ILLINOIS	All Vehicles	4.221	0.360	0.381	0.003	0.013	0.012	415.264	0.025
INDIANA	All Vehicles	4.342	0.371	0.425	0.003	0.014	0.012	406.701	0.024
IOWA	All Vehicles	4.523	0.388	0.450	0.003	0.014	0.013	398.288	0.024
KANSAS	All Vehicles	4.478	0.377	0.429	0.003	0.013	0.012	399.662	0.024
KENTUCKY	All Vehicles	4.383	0.368	0.445	0.003	0.013	0.012	398.040	0.024
LOUISIANA	All Vehicles	4.371	0.375	0.398	0.003	0.012	0.011	408.144	0.024
MAINE	All Vehicles	4.158	0.377	0.447	0.003	0.015	0.014	390.015	0.024
MARYLAND	All Vehicles	3.951	0.335	0.388	0.003	0.013	0.012	402.458	0.024
MASSACHUSETTS	All Vehicles	3.959	0.339	0.395	0.003	0.014	0.012	400.997	0.024
MICHIGAN	All Vehicles	4.480	0.380	0.436	0.003	0.015	0.013	404.502	0.024
MINNESOTA	All Vehicles	4.512	0.391	0.426	0.003	0.016	0.014	399.446	0.024
MISSISSIPPI	All Vehicles	4.256	0.372	0.399	0.003	0.012	0.010	399.793	0.024
MISSOURI	All Vehicles	4.333	0.359	0.422	0.003	0.013	0.011	394.437	0.024
MONTANA	All Vehicles	4.528	0.394	0.482	0.003	0.015	0.013	392.858	0.024

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
NEBRASKA	All Vehicles	4.569	0.390	0.463	0.003	0.014	0.013	399.141	0.024
NEVADA	All Vehicles	4.121	0.378	0.425	0.003	0.012	0.011	414.608	0.025
NEW HAMPSHIRE	All Vehicles	3.903	0.345	0.399	0.003	0.014	0.013	396.910	0.024
NEW JERSEY	All Vehicles	3.889	0.327	0.437	0.003	0.013	0.012	395.282	0.024
NEW MEXICO	All Vehicles	4.298	0.385	0.460	0.003	0.013	0.011	399.043	0.024
NEW YORK	All Vehicles	3.821	0.329	0.375	0.003	0.014	0.012	403.987	0.024
NORTH CAROLINA	All Vehicles	4.192	0.366	0.397	0.003	0.012	0.011	402.290	0.024
NORTH DAKOTA	All Vehicles	4.632	0.414	0.462	0.003	0.017	0.015	393.549	0.024
OHIO	All Vehicles	4.216	0.360	0.402	0.003	0.014	0.012	406.159	0.023
OKLAHOMA	All Vehicles	4.481	0.378	0.422	0.003	0.012	0.011	404.428	0.024
OREGON	All Vehicles	4.075	0.348	0.426	0.003	0.013	0.012	394.897	0.024
PACIFIC ISLANDS	All Vehicles	4.114	0.351	0.406	0.003	0.013	0.011	402.932	0.024
PENNSYLVANIA	All Vehicles	4.009	0.348	0.408	0.003	0.014	0.012	404.694	0.024
PUERTO RICO	All Vehicles	4.930	0.392	0.352	0.003	0.011	0.010	427.625	0.024
RHODE ISLAND	All Vehicles	3.959	0.334	0.387	0.003	0.014	0.012	407.136	0.024
SOUTH CAROLINA	All Vehicles	4.330	0.376	0.423	0.003	0.012	0.011	404.614	0.024
SOUTH DAKOTA	All Vehicles	4.536	0.397	0.472	0.003	0.016	0.014	393.737	0.024
TENNESSEE	All Vehicles	4.205	0.364	0.413	0.003	0.013	0.011	404.587	0.024
TEXAS	All Vehicles	4.140	0.351	0.380	0.003	0.011	0.010	407.160	0.024
UTAH	All Vehicles	4.312	0.375	0.426	0.003	0.014	0.013	408.744	0.024
VERMONT	All Vehicles	3.937	0.363	0.428	0.003	0.015	0.014	391.068	0.024
VIRGIN ISLANDS	All Vehicles	4.592	0.366	0.331	0.003	0.010	0.009	404.802	0.024
VIRGINIA	All Vehicles	4.177	0.356	0.415	0.003	0.013	0.012	403.542	0.024
WASHINGTON	All Vehicles	4.196	0.350	0.425	0.003	0.014	0.012	400.113	0.024
WEST VIRGINIA	All Vehicles	4.316	0.371	0.439	0.003	0.013	0.012	393.841	0.024
WISCONSIN	All Vehicles	4.343	0.377	0.430	0.003	0.015	0.013	397.784	0.024
WYOMING	All Vehicles	4.640	0.406	0.500	0.003	0.016	0.014	395.775	0.024



**Table 5-11. Air Force/State/Territory-Specific On-Road Vehicle Composite Emission Factors – 2022 POV**

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
ALABAMA	All Vehicles	4.051	0.351	0.362	0.003	0.011	0.010	394.878	0.024
ALASKA	All Vehicles	4.409	0.382	0.427	0.003	0.016	0.015	391.630	0.024
ARIZONA	All Vehicles	4.087	0.356	0.383	0.003	0.010	0.009	404.456	0.024
ARKANSAS	All Vehicles	4.239	0.348	0.389	0.003	0.011	0.010	388.918	0.024
COLORADO	All Vehicles	4.043	0.353	0.392	0.003	0.013	0.012	392.885	0.024
CONNECTICUT	All Vehicles	3.761	0.309	0.338	0.003	0.013	0.011	392.681	0.024
DELAWARE	All Vehicles	3.643	0.308	0.326	0.003	0.011	0.010	394.068	0.024
DISTRICT OF COLUMBIA	All Vehicles	3.717	0.313	0.318	0.003	0.012	0.011	411.157	0.023
FLORIDA	All Vehicles	4.289	0.364	0.336	0.003	0.011	0.010	413.807	0.024
GEORGIA	All Vehicles	3.862	0.334	0.362	0.003	0.011	0.010	391.043	0.024
HAWAII	All Vehicles	4.228	0.344	0.320	0.003	0.010	0.009	401.874	0.024
IDAHO	All Vehicles	4.112	0.354	0.411	0.003	0.013	0.012	388.805	0.024
ILLINOIS	All Vehicles	3.992	0.336	0.342	0.003	0.012	0.011	404.688	0.024
INDIANA	All Vehicles	4.110	0.346	0.383	0.003	0.013	0.011	396.352	0.024
IOWA	All Vehicles	4.285	0.363	0.408	0.003	0.013	0.012	388.201	0.024
KANSAS	All Vehicles	4.244	0.353	0.388	0.003	0.012	0.011	389.503	0.024
KENTUCKY	All Vehicles	4.153	0.343	0.404	0.003	0.012	0.011	387.944	0.024
LOUISIANA	All Vehicles	4.144	0.352	0.358	0.003	0.011	0.010	397.710	0.024
MAINE	All Vehicles	3.936	0.352	0.406	0.003	0.014	0.012	380.172	0.024
MARYLAND	All Vehicles	3.743	0.315	0.349	0.003	0.012	0.011	392.222	0.024
MASSACHUSETTS	All Vehicles	3.741	0.317	0.356	0.003	0.013	0.011	390.825	0.024
MICHIGAN	All Vehicles	4.240	0.354	0.394	0.003	0.014	0.012	394.240	0.024
MINNESOTA	All Vehicles	4.265	0.366	0.384	0.003	0.015	0.013	389.332	0.024
MISSISSIPPI	All Vehicles	4.035	0.349	0.359	0.003	0.011	0.010	389.583	0.024
MISSOURI	All Vehicles	4.106	0.336	0.382	0.003	0.012	0.011	384.438	0.024
MONTANA	All Vehicles	4.286	0.368	0.439	0.003	0.014	0.012	382.948	0.024

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
NEBRASKA	All Vehicles	4.330	0.366	0.421	0.003	0.013	0.012	389.040	0.024
NEVADA	All Vehicles	3.906	0.353	0.383	0.003	0.012	0.010	404.016	0.024
NEW HAMPSHIRE	All Vehicles	3.688	0.323	0.360	0.003	0.013	0.012	386.849	0.024
NEW JERSEY	All Vehicles	3.683	0.308	0.398	0.003	0.012	0.011	385.284	0.024
NEW MEXICO	All Vehicles	4.073	0.361	0.417	0.003	0.012	0.011	388.905	0.024
NEW YORK	All Vehicles	3.626	0.310	0.339	0.003	0.013	0.011	393.718	0.024
NORTH CAROLINA	All Vehicles	3.972	0.343	0.357	0.003	0.011	0.010	392.024	0.024
NORTH DAKOTA	All Vehicles	4.374	0.387	0.420	0.003	0.016	0.014	383.637	0.024
OHIO	All Vehicles	3.992	0.337	0.363	0.003	0.013	0.011	395.826	0.022
OKLAHOMA	All Vehicles	4.247	0.354	0.381	0.003	0.011	0.010	394.117	0.024
OREGON	All Vehicles	3.858	0.325	0.386	0.003	0.012	0.011	384.869	0.024
PACIFIC ISLANDS	All Vehicles	3.899	0.329	0.366	0.003	0.012	0.010	392.667	0.024
PENNSYLVANIA	All Vehicles	3.795	0.326	0.369	0.003	0.013	0.011	394.411	0.024
PUERTO RICO	All Vehicles	4.677	0.365	0.314	0.003	0.010	0.009	416.632	0.024
RHODE ISLAND	All Vehicles	3.756	0.315	0.350	0.003	0.013	0.011	396.792	0.024
SOUTH CAROLINA	All Vehicles	4.105	0.353	0.382	0.003	0.011	0.010	394.297	0.024
SOUTH DAKOTA	All Vehicles	4.286	0.371	0.429	0.003	0.014	0.013	383.812	0.024
TENNESSEE	All Vehicles	3.983	0.339	0.373	0.003	0.012	0.011	394.283	0.024
TEXAS	All Vehicles	3.925	0.329	0.343	0.003	0.011	0.010	396.757	0.024
UTAH	All Vehicles	4.082	0.351	0.385	0.003	0.013	0.012	398.358	0.024
VERMONT	All Vehicles	3.719	0.340	0.389	0.003	0.014	0.013	381.203	0.024
VIRGIN ISLANDS	All Vehicles	4.355	0.340	0.295	0.003	0.009	0.008	394.374	0.023
VIRGINIA	All Vehicles	3.960	0.334	0.375	0.003	0.012	0.011	393.273	0.024
WASHINGTON	All Vehicles	3.973	0.328	0.385	0.003	0.013	0.011	389.961	0.024
WEST VIRGINIA	All Vehicles	4.088	0.345	0.398	0.003	0.012	0.011	383.859	0.024
WISCONSIN	All Vehicles	4.103	0.352	0.389	0.003	0.014	0.012	387.717	0.024
WYOMING	All Vehicles	4.393	0.379	0.456	0.003	0.014	0.013	385.804	0.024

**Table 5-12. Air Force/State/Territory-Specific On-Road Vehicle Composite Emission Factors – 2023 POV**

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
ALABAMA	All Vehicles	3.829	0.328	0.328	0.003	0.010	0.009	384.457	0.024
ALASKA	All Vehicles	4.172	0.359	0.391	0.003	0.015	0.013	381.459	0.024
ARIZONA	All Vehicles	3.866	0.336	0.348	0.003	0.010	0.009	393.771	0.024
ARKANSAS	All Vehicles	4.011	0.327	0.355	0.003	0.010	0.009	378.704	0.024
COLORADO	All Vehicles	3.826	0.333	0.358	0.003	0.012	0.011	382.595	0.024
CONNECTICUT	All Vehicles	3.561	0.292	0.307	0.003	0.012	0.010	382.385	0.024
DELAWARE	All Vehicles	3.444	0.290	0.293	0.003	0.010	0.009	383.667	0.023
DISTRICT OF COLUMBIA	All Vehicles	3.516	0.296	0.287	0.003	0.011	0.010	400.298	0.022
FLORIDA	All Vehicles	4.052	0.341	0.302	0.003	0.010	0.009	402.826	0.024
GEORGIA	All Vehicles	3.652	0.313	0.329	0.003	0.011	0.010	380.754	0.024
HAWAII	All Vehicles	3.999	0.322	0.287	0.003	0.009	0.008	391.200	0.024
IDAHO	All Vehicles	3.887	0.333	0.375	0.003	0.012	0.011	378.632	0.024
ILLINOIS	All Vehicles	3.770	0.316	0.308	0.003	0.011	0.010	394.041	0.024
INDIANA	All Vehicles	3.883	0.325	0.349	0.003	0.012	0.010	385.939	0.024
IOWA	All Vehicles	4.055	0.341	0.372	0.003	0.012	0.011	378.052	0.024
KANSAS	All Vehicles	4.016	0.332	0.353	0.003	0.011	0.010	379.282	0.024
KENTUCKY	All Vehicles	3.926	0.322	0.368	0.003	0.011	0.010	377.789	0.024
LOUISIANA	All Vehicles	3.918	0.329	0.325	0.003	0.010	0.009	387.213	0.024
MAINE	All Vehicles	3.720	0.330	0.371	0.003	0.013	0.012	370.270	0.023
MARYLAND	All Vehicles	3.539	0.296	0.316	0.003	0.011	0.010	381.921	0.024
MASSACHUSETTS	All Vehicles	3.532	0.298	0.323	0.003	0.012	0.011	380.589	0.024
MICHIGAN	All Vehicles	4.005	0.332	0.359	0.003	0.013	0.011	383.915	0.024
MINNESOTA	All Vehicles	4.025	0.343	0.349	0.003	0.014	0.012	379.154	0.024
MISSISSIPPI	All Vehicles	3.814	0.326	0.325	0.003	0.010	0.009	379.309	0.023
MISSOURI	All Vehicles	3.884	0.315	0.347	0.003	0.011	0.010	374.378	0.024
MONTANA	All Vehicles	4.053	0.345	0.402	0.003	0.013	0.011	372.980	0.023

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
NEBRASKA	All Vehicles	4.098	0.344	0.385	0.003	0.012	0.011	378.880	0.024
NEVADA	All Vehicles	3.695	0.333	0.347	0.003	0.011	0.010	393.358	0.024
NEW HAMPSHIRE	All Vehicles	3.483	0.303	0.327	0.003	0.012	0.011	376.725	0.023
NEW JERSEY	All Vehicles	3.484	0.290	0.366	0.003	0.011	0.010	375.230	0.024
NEW MEXICO	All Vehicles	3.855	0.340	0.380	0.003	0.011	0.010	378.708	0.024
NEW YORK	All Vehicles	3.435	0.293	0.309	0.003	0.012	0.011	383.384	0.024
NORTH CAROLINA	All Vehicles	3.754	0.321	0.322	0.003	0.011	0.010	381.693	0.024
NORTH DAKOTA	All Vehicles	4.126	0.362	0.384	0.003	0.014	0.013	373.665	0.023
OHIO	All Vehicles	3.772	0.316	0.329	0.003	0.012	0.011	385.426	0.022
OKLAHOMA	All Vehicles	4.018	0.333	0.346	0.003	0.011	0.009	383.742	0.024
OREGON	All Vehicles	3.647	0.305	0.351	0.003	0.011	0.010	374.780	0.024
PACIFIC ISLANDS	All Vehicles	3.687	0.310	0.333	0.003	0.011	0.010	382.342	0.024
PENNSYLVANIA	All Vehicles	3.586	0.306	0.336	0.003	0.012	0.011	384.066	0.024
PUERTO RICO	All Vehicles	4.423	0.342	0.282	0.003	0.010	0.009	405.565	0.024
RHODE ISLAND	All Vehicles	3.558	0.297	0.319	0.003	0.012	0.011	386.382	0.024
SOUTH CAROLINA	All Vehicles	3.881	0.330	0.348	0.003	0.011	0.010	383.920	0.024
SOUTH DAKOTA	All Vehicles	4.044	0.347	0.393	0.003	0.013	0.012	373.830	0.024
TENNESSEE	All Vehicles	3.764	0.319	0.339	0.003	0.011	0.010	383.917	0.024
TEXAS	All Vehicles	3.713	0.309	0.311	0.003	0.010	0.009	386.291	0.024
UTAH	All Vehicles	3.860	0.331	0.350	0.003	0.012	0.011	387.906	0.024
VERMONT	All Vehicles	3.511	0.319	0.355	0.003	0.013	0.012	371.280	0.023
VIRGIN ISLANDS	All Vehicles	4.117	0.318	0.265	0.003	0.008	0.007	383.877	0.023
VIRGINIA	All Vehicles	3.745	0.314	0.341	0.003	0.011	0.010	382.942	0.024
WASHINGTON	All Vehicles	3.757	0.308	0.351	0.003	0.012	0.010	379.749	0.024
WEST VIRGINIA	All Vehicles	3.864	0.324	0.363	0.003	0.011	0.010	373.818	0.024
WISCONSIN	All Vehicles	3.872	0.330	0.354	0.003	0.013	0.011	377.588	0.024
WYOMING	All Vehicles	4.154	0.357	0.418	0.003	0.013	0.012	375.777	0.024

**Table 5-13. Air Force/State/Territory-Specific On-Road Vehicle Composite Emission Factors – 2024 POV**

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
ALABAMA	All Vehicles	3.614	0.309	0.298	0.003	0.010	0.009	374.002	0.023
ALASKA	All Vehicles	3.948	0.339	0.360	0.003	0.014	0.012	371.255	0.023
ARIZONA	All Vehicles	3.653	0.319	0.318	0.003	0.009	0.008	383.050	0.024
ARKANSAS	All Vehicles	3.791	0.308	0.324	0.003	0.010	0.009	368.459	0.023
COLORADO	All Vehicles	3.618	0.315	0.328	0.003	0.011	0.010	372.271	0.023
CONNECTICUT	All Vehicles	3.369	0.276	0.280	0.003	0.011	0.010	372.050	0.023
DELAWARE	All Vehicles	3.254	0.273	0.265	0.003	0.010	0.009	373.226	0.023
DISTRICT OF COLUMBIA	All Vehicles	3.325	0.280	0.260	0.003	0.010	0.009	389.397	0.022
FLORIDA	All Vehicles	3.822	0.320	0.273	0.003	0.009	0.008	391.805	0.024
GEORGIA	All Vehicles	3.449	0.294	0.301	0.003	0.010	0.009	370.432	0.023
HAWAII	All Vehicles	3.774	0.304	0.259	0.003	0.009	0.008	380.488	0.023
IDAHO	All Vehicles	3.672	0.314	0.343	0.003	0.011	0.010	368.427	0.023
ILLINOIS	All Vehicles	3.557	0.297	0.279	0.003	0.011	0.009	383.353	0.024
INDIANA	All Vehicles	3.666	0.306	0.318	0.003	0.011	0.010	375.490	0.023
IOWA	All Vehicles	3.834	0.321	0.341	0.003	0.011	0.010	367.873	0.023
KANSAS	All Vehicles	3.796	0.312	0.322	0.003	0.010	0.009	369.028	0.023
KENTUCKY	All Vehicles	3.707	0.303	0.338	0.003	0.010	0.009	367.603	0.023
LOUISIANA	All Vehicles	3.698	0.310	0.295	0.003	0.010	0.009	376.682	0.023
MAINE	All Vehicles	3.515	0.311	0.340	0.002	0.012	0.011	360.339	0.023
MARYLAND	All Vehicles	3.344	0.279	0.288	0.003	0.010	0.009	371.583	0.023
MASSACHUSETTS	All Vehicles	3.334	0.280	0.294	0.003	0.011	0.010	370.317	0.023
MICHIGAN	All Vehicles	3.781	0.313	0.327	0.003	0.012	0.010	373.555	0.023
MINNESOTA	All Vehicles	3.798	0.323	0.319	0.003	0.012	0.011	368.940	0.023
MISSISSIPPI	All Vehicles	3.601	0.306	0.295	0.003	0.009	0.008	369.002	0.023
MISSOURI	All Vehicles	3.670	0.297	0.317	0.003	0.010	0.009	364.285	0.023
MONTANA	All Vehicles	3.829	0.325	0.369	0.002	0.012	0.011	362.982	0.023

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
NEBRASKA	All Vehicles	3.875	0.324	0.353	0.003	0.011	0.010	368.689	0.023
NEVADA	All Vehicles	3.492	0.317	0.316	0.003	0.010	0.009	382.662	0.024
NEW HAMPSHIRE	All Vehicles	3.290	0.286	0.299	0.003	0.011	0.010	366.567	0.023
NEW JERSEY	All Vehicles	3.295	0.274	0.337	0.003	0.011	0.009	365.148	0.023
NEW MEXICO	All Vehicles	3.644	0.321	0.348	0.003	0.010	0.009	368.480	0.023
NEW YORK	All Vehicles	3.252	0.277	0.282	0.003	0.011	0.010	373.012	0.023
NORTH CAROLINA	All Vehicles	3.544	0.302	0.293	0.003	0.010	0.009	371.327	0.023
NORTH DAKOTA	All Vehicles	3.892	0.341	0.352	0.003	0.013	0.012	363.663	0.023
OHIO	All Vehicles	3.562	0.298	0.300	0.003	0.011	0.010	374.990	0.022
OKLAHOMA	All Vehicles	3.796	0.313	0.315	0.003	0.010	0.009	373.333	0.023
OREGON	All Vehicles	3.446	0.288	0.321	0.003	0.010	0.009	364.658	0.023
PACIFIC ISLANDS	All Vehicles	3.484	0.292	0.304	0.003	0.010	0.009	371.984	0.023
PENNSYLVANIA	All Vehicles	3.388	0.288	0.307	0.003	0.011	0.010	373.686	0.023
PUERTO RICO	All Vehicles	4.173	0.323	0.254	0.003	0.009	0.008	394.454	0.024
RHODE ISLAND	All Vehicles	3.368	0.281	0.291	0.003	0.011	0.010	375.934	0.024
SOUTH CAROLINA	All Vehicles	3.664	0.311	0.317	0.003	0.010	0.009	373.510	0.023
SOUTH DAKOTA	All Vehicles	3.814	0.327	0.361	0.003	0.012	0.011	363.818	0.023
TENNESSEE	All Vehicles	3.554	0.300	0.309	0.003	0.010	0.009	373.517	0.023
TEXAS	All Vehicles	3.508	0.291	0.283	0.003	0.009	0.008	375.788	0.023
UTAH	All Vehicles	3.647	0.312	0.319	0.003	0.011	0.010	377.417	0.024
VERMONT	All Vehicles	3.316	0.300	0.326	0.002	0.012	0.011	361.327	0.023
VIRGIN ISLANDS	All Vehicles	3.883	0.298	0.238	0.003	0.008	0.007	373.342	0.023
VIRGINIA	All Vehicles	3.538	0.296	0.311	0.003	0.010	0.009	372.577	0.023
WASHINGTON	All Vehicles	3.551	0.291	0.322	0.003	0.011	0.010	369.502	0.023
WEST VIRGINIA	All Vehicles	3.649	0.305	0.332	0.003	0.011	0.010	363.747	0.023
WISCONSIN	All Vehicles	3.652	0.310	0.324	0.003	0.012	0.010	367.425	0.023
WYOMING	All Vehicles	3.925	0.336	0.385	0.003	0.012	0.011	365.721	0.023

**Table 5-14. Air Force/State/Territory-Specific On-Road Vehicle Composite Emission Factors – 2020 GOV**

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
ALABAMA	All Vehicles	4.213	0.343	1.265	0.005	0.041	0.038	654.798	0.023
ALASKA	All Vehicles	4.366	0.411	1.534	0.005	0.047	0.043	646.927	0.023
ARIZONA	All Vehicles	4.363	0.345	1.426	0.005	0.042	0.039	674.936	0.023
ARKANSAS	All Vehicles	4.385	0.358	1.381	0.005	0.042	0.038	650.338	0.023
COLORADO	All Vehicles	4.146	0.350	1.378	0.005	0.044	0.040	648.916	0.023
CONNECTICUT	All Vehicles	3.914	0.299	1.160	0.005	0.042	0.039	643.973	0.022
DELAWARE	All Vehicles	3.763	0.285	1.061	0.005	0.041	0.037	641.555	0.022
DISTRICT OF COLUMBIA	All Vehicles	3.901	0.291	1.085	0.005	0.044	0.040	671.402	0.022
FLORIDA	All Vehicles	4.515	0.343	1.168	0.005	0.043	0.039	685.194	0.023
GEORGIA	All Vehicles	4.078	0.338	1.312	0.005	0.042	0.038	651.521	0.023
HAWAII	All Vehicles	4.366	0.307	1.033	0.005	0.040	0.037	660.871	0.022
IDAHO	All Vehicles	4.190	0.367	1.464	0.005	0.044	0.040	644.704	0.023
ILLINOIS	All Vehicles	4.133	0.325	1.149	0.005	0.044	0.040	661.045	0.022
INDIANA	All Vehicles	4.214	0.355	1.338	0.005	0.044	0.040	653.836	0.023
IOWA	All Vehicles	4.323	0.380	1.440	0.005	0.044	0.040	644.833	0.023
KANSAS	All Vehicles	4.325	0.354	1.331	0.005	0.042	0.038	645.590	0.023
KENTUCKY	All Vehicles	4.324	0.372	1.480	0.005	0.043	0.039	650.396	0.023
LOUISIANA	All Vehicles	4.359	0.348	1.279	0.005	0.042	0.038	663.095	0.023
MAINE	All Vehicles	3.998	0.376	1.461	0.005	0.044	0.040	632.538	0.023
MARYLAND	All Vehicles	3.935	0.313	1.227	0.005	0.042	0.038	647.046	0.023
MASSACHUSETTS	All Vehicles	3.918	0.324	1.256	0.005	0.043	0.039	643.186	0.023
MICHIGAN	All Vehicles	4.316	0.368	1.368	0.005	0.044	0.040	650.508	0.023
MINNESOTA	All Vehicles	4.262	0.362	1.284	0.005	0.044	0.040	638.564	0.022
MISSISSIPPI	All Vehicles	4.183	0.338	1.246	0.005	0.040	0.037	647.252	0.022
MISSOURI	All Vehicles	4.244	0.346	1.341	0.005	0.041	0.038	640.479	0.023
MONTANA	All Vehicles	4.320	0.395	1.578	0.005	0.044	0.040	639.782	0.023

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
NEBRASKA	All Vehicles	4.416	0.390	1.517	0.005	0.044	0.040	650.030	0.023
NEVADA	All Vehicles	4.127	0.342	1.398	0.005	0.043	0.040	669.281	0.023
NEW HAMPSHIRE	All Vehicles	3.817	0.332	1.286	0.005	0.043	0.039	636.609	0.022
NEW JERSEY	All Vehicles	3.949	0.356	1.576	0.005	0.044	0.040	650.625	0.023
NEW MEXICO	All Vehicles	4.223	0.370	1.518	0.005	0.043	0.039	649.971	0.023
NEW YORK	All Vehicles	3.756	0.306	1.208	0.005	0.043	0.039	646.106	0.022
NORTH CAROLINA	All Vehicles	4.106	0.330	1.214	0.005	0.041	0.038	646.693	0.022
NORTH DAKOTA	All Vehicles	4.359	0.404	1.489	0.005	0.045	0.041	636.937	0.023
OHIO	All Vehicles	4.094	0.337	1.261	0.005	0.043	0.040	650.623	0.023
OKLAHOMA	All Vehicles	4.374	0.352	1.323	0.005	0.042	0.038	654.283	0.023
OREGON	All Vehicles	3.971	0.337	1.366	0.005	0.042	0.039	637.506	0.023
PACIFIC ISLANDS	All Vehicles	4.069	0.333	1.306	0.005	0.042	0.039	650.271	0.023
PENNSYLVANIA	All Vehicles	3.975	0.341	1.351	0.005	0.044	0.040	652.402	0.023
PUERTO RICO	All Vehicles	4.877	0.325	1.027	0.005	0.041	0.038	688.539	0.022
RHODE ISLAND	All Vehicles	3.919	0.315	1.246	0.005	0.044	0.040	652.536	0.023
SOUTH CAROLINA	All Vehicles	4.306	0.363	1.389	0.005	0.042	0.039	658.968	0.023
SOUTH DAKOTA	All Vehicles	4.376	0.402	1.569	0.005	0.045	0.041	643.136	0.023
TENNESSEE	All Vehicles	4.175	0.349	1.351	0.005	0.043	0.039	655.613	0.023
TEXAS	All Vehicles	4.180	0.321	1.228	0.005	0.041	0.037	659.712	0.023
UTAH	All Vehicles	4.210	0.346	1.351	0.005	0.044	0.040	656.387	0.023
VERMONT	All Vehicles	3.848	0.367	1.461	0.005	0.044	0.040	634.934	0.023
VIRGIN ISLANDS	All Vehicles	4.455	0.292	0.906	0.005	0.036	0.033	650.273	0.022
VIRGINIA	All Vehicles	4.137	0.344	1.340	0.005	0.043	0.039	652.642	0.023
WASHINGTON	All Vehicles	4.109	0.344	1.381	0.005	0.043	0.040	646.003	0.023
WEST VIRGINIA	All Vehicles	4.203	0.364	1.418	0.005	0.042	0.039	640.353	0.023
WISCONSIN	All Vehicles	4.178	0.366	1.372	0.005	0.044	0.040	640.579	0.023
WYOMING	All Vehicles	4.459	0.415	1.680	0.005	0.046	0.042	647.821	0.023

**Table 5-15. Air Force/State/Territory-Specific On-Road Vehicle Composite Emission Factors – 2021 GOV**

State	Vehicle Type	Emission Factors (g/mi)								
		Criteria Pollutants and Ozone Precursors								
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>	
ALABAMA	All Vehicles	3.939	0.310	1.145	0.005	0.037	0.033	642.133	0.022	
ALASKA	All Vehicles	4.090	0.377	1.401	0.005	0.042	0.038	634.488	0.023	
ARIZONA	All Vehicles	4.088	0.314	1.295	0.005	0.037	0.034	661.924	0.023	
ARKANSAS	All Vehicles	4.108	0.325	1.257	0.005	0.037	0.034	637.796	0.022	
COLORADO	All Vehicles	3.883	0.319	1.249	0.005	0.039	0.035	636.416	0.022	
CONNECTICUT	All Vehicles	3.662	0.272	1.041	0.005	0.037	0.034	631.579	0.022	
DELAWARE	All Vehicles	3.511	0.257	0.944	0.005	0.036	0.033	629.129	0.022	
DISTRICT OF COLUMBIA	All Vehicles	3.646	0.263	0.967	0.005	0.039	0.035	658.504	0.022	
FLORIDA	All Vehicles	4.221	0.308	1.052	0.005	0.038	0.034	671.978	0.022	
GEORGIA	All Vehicles	3.813	0.307	1.192	0.005	0.037	0.034	638.944	0.022	
HAWAII	All Vehicles	4.083	0.275	0.921	0.005	0.035	0.032	648.083	0.022	
IDAHO	All Vehicles	3.919	0.335	1.333	0.005	0.038	0.035	632.265	0.022	
ILLINOIS	All Vehicles	3.855	0.293	1.027	0.005	0.038	0.035	648.333	0.022	
INDIANA	All Vehicles	3.937	0.322	1.213	0.005	0.038	0.035	641.214	0.022	
IOWA	All Vehicles	4.049	0.347	1.313	0.005	0.039	0.035	632.397	0.022	
KANSAS	All Vehicles	4.049	0.322	1.207	0.005	0.037	0.034	633.129	0.022	
KENTUCKY	All Vehicles	4.047	0.339	1.353	0.005	0.038	0.035	637.872	0.023	
LOUISIANA	All Vehicles	4.078	0.315	1.160	0.005	0.037	0.034	650.292	0.022	
MAINE	All Vehicles	3.738	0.343	1.332	0.005	0.039	0.035	620.346	0.022	
MARYLAND	All Vehicles	3.678	0.284	1.106	0.005	0.037	0.034	634.575	0.022	
MASSACHUSETTS	All Vehicles	3.654	0.294	1.133	0.005	0.038	0.034	630.796	0.022	
MICHIGAN	All Vehicles	4.033	0.334	1.241	0.005	0.039	0.036	637.970	0.022	
MINNESOTA	All Vehicles	3.976	0.329	1.160	0.005	0.039	0.035	626.242	0.022	
MISSISSIPPI	All Vehicles	3.911	0.306	1.127	0.005	0.036	0.033	634.724	0.022	
MISSOURI	All Vehicles	3.972	0.314	1.218	0.005	0.037	0.033	628.146	0.022	
MONTANA	All Vehicles	4.044	0.361	1.444	0.005	0.039	0.036	627.466	0.023	

State	Vehicle Type	Emission Factors (g/mi)								
		Criteria Pollutants and Ozone Precursors								
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>	
NEBRASKA	All Vehicles	4.138	0.356	1.387	0.005	0.039	0.036	637.520	0.023	
NEVADA	All Vehicles	3.862	0.310	1.265	0.005	0.038	0.035	656.377	0.022	
NEW HAMPSHIRE	All Vehicles	3.560	0.301	1.163	0.005	0.038	0.034	624.316	0.022	
NEW JERSEY	All Vehicles	3.697	0.327	1.448	0.005	0.039	0.036	638.126	0.023	
NEW MEXICO	All Vehicles	3.955	0.336	1.385	0.005	0.038	0.035	637.436	0.023	
NEW YORK	All Vehicles	3.517	0.279	1.088	0.005	0.038	0.035	633.646	0.022	
NORTH CAROLINA	All Vehicles	3.836	0.298	1.094	0.005	0.036	0.033	634.189	0.022	
NORTH DAKOTA	All Vehicles	4.070	0.369	1.359	0.005	0.040	0.037	624.673	0.022	
OHIO	All Vehicles	3.825	0.305	1.139	0.005	0.038	0.035	638.067	0.022	
OKLAHOMA	All Vehicles	4.095	0.319	1.200	0.005	0.037	0.034	641.647	0.022	
OREGON	All Vehicles	3.713	0.307	1.240	0.005	0.037	0.034	625.192	0.022	
PACIFIC ISLANDS	All Vehicles	3.806	0.302	1.183	0.005	0.037	0.034	637.722	0.022	
PENNSYLVANIA	All Vehicles	3.714	0.310	1.226	0.005	0.039	0.035	639.824	0.022	
PUERTO RICO	All Vehicles	4.566	0.291	0.918	0.005	0.036	0.033	675.280	0.022	
RHODE ISLAND	All Vehicles	3.669	0.287	1.124	0.005	0.038	0.035	639.977	0.022	
SOUTH CAROLINA	All Vehicles	4.030	0.329	1.265	0.005	0.038	0.034	646.253	0.023	
SOUTH DAKOTA	All Vehicles	4.087	0.367	1.437	0.005	0.040	0.036	630.775	0.023	
TENNESSEE	All Vehicles	3.903	0.316	1.227	0.005	0.038	0.034	642.967	0.022	
TEXAS	All Vehicles	3.912	0.290	1.111	0.005	0.036	0.033	646.985	0.022	
UTAH	All Vehicles	3.938	0.315	1.221	0.005	0.039	0.036	643.750	0.022	
VERMONT	All Vehicles	3.591	0.335	1.333	0.005	0.039	0.036	622.704	0.022	
VIRGIN ISLANDS	All Vehicles	4.166	0.261	0.805	0.005	0.032	0.029	637.604	0.021	
VIRGINIA	All Vehicles	3.871	0.312	1.216	0.005	0.038	0.034	640.057	0.022	
WASHINGTON	All Vehicles	3.843	0.313	1.255	0.005	0.038	0.035	633.561	0.022	
WEST VIRGINIA	All Vehicles	3.931	0.331	1.292	0.005	0.038	0.034	628.009	0.022	
WISCONSIN	All Vehicles	3.899	0.333	1.246	0.005	0.039	0.035	628.226	0.022	
WYOMING	All Vehicles	4.177	0.380	1.542	0.005	0.040	0.037	635.379	0.023	

**Table 5-16. Air Force/State/Territory-Specific On-Road Vehicle Composite Emission Factors – 2022 GOV**

State	Vehicle Type	Emission Factors (g/mi)								
		Criteria Pollutants and Ozone Precursors								
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>	
ALABAMA	All Vehicles	3.702	0.283	1.042	0.005	0.033	0.030	629.887	0.022	
ALASKA	All Vehicles	3.848	0.349	1.286	0.005	0.037	0.034	622.469	0.022	
ARIZONA	All Vehicles	3.847	0.287	1.183	0.005	0.033	0.030	649.345	0.022	
ARKANSAS	All Vehicles	3.866	0.298	1.151	0.005	0.033	0.030	625.676	0.022	
COLORADO	All Vehicles	3.651	0.293	1.139	0.005	0.034	0.031	624.328	0.022	
CONNECTICUT	All Vehicles	3.443	0.250	0.939	0.005	0.033	0.030	619.582	0.022	
DELAWARE	All Vehicles	3.292	0.234	0.843	0.005	0.032	0.029	617.096	0.021	
DISTRICT OF COLUMBIA	All Vehicles	3.421	0.240	0.865	0.005	0.034	0.031	646.013	0.022	
FLORIDA	All Vehicles	3.967	0.280	0.952	0.005	0.033	0.031	659.192	0.022	
GEORGIA	All Vehicles	3.585	0.281	1.088	0.005	0.033	0.030	626.787	0.022	
HAWAII	All Vehicles	3.838	0.248	0.825	0.005	0.031	0.029	635.704	0.022	
IDAHO	All Vehicles	3.682	0.307	1.220	0.005	0.034	0.031	620.244	0.022	
ILLINOIS	All Vehicles	3.616	0.266	0.922	0.005	0.034	0.031	636.024	0.022	
INDIANA	All Vehicles	3.699	0.295	1.105	0.005	0.034	0.031	629.009	0.022	
IOWA	All Vehicles	3.810	0.319	1.203	0.005	0.034	0.031	620.380	0.022	
KANSAS	All Vehicles	3.809	0.295	1.100	0.005	0.033	0.030	621.081	0.022	
KENTUCKY	All Vehicles	3.808	0.311	1.243	0.005	0.034	0.031	625.777	0.022	
LOUISIANA	All Vehicles	3.836	0.288	1.058	0.005	0.033	0.030	637.915	0.022	
MAINE	All Vehicles	3.513	0.316	1.222	0.005	0.034	0.031	608.569	0.022	
MARYLAND	All Vehicles	3.455	0.260	1.001	0.005	0.033	0.030	622.510	0.022	
MASSACHUSETTS	All Vehicles	3.425	0.269	1.027	0.005	0.033	0.031	618.810	0.022	
MICHIGAN	All Vehicles	3.789	0.306	1.132	0.005	0.035	0.032	625.848	0.022	
MINNESOTA	All Vehicles	3.730	0.302	1.053	0.005	0.034	0.031	614.323	0.022	
MISSISSIPPI	All Vehicles	3.677	0.279	1.025	0.005	0.032	0.029	622.612	0.022	
MISSOURI	All Vehicles	3.736	0.288	1.112	0.005	0.033	0.030	616.225	0.022	
MONTANA	All Vehicles	3.803	0.333	1.329	0.005	0.035	0.032	615.573	0.022	

State	Vehicle Type	Emission Factors (g/mi)								
		Criteria Pollutants and Ozone Precursors								
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>	
NEBRASKA	All Vehicles	3.895	0.328	1.275	0.005	0.035	0.032	625.435	0.022	
NEVADA	All Vehicles	3.630	0.283	1.152	0.005	0.034	0.031	643.898	0.022	
NEW HAMPSHIRE	All Vehicles	3.338	0.276	1.056	0.005	0.034	0.031	612.428	0.022	
NEW JERSEY	All Vehicles	3.478	0.302	1.337	0.005	0.035	0.032	626.061	0.023	
NEW MEXICO	All Vehicles	3.721	0.309	1.271	0.005	0.034	0.031	625.327	0.022	
NEW YORK	All Vehicles	3.308	0.256	0.985	0.005	0.034	0.031	621.588	0.022	
NORTH CAROLINA	All Vehicles	3.604	0.272	0.990	0.005	0.032	0.030	622.094	0.022	
NORTH DAKOTA	All Vehicles	3.820	0.340	1.247	0.005	0.036	0.033	612.826	0.022	
OHIO	All Vehicles	3.592	0.279	1.033	0.005	0.034	0.031	625.921	0.022	
OKLAHOMA	All Vehicles	3.851	0.292	1.094	0.005	0.033	0.030	629.430	0.022	
OREGON	All Vehicles	3.487	0.281	1.132	0.005	0.033	0.030	613.289	0.022	
PACIFIC ISLANDS	All Vehicles	3.577	0.277	1.077	0.005	0.033	0.030	625.585	0.022	
PENNSYLVANIA	All Vehicles	3.488	0.285	1.119	0.005	0.034	0.031	627.663	0.022	
PUERTO RICO	All Vehicles	4.295	0.263	0.825	0.005	0.032	0.029	662.445	0.022	
RHODE ISLAND	All Vehicles	3.451	0.264	1.020	0.005	0.034	0.031	627.824	0.022	
SOUTH CAROLINA	All Vehicles	3.791	0.301	1.158	0.005	0.033	0.031	633.967	0.022	
SOUTH DAKOTA	All Vehicles	3.839	0.338	1.324	0.005	0.035	0.032	618.841	0.022	
TENNESSEE	All Vehicles	3.668	0.289	1.120	0.005	0.034	0.031	630.743	0.022	
TEXAS	All Vehicles	3.678	0.265	1.010	0.005	0.032	0.029	634.677	0.022	
UTAH	All Vehicles	3.699	0.288	1.110	0.005	0.035	0.032	631.525	0.022	
VERMONT	All Vehicles	3.370	0.308	1.224	0.005	0.035	0.032	610.891	0.022	
VIRGIN ISLANDS	All Vehicles	3.914	0.235	0.719	0.005	0.028	0.026	625.343	0.021	
VIRGINIA	All Vehicles	3.641	0.286	1.109	0.005	0.034	0.031	627.890	0.022	
WASHINGTON	All Vehicles	3.610	0.287	1.146	0.005	0.034	0.031	621.532	0.022	
WEST VIRGINIA	All Vehicles	3.696	0.303	1.184	0.005	0.033	0.031	616.083	0.022	
WISCONSIN	All Vehicles	3.658	0.305	1.137	0.005	0.034	0.031	616.285	0.022	
WYOMING	All Vehicles	3.931	0.351	1.424	0.005	0.036	0.033	623.369	0.023	

**Table 5-17. Air Force/State/Territory-Specific On-Road Vehicle Composite Emission Factors – 2023 GOV**

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
ALABAMA	All Vehicles	3.475	0.260	0.953	0.005	0.029	0.027	618.056	0.022
ALASKA	All Vehicles	3.621	0.324	1.188	0.005	0.033	0.031	610.867	0.022
ARIZONA	All Vehicles	3.615	0.264	1.086	0.005	0.030	0.027	637.193	0.022
ARKANSAS	All Vehicles	3.635	0.274	1.059	0.005	0.029	0.027	613.978	0.022
COLORADO	All Vehicles	3.431	0.271	1.045	0.005	0.031	0.028	612.648	0.022
CONNECTICUT	All Vehicles	3.233	0.230	0.851	0.005	0.030	0.027	607.975	0.022
DELAWARE	All Vehicles	3.086	0.214	0.757	0.005	0.028	0.026	605.450	0.021
DISTRICT OF COLUMBIA	All Vehicles	3.209	0.220	0.777	0.005	0.031	0.028	633.916	0.022
FLORIDA	All Vehicles	3.721	0.256	0.867	0.005	0.030	0.027	646.825	0.022
GEORGIA	All Vehicles	3.366	0.258	0.999	0.005	0.029	0.027	615.049	0.022
HAWAII	All Vehicles	3.600	0.225	0.742	0.005	0.028	0.025	623.723	0.021
IDAHO	All Vehicles	3.458	0.284	1.123	0.005	0.031	0.028	608.640	0.022
ILLINOIS	All Vehicles	3.388	0.244	0.832	0.005	0.030	0.028	624.107	0.022
INDIANA	All Vehicles	3.471	0.272	1.012	0.005	0.031	0.028	617.215	0.022
IOWA	All Vehicles	3.583	0.295	1.109	0.005	0.031	0.028	608.782	0.022
KANSAS	All Vehicles	3.580	0.271	1.008	0.005	0.030	0.027	609.445	0.022
KENTUCKY	All Vehicles	3.579	0.287	1.149	0.005	0.030	0.028	614.108	0.022
LOUISIANA	All Vehicles	3.601	0.264	0.970	0.005	0.029	0.027	625.960	0.022
MAINE	All Vehicles	3.300	0.292	1.127	0.005	0.031	0.028	597.207	0.022
MARYLAND	All Vehicles	3.241	0.239	0.912	0.005	0.029	0.027	610.846	0.022
MASSACHUSETTS	All Vehicles	3.210	0.247	0.936	0.005	0.030	0.027	607.222	0.022
MICHIGAN	All Vehicles	3.556	0.282	1.038	0.005	0.031	0.028	614.135	0.022
MINNESOTA	All Vehicles	3.497	0.278	0.961	0.005	0.031	0.028	602.803	0.022
MISSISSIPPI	All Vehicles	3.451	0.256	0.938	0.005	0.028	0.026	610.914	0.022
MISSOURI	All Vehicles	3.511	0.265	1.021	0.005	0.029	0.027	604.716	0.022
MONTANA	All Vehicles	3.576	0.308	1.230	0.005	0.031	0.029	604.104	0.022

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
NEBRASKA	All Vehicles	3.665	0.303	1.179	0.005	0.031	0.029	613.776	0.022
NEVADA	All Vehicles	3.408	0.261	1.054	0.005	0.031	0.028	631.837	0.022
NEW HAMPSHIRE	All Vehicles	3.130	0.255	0.966	0.005	0.030	0.027	600.942	0.022
NEW JERSEY	All Vehicles	3.270	0.281	1.242	0.005	0.031	0.029	614.432	0.022
NEW MEXICO	All Vehicles	3.498	0.285	1.173	0.005	0.030	0.028	613.642	0.022
NEW YORK	All Vehicles	3.109	0.237	0.897	0.005	0.030	0.027	609.929	0.022
NORTH CAROLINA	All Vehicles	3.380	0.249	0.901	0.005	0.029	0.026	610.402	0.022
NORTH DAKOTA	All Vehicles	3.584	0.315	1.151	0.005	0.032	0.029	601.395	0.022
OHIO	All Vehicles	3.370	0.257	0.943	0.005	0.030	0.028	614.178	0.022
OKLAHOMA	All Vehicles	3.620	0.268	1.003	0.005	0.029	0.027	617.630	0.022
OREGON	All Vehicles	3.273	0.259	1.038	0.005	0.030	0.027	601.796	0.022
PACIFIC ISLANDS	All Vehicles	3.359	0.255	0.986	0.005	0.030	0.027	613.862	0.022
PENNSYLVANIA	All Vehicles	3.273	0.263	1.027	0.005	0.031	0.028	615.916	0.022
PUERTO RICO	All Vehicles	4.031	0.239	0.744	0.005	0.029	0.026	650.018	0.022
RHODE ISLAND	All Vehicles	3.245	0.244	0.930	0.005	0.031	0.028	616.073	0.022
SOUTH CAROLINA	All Vehicles	3.561	0.277	1.066	0.005	0.030	0.027	622.106	0.022
SOUTH DAKOTA	All Vehicles	3.604	0.313	1.227	0.005	0.032	0.029	607.333	0.022
TENNESSEE	All Vehicles	3.443	0.266	1.029	0.005	0.030	0.028	618.937	0.022
TEXAS	All Vehicles	3.454	0.243	0.923	0.005	0.029	0.026	622.782	0.022
UTAH	All Vehicles	3.472	0.266	1.015	0.005	0.031	0.028	619.707	0.022
VERMONT	All Vehicles	3.161	0.285	1.130	0.005	0.031	0.029	599.496	0.022
VIRGIN ISLANDS	All Vehicles	3.671	0.213	0.644	0.005	0.025	0.023	613.482	0.021
VIRGINIA	All Vehicles	3.420	0.264	1.018	0.005	0.030	0.028	616.138	0.022
WASHINGTON	All Vehicles	3.390	0.265	1.052	0.005	0.031	0.028	609.913	0.022
WEST VIRGINIA	All Vehicles	3.471	0.280	1.090	0.005	0.030	0.027	604.574	0.022
WISCONSIN	All Vehicles	3.430	0.282	1.044	0.005	0.031	0.028	604.754	0.022
WYOMING	All Vehicles	3.698	0.326	1.323	0.005	0.032	0.030	611.792	0.022

**Table 5-18. Air Force/State/Territory-Specific On-Road Vehicle Composite Emission Factors – 2024 GOV**

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
ALABAMA	All Vehicles	3.252	0.238	0.874	0.005	0.026	0.024	606.545	0.022
ALASKA	All Vehicles	3.403	0.302	1.101	0.005	0.030	0.027	599.592	0.022
ARIZONA	All Vehicles	3.389	0.243	1.001	0.005	0.027	0.024	625.368	0.022
ARKANSAS	All Vehicles	3.408	0.253	0.979	0.005	0.026	0.024	602.609	0.022
COLORADO	All Vehicles	3.218	0.251	0.961	0.005	0.028	0.025	601.284	0.022
CONNECTICUT	All Vehicles	3.031	0.212	0.773	0.005	0.026	0.024	596.665	0.021
DELAWARE	All Vehicles	2.886	0.196	0.680	0.005	0.025	0.023	594.097	0.021
DISTRICT OF COLUMBIA	All Vehicles	3.005	0.202	0.700	0.005	0.027	0.025	622.109	0.021
FLORIDA	All Vehicles	3.479	0.233	0.791	0.005	0.027	0.024	634.774	0.022
GEORGIA	All Vehicles	3.154	0.238	0.920	0.005	0.026	0.024	603.633	0.022
HAWAII	All Vehicles	3.366	0.205	0.669	0.005	0.025	0.023	612.042	0.021
IDAHO	All Vehicles	3.241	0.263	1.037	0.005	0.028	0.025	597.359	0.022
ILLINOIS	All Vehicles	3.169	0.223	0.753	0.005	0.027	0.025	612.487	0.021
INDIANA	All Vehicles	3.250	0.250	0.930	0.005	0.027	0.025	605.739	0.022
IOWA	All Vehicles	3.363	0.273	1.025	0.005	0.028	0.025	597.511	0.022
KANSAS	All Vehicles	3.356	0.250	0.927	0.005	0.026	0.024	598.128	0.022
KENTUCKY	All Vehicles	3.355	0.265	1.066	0.005	0.027	0.025	602.773	0.022
LOUISIANA	All Vehicles	3.372	0.242	0.893	0.005	0.026	0.024	614.331	0.022
MAINE	All Vehicles	3.094	0.271	1.043	0.005	0.028	0.025	586.171	0.022
MARYLAND	All Vehicles	3.035	0.220	0.833	0.005	0.026	0.024	599.490	0.021
MASSACHUSETTS	All Vehicles	3.003	0.228	0.855	0.005	0.027	0.024	595.941	0.022
MICHIGAN	All Vehicles	3.331	0.260	0.954	0.005	0.028	0.025	602.739	0.022
MINNESOTA	All Vehicles	3.273	0.257	0.879	0.005	0.028	0.025	591.592	0.021
MISSISSIPPI	All Vehicles	3.230	0.235	0.860	0.005	0.025	0.023	599.535	0.021
MISSOURI	All Vehicles	3.291	0.245	0.940	0.005	0.026	0.024	593.526	0.022
MONTANA	All Vehicles	3.355	0.286	1.143	0.005	0.028	0.026	592.969	0.022

State	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
NEBRASKA	All Vehicles	3.441	0.281	1.094	0.005	0.028	0.026	602.451	0.022
NEVADA	All Vehicles	3.193	0.241	0.968	0.005	0.027	0.025	620.095	0.022
NEW HAMPSHIRE	All Vehicles	2.930	0.235	0.885	0.005	0.027	0.025	589.767	0.021
NEW JERSEY	All Vehicles	3.071	0.261	1.158	0.005	0.028	0.026	603.147	0.022
NEW MEXICO	All Vehicles	3.282	0.264	1.086	0.005	0.027	0.025	602.289	0.022
NEW YORK	All Vehicles	2.917	0.219	0.819	0.005	0.027	0.025	598.574	0.021
NORTH CAROLINA	All Vehicles	3.162	0.228	0.822	0.005	0.026	0.024	599.020	0.021
NORTH DAKOTA	All Vehicles	3.358	0.292	1.066	0.005	0.029	0.026	590.292	0.022
OHIO	All Vehicles	3.155	0.237	0.863	0.005	0.027	0.025	602.745	0.022
OKLAHOMA	All Vehicles	3.392	0.247	0.922	0.005	0.026	0.024	606.151	0.022
OREGON	All Vehicles	3.065	0.239	0.956	0.005	0.027	0.024	590.619	0.022
PACIFIC ISLANDS	All Vehicles	3.147	0.235	0.906	0.005	0.027	0.024	602.455	0.022
PENNSYLVANIA	All Vehicles	3.066	0.242	0.945	0.005	0.028	0.025	604.487	0.022
PUERTO RICO	All Vehicles	3.771	0.218	0.673	0.005	0.026	0.023	637.899	0.021
RHODE ISLAND	All Vehicles	3.045	0.226	0.851	0.005	0.027	0.025	604.627	0.022
SOUTH CAROLINA	All Vehicles	3.336	0.255	0.985	0.005	0.027	0.025	610.577	0.022
SOUTH DAKOTA	All Vehicles	3.376	0.290	1.140	0.005	0.029	0.026	596.162	0.022
TENNESSEE	All Vehicles	3.224	0.245	0.948	0.005	0.027	0.025	607.454	0.022
TEXAS	All Vehicles	3.235	0.223	0.846	0.005	0.026	0.023	611.206	0.022
UTAH	All Vehicles	3.253	0.245	0.930	0.005	0.028	0.025	608.201	0.022
VERMONT	All Vehicles	2.962	0.265	1.047	0.005	0.028	0.026	588.428	0.022
VIRGIN ISLANDS	All Vehicles	3.429	0.193	0.579	0.005	0.022	0.020	601.927	0.021
VIRGINIA	All Vehicles	3.204	0.243	0.937	0.005	0.027	0.025	604.705	0.022
WASHINGTON	All Vehicles	3.177	0.245	0.969	0.005	0.027	0.025	598.610	0.022
WEST VIRGINIA	All Vehicles	3.252	0.258	1.008	0.005	0.027	0.025	593.391	0.022
WISCONSIN	All Vehicles	3.210	0.260	0.961	0.005	0.028	0.025	593.540	0.022
WYOMING	All Vehicles	3.472	0.303	1.233	0.005	0.029	0.027	600.558	0.022



**Table 5-19. On-Road Vehicle Emission Factors – 2020**

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Alabama	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.351	0.283	0.217	0.002	0.006	0.006	324.787	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.515	0.331	0.351	0.003	0.008	0.007	414.455	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.011	0.719	0.982	0.005	0.018	0.016	766.021	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.584	0.096	0.131	0.003	0.004	0.004	316.390	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.394	0.229	0.371	0.004	0.007	0.006	448.251	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.678	0.415	4.584	0.013	0.166	0.153	1497.653	0.028
	NA	MC	Motorcycles	13.109	2.680	0.703	0.003	0.026	0.023	393.304	0.054
Alaska	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.898	0.358	0.244	0.002	0.013	0.011	322.121	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.734	0.380	0.380	0.003	0.015	0.013	410.594	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.575	0.670	1.087	0.005	0.035	0.031	750.761	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.292	0.155	0.135	0.003	0.004	0.004	307.430	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.914	0.292	0.384	0.004	0.007	0.006	436.084	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.925	0.549	5.739	0.013	0.170	0.157	1483.299	0.030
	NA	MC	Motorcycles	13.994	1.973	0.863	0.003	0.029	0.026	401.208	0.054
Arizona	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.319	0.271	0.208	0.002	0.006	0.005	331.434	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.452	0.311	0.344	0.003	0.007	0.006	424.391	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	16.786	0.761	1.082	0.005	0.018	0.016	794.301	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.798	0.088	0.141	0.003	0.004	0.004	323.935	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.810	0.228	0.407	0.004	0.007	0.006	459.736	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.823	0.468	5.309	0.013	0.172	0.158	1552.295	0.029
	NA	MC	Motorcycles	12.701	3.144	0.800	0.002	0.025	0.022	393.851	0.053
Arkansas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.555	0.288	0.228	0.002	0.007	0.006	317.853	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.728	0.330	0.368	0.003	0.008	0.007	407.183	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.332	0.683	1.000	0.005	0.020	0.017	757.770	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.608	0.103	0.135	0.003	0.004	0.004	309.119	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.432	0.236	0.381	0.004	0.007	0.006	439.312	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.826	0.487	5.074	0.013	0.165	0.152	1504.829	0.029
	NA	MC	Motorcycles	13.209	2.555	0.742	0.003	0.026	0.023	395.170	0.055
Colorado	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.349	0.291	0.224	0.002	0.009	0.008	322.536	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.341	0.326	0.360	0.003	0.011	0.010	412.980	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.974	0.699	1.093	0.005	0.026	0.023	763.061	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.440	0.120	0.135	0.003	0.004	0.004	311.479	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.194	0.261	0.389	0.004	0.007	0.006	442.693	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.697	0.436	5.051	0.013	0.167	0.153	1479.339	0.028
	NA	MC	Motorcycles	13.588	2.623	0.833	0.003	0.029	0.025	398.006	0.054
Connecticut	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.026	0.251	0.192	0.002	0.008	0.007	322.259	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.987	0.284	0.317	0.003	0.010	0.009	414.300	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	16.092	0.687	1.068	0.005	0.026	0.023	769.191	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.485	0.115	0.132	0.003	0.004	0.004	311.714	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.312	0.261	0.384	0.004	0.007	0.007	444.295	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.407	0.310	4.146	0.012	0.161	0.148	1450.709	0.026
	NA	MC	Motorcycles	12.861	2.267	0.774	0.003	0.028	0.025	398.796	0.053
Delaware	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.953	0.255	0.203	0.002	0.007	0.006	326.435	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.827	0.285	0.327	0.003	0.009	0.008	415.875	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.921	0.690	1.037	0.005	0.018	0.016	760.165	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.411	0.108	0.128	0.003	0.004	0.004	316.523	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.109	0.244	0.366	0.004	0.007	0.006	448.282	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.280	0.249	3.671	0.012	0.160	0.147	1432.612	0.025
	NA	MC	Motorcycles	12.708	2.281	0.748	0.003	0.025	0.022	393.979	0.053
District of Columbia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.956	0.243	0.186	0.002	0.007	0.006	340.016	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.883	0.279	0.304	0.003	0.009	0.008	434.701	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	17.054	0.758	1.074	0.005	0.020	0.018	801.978	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.487	0.103	0.126	0.003	0.004	0.004	330.042	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.317	0.250	0.366	0.004	0.007	0.006	468.758	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.396	0.277	3.836	0.013	0.176	0.162	1500.101	0.026
	NA	MC	Motorcycles	12.713	2.505	0.713	0.003	0.026	0.023	394.471	0.051

**Table 5-19. On-Road Vehicle Emission Factors – 2020 (cont.)**

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>e</sub>	NH <sub>3</sub>
Florida	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.523	0.276	0.203	0.002	0.006	0.005	341.139	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.856	0.343	0.336	0.003	0.007	0.006	435.415	0.024
	Gasoline	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	16.230	0.811	0.963	0.005	0.016	0.014	810.473	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.820	0.079	0.127	0.003	0.004	0.004	333.904	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.845	0.219	0.364	0.004	0.007	0.006	472.877	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.653	0.378	4.174	0.013	0.174	0.160	1557.827	0.028
	NA	MC	Motorcycles	12.996	3.023	0.623	0.003	0.026	0.023	391.756	0.052
Georgia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.146	0.265	0.206	0.002	0.007	0.006	320.209	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.248	0.310	0.336	0.003	0.008	0.007	409.969	0.023
	Gasoline	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	14.753	0.696	0.986	0.005	0.020	0.017	762.152	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.601	0.098	0.133	0.003	0.004	0.004	311.725	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.432	0.233	0.378	0.004	0.007	0.006	442.736	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.748	0.450	4.838	0.013	0.165	0.152	1499.483	0.028
	NA	MC	Motorcycles	13.062	2.569	0.719	0.003	0.027	0.024	394.708	0.054
Hawaii	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.450	0.269	0.204	0.002	0.005	0.005	331.619	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.723	0.329	0.337	0.003	0.006	0.006	423.573	0.024
	Gasoline	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	16.647	0.781	0.970	0.005	0.015	0.013	785.403	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.705	0.073	0.127	0.003	0.004	0.004	324.862	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.625	0.210	0.362	0.004	0.007	0.006	460.398	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.358	0.257	3.536	0.013	0.163	0.150	1489.145	0.026
	NA	MC	Motorcycles	13.045	2.831	0.673	0.003	0.025	0.022	391.266	0.052
Idaho	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.484	0.305	0.237	0.002	0.009	0.008	319.410	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.455	0.336	0.375	0.003	0.011	0.009	407.511	0.023
	Gasoline	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	15.452	0.672	1.079	0.005	0.024	0.021	748.861	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.379	0.126	0.136	0.003	0.004	0.004	308.053	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.042	0.258	0.386	0.004	0.007	0.006	436.925	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.822	0.494	5.426	0.013	0.167	0.154	1480.635	0.029
	NA	MC	Motorcycles	13.626	2.415	0.853	0.003	0.027	0.024	396.902	0.054
Illinois	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.278	0.273	0.206	0.002	0.008	0.007	333.954	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.357	0.330	0.340	0.003	0.010	0.009	427.614	0.024
	Gasoline	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	16.615	0.738	1.056	0.005	0.024	0.021	788.948	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.463	0.114	0.128	0.003	0.004	0.004	323.055	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.276	0.261	0.373	0.004	0.007	0.006	459.297	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.427	0.306	4.048	0.013	0.170	0.156	1480.111	0.026
	NA	MC	Motorcycles	12.819	2.449	0.732	0.003	0.026	0.023	396.864	0.052
Indiana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.446	0.290	0.223	0.002	0.008	0.007	326.668	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.506	0.336	0.358	0.003	0.010	0.009	416.442	0.024
	Gasoline	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	15.646	0.704	1.033	0.005	0.022	0.020	765.203	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.420	0.116	0.130	0.003	0.004	0.004	315.910	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.140	0.254	0.372	0.004	0.007	0.006	447.568	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.721	0.441	4.881	0.013	0.170	0.156	1488.585	0.028
	NA	MC	Motorcycles	13.371	2.410	0.758	0.003	0.027	0.024	395.914	0.053
Iowa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.700	0.323	0.240	0.002	0.009	0.008	318.681	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.690	0.355	0.378	0.003	0.011	0.010	406.582	0.023
	Gasoline	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	15.245	0.664	1.033	0.005	0.025	0.022	747.500	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.405	0.126	0.134	0.003	0.004	0.004	307.181	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.077	0.257	0.378	0.004	0.007	0.006	435.770	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.853	0.508	5.321	0.013	0.167	0.154	1484.846	0.029
	NA	MC	Motorcycles	13.518	2.265	0.795	0.003	0.027	0.024	397.032	0.054
Kansas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.590	0.300	0.233	0.002	0.008	0.007	319.627	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.696	0.341	0.374	0.003	0.009	0.008	408.761	0.023
	Gasoline	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	15.519	0.682	1.031	0.005	0.022	0.019	755.293	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.512	0.113	0.134	0.003	0.004	0.004	309.646	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.273	0.247	0.380	0.004	0.007	0.006	439.709	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.685	0.431	4.819	0.013	0.163	0.150	1478.366	0.028
	NA	MC	Motorcycles	13.310	2.453	0.772	0.003	0.027	0.024	395.965	0.054

Table 5-19. On-Road Vehicle Emission Factors – 2020 (cont.)

State	Fuel Type	Vehicle Type	Emission Factors (g/mi)								
			Criteria Pollutants and Ozone Precursors								
			CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>	
Kentucky	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.497	0.287	0.228	0.002	0.007	0.006	316.583	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.635	0.331	0.368	0.003	0.009	0.008	405.644	0.024
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	14.881	0.661	0.999	0.005	0.022	0.020	755.139	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.532	0.111	0.136	0.003	0.004	0.004	306.924	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.312	0.245	0.384	0.004	0.007	0.006	436.358	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.965	0.550	5.540	0.013	0.169	0.155	1512.001	0.030
	NA	MC	Motorcycles	13.062	2.383	0.759	0.003	0.027	0.024	396.720	0.055
Louisiana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.421	0.277	0.210	0.002	0.006	0.005	326.051	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.662	0.329	0.344	0.003	0.007	0.007	417.046	0.024
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	15.168	0.734	0.961	0.005	0.018	0.016	777.203	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.739	0.090	0.132	0.003	0.004	0.004	318.373	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.673	0.226	0.374	0.004	0.007	0.006	451.605	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.756	0.445	4.669	0.013	0.167	0.154	1525.368	0.028
	NA	MC	Motorcycles	13.056	2.768	0.673	0.003	0.027	0.024	393.562	0.054
Maine	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.389	0.322	0.235	0.002	0.010	0.009	311.361	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.254	0.344	0.366	0.003	0.012	0.010	397.813	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.956	0.632	1.021	0.005	0.026	0.023	729.841	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.309	0.136	0.136	0.003	0.004	0.004	299.212	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.890	0.261	0.380	0.004	0.007	0.006	425.441	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.849	0.514	5.448	0.012	0.164	0.151	1461.720	0.029
	NA	MC	Motorcycles	13.418	2.048	0.824	0.003	0.028	0.025	397.681	0.055
Maryland	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.038	0.254	0.202	0.002	0.007	0.007	321.709	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.014	0.293	0.331	0.003	0.009	0.008	412.796	0.024
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	15.457	0.685	1.037	0.005	0.023	0.021	766.611	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.538	0.108	0.133	0.003	0.004	0.004	311.994	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.370	0.250	0.383	0.004	0.007	0.007	443.966	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.537	0.363	4.434	0.012	0.162	0.149	1469.558	0.027
	NA	MC	Motorcycles	12.758	2.335	0.754	0.003	0.027	0.024	397.088	0.054
Massachusetts	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.059	0.264	0.204	0.002	0.008	0.007	320.821	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.000	0.305	0.332	0.003	0.010	0.009	411.445	0.024
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	15.728	0.669	1.061	0.005	0.026	0.023	760.899	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.436	0.120	0.133	0.003	0.004	0.004	309.865	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.198	0.262	0.383	0.004	0.007	0.007	440.954	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.553	0.376	4.563	0.012	0.163	0.150	1458.393	0.027
	NA	MC	Motorcycles	12.888	2.199	0.789	0.003	0.028	0.025	398.452	0.054
Michigan	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.595	0.304	0.233	0.002	0.009	0.008	324.236	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.701	0.354	0.376	0.003	0.011	0.010	414.299	0.024
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	15.574	0.694	1.049	0.005	0.026	0.023	762.856	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.412	0.124	0.132	0.003	0.004	0.004	312.741	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.138	0.263	0.379	0.004	0.007	0.006	443.903	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.725	0.449	4.988	0.013	0.168	0.155	1482.202	0.028
	NA	MC	Motorcycles	13.517	2.297	0.784	0.003	0.029	0.025	397.804	0.053
Minnesota	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.692	0.325	0.237	0.002	0.011	0.009	320.870	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.692	0.363	0.374	0.003	0.013	0.011	409.580	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	15.437	0.701	1.045	0.005	0.029	0.026	749.591	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.368	0.133	0.133	0.003	0.004	0.004	308.435	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.035	0.268	0.378	0.004	0.007	0.006	437.771	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.558	0.386	4.596	0.012	0.161	0.148	1445.652	0.027
	NA	MC	Motorcycles	13.817	2.253	0.801	0.003	0.029	0.026	398.201	0.054
Mississippi	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.350	0.285	0.217	0.002	0.006	0.005	319.886	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.498	0.327	0.349	0.003	0.008	0.007	408.652	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	14.740	0.704	0.964	0.005	0.017	0.015	755.160	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.590	0.096	0.132	0.003	0.004	0.004	311.761	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.381	0.225	0.370	0.004	0.007	0.006	442.188	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.645	0.405	4.499	0.013	0.162	0.149	1484.364	0.028
	NA	MC	Motorcycles	13.123	2.647	0.704	0.003	0.026	0.023	392.944	0.054

**Table 5-19. On-Road Vehicle Emission Factors – 2020 (cont.)**

State	Fuel Type	Vehicle Type	Emission Factors (g/mi)								
			Criteria Pollutants and Ozone Precursors								
			CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>	
Missouri	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.446	0.283	0.222	0.002	0.007	0.007	313.733	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.539	0.323	0.361	0.003	0.009	0.008	403.064	0.023
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	15.206	0.657	1.012	0.005	0.023	0.020	750.647	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.562	0.112	0.136	0.003	0.004	0.004	304.046	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.364	0.247	0.387	0.004	0.007	0.006	433.198	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.707	0.444	4.899	0.012	0.161	0.148	1475.813	0.028
	NA	MC	Motorcycles	13.011	2.335	0.768	0.003	0.027	0.024	397.348	0.055
Montana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.732	0.332	0.252	0.002	0.010	0.009	313.249	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.689	0.356	0.394	0.003	0.011	0.010	400.163	0.023
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	14.909	0.637	1.063	0.005	0.026	0.023	736.593	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.351	0.136	0.139	0.003	0.004	0.004	301.076	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.967	0.263	0.389	0.004	0.007	0.006	427.870	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.983	0.570	5.915	0.013	0.168	0.154	1486.384	0.030
	NA	MC	Motorcycles	13.720	2.247	0.871	0.003	0.028	0.024	398.021	0.055
Nebraska	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.718	0.318	0.241	0.002	0.009	0.008	318.166	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.785	0.354	0.384	0.003	0.011	0.009	406.949	0.024
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	15.221	0.663	1.039	0.005	0.026	0.023	753.737	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.477	0.123	0.136	0.003	0.004	0.004	307.080	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.215	0.257	0.386	0.004	0.007	0.006	436.223	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.971	0.557	5.662	0.013	0.169	0.156	1507.066	0.030
	NA	MC	Motorcycles	13.479	2.373	0.800	0.003	0.027	0.024	397.826	0.055
Nevada	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.137	0.273	0.212	0.002	0.007	0.006	332.271	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.175	0.313	0.350	0.003	0.008	0.007	424.727	0.024
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	16.434	0.758	1.123	0.005	0.020	0.018	788.040	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.594	0.099	0.137	0.003	0.004	0.004	323.342	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.470	0.241	0.396	0.004	0.007	0.006	458.665	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.749	0.438	5.163	0.013	0.174	0.160	1526.724	0.028
	NA	MC	Motorcycles	13.236	3.033	0.823	0.003	0.026	0.023	394.576	0.052
New Hampshire	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.062	0.280	0.205	0.002	0.009	0.008	318.399	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.890	0.308	0.326	0.003	0.011	0.010	406.553	0.023
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	15.125	0.653	1.046	0.005	0.025	0.022	744.983	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.352	0.127	0.133	0.003	0.004	0.004	306.763	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.999	0.261	0.377	0.004	0.007	0.006	435.473	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.602	0.402	4.722	0.012	0.162	0.149	1447.092	0.028
	NA	MC	Motorcycles	13.084	2.125	0.807	0.003	0.027	0.024	397.261	0.054
New Jersey	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.051	0.255	0.205	0.002	0.008	0.007	313.029	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.901	0.274	0.321	0.003	0.009	0.008	401.891	0.024
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	14.452	0.610	1.015	0.005	0.024	0.021	752.072	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.510	0.115	0.137	0.003	0.004	0.004	303.079	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.279	0.247	0.390	0.004	0.007	0.006	431.584	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.135	0.626	6.097	0.013	0.172	0.158	1527.482	0.031
	NA	MC	Motorcycles	12.737	2.125	0.791	0.003	0.027	0.024	397.952	0.055
New Mexico	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.404	0.299	0.234	0.002	0.007	0.006	318.209	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.454	0.332	0.378	0.003	0.009	0.008	406.964	0.023
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	15.205	0.676	1.073	0.005	0.021	0.019	754.279	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.490	0.110	0.139	0.003	0.004	0.004	308.586	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.234	0.243	0.394	0.004	0.007	0.006	438.126	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.917	0.528	5.669	0.013	0.169	0.155	1505.099	0.030
	NA	MC	Motorcycles	13.284	2.749	0.841	0.003	0.026	0.023	395.751	0.054
New York	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.938	0.255	0.190	0.002	0.008	0.007	324.162	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.721	0.276	0.303	0.003	0.010	0.009	414.769	0.024
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	15.601	0.693	1.055	0.005	0.025	0.022	764.138	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.417	0.118	0.131	0.003	0.004	0.004	313.294	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.159	0.259	0.377	0.004	0.007	0.006	445.114	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.518	0.357	4.412	0.012	0.164	0.151	1459.242	0.027
	NA	MC	Motorcycles	13.114	2.273	0.773	0.003	0.028	0.024	397.237	0.053

**Table 5-19. On-Road Vehicle Emission Factors – 2020 (cont.)**

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
North Carolina	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.270	0.278	0.217	0.002	0.007	0.006	322.538	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.397	0.328	0.353	0.003	0.008	0.007	412.237	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.054	0.712	1.006	0.005	0.019	0.017	761.115	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.520	0.101	0.131	0.003	0.004	0.004	313.549	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.297	0.237	0.373	0.004	0.007	0.006	444.897	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.538	0.360	4.332	0.012	0.163	0.150	1469.156	0.027
North Dakota	NA	MC	Motorcycles	13.174	2.581	0.728	0.003	0.027	0.024	394.406	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.900	0.361	0.247	0.002	0.012	0.011	314.754	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.821	0.383	0.384	0.003	0.014	0.013	401.483	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.714	0.664	1.033	0.005	0.031	0.028	734.985	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.335	0.145	0.137	0.003	0.004	0.004	301.338	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.935	0.271	0.383	0.004	0.007	0.006	428.048	0.008
Ohio	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.873	0.527	5.533	0.012	0.165	0.151	1469.573	0.029
	NA	MC	Motorcycles	13.922	2.142	0.836	0.003	0.029	0.026	398.790	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.309	0.279	0.212	0.002	0.008	0.007	326.301	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.315	0.320	0.341	0.003	0.010	0.009	416.567	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.794	0.711	1.042	0.005	0.023	0.021	765.850	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.419	0.116	0.130	0.003	0.004	0.004	315.487	0.008
Oklahoma	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.149	0.256	0.373	0.004	0.007	0.006	447.468	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.600	0.390	4.574	0.012	0.167	0.154	1473.301	0.027
	NA	MC	Motorcycles	13.469	2.417	0.762	0.003	0.028	0.025	396.342	0.053
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.554	0.291	0.228	0.002	0.007	0.006	323.633	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.722	0.336	0.368	0.003	0.008	0.007	413.535	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.751	0.707	1.021	0.005	0.019	0.017	765.797	0.045
Oregon	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.586	0.103	0.133	0.003	0.004	0.004	314.620	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.406	0.238	0.378	0.004	0.007	0.006	446.240	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.719	0.437	4.802	0.013	0.166	0.153	1499.452	0.028
	NA	MC	Motorcycles	13.229	2.656	0.743	0.003	0.026	0.023	394.630	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.179	0.272	0.223	0.002	0.008	0.007	315.859	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.134	0.306	0.352	0.003	0.009	0.008	403.768	0.023
Pacific Islands	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.287	0.663	1.055	0.005	0.021	0.019	743.300	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.350	0.117	0.134	0.003	0.004	0.004	305.576	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.996	0.249	0.379	0.004	0.007	0.006	433.982	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.710	0.444	5.034	0.012	0.164	0.151	1460.193	0.028
	NA	MC	Motorcycles	13.439	2.292	0.830	0.003	0.027	0.024	396.125	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.189	0.266	0.210	0.002	0.007	0.006	322.300	0.023
Pennsylvania	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.231	0.308	0.341	0.003	0.009	0.008	412.487	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.499	0.694	1.026	0.005	0.021	0.019	763.978	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.497	0.106	0.132	0.003	0.004	0.004	312.864	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.280	0.244	0.379	0.004	0.007	0.006	444.356	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.681	0.422	4.788	0.013	0.166	0.153	1485.391	0.028
	NA	MC	Motorcycles	13.014	2.472	0.756	0.003	0.027	0.024	395.769	0.054
Puerto Rico	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.100	0.265	0.205	0.002	0.008	0.007	324.079	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.068	0.305	0.333	0.003	0.010	0.009	414.267	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.302	0.689	1.040	0.005	0.024	0.021	764.676	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.440	0.117	0.132	0.003	0.004	0.004	313.378	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.188	0.256	0.378	0.004	0.007	0.006	444.829	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.753	0.457	5.017	0.013	0.169	0.156	1490.143	0.028
Puerto Rico	NA	MC	Motorcycles	13.237	2.340	0.767	0.003	0.028	0.025	397.006	0.053
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.867	0.276	0.199	0.002	0.005	0.005	342.880	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	5.366	0.347	0.333	0.003	0.007	0.006	439.291	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	17.633	0.838	0.943	0.005	0.016	0.014	824.346	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	3.053	0.071	0.127	0.003	0.004	0.004	336.396	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	5.262	0.214	0.366	0.004	0.007	0.006	477.629	0.008
Puerto Rico	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.448	0.285	3.522	0.013	0.168	0.155	1557.490	0.026
	NA	MC	Motorcycles	13.044	3.141	0.603	0.003	0.026	0.023	392.087	0.052

Table 5-19. On-Road Vehicle Emission Factors – 2020 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Rhode Island	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.040	0.256	0.194	0.002	0.008	0.007	326.035	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.945	0.285	0.317	0.003	0.010	0.009	418.136	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	16.087	0.692	1.067	0.005	0.025	0.023	773.985	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.446	0.116	0.131	0.003	0.004	0.004	315.248	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.241	0.261	0.380	0.004	0.007	0.007	448.591	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.575	0.378	4.553	0.013	0.168	0.154	1476.363	0.027
	NA	MC	Motorcycles	12.856	2.282	0.768	0.003	0.028	0.024	398.090	0.053
South Carolina	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.398	0.282	0.220	0.002	0.006	0.006	322.835	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.604	0.333	0.358	0.003	0.008	0.007	412.917	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.852	0.710	0.986	0.005	0.019	0.017	768.355	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.618	0.097	0.133	0.003	0.004	0.004	314.381	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.466	0.233	0.378	0.004	0.007	0.006	446.079	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.878	0.503	5.142	0.013	0.170	0.156	1522.836	0.029
	NA	MC	Motorcycles	13.144	2.670	0.712	0.003	0.027	0.024	394.593	0.054
South Dakota	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.732	0.331	0.244	0.002	0.010	0.009	313.205	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.777	0.362	0.385	0.003	0.012	0.011	400.880	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.542	0.652	1.025	0.005	0.029	0.025	741.779	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.426	0.134	0.138	0.003	0.004	0.004	301.218	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.103	0.263	0.389	0.004	0.007	0.006	428.542	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.025	0.587	5.906	0.013	0.168	0.155	1498.981	0.030
	NA	MC	Motorcycles	13.720	2.267	0.821	0.003	0.029	0.025	398.760	0.055
Tennessee	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.273	0.272	0.213	0.002	0.007	0.006	323.282	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.383	0.319	0.346	0.003	0.009	0.008	413.603	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.245	0.707	1.009	0.005	0.021	0.019	767.647	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.559	0.104	0.133	0.003	0.004	0.004	314.046	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.379	0.242	0.378	0.004	0.007	0.006	445.826	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.786	0.466	4.987	0.013	0.168	0.155	1505.673	0.029
	NA	MC	Motorcycles	13.245	2.599	0.733	0.003	0.027	0.024	395.583	0.054
Texas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.191	0.254	0.196	0.002	0.006	0.005	324.993	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.328	0.300	0.323	0.003	0.007	0.006	416.676	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.468	0.717	0.982	0.005	0.018	0.016	778.735	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.765	0.090	0.134	0.003	0.004	0.004	317.317	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.734	0.228	0.382	0.004	0.007	0.006	450.890	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.638	0.396	4.473	0.013	0.164	0.151	1511.000	0.028
	NA	MC	Motorcycles	12.562	2.729	0.693	0.003	0.026	0.023	394.358	0.054
Utah	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.356	0.285	0.219	0.002	0.009	0.008	327.449	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.421	0.327	0.358	0.003	0.011	0.009	419.368	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	16.421	0.727	1.116	0.005	0.026	0.023	775.708	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.481	0.117	0.135	0.003	0.004	0.004	316.579	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.286	0.261	0.392	0.004	0.007	0.006	449.962	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.651	0.411	4.925	0.013	0.169	0.155	1489.652	0.028
	NA	MC	Motorcycles	13.589	2.667	0.834	0.003	0.028	0.025	397.728	0.053
Vermont	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.146	0.304	0.212	0.002	0.010	0.009	312.043	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.939	0.322	0.333	0.003	0.012	0.011	398.772	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.077	0.639	1.022	0.005	0.027	0.024	732.670	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.335	0.136	0.136	0.003	0.004	0.004	299.795	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.936	0.263	0.382	0.004	0.007	0.006	426.289	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.882	0.528	5.529	0.012	0.165	0.151	1469.289	0.029
	NA	MC	Motorcycles	13.542	2.114	0.822	0.003	0.028	0.025	398.001	0.055
Virgin Islands	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.651	0.290	0.202	0.002	0.005	0.004	325.397	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.915	0.321	0.319	0.003	0.006	0.005	415.441	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	16.101	0.749	0.869	0.005	0.010	0.009	764.047	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.873	0.073	0.129	0.003	0.004	0.004	319.813	0.007
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.837	0.196	0.355	0.004	0.006	0.006	453.267	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.213	0.210	3.008	0.012	0.148	0.136	1470.336	0.025
	NA	MC	Motorcycles	13.018	2.622	0.623	0.003	0.023	0.021	388.214	0.054

Table 5-19. On-Road Vehicle Emission Factors – 2020 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Virginia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.264	0.272	0.215	0.002	0.007	0.006	322.462	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.354	0.317	0.351	0.003	0.009	0.008	412.850	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.130	0.686	1.019	0.005	0.022	0.019	765.871	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.522	0.107	0.132	0.003	0.004	0.004	312.895	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.325	0.246	0.379	0.004	0.007	0.006	444.495	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.742	0.449	4.921	0.013	0.168	0.154	1495.166	0.028
	NA	MC	Motorcycles	12.914	2.416	0.742	0.003	0.027	0.024	396.223	0.054
Washington	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.256	0.267	0.215	0.002	0.008	0.007	319.423	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.304	0.311	0.347	0.003	0.010	0.009	409.604	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.769	0.685	1.072	0.005	0.025	0.022	759.076	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.394	0.117	0.133	0.003	0.004	0.004	308.914	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.128	0.258	0.384	0.004	0.007	0.007	439.522	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.743	0.455	5.110	0.013	0.168	0.154	1477.901	0.028
	NA	MC	Motorcycles	13.530	2.335	0.816	0.003	0.028	0.025	398.083	0.054
West Virginia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.446	0.294	0.232	0.002	0.008	0.007	313.782	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.530	0.334	0.370	0.003	0.010	0.008	401.883	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.641	0.659	1.007	0.005	0.023	0.020	744.040	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.445	0.116	0.135	0.003	0.004	0.004	303.595	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.147	0.248	0.381	0.004	0.007	0.006	431.782	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.829	0.497	5.243	0.013	0.165	0.152	1480.330	0.029
	NA	MC	Motorcycles	13.381	2.360	0.778	0.003	0.028	0.024	396.682	0.055
Wisconsin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.521	0.310	0.228	0.002	0.010	0.009	318.601	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.502	0.347	0.362	0.003	0.012	0.010	406.895	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.100	0.669	1.030	0.005	0.027	0.024	747.123	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.376	0.130	0.134	0.003	0.004	0.004	306.620	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.041	0.264	0.379	0.004	0.007	0.006	435.335	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.724	0.456	5.040	0.012	0.164	0.151	1464.590	0.028
	NA	MC	Motorcycles	13.409	2.190	0.797	0.003	0.028	0.025	397.987	0.054
Wyoming	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.829	0.338	0.255	0.002	0.010	0.009	314.715	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.848	0.366	0.401	0.003	0.012	0.011	402.608	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.966	0.643	1.072	0.005	0.029	0.026	745.693	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.411	0.136	0.140	0.003	0.004	0.004	302.468	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.089	0.267	0.397	0.004	0.007	0.006	430.027	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.139	0.635	6.367	0.013	0.172	0.158	1514.501	0.031
	NA	MC	Motorcycles	13.761	2.355	0.875	0.003	0.028	0.025	399.344	0.055

Table 5-20. On-Road Vehicle Emission Factors – 2021

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub> e	NH <sub>3</sub>
Alabama	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.157	0.257	0.188	0.002	0.006	0.005	314.929	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.212	0.298	0.309	0.003	0.007	0.007	402.001	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.085	0.661	0.880	0.005	0.017	0.015	763.257	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.547	0.092	0.124	0.003	0.004	0.004	306.609	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.108	0.202	0.328	0.004	0.006	0.006	428.931	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.563	0.379	4.180	0.013	0.144	0.133	1485.869	0.028
	NA	MC	Motorcycles	12.963	2.670	0.701	0.003	0.026	0.023	393.394	0.054
Alaska	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.667	0.328	0.215	0.002	0.011	0.010	312.520	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.425	0.348	0.337	0.003	0.014	0.012	398.473	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.630	0.616	0.977	0.005	0.032	0.028	747.903	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.260	0.151	0.128	0.002	0.004	0.004	298.049	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.659	0.263	0.340	0.004	0.007	0.006	417.489	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.811	0.509	5.280	0.012	0.148	0.137	1471.175	0.030
	NA	MC	Motorcycles	13.825	1.966	0.861	0.003	0.029	0.026	401.288	0.055
Arizona	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.133	0.247	0.180	0.002	0.005	0.005	321.339	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.159	0.281	0.303	0.003	0.007	0.006	411.605	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.819	0.699	0.970	0.005	0.017	0.015	791.510	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.758	0.083	0.133	0.003	0.004	0.004	313.894	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.501	0.200	0.360	0.004	0.007	0.006	439.942	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.706	0.429	4.860	0.013	0.150	0.138	1540.095	0.029
	NA	MC	Motorcycles	12.569	3.132	0.798	0.002	0.025	0.022	393.941	0.053
Arkansas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.354	0.261	0.198	0.002	0.006	0.005	308.233	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.419	0.298	0.324	0.003	0.008	0.007	394.975	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.408	0.628	0.898	0.005	0.019	0.017	754.987	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.571	0.098	0.128	0.003	0.004	0.004	299.572	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.146	0.208	0.337	0.004	0.007	0.006	420.423	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.714	0.449	4.657	0.013	0.144	0.133	1492.630	0.029
	NA	MC	Motorcycles	13.061	2.524	0.740	0.003	0.026	0.023	395.263	0.055
Colorado	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.155	0.266	0.196	0.002	0.008	0.007	312.819	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.060	0.297	0.319	0.003	0.010	0.009	400.673	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.998	0.642	0.982	0.005	0.025	0.022	760.282	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.405	0.116	0.128	0.003	0.004	0.004	301.897	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.922	0.232	0.345	0.004	0.007	0.006	423.732	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.583	0.400	4.609	0.012	0.145	0.133	1467.660	0.028
	NA	MC	Motorcycles	13.434	2.616	0.831	0.003	0.028	0.025	398.091	0.054
Connecticut	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.855	0.230	0.169	0.002	0.007	0.007	312.534	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.727	0.260	0.281	0.003	0.010	0.009	401.943	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.139	0.631	0.959	0.005	0.025	0.022	766.470	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.450	0.111	0.125	0.003	0.004	0.004	302.109	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.034	0.232	0.340	0.004	0.007	0.006	425.279	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.296	0.279	3.735	0.012	0.139	0.128	1439.677	0.026
	NA	MC	Motorcycles	12.711	2.261	0.773	0.003	0.028	0.025	398.880	0.054
Delaware	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.775	0.233	0.176	0.002	0.006	0.006	316.557	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.561	0.259	0.287	0.003	0.008	0.007	403.423	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.998	0.634	0.931	0.005	0.017	0.015	757.454	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.377	0.104	0.121	0.003	0.004	0.004	306.764	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.839	0.216	0.323	0.004	0.006	0.006	428.978	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.167	0.219	3.277	0.012	0.139	0.127	1421.934	0.025
	NA	MC	Motorcycles	12.562	2.274	0.746	0.003	0.025	0.022	394.064	0.053
District of Columbia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.782	0.222	0.162	0.002	0.006	0.006	329.697	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.626	0.256	0.268	0.003	0.008	0.007	421.668	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	16.071	0.695	0.964	0.005	0.019	0.017	799.271	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.452	0.099	0.119	0.003	0.004	0.004	319.855	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.032	0.221	0.323	0.004	0.007	0.006	448.594	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.274	0.244	3.427	0.013	0.152	0.140	1489.362	0.026
	NA	MC	Motorcycles	12.569	2.496	0.711	0.003	0.026	0.023	394.549	0.051



Table 5-20. On-Road Vehicle Emission Factors – 2021 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Florida	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.320	0.250	0.174	0.002	0.005	0.005	330.722	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.531	0.308	0.294	0.003	0.007	0.006	422.267	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.246	0.745	0.862	0.005	0.016	0.014	807.709	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.779	0.075	0.120	0.003	0.004	0.004	323.543	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.530	0.191	0.322	0.004	0.007	0.006	452.469	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.532	0.342	3.789	0.013	0.151	0.139	1546.096	0.028
	NA	MC	Motorcycles	12.855	3.009	0.621	0.003	0.026	0.023	391.843	0.052
Georgia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.964	0.240	0.179	0.002	0.006	0.005	310.503	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.961	0.280	0.295	0.003	0.008	0.007	397.665	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.833	0.639	0.885	0.005	0.019	0.017	759.384	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.565	0.094	0.126	0.003	0.004	0.004	302.090	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.146	0.205	0.335	0.004	0.007	0.006	423.689	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.635	0.413	4.427	0.013	0.144	0.132	1487.500	0.028
	NA	MC	Motorcycles	12.916	2.560	0.718	0.003	0.027	0.024	394.800	0.055
Hawaii	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.256	0.243	0.175	0.002	0.005	0.004	321.492	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.410	0.295	0.295	0.003	0.006	0.005	410.777	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.691	0.718	0.869	0.005	0.014	0.013	782.702	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.666	0.070	0.120	0.003	0.004	0.004	314.777	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.324	0.183	0.320	0.004	0.007	0.006	440.507	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.243	0.227	3.168	0.012	0.141	0.130	1478.096	0.026
	NA	MC	Motorcycles	12.914	2.819	0.671	0.003	0.025	0.022	391.355	0.053
Idaho	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.277	0.279	0.206	0.002	0.008	0.007	309.805	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.155	0.305	0.331	0.003	0.010	0.009	395.372	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.501	0.617	0.969	0.005	0.023	0.020	746.060	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.346	0.121	0.129	0.003	0.004	0.004	298.592	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.779	0.230	0.342	0.004	0.007	0.006	418.186	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.709	0.456	4.977	0.012	0.146	0.134	1468.654	0.029
	NA	MC	Motorcycles	13.471	2.408	0.851	0.003	0.027	0.024	396.988	0.055
Illinois	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.080	0.248	0.179	0.002	0.007	0.006	323.858	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.053	0.298	0.298	0.003	0.009	0.008	414.842	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.634	0.677	0.947	0.005	0.022	0.020	786.219	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.428	0.109	0.121	0.003	0.004	0.004	313.103	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.996	0.232	0.329	0.004	0.007	0.006	439.596	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.309	0.273	3.635	0.012	0.147	0.135	1469.205	0.026
	NA	MC	Motorcycles	12.669	2.441	0.731	0.003	0.026	0.023	396.943	0.052
Indiana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.240	0.264	0.194	0.002	0.007	0.007	316.809	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.200	0.304	0.316	0.003	0.009	0.008	404.005	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.676	0.646	0.927	0.005	0.021	0.019	762.418	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.386	0.112	0.123	0.003	0.004	0.004	306.188	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.869	0.225	0.329	0.004	0.007	0.006	428.347	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.606	0.404	4.455	0.012	0.148	0.136	1476.892	0.028
	NA	MC	Motorcycles	13.215	2.401	0.757	0.003	0.027	0.024	395.998	0.053
Iowa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.484	0.294	0.210	0.002	0.008	0.007	309.106	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.383	0.322	0.334	0.003	0.010	0.009	394.476	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.323	0.610	0.928	0.005	0.023	0.020	744.691	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.371	0.122	0.127	0.002	0.004	0.004	297.750	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.812	0.229	0.334	0.004	0.007	0.006	417.083	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.740	0.469	4.887	0.012	0.145	0.134	1472.750	0.029
	NA	MC	Motorcycles	13.356	2.242	0.793	0.003	0.027	0.024	397.120	0.055
Kansas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.384	0.273	0.203	0.002	0.007	0.006	309.980	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.387	0.309	0.330	0.003	0.009	0.008	396.542	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.591	0.627	0.926	0.005	0.021	0.018	752.523	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.476	0.108	0.127	0.003	0.004	0.004	300.105	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.996	0.219	0.336	0.004	0.007	0.006	420.823	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.573	0.395	4.400	0.012	0.142	0.131	1466.583	0.028
	NA	MC	Motorcycles	13.157	2.425	0.770	0.003	0.027	0.024	396.055	0.055

Table 5-20. On-Road Vehicle Emission Factors – 2021 (cont.)

State	Fuel Type	Vehicle Type	Emission Factors (g/mi)								
			Criteria Pollutants and Ozone Precursors								
			CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>	
Kentucky	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.292	0.261	0.199	0.002	0.007	0.006	307.028	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.325	0.298	0.325	0.003	0.008	0.007	393.515	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.945	0.608	0.897	0.005	0.021	0.018	752.329	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.496	0.107	0.128	0.002	0.004	0.004	297.465	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.034	0.217	0.340	0.004	0.007	0.006	417.637	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.851	0.509	5.105	0.013	0.147	0.136	1499.562	0.030
	NA	MC	Motorcycles	12.913	2.376	0.757	0.003	0.027	0.024	396.811	0.055
Louisiana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.225	0.252	0.181	0.002	0.006	0.005	316.136	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.352	0.296	0.302	0.003	0.007	0.006	404.494	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	14.230	0.675	0.862	0.005	0.017	0.015	774.424	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.701	0.086	0.125	0.003	0.004	0.004	308.512	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.372	0.198	0.331	0.004	0.007	0.006	432.148	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.641	0.408	4.270	0.013	0.145	0.134	1513.286	0.028
	NA	MC	Motorcycles	12.912	2.757	0.672	0.003	0.027	0.024	393.654	0.054
Maine	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.184	0.294	0.205	0.002	0.009	0.008	302.041	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.965	0.313	0.323	0.003	0.011	0.010	385.998	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.068	0.580	0.917	0.005	0.024	0.022	727.044	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.277	0.131	0.129	0.002	0.004	0.004	290.048	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.637	0.234	0.336	0.003	0.006	0.006	407.213	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.739	0.476	5.008	0.012	0.143	0.131	1449.648	0.029
	NA	MC	Motorcycles	13.257	2.041	0.823	0.003	0.028	0.025	397.770	0.056
Maryland	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.863	0.232	0.175	0.002	0.007	0.006	311.982	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.741	0.266	0.290	0.003	0.009	0.008	400.451	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	14.524	0.629	0.931	0.005	0.022	0.019	763.872	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.503	0.104	0.126	0.003	0.004	0.004	302.368	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.089	0.221	0.339	0.004	0.007	0.006	424.924	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.425	0.330	4.021	0.012	0.141	0.130	1458.161	0.027
	NA	MC	Motorcycles	12.613	2.328	0.753	0.003	0.027	0.024	397.176	0.054
Massachusetts	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.872	0.240	0.177	0.002	0.008	0.007	311.155	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.712	0.276	0.291	0.003	0.010	0.009	399.184	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	14.790	0.614	0.954	0.005	0.024	0.022	758.149	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.402	0.115	0.126	0.003	0.004	0.004	300.330	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.926	0.233	0.339	0.004	0.007	0.006	422.075	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.442	0.342	4.141	0.012	0.141	0.130	1447.037	0.027
	NA	MC	Motorcycles	12.737	2.193	0.787	0.003	0.028	0.024	398.537	0.054
Michigan	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.378	0.277	0.203	0.002	0.008	0.007	314.476	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.383	0.320	0.332	0.003	0.010	0.009	401.960	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	14.596	0.637	0.942	0.005	0.025	0.022	760.066	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.378	0.119	0.125	0.003	0.004	0.004	303.131	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.869	0.235	0.335	0.004	0.007	0.006	424.886	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.611	0.412	4.556	0.012	0.146	0.135	1470.487	0.028
	NA	MC	Motorcycles	13.356	2.289	0.783	0.003	0.028	0.025	397.887	0.054
Minnesota	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.463	0.297	0.207	0.002	0.010	0.009	311.246	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.369	0.329	0.331	0.003	0.012	0.011	397.415	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	14.433	0.644	0.938	0.005	0.027	0.024	746.816	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.335	0.128	0.126	0.003	0.004	0.004	298.977	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.772	0.239	0.334	0.004	0.007	0.006	419.025	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.447	0.352	4.175	0.012	0.140	0.129	1434.285	0.027
	NA	MC	Motorcycles	13.646	2.259	0.799	0.003	0.029	0.025	398.284	0.054
Mississippi	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.156	0.259	0.188	0.002	0.006	0.005	310.182	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.196	0.294	0.307	0.003	0.007	0.006	396.370	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.830	0.647	0.864	0.005	0.016	0.014	752.406	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.553	0.092	0.125	0.003	0.004	0.004	302.122	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.096	0.198	0.328	0.004	0.006	0.006	423.116	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.533	0.371	4.103	0.012	0.141	0.129	1472.574	0.028
	NA	MC	Motorcycles	12.977	2.637	0.702	0.003	0.026	0.023	393.036	0.055

Table 5-20. On-Road Vehicle Emission Factors – 2021 (cont.)

State	Fuel Type	Vehicle Type	Emission Factors (g/mi)								
			Criteria Pollutants and Ozone Precursors								
			CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>	
Missouri	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.248	0.257	0.194	0.002	0.007	0.006	304.270	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.238	0.292	0.318	0.003	0.009	0.008	391.022	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.290	0.604	0.910	0.005	0.022	0.019	747.885	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.526	0.108	0.129	0.002	0.004	0.004	294.672	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.085	0.219	0.343	0.004	0.007	0.006	414.624	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.597	0.408	4.482	0.012	0.140	0.129	1463.908	0.028
	NA	MC	Motorcycles	12.862	2.314	0.767	0.003	0.027	0.024	397.440	0.056
Montana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.510	0.303	0.221	0.002	0.009	0.008	303.871	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.378	0.323	0.349	0.003	0.011	0.009	388.277	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.976	0.586	0.956	0.005	0.025	0.022	733.766	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.319	0.131	0.131	0.002	0.004	0.004	291.854	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.710	0.235	0.345	0.003	0.006	0.006	409.549	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.870	0.529	5.456	0.012	0.146	0.135	1473.992	0.030
	NA	MC	Motorcycles	13.561	2.240	0.869	0.003	0.027	0.024	398.110	0.056
Nebraska	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.503	0.290	0.211	0.002	0.008	0.007	308.598	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.472	0.321	0.340	0.003	0.010	0.009	394.825	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.291	0.610	0.934	0.005	0.024	0.021	750.909	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.442	0.119	0.129	0.002	0.004	0.004	297.643	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.943	0.229	0.342	0.004	0.007	0.006	417.537	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.857	0.516	5.217	0.013	0.148	0.136	1494.656	0.030
	NA	MC	Motorcycles	13.320	2.347	0.798	0.003	0.027	0.024	397.915	0.055
Nevada	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.959	0.248	0.183	0.002	0.006	0.005	322.181	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.895	0.283	0.306	0.003	0.008	0.007	411.974	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.469	0.697	1.008	0.005	0.019	0.017	785.264	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.558	0.095	0.129	0.003	0.004	0.004	313.348	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.179	0.212	0.350	0.004	0.007	0.006	438.937	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.631	0.401	4.710	0.013	0.151	0.139	1514.905	0.028
	NA	MC	Motorcycles	13.097	3.024	0.821	0.003	0.026	0.023	394.660	0.053
New Hampshire	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.874	0.255	0.178	0.002	0.008	0.007	308.832	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.612	0.279	0.286	0.003	0.010	0.009	394.454	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.211	0.600	0.940	0.005	0.023	0.021	742.217	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.319	0.123	0.126	0.002	0.004	0.004	297.345	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.739	0.232	0.334	0.004	0.007	0.006	416.802	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.490	0.368	4.298	0.012	0.141	0.129	1435.629	0.027
	NA	MC	Motorcycles	12.928	2.119	0.805	0.003	0.027	0.024	397.347	0.054
New Jersey	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.870	0.234	0.179	0.002	0.007	0.006	303.594	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.634	0.250	0.283	0.003	0.009	0.008	389.888	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.554	0.561	0.912	0.005	0.023	0.020	749.233	0.043
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.475	0.110	0.130	0.002	0.004	0.004	293.743	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.005	0.219	0.346	0.003	0.007	0.006	413.095	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.021	0.582	5.644	0.013	0.150	0.138	1514.648	0.031
	NA	MC	Motorcycles	12.591	2.119	0.790	0.003	0.027	0.024	398.045	0.056
New Mexico	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.209	0.271	0.204	0.002	0.007	0.006	308.598	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.159	0.300	0.333	0.003	0.008	0.007	394.790	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.284	0.622	0.964	0.005	0.020	0.018	751.478	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.455	0.105	0.131	0.003	0.004	0.004	299.076	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.960	0.215	0.349	0.004	0.007	0.006	419.306	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.803	0.488	5.215	0.013	0.147	0.135	1492.809	0.029
	NA	MC	Motorcycles	13.132	2.710	0.839	0.003	0.026	0.023	395.841	0.055
New York	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.770	0.233	0.166	0.002	0.008	0.007	314.385	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.483	0.253	0.268	0.003	0.010	0.009	402.396	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.658	0.636	0.947	0.005	0.023	0.020	761.393	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.383	0.113	0.124	0.003	0.004	0.004	303.651	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.888	0.230	0.334	0.004	0.007	0.006	426.028	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.404	0.324	3.994	0.012	0.143	0.131	1448.016	0.027
	NA	MC	Motorcycles	12.960	2.266	0.771	0.003	0.028	0.024	397.321	0.054

Table 5-20. On-Road Vehicle Emission Factors – 2021 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
North Carolina	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.079	0.252	0.188	0.002	0.006	0.006	312.766	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.099	0.295	0.310	0.003	0.008	0.007	399.874	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.127	0.654	0.902	0.005	0.019	0.016	758.377	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.485	0.097	0.124	0.003	0.004	0.004	303.866	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.018	0.209	0.330	0.004	0.007	0.006	425.750	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.426	0.326	3.928	0.012	0.141	0.130	1457.747	0.027
North Dakota	NA	MC	Motorcycles	13.026	2.572	0.726	0.003	0.027	0.024	394.494	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.652	0.331	0.216	0.002	0.011	0.010	305.362	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.488	0.348	0.339	0.003	0.013	0.012	389.594	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.738	0.610	0.928	0.005	0.029	0.025	732.159	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.303	0.140	0.129	0.002	0.004	0.004	292.129	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.679	0.243	0.339	0.003	0.006	0.006	409.737	0.008
Ohio	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.761	0.488	5.089	0.012	0.144	0.132	1457.430	0.029
	NA	MC	Motorcycles	13.746	2.148	0.834	0.003	0.029	0.025	398.877	0.056
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.111	0.254	0.185	0.002	0.008	0.007	316.454	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.024	0.290	0.301	0.003	0.010	0.008	404.130	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.813	0.653	0.935	0.005	0.022	0.019	763.087	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.385	0.112	0.123	0.003	0.004	0.004	305.777	0.008
Oklahoma	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.878	0.227	0.330	0.004	0.007	0.006	428.261	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.485	0.355	4.155	0.012	0.145	0.133	1461.894	0.027
	NA	MC	Motorcycles	13.312	2.409	0.760	0.003	0.028	0.024	396.426	0.053
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.351	0.264	0.198	0.002	0.006	0.005	313.830	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.411	0.303	0.324	0.003	0.008	0.007	401.134	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.813	0.650	0.916	0.005	0.019	0.016	763.022	0.045
Oregon	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.549	0.098	0.126	0.003	0.004	0.004	304.905	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.120	0.210	0.335	0.004	0.007	0.006	427.041	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.605	0.401	4.386	0.013	0.144	0.133	1487.567	0.028
	NA	MC	Motorcycles	13.080	2.623	0.741	0.003	0.026	0.023	394.720	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.993	0.248	0.194	0.002	0.007	0.006	306.337	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.853	0.277	0.310	0.003	0.009	0.008	391.711	0.023
Pacific Islands	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.353	0.609	0.948	0.005	0.020	0.018	740.541	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.317	0.112	0.127	0.002	0.004	0.004	296.173	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.736	0.222	0.336	0.004	0.007	0.006	415.347	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.598	0.408	4.600	0.012	0.143	0.132	1448.491	0.028
	NA	MC	Motorcycles	13.291	2.286	0.827	0.003	0.027	0.024	396.214	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.005	0.242	0.182	0.002	0.006	0.006	312.546	0.022
Pennsylvania	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.948	0.279	0.300	0.003	0.008	0.007	400.134	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.559	0.637	0.921	0.005	0.020	0.018	761.216	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.462	0.101	0.125	0.003	0.004	0.004	303.211	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.003	0.215	0.335	0.004	0.007	0.006	425.267	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.567	0.386	4.367	0.012	0.145	0.133	1473.699	0.028
	NA	MC	Motorcycles	12.869	2.457	0.755	0.003	0.027	0.024	395.854	0.054
Puerto Rico	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.916	0.242	0.179	0.002	0.007	0.007	314.302	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.788	0.277	0.293	0.003	0.010	0.008	401.901	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.355	0.633	0.934	0.005	0.023	0.020	761.890	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.406	0.112	0.125	0.003	0.004	0.004	303.732	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.916	0.227	0.335	0.004	0.007	0.006	425.752	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.638	0.419	4.587	0.012	0.147	0.135	1478.348	0.028
Puerto Rico	NA	MC	Motorcycles	13.084	2.339	0.765	0.003	0.028	0.024	397.091	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.651	0.249	0.171	0.002	0.005	0.004	332.390	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	5.017	0.312	0.292	0.003	0.006	0.006	426.003	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	16.619	0.771	0.845	0.005	0.016	0.014	821.610	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	3.009	0.067	0.120	0.003	0.004	0.004	325.935	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.924	0.186	0.323	0.004	0.007	0.006	457.024	0.008
Puerto Rico	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.329	0.253	3.166	0.013	0.146	0.134	1546.044	0.026
	NA	MC	Motorcycles	12.913	3.126	0.601	0.003	0.026	0.023	392.176	0.052

Table 5-20. On-Road Vehicle Emission Factors – 2021 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Rhode Island	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.862	0.234	0.170	0.002	0.007	0.007	316.194	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.690	0.262	0.281	0.003	0.010	0.008	405.661	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.132	0.635	0.959	0.005	0.024	0.021	771.235	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.412	0.112	0.124	0.003	0.004	0.004	305.540	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.966	0.232	0.336	0.004	0.007	0.006	429.377	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.461	0.344	4.130	0.012	0.145	0.134	1465.026	0.027
	NA	MC	Motorcycles	12.706	2.276	0.766	0.003	0.027	0.024	398.172	0.053
South Carolina	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.202	0.256	0.190	0.002	0.006	0.005	313.043	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.298	0.300	0.315	0.003	0.008	0.007	400.518	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.922	0.653	0.884	0.005	0.019	0.016	765.560	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.581	0.093	0.126	0.003	0.004	0.004	304.664	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.178	0.205	0.335	0.004	0.007	0.006	426.887	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.763	0.463	4.722	0.013	0.148	0.136	1510.567	0.029
	NA	MC	Motorcycles	12.998	2.660	0.711	0.003	0.027	0.024	394.683	0.054
South Dakota	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.499	0.302	0.213	0.002	0.009	0.008	303.825	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.448	0.328	0.340	0.003	0.011	0.010	388.972	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.567	0.600	0.921	0.005	0.027	0.023	738.941	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.392	0.129	0.131	0.002	0.004	0.004	291.985	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.839	0.235	0.345	0.003	0.007	0.006	410.209	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.912	0.545	5.455	0.013	0.147	0.135	1486.439	0.030
	NA	MC	Motorcycles	13.552	2.277	0.819	0.003	0.029	0.025	398.850	0.056
Tennessee	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.082	0.247	0.184	0.002	0.007	0.006	313.494	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.086	0.288	0.304	0.003	0.008	0.007	401.210	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.292	0.650	0.906	0.005	0.020	0.018	764.864	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.523	0.100	0.125	0.003	0.004	0.004	304.352	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.096	0.213	0.335	0.004	0.007	0.006	426.670	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.672	0.428	4.565	0.013	0.147	0.135	1493.683	0.029
	NA	MC	Motorcycles	13.096	2.590	0.732	0.003	0.027	0.024	395.671	0.054
Texas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.011	0.230	0.169	0.002	0.005	0.005	315.112	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.041	0.270	0.284	0.003	0.007	0.006	404.140	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.540	0.659	0.881	0.005	0.018	0.016	775.981	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.726	0.086	0.126	0.003	0.004	0.004	307.486	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.430	0.200	0.338	0.004	0.007	0.006	431.484	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.525	0.361	4.073	0.013	0.143	0.131	1499.179	0.028
	NA	MC	Motorcycles	12.425	2.699	0.691	0.003	0.026	0.023	394.450	0.054
Utah	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.160	0.260	0.191	0.002	0.008	0.007	317.566	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.126	0.297	0.316	0.003	0.010	0.009	406.855	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.424	0.668	1.003	0.005	0.024	0.022	772.936	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.446	0.113	0.128	0.003	0.004	0.004	306.832	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.008	0.232	0.347	0.004	0.007	0.006	430.682	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.535	0.375	4.481	0.012	0.147	0.135	1478.106	0.028
	NA	MC	Motorcycles	13.436	2.659	0.832	0.003	0.028	0.025	397.811	0.053
Vermont	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.949	0.277	0.185	0.002	0.009	0.008	302.705	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.659	0.292	0.293	0.003	0.011	0.010	386.931	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.179	0.587	0.918	0.005	0.025	0.022	729.863	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.302	0.131	0.129	0.002	0.004	0.004	290.613	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.680	0.235	0.338	0.003	0.006	0.006	408.033	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.771	0.489	5.087	0.012	0.144	0.132	1457.127	0.029
	NA	MC	Motorcycles	13.379	2.107	0.820	0.003	0.028	0.025	398.090	0.056
Virgin Islands	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.443	0.262	0.174	0.002	0.004	0.004	315.459	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.590	0.288	0.279	0.003	0.005	0.005	402.865	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.187	0.691	0.779	0.005	0.010	0.009	761.325	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.831	0.069	0.122	0.003	0.004	0.004	309.869	0.007
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.521	0.170	0.313	0.004	0.006	0.006	433.572	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.104	0.184	2.685	0.012	0.128	0.118	1459.121	0.025
	NA	MC	Motorcycles	12.885	2.607	0.622	0.003	0.023	0.021	388.311	0.055

Table 5-20. On-Road Vehicle Emission Factors – 2021 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Virginia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.076	0.248	0.187	0.002	0.007	0.006	312.708	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.065	0.287	0.309	0.003	0.008	0.007	400.493	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	14.202	0.630	0.915	0.005	0.021	0.018	763.098	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.487	0.103	0.125	0.003	0.004	0.004	303.243	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.046	0.217	0.336	0.004	0.007	0.006	425.412	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.628	0.412	4.498	0.013	0.146	0.134	1483.312	0.028
	NA	MC	Motorcycles	12.768	2.408	0.741	0.003	0.027	0.024	396.311	0.054
Washington	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.064	0.244	0.188	0.002	0.007	0.006	309.789	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.014	0.282	0.308	0.003	0.009	0.008	397.383	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	14.800	0.630	0.963	0.005	0.023	0.021	756.309	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.360	0.113	0.126	0.003	0.004	0.004	299.405	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.861	0.230	0.340	0.004	0.007	0.006	420.698	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.629	0.418	4.672	0.012	0.146	0.134	1466.158	0.028
	NA	MC	Motorcycles	13.380	2.329	0.814	0.003	0.028	0.025	398.169	0.054
West Virginia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.243	0.268	0.202	0.002	0.007	0.006	304.330	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.225	0.302	0.327	0.003	0.009	0.008	389.886	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.712	0.605	0.905	0.005	0.022	0.019	741.258	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.411	0.112	0.128	0.002	0.004	0.004	294.252	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.880	0.220	0.337	0.003	0.007	0.006	413.255	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.717	0.459	4.814	0.012	0.143	0.132	1468.239	0.029
	NA	MC	Motorcycles	13.227	2.353	0.776	0.003	0.028	0.024	396.774	0.055
Wisconsin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.302	0.283	0.199	0.002	0.009	0.008	309.039	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.187	0.314	0.319	0.003	0.011	0.010	394.798	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	14.134	0.615	0.925	0.005	0.025	0.022	744.331	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.343	0.126	0.127	0.002	0.004	0.004	297.213	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.779	0.236	0.336	0.004	0.007	0.006	416.689	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.612	0.419	4.609	0.012	0.143	0.131	1452.825	0.028
	NA	MC	Motorcycles	13.246	2.194	0.795	0.003	0.028	0.024	398.073	0.055
Wyoming	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.602	0.309	0.223	0.002	0.009	0.008	305.293	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.529	0.333	0.355	0.003	0.011	0.010	390.656	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	14.019	0.592	0.964	0.005	0.027	0.024	742.828	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.377	0.131	0.133	0.002	0.004	0.004	293.202	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.825	0.239	0.352	0.003	0.007	0.006	411.648	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.025	0.591	5.895	0.013	0.150	0.138	1501.737	0.031
	NA	MC	Motorcycles	13.600	2.349	0.873	0.003	0.028	0.025	399.433	0.056

**Table 5-21. On-Road Vehicle Emission Factors – 2022**

State	Fuel Type	Vehicle Type	Emission Factors (g/mi)								
			Criteria Pollutants and Ozone Precursors								
			CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub> e	NH <sub>3</sub>	
Alabama	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.995	0.236	0.164	0.002	0.006	0.005	304.791	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.947	0.271	0.273	0.003	0.007	0.006	389.540	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.290	0.612	0.790	0.005	0.016	0.015	760.930	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.514	0.088	0.117	0.002	0.004	0.004	296.976	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.868	0.179	0.293	0.003	0.006	0.006	410.578	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.466	0.349	3.829	0.012	0.126	0.116	1475.362	0.028
Alaska	NA	MC	Motorcycles	12.835	2.685	0.700	0.003	0.026	0.023	393.466	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.466	0.304	0.191	0.002	0.010	0.009	302.640	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.150	0.322	0.300	0.003	0.013	0.012	386.342	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.818	0.570	0.880	0.005	0.030	0.026	745.484	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.231	0.147	0.121	0.002	0.004	0.004	288.812	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.444	0.239	0.304	0.003	0.007	0.006	399.815	0.008
Arizona	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.713	0.474	4.881	0.012	0.130	0.120	1460.367	0.029
	NA	MC	Motorcycles	13.669	1.954	0.859	0.003	0.029	0.026	401.363	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.974	0.225	0.157	0.002	0.005	0.004	310.958	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.896	0.256	0.267	0.003	0.006	0.006	398.813	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.984	0.647	0.871	0.005	0.016	0.015	789.171	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.722	0.080	0.126	0.003	0.004	0.004	304.003	0.008
Arkansas	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.239	0.177	0.321	0.004	0.007	0.006	421.133	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.606	0.397	4.470	0.013	0.131	0.121	1529.226	0.029
	NA	MC	Motorcycles	12.450	3.088	0.796	0.002	0.025	0.022	394.013	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.183	0.240	0.174	0.002	0.006	0.005	298.336	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.143	0.271	0.288	0.003	0.007	0.007	382.757	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.608	0.582	0.808	0.005	0.018	0.016	752.639	0.044
Colorado	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.538	0.095	0.121	0.002	0.004	0.004	290.172	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.906	0.185	0.302	0.003	0.006	0.006	402.476	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.617	0.417	4.294	0.012	0.126	0.116	1481.749	0.029
	NA	MC	Motorcycles	12.919	2.516	0.739	0.003	0.026	0.023	395.336	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.988	0.245	0.174	0.002	0.007	0.006	302.822	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.807	0.273	0.285	0.003	0.010	0.008	388.356	0.023
Connecticut	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.152	0.594	0.884	0.005	0.023	0.021	757.940	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.375	0.112	0.121	0.002	0.004	0.004	292.464	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.693	0.209	0.308	0.003	0.007	0.006	405.713	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.486	0.369	4.226	0.012	0.127	0.117	1457.249	0.028
	NA	MC	Motorcycles	13.285	2.584	0.829	0.003	0.028	0.025	398.165	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.707	0.213	0.149	0.002	0.007	0.006	302.528	0.021
Delaware	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.493	0.241	0.250	0.003	0.009	0.008	389.575	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.324	0.583	0.863	0.005	0.023	0.021	764.186	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.419	0.107	0.119	0.002	0.004	0.004	292.652	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.800	0.208	0.304	0.003	0.007	0.006	407.204	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.201	0.253	3.378	0.012	0.122	0.112	1429.840	0.026
	NA	MC	Motorcycles	12.579	2.262	0.771	0.003	0.028	0.025	398.953	0.054
District of Columbia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.628	0.215	0.154	0.002	0.006	0.005	306.399	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.325	0.238	0.253	0.003	0.008	0.007	390.964	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.204	0.586	0.837	0.005	0.017	0.015	755.171	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.346	0.100	0.115	0.002	0.004	0.004	297.154	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.612	0.193	0.288	0.003	0.006	0.006	410.639	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.071	0.195	2.935	0.012	0.121	0.111	1412.415	0.025
District of Columbia	NA	MC	Motorcycles	12.434	2.274	0.745	0.003	0.025	0.022	394.136	0.053
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.630	0.205	0.142	0.002	0.006	0.005	319.087	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.391	0.236	0.238	0.003	0.008	0.007	408.629	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.226	0.642	0.865	0.005	0.018	0.016	797.008	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.421	0.095	0.112	0.003	0.004	0.004	309.820	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.792	0.197	0.288	0.004	0.007	0.006	429.432	0.008
District of Columbia	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.170	0.217	3.071	0.012	0.132	0.122	1479.817	0.026
	NA	MC	Motorcycles	12.441	2.497	0.710	0.003	0.026	0.023	394.619	0.051

Table 5-21. On-Road Vehicle Emission Factors – 2022 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Florida	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.152	0.229	0.151	0.002	0.005	0.004	320.012	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.245	0.279	0.259	0.003	0.006	0.006	409.112	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.397	0.690	0.772	0.005	0.015	0.014	805.400	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.743	0.071	0.113	0.003	0.004	0.004	313.336	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.264	0.168	0.287	0.004	0.007	0.006	433.077	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.429	0.312	3.453	0.013	0.132	0.122	1535.655	0.028
	NA	MC	Motorcycles	12.732	3.025	0.620	0.003	0.026	0.023	391.913	0.052
Georgia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.811	0.221	0.156	0.002	0.006	0.005	300.519	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.711	0.255	0.262	0.003	0.007	0.007	385.351	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.045	0.592	0.795	0.005	0.018	0.016	757.052	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.532	0.090	0.119	0.002	0.004	0.004	292.603	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.905	0.183	0.299	0.003	0.006	0.006	405.591	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.539	0.382	4.069	0.012	0.126	0.116	1476.813	0.028
	NA	MC	Motorcycles	12.788	2.569	0.716	0.003	0.027	0.024	394.873	0.055
Hawaii	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.094	0.222	0.152	0.002	0.005	0.004	311.081	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.134	0.267	0.260	0.003	0.006	0.005	397.976	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.861	0.665	0.780	0.005	0.014	0.012	780.442	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.631	0.066	0.113	0.003	0.004	0.004	304.845	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.071	0.160	0.285	0.004	0.006	0.006	421.609	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.144	0.202	2.849	0.012	0.123	0.113	1468.252	0.026
	NA	MC	Motorcycles	12.793	2.783	0.669	0.003	0.025	0.022	391.427	0.053
Idaho	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.100	0.256	0.182	0.002	0.007	0.006	299.924	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.888	0.278	0.294	0.003	0.009	0.008	383.224	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.677	0.571	0.873	0.005	0.021	0.019	743.692	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.316	0.117	0.122	0.002	0.004	0.004	289.277	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.557	0.207	0.306	0.003	0.006	0.006	400.380	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.612	0.423	4.586	0.012	0.128	0.118	1457.970	0.029
	NA	MC	Motorcycles	13.320	2.380	0.850	0.003	0.027	0.024	397.062	0.055
Illinois	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.912	0.228	0.157	0.002	0.007	0.006	313.475	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.786	0.272	0.264	0.003	0.009	0.008	402.063	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.791	0.625	0.851	0.005	0.021	0.019	783.932	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.397	0.106	0.115	0.003	0.004	0.004	303.302	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.761	0.208	0.294	0.004	0.007	0.006	420.870	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.209	0.246	3.276	0.012	0.128	0.118	1459.498	0.026
	NA	MC	Motorcycles	12.536	2.422	0.729	0.003	0.026	0.023	397.014	0.052
Indiana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.066	0.243	0.171	0.002	0.007	0.006	306.668	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.933	0.277	0.280	0.003	0.009	0.008	391.560	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.844	0.597	0.834	0.005	0.020	0.018	760.072	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.356	0.108	0.117	0.002	0.004	0.004	296.614	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.641	0.202	0.294	0.003	0.006	0.006	410.082	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.507	0.373	4.084	0.012	0.129	0.119	1466.474	0.028
	NA	MC	Motorcycles	13.077	2.377	0.755	0.003	0.027	0.024	396.071	0.054
Iowa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.300	0.272	0.185	0.002	0.008	0.007	299.255	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.110	0.295	0.297	0.003	0.010	0.008	382.360	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.525	0.565	0.836	0.005	0.022	0.019	742.313	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.341	0.118	0.120	0.002	0.004	0.004	288.465	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.589	0.207	0.299	0.003	0.006	0.006	399.327	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.643	0.436	4.510	0.012	0.128	0.117	1461.963	0.029
	NA	MC	Motorcycles	13.203	2.235	0.792	0.003	0.027	0.024	397.193	0.055
Kansas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.208	0.251	0.179	0.002	0.006	0.006	300.055	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.113	0.282	0.293	0.003	0.008	0.007	384.315	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.786	0.581	0.834	0.005	0.020	0.017	750.185	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.445	0.105	0.120	0.002	0.004	0.004	290.710	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.763	0.196	0.301	0.003	0.006	0.006	402.879	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.477	0.365	4.036	0.012	0.124	0.115	1456.074	0.028
	NA	MC	Motorcycles	13.010	2.417	0.769	0.003	0.027	0.024	396.128	0.055



Table 5-21. On-Road Vehicle Emission Factors – 2022 (cont.)

State	Fuel Type	Vehicle Type	Emission Factors (g/mi)								
			Criteria Pollutants and Ozone Precursors								
			CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>	
Kentucky	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.121	0.239	0.175	0.002	0.006	0.005	297.197	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.054	0.272	0.289	0.003	0.008	0.007	381.377	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.146	0.562	0.807	0.005	0.020	0.018	749.956	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.464	0.103	0.122	0.002	0.004	0.004	288.152	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.800	0.195	0.305	0.003	0.007	0.006	399.847	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.754	0.475	4.727	0.013	0.129	0.119	1488.469	0.030
	NA	MC	Motorcycles	12.781	2.353	0.755	0.003	0.027	0.024	396.886	0.056
Louisiana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.063	0.231	0.158	0.002	0.005	0.005	305.940	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.080	0.269	0.267	0.003	0.007	0.006	391.933	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.424	0.626	0.774	0.005	0.017	0.015	772.088	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.665	0.082	0.118	0.002	0.004	0.004	298.801	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.118	0.175	0.296	0.003	0.006	0.006	413.662	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.543	0.377	3.923	0.013	0.127	0.117	1502.514	0.028
	NA	MC	Motorcycles	12.787	2.771	0.670	0.003	0.027	0.024	393.726	0.055
Maine	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.011	0.271	0.181	0.002	0.008	0.007	292.451	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.713	0.287	0.287	0.002	0.010	0.009	374.172	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	12.310	0.537	0.825	0.005	0.023	0.020	724.672	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.249	0.127	0.122	0.002	0.004	0.004	281.026	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.424	0.211	0.301	0.003	0.006	0.006	389.896	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.644	0.443	4.626	0.012	0.125	0.115	1438.878	0.029
	NA	MC	Motorcycles	13.114	2.043	0.821	0.003	0.028	0.025	397.844	0.056
Maryland	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.712	0.214	0.153	0.002	0.006	0.006	301.976	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.499	0.244	0.256	0.003	0.008	0.007	388.097	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.727	0.581	0.837	0.005	0.021	0.019	761.570	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.471	0.100	0.119	0.002	0.004	0.004	292.891	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.851	0.198	0.303	0.003	0.007	0.006	406.828	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.329	0.302	3.663	0.012	0.123	0.113	1447.997	0.027
	NA	MC	Motorcycles	12.485	2.331	0.751	0.003	0.027	0.024	397.249	0.054
Massachusetts	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.713	0.221	0.155	0.002	0.007	0.006	301.210	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.458	0.253	0.257	0.003	0.009	0.008	386.914	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.989	0.567	0.858	0.005	0.023	0.020	755.834	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.371	0.112	0.119	0.002	0.004	0.004	290.943	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.697	0.210	0.303	0.003	0.007	0.006	404.133	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.346	0.314	3.775	0.012	0.124	0.114	1436.911	0.027
	NA	MC	Motorcycles	12.603	2.194	0.786	0.003	0.027	0.024	398.610	0.054
Michigan	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.196	0.254	0.179	0.002	0.008	0.007	304.435	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.104	0.293	0.295	0.003	0.010	0.009	389.612	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.759	0.588	0.848	0.005	0.023	0.021	757.714	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.348	0.115	0.118	0.002	0.004	0.004	293.667	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.642	0.211	0.299	0.003	0.007	0.006	406.812	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.513	0.381	4.180	0.012	0.128	0.118	1460.046	0.028
	NA	MC	Motorcycles	13.213	2.271	0.781	0.003	0.028	0.025	397.961	0.054
Minnesota	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.270	0.274	0.182	0.002	0.009	0.008	301.344	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.088	0.302	0.294	0.003	0.011	0.010	385.242	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.574	0.596	0.844	0.005	0.025	0.022	744.472	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.306	0.124	0.119	0.002	0.004	0.004	289.664	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.550	0.216	0.299	0.003	0.006	0.006	401.213	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.352	0.324	3.809	0.012	0.123	0.113	1424.147	0.027
	NA	MC	Motorcycles	13.492	2.252	0.797	0.003	0.029	0.025	398.358	0.055
Mississippi	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.995	0.238	0.164	0.002	0.005	0.005	300.202	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.932	0.268	0.271	0.003	0.007	0.006	384.081	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.048	0.600	0.776	0.005	0.016	0.014	750.084	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.520	0.088	0.118	0.002	0.004	0.004	292.629	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.857	0.176	0.293	0.003	0.006	0.006	405.000	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.437	0.341	3.758	0.012	0.123	0.113	1462.057	0.028
	NA	MC	Motorcycles	12.849	2.652	0.701	0.003	0.026	0.023	393.110	0.055

**Table 5-21. On-Road Vehicle Emission Factors – 2022 (cont.)**

State	Fuel Type	Vehicle Type	Emission Factors (g/mi)								
			Criteria Pollutants and Ozone Precursors								
			CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>	
Missouri	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.079	0.237	0.171	0.002	0.006	0.006	294.533	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.969	0.267	0.283	0.003	0.008	0.007	378.971	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	13.500	0.559	0.819	0.005	0.021	0.018	745.555	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.493	0.104	0.122	0.002	0.004	0.004	285.445	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.849	0.196	0.307	0.003	0.007	0.006	396.974	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.503	0.378	4.119	0.012	0.123	0.113	1453.285	0.028
	NA	MC	Motorcycles	12.722	2.307	0.765	0.003	0.027	0.024	397.515	0.056
Montana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.320	0.279	0.196	0.002	0.008	0.007	294.220	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.101	0.296	0.311	0.003	0.010	0.009	376.382	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	13.169	0.542	0.861	0.005	0.023	0.020	731.370	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.289	0.127	0.124	0.002	0.004	0.004	282.775	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.493	0.213	0.308	0.003	0.006	0.006	392.141	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.774	0.494	5.057	0.012	0.128	0.118	1462.938	0.030
	NA	MC	Motorcycles	13.407	2.216	0.867	0.003	0.027	0.024	398.185	0.056
Nebraska	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.320	0.267	0.186	0.002	0.007	0.006	298.754	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.195	0.294	0.302	0.003	0.009	0.008	382.691	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	13.488	0.565	0.841	0.005	0.023	0.020	748.517	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.411	0.115	0.122	0.002	0.004	0.004	288.552	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.713	0.206	0.306	0.003	0.007	0.006	399.780	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.760	0.482	4.831	0.013	0.130	0.119	1483.590	0.030
	NA	MC	Motorcycles	13.168	2.340	0.797	0.003	0.027	0.024	397.989	0.055
Nevada	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.806	0.227	0.160	0.002	0.006	0.005	311.806	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.644	0.258	0.269	0.003	0.007	0.007	399.214	0.023
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	14.635	0.644	0.905	0.005	0.018	0.016	782.936	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.525	0.091	0.122	0.003	0.004	0.004	303.505	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.934	0.189	0.313	0.004	0.007	0.006	420.188	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.530	0.369	4.317	0.013	0.132	0.121	1504.381	0.028
	NA	MC	Motorcycles	12.969	2.980	0.819	0.003	0.026	0.023	394.733	0.053
New Hampshire	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.712	0.235	0.157	0.002	0.008	0.007	298.990	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.368	0.256	0.253	0.003	0.010	0.009	382.347	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	13.430	0.554	0.846	0.005	0.022	0.019	739.879	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.290	0.119	0.119	0.002	0.004	0.004	288.072	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.519	0.209	0.299	0.003	0.006	0.006	399.062	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.395	0.339	3.930	0.012	0.123	0.113	1425.404	0.027
	NA	MC	Motorcycles	12.790	2.121	0.803	0.003	0.027	0.024	397.420	0.055
New Jersey	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.719	0.216	0.157	0.002	0.006	0.006	293.886	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.397	0.229	0.251	0.003	0.008	0.007	377.874	0.023
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	12.790	0.519	0.821	0.005	0.021	0.019	746.833	0.043
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.443	0.107	0.124	0.002	0.004	0.004	284.552	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.774	0.197	0.310	0.003	0.007	0.006	395.524	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.923	0.546	5.250	0.013	0.132	0.121	1503.201	0.031
	NA	MC	Motorcycles	12.461	2.120	0.788	0.003	0.027	0.024	398.119	0.056
New Mexico	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.042	0.250	0.179	0.002	0.006	0.005	298.711	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.897	0.274	0.295	0.003	0.008	0.007	382.606	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	13.487	0.576	0.868	0.005	0.019	0.017	749.111	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.424	0.102	0.124	0.002	0.004	0.004	289.712	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.729	0.192	0.312	0.003	0.006	0.006	401.424	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.705	0.455	4.820	0.013	0.129	0.119	1481.849	0.029
	NA	MC	Motorcycles	12.987	2.701	0.838	0.003	0.026	0.023	395.915	0.055
New York	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.625	0.216	0.147	0.002	0.007	0.006	304.326	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.270	0.235	0.238	0.003	0.009	0.008	390.013	0.023
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	13.851	0.588	0.852	0.005	0.022	0.019	759.081	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.353	0.109	0.117	0.002	0.004	0.004	294.157	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.660	0.207	0.298	0.003	0.007	0.006	407.890	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.308	0.296	3.632	0.012	0.125	0.115	1438.010	0.027
	NA	MC	Motorcycles	12.825	2.269	0.769	0.003	0.027	0.024	397.393	0.054

Table 5-21. On-Road Vehicle Emission Factors – 2022 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
North Carolina	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.920	0.232	0.164	0.002	0.006	0.005	302.715	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.839	0.269	0.274	0.003	0.008	0.007	387.504	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.331	0.605	0.810	0.005	0.018	0.016	756.072	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.453	0.093	0.117	0.002	0.004	0.004	294.331	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.783	0.186	0.295	0.003	0.006	0.006	407.558	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.329	0.298	3.578	0.012	0.123	0.113	1447.574	0.027
North Dakota	NA	MC	Motorcycles	12.896	2.585	0.725	0.003	0.027	0.024	394.567	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.442	0.305	0.191	0.002	0.010	0.009	295.696	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.198	0.319	0.302	0.003	0.012	0.011	377.695	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.904	0.565	0.835	0.005	0.027	0.024	729.762	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.274	0.136	0.123	0.002	0.004	0.004	283.062	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.464	0.220	0.303	0.003	0.006	0.006	392.341	0.008
Ohio	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.666	0.455	4.703	0.012	0.126	0.116	1446.596	0.029
	NA	MC	Motorcycles	13.587	2.141	0.832	0.003	0.028	0.025	398.951	0.056
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.944	0.234	0.163	0.002	0.007	0.006	306.325	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.767	0.266	0.267	0.003	0.009	0.008	391.686	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.974	0.603	0.841	0.005	0.021	0.019	760.760	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.355	0.108	0.116	0.002	0.004	0.004	296.215	0.008
Oklahoma	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.650	0.204	0.295	0.003	0.006	0.006	410.009	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.387	0.326	3.790	0.012	0.127	0.117	1451.731	0.027
	NA	MC	Motorcycles	13.173	2.385	0.758	0.003	0.028	0.024	396.498	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.180	0.243	0.173	0.002	0.006	0.005	303.747	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.135	0.276	0.287	0.003	0.007	0.007	388.725	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.999	0.602	0.824	0.005	0.018	0.016	760.685	0.045
Oregon	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.516	0.095	0.119	0.002	0.004	0.004	295.337	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.879	0.187	0.299	0.003	0.006	0.006	408.800	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.508	0.370	4.026	0.012	0.126	0.116	1476.970	0.028
	NA	MC	Motorcycles	12.938	2.613	0.740	0.003	0.026	0.023	394.793	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.833	0.228	0.171	0.002	0.006	0.006	296.541	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.602	0.253	0.276	0.003	0.008	0.007	379.645	0.022
Pacific Islands	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.542	0.564	0.853	0.005	0.019	0.017	738.211	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.288	0.108	0.120	0.002	0.004	0.004	286.916	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.517	0.199	0.300	0.003	0.006	0.006	397.642	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.502	0.377	4.224	0.012	0.125	0.115	1438.054	0.028
	NA	MC	Motorcycles	13.148	2.265	0.826	0.003	0.027	0.024	396.288	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.849	0.223	0.160	0.002	0.006	0.005	302.509	0.021
Pennsylvania	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.697	0.255	0.266	0.003	0.008	0.007	387.768	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.751	0.590	0.827	0.005	0.019	0.017	758.883	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.431	0.098	0.119	0.002	0.004	0.004	293.705	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.769	0.193	0.300	0.003	0.007	0.006	407.128	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.470	0.356	4.001	0.012	0.127	0.117	1463.277	0.028
	NA	MC	Motorcycles	12.737	2.450	0.753	0.003	0.027	0.024	395.920	0.054
Puerto Rico	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.759	0.223	0.157	0.002	0.007	0.006	304.245	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.542	0.253	0.259	0.003	0.009	0.008	389.527	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.544	0.585	0.839	0.005	0.022	0.019	759.542	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.376	0.109	0.118	0.002	0.004	0.004	294.235	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.686	0.204	0.299	0.003	0.007	0.006	407.623	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.540	0.388	4.212	0.012	0.129	0.118	1467.837	0.028
Puerto Rico	NA	MC	Motorcycles	12.947	2.338	0.764	0.003	0.028	0.024	397.164	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.471	0.227	0.149	0.002	0.005	0.004	321.606	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.707	0.282	0.258	0.003	0.006	0.005	412.710	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	15.737	0.714	0.758	0.005	0.016	0.014	819.336	0.046
Puerto Rico	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.970	0.064	0.113	0.003	0.004	0.004	315.628	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.639	0.163	0.289	0.004	0.007	0.006	437.444	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.228	0.227	2.858	0.013	0.127	0.117	1535.851	0.026
	NA	MC	Motorcycles	12.793	3.082	0.600	0.003	0.026	0.023	392.247	0.053

Table 5-21. On-Road Vehicle Emission Factors – 2022 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Rhode Island	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.713	0.217	0.151	0.002	0.007	0.006	306.070	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.461	0.243	0.250	0.003	0.009	0.008	393.176	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.316	0.587	0.862	0.005	0.023	0.020	768.924	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.381	0.108	0.117	0.002	0.004	0.004	295.981	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.734	0.209	0.300	0.003	0.007	0.006	411.114	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.363	0.315	3.762	0.012	0.127	0.117	1454.926	0.027
	NA	MC	Motorcycles	12.574	2.277	0.764	0.003	0.027	0.024	398.244	0.054
South Carolina	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.040	0.235	0.166	0.002	0.006	0.005	302.972	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.028	0.273	0.279	0.003	0.007	0.006	388.111	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.125	0.605	0.794	0.005	0.018	0.016	763.206	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.548	0.089	0.119	0.002	0.004	0.004	295.095	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.935	0.182	0.299	0.003	0.006	0.006	408.652	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.665	0.430	4.358	0.013	0.130	0.119	1499.630	0.029
	NA	MC	Motorcycles	12.870	2.675	0.709	0.003	0.027	0.024	394.757	0.055
South Dakota	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.303	0.278	0.188	0.002	0.008	0.007	294.172	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.161	0.300	0.303	0.003	0.011	0.009	377.053	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.737	0.555	0.829	0.005	0.025	0.022	736.537	0.043
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.361	0.125	0.124	0.002	0.004	0.004	282.896	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.616	0.212	0.309	0.003	0.006	0.006	392.789	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.816	0.510	5.062	0.012	0.129	0.119	1475.252	0.030
	NA	MC	Motorcycles	13.402	2.270	0.817	0.003	0.028	0.025	398.925	0.056
Tennessee	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.921	0.227	0.161	0.002	0.006	0.005	303.426	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.824	0.262	0.269	0.003	0.008	0.007	388.808	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.475	0.601	0.814	0.005	0.019	0.017	762.521	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.490	0.096	0.119	0.002	0.004	0.004	294.806	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.857	0.191	0.300	0.003	0.007	0.006	408.467	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.574	0.396	4.199	0.013	0.128	0.118	1482.996	0.028
	NA	MC	Motorcycles	12.964	2.560	0.730	0.003	0.027	0.024	395.744	0.054
Texas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.859	0.212	0.148	0.002	0.005	0.005	304.948	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.785	0.246	0.251	0.003	0.007	0.006	391.595	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.739	0.610	0.792	0.005	0.017	0.015	773.668	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.691	0.082	0.120	0.002	0.004	0.004	297.804	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.174	0.178	0.303	0.003	0.007	0.006	413.044	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.428	0.332	3.726	0.013	0.125	0.115	1488.638	0.027
	NA	MC	Motorcycles	12.299	2.709	0.690	0.003	0.026	0.023	394.523	0.055
Utah	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.990	0.239	0.168	0.002	0.007	0.006	307.401	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.862	0.272	0.281	0.003	0.009	0.008	394.334	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.559	0.617	0.902	0.005	0.023	0.020	770.605	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.415	0.109	0.121	0.002	0.004	0.004	297.234	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.774	0.209	0.310	0.003	0.007	0.006	412.358	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.437	0.345	4.095	0.012	0.128	0.118	1467.820	0.028
	NA	MC	Motorcycles	13.288	2.626	0.831	0.003	0.028	0.025	397.883	0.054
Vermont	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.782	0.255	0.163	0.002	0.008	0.007	293.095	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.413	0.267	0.259	0.002	0.011	0.009	375.081	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.413	0.543	0.826	0.005	0.024	0.021	727.483	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.273	0.127	0.122	0.002	0.004	0.004	281.574	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.465	0.212	0.302	0.003	0.006	0.006	390.689	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.676	0.456	4.703	0.012	0.126	0.116	1446.276	0.029
	NA	MC	Motorcycles	13.234	2.112	0.819	0.003	0.028	0.025	398.165	0.056
Virgin Islands	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.270	0.239	0.151	0.002	0.004	0.004	305.242	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.302	0.261	0.246	0.003	0.005	0.005	390.284	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.386	0.641	0.699	0.005	0.010	0.009	759.037	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.794	0.066	0.115	0.003	0.004	0.004	300.073	0.007
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.256	0.149	0.280	0.003	0.006	0.005	414.878	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.011	0.161	2.404	0.012	0.112	0.103	1449.103	0.025
	NA	MC	Motorcycles	12.763	2.572	0.620	0.003	0.023	0.021	388.385	0.055

Table 5-21. On-Road Vehicle Emission Factors – 2022 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Virginia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.917	0.228	0.164	0.002	0.006	0.005	302.675	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.810	0.263	0.274	0.003	0.008	0.007	388.127	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.408	0.583	0.822	0.005	0.020	0.018	760.763	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.455	0.099	0.119	0.002	0.004	0.004	293.739	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.810	0.194	0.300	0.003	0.007	0.006	407.277	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.531	0.381	4.131	0.012	0.128	0.117	1472.745	0.028
Washington	NA	MC	Motorcycles	12.639	2.415	0.739	0.003	0.027	0.024	396.384	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.902	0.225	0.167	0.002	0.007	0.006	299.878	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.755	0.258	0.274	0.003	0.009	0.008	385.153	0.023
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.962	0.582	0.867	0.005	0.022	0.020	753.978	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.330	0.109	0.119	0.002	0.004	0.004	290.042	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.635	0.206	0.304	0.003	0.007	0.006	402.806	0.008
West Virginia	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.532	0.387	4.291	0.012	0.128	0.118	1455.691	0.028
	NA	MC	Motorcycles	13.235	2.308	0.813	0.003	0.028	0.025	398.243	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.072	0.246	0.177	0.002	0.007	0.006	294.604	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.959	0.275	0.290	0.003	0.009	0.008	377.879	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	12.919	0.560	0.814	0.005	0.021	0.018	738.906	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.380	0.108	0.121	0.002	0.004	0.004	285.054	0.008
Wisconsin	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.654	0.198	0.302	0.003	0.006	0.006	395.652	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.622	0.426	4.441	0.012	0.126	0.116	1457.453	0.029
	NA	MC	Motorcycles	13.090	2.328	0.774	0.003	0.027	0.024	396.847	0.056
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.116	0.260	0.175	0.002	0.008	0.007	299.201	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.912	0.287	0.283	0.003	0.010	0.009	382.693	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.308	0.568	0.832	0.005	0.023	0.021	741.972	0.044
Wyoming	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.313	0.122	0.120	0.002	0.004	0.004	287.951	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.557	0.213	0.300	0.003	0.006	0.006	398.971	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.516	0.388	4.235	0.012	0.125	0.115	1442.332	0.028
	NA	MC	Motorcycles	13.100	2.187	0.793	0.003	0.027	0.024	398.147	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.408	0.285	0.198	0.002	0.008	0.007	295.596	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.245	0.305	0.317	0.003	0.011	0.009	378.694	0.022
Wyoming	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.201	0.548	0.868	0.005	0.025	0.022	740.402	0.043
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.347	0.127	0.126	0.002	0.004	0.004	284.079	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.603	0.216	0.315	0.003	0.006	0.006	394.182	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.928	0.554	5.484	0.013	0.132	0.122	1490.354	0.031
	NA	MC	Motorcycles	13.445	2.321	0.871	0.003	0.028	0.025	399.508	0.056

Table 5-22. On-Road Vehicle Emission Factors – 2023

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Alabama	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.821	0.217	0.144	0.002	0.005	0.005	294.454	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.684	0.248	0.242	0.003	0.007	0.006	377.024	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.617	0.570	0.716	0.005	0.016	0.014	758.790	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.449	0.085	0.111	0.002	0.004	0.004	287.393	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.625	0.160	0.262	0.003	0.006	0.006	393.209	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.384	0.324	3.528	0.012	0.111	0.102	1466.217	0.028
Alaska	NA	MC	Motorcycles	12.723	2.653	0.698	0.003	0.026	0.023	393.530	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.264	0.282	0.171	0.002	0.009	0.008	292.561	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.886	0.298	0.269	0.002	0.012	0.011	374.156	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.133	0.530	0.801	0.005	0.028	0.025	743.276	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.174	0.143	0.114	0.002	0.004	0.004	279.622	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.228	0.219	0.272	0.003	0.006	0.006	383.086	0.008
Arizona	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.632	0.445	4.538	0.012	0.115	0.106	1450.966	0.029
	NA	MC	Motorcycles	13.531	1.949	0.857	0.003	0.029	0.025	401.429	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.804	0.207	0.138	0.002	0.005	0.004	300.374	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.635	0.235	0.237	0.002	0.006	0.005	385.963	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.278	0.603	0.790	0.005	0.016	0.014	787.017	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.651	0.076	0.119	0.002	0.004	0.004	294.163	0.008
Arkansas	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.976	0.157	0.287	0.003	0.006	0.006	403.328	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.522	0.370	4.135	0.013	0.116	0.107	1519.763	0.029
	NA	MC	Motorcycles	12.345	3.076	0.795	0.002	0.025	0.022	394.077	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.002	0.221	0.154	0.002	0.005	0.005	288.243	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.874	0.248	0.257	0.002	0.007	0.006	370.485	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.943	0.543	0.734	0.005	0.018	0.016	750.494	0.044
Colorado	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.473	0.091	0.114	0.002	0.004	0.004	280.822	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.664	0.166	0.270	0.003	0.006	0.006	385.491	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.537	0.390	3.983	0.012	0.112	0.103	1472.277	0.029
	NA	MC	Motorcycles	12.806	2.508	0.738	0.003	0.026	0.023	395.401	0.056
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.815	0.227	0.155	0.002	0.007	0.006	292.628	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.560	0.252	0.255	0.003	0.009	0.008	375.985	0.022
Connecticut	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.444	0.552	0.803	0.005	0.022	0.020	755.795	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.314	0.108	0.115	0.002	0.004	0.004	283.079	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.463	0.189	0.276	0.003	0.006	0.006	388.656	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.405	0.344	3.896	0.012	0.112	0.103	1448.186	0.028
	NA	MC	Motorcycles	13.161	2.579	0.827	0.003	0.028	0.025	398.229	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.552	0.197	0.133	0.002	0.006	0.006	292.326	0.021
Delaware	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.264	0.223	0.224	0.003	0.009	0.008	377.154	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.635	0.542	0.784	0.005	0.022	0.020	762.091	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.357	0.103	0.112	0.002	0.004	0.004	283.245	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.564	0.188	0.273	0.003	0.007	0.006	390.093	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.121	0.232	3.071	0.012	0.107	0.098	1421.264	0.026
	NA	MC	Motorcycles	12.462	2.250	0.769	0.003	0.028	0.025	399.018	0.055
District of Columbia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.474	0.199	0.136	0.002	0.006	0.005	296.042	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.098	0.219	0.224	0.003	0.007	0.007	378.451	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.531	0.544	0.759	0.005	0.016	0.014	753.064	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.285	0.097	0.108	0.002	0.004	0.004	287.593	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.383	0.173	0.258	0.003	0.006	0.006	393.286	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	0.990	0.174	2.641	0.012	0.106	0.098	1404.124	0.025
District of Columbia	NA	MC	Motorcycles	12.321	2.261	0.743	0.003	0.025	0.022	394.199	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.476	0.190	0.126	0.002	0.006	0.005	308.270	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.162	0.219	0.211	0.003	0.008	0.007	395.535	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.507	0.596	0.784	0.005	0.018	0.015	794.902	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.357	0.092	0.106	0.003	0.004	0.004	299.836	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.552	0.177	0.257	0.003	0.006	0.006	411.295	0.008
District of Columbia	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.083	0.194	2.766	0.012	0.116	0.107	1471.513	0.026
	NA	MC	Motorcycles	12.328	2.482	0.708	0.003	0.026	0.023	394.681	0.052

**Table 5-22. On-Road Vehicle Emission Factors – 2023 (cont.)**

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Florida	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.970	0.210	0.132	0.002	0.005	0.004	309.093	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.962	0.254	0.229	0.003	0.006	0.006	395.901	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	13.677	0.643	0.698	0.005	0.015	0.013	803.256	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.670	0.068	0.107	0.003	0.004	0.004	303.180	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.997	0.149	0.256	0.003	0.006	0.006	414.722	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.343	0.287	3.166	0.013	0.116	0.107	1526.569	0.027
	NA	MC	Motorcycles	12.625	2.985	0.618	0.003	0.026	0.023	391.976	0.053
Georgia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.648	0.203	0.138	0.002	0.005	0.005	290.339	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.464	0.234	0.233	0.002	0.007	0.006	372.985	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	12.379	0.551	0.721	0.005	0.018	0.016	754.917	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.466	0.087	0.113	0.002	0.004	0.004	283.166	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.662	0.163	0.268	0.003	0.006	0.006	388.464	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.458	0.357	3.762	0.012	0.111	0.102	1467.509	0.028
	NA	MC	Motorcycles	12.676	2.543	0.715	0.003	0.027	0.024	394.938	0.055
Hawaii	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.917	0.204	0.133	0.002	0.004	0.004	300.468	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.860	0.244	0.231	0.003	0.006	0.005	385.119	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	14.157	0.620	0.706	0.005	0.014	0.012	778.348	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.562	0.063	0.107	0.002	0.004	0.004	294.963	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.815	0.141	0.255	0.003	0.006	0.006	403.726	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.062	0.181	2.575	0.012	0.108	0.100	1459.675	0.026
	NA	MC	Motorcycles	12.688	2.772	0.668	0.003	0.025	0.022	391.490	0.053
Idaho	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.917	0.236	0.162	0.002	0.007	0.006	289.847	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.630	0.256	0.262	0.002	0.009	0.008	371.021	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	12.988	0.531	0.793	0.005	0.020	0.018	741.527	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.256	0.114	0.115	0.002	0.004	0.004	280.010	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.334	0.188	0.273	0.003	0.006	0.006	383.530	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.531	0.396	4.251	0.012	0.113	0.104	1448.676	0.029
	NA	MC	Motorcycles	13.195	2.375	0.848	0.003	0.027	0.024	397.127	0.055
Illinois	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.738	0.210	0.138	0.002	0.006	0.005	302.888	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.527	0.250	0.234	0.003	0.008	0.007	389.228	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	14.075	0.580	0.772	0.005	0.020	0.018	781.815	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.334	0.102	0.108	0.002	0.004	0.004	293.550	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.524	0.188	0.262	0.003	0.007	0.006	403.146	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.125	0.223	2.968	0.012	0.113	0.104	1451.046	0.026
	NA	MC	Motorcycles	12.417	2.416	0.727	0.003	0.026	0.023	397.077	0.053
Indiana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.885	0.223	0.151	0.002	0.006	0.006	296.327	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.671	0.254	0.250	0.003	0.008	0.007	379.059	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	13.140	0.555	0.756	0.005	0.019	0.017	757.913	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.294	0.105	0.110	0.002	0.004	0.004	287.089	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.412	0.182	0.263	0.003	0.006	0.006	392.797	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.424	0.347	3.766	0.012	0.114	0.105	1457.411	0.028
	NA	MC	Motorcycles	12.954	2.371	0.753	0.003	0.027	0.024	396.135	0.054
Iowa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.110	0.251	0.165	0.002	0.007	0.006	289.208	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.846	0.271	0.266	0.002	0.009	0.008	370.190	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	12.861	0.526	0.759	0.005	0.021	0.018	740.142	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.281	0.114	0.114	0.002	0.004	0.004	279.228	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.364	0.187	0.268	0.003	0.006	0.006	382.524	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.562	0.409	4.186	0.012	0.113	0.104	1452.579	0.029
	NA	MC	Motorcycles	13.078	2.229	0.790	0.003	0.027	0.023	397.259	0.055
Kansas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.025	0.232	0.159	0.002	0.006	0.005	289.934	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.847	0.259	0.262	0.002	0.008	0.007	372.033	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	13.116	0.541	0.757	0.005	0.019	0.017	748.045	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.381	0.101	0.114	0.002	0.004	0.004	281.365	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.528	0.177	0.269	0.003	0.006	0.006	385.897	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.397	0.340	3.724	0.012	0.110	0.101	1446.924	0.028
	NA	MC	Motorcycles	12.892	2.411	0.767	0.003	0.027	0.024	396.193	0.055

Table 5-22. On-Road Vehicle Emission Factors – 2023 (cont.)

State	Fuel Type	Vehicle Type	Emission Factors (g/mi)								
			Criteria Pollutants and Ozone Precursors								
			CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>	
Kentucky	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.940	0.220	0.154	0.002	0.006	0.005	287.171	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.787	0.249	0.258	0.002	0.008	0.007	369.185	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	12.473	0.524	0.733	0.005	0.019	0.017	747.793	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.401	0.099	0.115	0.002	0.004	0.004	278.889	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.565	0.175	0.273	0.003	0.006	0.006	383.009	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.673	0.446	4.403	0.012	0.115	0.105	1478.816	0.030
	NA	MC	Motorcycles	12.664	2.347	0.754	0.003	0.027	0.023	396.951	0.056
Louisiana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.887	0.212	0.139	0.002	0.005	0.004	295.543	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.809	0.245	0.237	0.003	0.007	0.006	379.317	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	12.743	0.583	0.701	0.005	0.016	0.015	769.942	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.596	0.079	0.112	0.002	0.004	0.004	289.139	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.862	0.156	0.265	0.003	0.006	0.006	396.166	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.461	0.351	3.626	0.013	0.112	0.103	1493.135	0.028
	NA	MC	Motorcycles	12.677	2.737	0.669	0.003	0.027	0.024	393.791	0.055
Maine	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.832	0.251	0.161	0.002	0.008	0.007	282.669	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.468	0.264	0.256	0.002	0.010	0.009	362.293	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	11.671	0.499	0.749	0.005	0.022	0.019	722.514	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.191	0.123	0.115	0.002	0.004	0.004	272.051	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.210	0.192	0.270	0.003	0.006	0.006	373.509	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.564	0.415	4.298	0.012	0.111	0.102	1429.508	0.029
	NA	MC	Motorcycles	12.988	2.030	0.819	0.003	0.028	0.025	397.910	0.056
Maryland	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.555	0.197	0.135	0.002	0.006	0.005	291.773	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.262	0.224	0.227	0.002	0.008	0.007	375.689	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.053	0.540	0.760	0.005	0.020	0.018	759.459	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.407	0.097	0.113	0.002	0.004	0.004	283.462	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.612	0.178	0.272	0.003	0.007	0.006	389.699	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.249	0.279	3.355	0.012	0.109	0.100	1439.142	0.027
	NA	MC	Motorcycles	12.371	2.315	0.749	0.003	0.027	0.024	397.313	0.055
Massachusetts	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.551	0.204	0.138	0.002	0.007	0.006	291.069	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.214	0.232	0.228	0.002	0.009	0.008	374.590	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.312	0.527	0.779	0.005	0.022	0.019	753.714	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.310	0.108	0.113	0.002	0.004	0.004	281.604	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.467	0.190	0.271	0.003	0.007	0.006	387.149	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.266	0.290	3.461	0.012	0.109	0.100	1428.090	0.027
	NA	MC	Motorcycles	12.484	2.182	0.784	0.003	0.027	0.024	398.675	0.055
Michigan	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.006	0.234	0.159	0.002	0.007	0.006	294.196	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.833	0.269	0.263	0.003	0.009	0.008	377.209	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.051	0.547	0.770	0.005	0.022	0.020	755.556	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.287	0.112	0.112	0.002	0.004	0.004	284.252	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.414	0.191	0.268	0.003	0.006	0.006	389.706	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.432	0.355	3.858	0.012	0.113	0.104	1450.961	0.028
	NA	MC	Motorcycles	13.086	2.265	0.779	0.003	0.028	0.025	398.025	0.054
Minnesota	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.073	0.253	0.162	0.002	0.008	0.007	291.245	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.816	0.278	0.263	0.002	0.011	0.009	373.015	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	12.846	0.554	0.766	0.005	0.024	0.021	742.326	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.246	0.121	0.112	0.002	0.004	0.004	280.399	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.328	0.197	0.267	0.003	0.006	0.006	384.354	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.273	0.300	3.495	0.012	0.108	0.099	1415.319	0.027
	NA	MC	Motorcycles	13.354	2.231	0.795	0.003	0.029	0.025	398.423	0.055
Mississippi	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.822	0.218	0.144	0.002	0.005	0.005	290.025	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.672	0.244	0.241	0.002	0.007	0.006	371.737	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	12.387	0.559	0.703	0.005	0.015	0.014	747.953	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.454	0.084	0.112	0.002	0.004	0.004	283.187	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.616	0.157	0.262	0.003	0.006	0.006	387.858	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.357	0.317	3.462	0.012	0.109	0.100	1452.900	0.028
	NA	MC	Motorcycles	12.737	2.620	0.699	0.003	0.026	0.023	393.174	0.055



Table 5-22. On-Road Vehicle Emission Factors – 2023 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Missouri	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.903	0.218	0.151	0.002	0.006	0.005	284.602	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.709	0.245	0.252	0.002	0.008	0.007	366.865	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.842	0.521	0.744	0.005	0.020	0.018	743.431	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.430	0.100	0.116	0.002	0.004	0.004	276.266	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.611	0.177	0.275	0.003	0.006	0.006	380.269	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.424	0.353	3.807	0.012	0.109	0.100	1444.032	0.028
	NA	MC	Motorcycles	12.607	2.301	0.764	0.003	0.027	0.024	397.580	0.056
Montana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.125	0.258	0.174	0.002	0.007	0.007	284.377	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.835	0.272	0.279	0.002	0.010	0.008	364.432	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.496	0.505	0.783	0.005	0.022	0.019	729.190	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.231	0.124	0.118	0.002	0.004	0.004	273.743	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.275	0.193	0.276	0.003	0.006	0.006	375.667	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.694	0.465	4.715	0.012	0.114	0.105	1453.323	0.030
	NA	MC	Motorcycles	13.278	2.211	0.866	0.003	0.027	0.024	398.251	0.056
Nebraska	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.130	0.247	0.165	0.002	0.007	0.006	288.714	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.926	0.270	0.271	0.002	0.009	0.008	370.503	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.821	0.526	0.764	0.005	0.022	0.019	746.337	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.349	0.111	0.116	0.002	0.004	0.004	279.109	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.482	0.186	0.274	0.003	0.006	0.006	382.972	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.678	0.453	4.500	0.012	0.115	0.106	1473.961	0.030
	NA	MC	Motorcycles	13.045	2.334	0.795	0.003	0.027	0.024	398.054	0.056
Nevada	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.644	0.209	0.140	0.002	0.005	0.005	301.227	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.398	0.237	0.238	0.003	0.007	0.006	386.399	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.929	0.600	0.821	0.005	0.018	0.016	780.787	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.459	0.088	0.115	0.002	0.004	0.004	293.712	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.688	0.169	0.279	0.003	0.006	0.006	402.443	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.445	0.343	3.979	0.013	0.116	0.107	1495.224	0.028
	NA	MC	Motorcycles	12.857	2.972	0.817	0.003	0.026	0.023	394.796	0.053
New Hampshire	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.549	0.217	0.139	0.002	0.007	0.006	288.952	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.134	0.235	0.225	0.002	0.009	0.008	370.186	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.768	0.515	0.768	0.005	0.021	0.019	737.741	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.231	0.115	0.113	0.002	0.004	0.004	278.848	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.299	0.190	0.267	0.003	0.006	0.006	382.274	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.316	0.315	3.613	0.012	0.109	0.100	1416.503	0.027
	NA	MC	Motorcycles	12.667	2.108	0.801	0.003	0.027	0.024	397.486	0.055
New Jersey	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.563	0.200	0.140	0.002	0.006	0.005	283.986	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.168	0.212	0.224	0.002	0.008	0.007	365.807	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.148	0.483	0.746	0.005	0.021	0.018	744.654	0.043
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.381	0.103	0.117	0.002	0.004	0.004	275.410	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.541	0.177	0.278	0.003	0.006	0.006	378.891	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.841	0.515	4.912	0.013	0.117	0.108	1493.242	0.031
	NA	MC	Motorcycles	12.347	2.107	0.786	0.003	0.027	0.023	398.186	0.056
New Mexico	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.868	0.230	0.158	0.002	0.006	0.005	288.629	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.642	0.251	0.263	0.002	0.008	0.007	370.369	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.825	0.537	0.788	0.005	0.018	0.016	746.950	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.361	0.098	0.118	0.002	0.004	0.004	280.397	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.496	0.173	0.279	0.003	0.006	0.006	384.501	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.624	0.426	4.481	0.012	0.114	0.105	1472.314	0.029
	NA	MC	Motorcycles	12.871	2.695	0.836	0.003	0.026	0.023	395.980	0.055
New York	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.474	0.200	0.131	0.002	0.007	0.006	294.070	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.059	0.218	0.213	0.003	0.009	0.008	377.577	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.168	0.546	0.773	0.005	0.021	0.019	756.958	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.292	0.106	0.111	0.002	0.004	0.004	284.711	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.431	0.187	0.266	0.003	0.006	0.006	390.723	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.227	0.272	3.320	0.012	0.110	0.101	1429.295	0.027
	NA	MC	Motorcycles	12.705	2.254	0.768	0.003	0.027	0.024	397.458	0.054

Table 5-22. On-Road Vehicle Emission Factors – 2023 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
North Carolina	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.750	0.213	0.144	0.002	0.006	0.005	292.467	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.583	0.246	0.243	0.002	0.007	0.006	375.080	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.657	0.563	0.734	0.005	0.017	0.015	753.954	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.389	0.090	0.111	0.002	0.004	0.004	284.845	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.546	0.167	0.264	0.003	0.006	0.006	390.343	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.249	0.275	3.276	0.012	0.109	0.100	1438.715	0.027
North Dakota	NA	MC	Motorcycles	12.782	2.557	0.723	0.003	0.027	0.024	394.631	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.231	0.281	0.170	0.002	0.009	0.008	285.836	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.919	0.294	0.270	0.002	0.012	0.010	365.741	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.199	0.526	0.759	0.005	0.025	0.022	727.581	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.216	0.132	0.116	0.002	0.004	0.004	274.042	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.247	0.200	0.271	0.003	0.006	0.006	375.877	0.008
Ohio	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.586	0.427	4.372	0.012	0.112	0.103	1437.171	0.029
	NA	MC	Motorcycles	13.445	2.121	0.830	0.003	0.028	0.025	399.017	0.056
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.770	0.216	0.145	0.002	0.006	0.006	295.997	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.516	0.244	0.239	0.003	0.009	0.008	379.188	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.261	0.561	0.763	0.005	0.020	0.018	758.620	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.294	0.105	0.110	0.002	0.004	0.004	286.702	0.008
Oklahoma	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.420	0.184	0.263	0.003	0.006	0.006	392.735	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.305	0.301	3.477	0.012	0.112	0.103	1442.884	0.027
	NA	MC	Motorcycles	13.048	2.379	0.757	0.003	0.027	0.024	396.562	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.998	0.223	0.153	0.002	0.005	0.005	293.466	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.865	0.253	0.256	0.003	0.007	0.006	376.261	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.321	0.561	0.748	0.005	0.017	0.015	758.540	0.044
Oregon	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.451	0.091	0.113	0.002	0.004	0.004	285.819	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.637	0.168	0.268	0.003	0.006	0.006	391.537	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.426	0.344	3.716	0.012	0.112	0.103	1467.746	0.028
	NA	MC	Motorcycles	12.824	2.606	0.738	0.003	0.026	0.023	394.857	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.667	0.211	0.152	0.002	0.006	0.005	286.551	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.360	0.232	0.246	0.002	0.008	0.007	367.527	0.022
Pacific Islands	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.865	0.524	0.775	0.005	0.019	0.017	736.080	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.229	0.105	0.113	0.002	0.004	0.004	277.707	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.296	0.179	0.269	0.003	0.006	0.006	380.887	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.422	0.351	3.901	0.012	0.111	0.102	1428.972	0.028
	NA	MC	Motorcycles	13.029	2.260	0.824	0.003	0.027	0.024	396.353	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.684	0.205	0.142	0.002	0.006	0.005	292.280	0.021
Pennsylvania	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.451	0.234	0.237	0.002	0.007	0.007	375.354	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.071	0.548	0.751	0.005	0.018	0.016	756.752	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.368	0.094	0.112	0.002	0.004	0.004	284.249	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.533	0.173	0.268	0.003	0.006	0.006	389.961	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.389	0.331	3.686	0.012	0.112	0.103	1454.204	0.028
	NA	MC	Motorcycles	12.623	2.444	0.751	0.003	0.027	0.023	395.983	0.055
Puerto Rico	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.596	0.205	0.139	0.002	0.006	0.006	293.990	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.302	0.233	0.230	0.003	0.009	0.008	377.099	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.858	0.544	0.762	0.005	0.021	0.018	757.390	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.314	0.105	0.112	0.002	0.004	0.004	284.786	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.456	0.184	0.267	0.003	0.006	0.006	390.464	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.458	0.361	3.891	0.012	0.114	0.105	1458.690	0.028
Puerto Rico	NA	MC	Motorcycles	12.827	2.320	0.762	0.003	0.027	0.024	397.228	0.054
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.274	0.208	0.130	0.002	0.005	0.004	310.612	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.398	0.257	0.229	0.003	0.006	0.005	399.358	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.990	0.666	0.685	0.005	0.015	0.014	817.221	0.046
Puerto Rico	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.891	0.060	0.107	0.003	0.004	0.004	305.372	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.350	0.143	0.258	0.004	0.007	0.006	418.908	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.144	0.205	2.593	0.013	0.112	0.103	1526.967	0.026
	NA	MC	Motorcycles	12.689	3.069	0.598	0.003	0.026	0.023	392.310	0.053

Table 5-22. On-Road Vehicle Emission Factors – 2023 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Rhode Island	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.558	0.201	0.135	0.002	0.006	0.006	295.747	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.238	0.225	0.224	0.003	0.009	0.008	380.638	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.626	0.545	0.783	0.005	0.022	0.019	766.800	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.319	0.104	0.111	0.002	0.004	0.004	286.472	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.501	0.189	0.268	0.003	0.007	0.006	393.826	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.281	0.290	3.446	0.012	0.112	0.103	1446.130	0.027
	NA	MC	Motorcycles	12.456	2.265	0.763	0.003	0.027	0.024	398.309	0.054
South Carolina	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.864	0.216	0.146	0.002	0.005	0.005	292.703	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.763	0.249	0.248	0.002	0.007	0.006	375.650	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.453	0.563	0.720	0.005	0.017	0.015	761.049	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.482	0.086	0.113	0.002	0.004	0.004	285.576	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.690	0.163	0.268	0.003	0.006	0.006	391.393	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.583	0.403	4.044	0.013	0.115	0.105	1490.112	0.029
	NA	MC	Motorcycles	12.758	2.643	0.707	0.003	0.027	0.024	394.821	0.055
South Dakota	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.104	0.256	0.167	0.002	0.008	0.007	284.326	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.883	0.275	0.271	0.002	0.010	0.009	365.080	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.037	0.517	0.753	0.005	0.024	0.021	734.353	0.043
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.301	0.122	0.118	0.002	0.004	0.004	273.854	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.391	0.193	0.277	0.003	0.006	0.006	376.301	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.735	0.480	4.725	0.012	0.114	0.105	1465.519	0.030
	NA	MC	Motorcycles	13.267	2.247	0.816	0.003	0.028	0.025	398.991	0.057
Tennessee	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.751	0.208	0.142	0.002	0.006	0.005	293.161	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.568	0.239	0.239	0.003	0.008	0.007	376.353	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.785	0.559	0.738	0.005	0.019	0.017	760.374	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.426	0.093	0.112	0.002	0.004	0.004	285.310	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.617	0.171	0.268	0.003	0.006	0.006	391.239	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.492	0.370	3.885	0.012	0.113	0.104	1473.693	0.028
	NA	MC	Motorcycles	12.848	2.553	0.728	0.003	0.027	0.024	395.808	0.055
Texas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.696	0.194	0.130	0.002	0.005	0.004	294.586	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.533	0.225	0.223	0.003	0.006	0.006	378.996	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.068	0.568	0.718	0.005	0.017	0.015	771.546	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.621	0.079	0.113	0.002	0.004	0.004	288.172	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.915	0.158	0.271	0.003	0.006	0.006	395.590	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.347	0.307	3.428	0.012	0.110	0.101	1479.454	0.027
	NA	MC	Motorcycles	12.193	2.681	0.689	0.003	0.026	0.023	394.588	0.055
Utah	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.815	0.220	0.149	0.002	0.007	0.006	297.035	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.605	0.251	0.250	0.003	0.009	0.008	381.759	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.834	0.574	0.819	0.005	0.022	0.020	768.463	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.352	0.105	0.114	0.002	0.004	0.004	287.685	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.538	0.189	0.277	0.003	0.007	0.006	395.013	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.355	0.320	3.764	0.012	0.113	0.104	1458.864	0.028
	NA	MC	Motorcycles	13.164	2.620	0.829	0.003	0.028	0.025	397.947	0.054
Vermont	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.613	0.235	0.145	0.002	0.008	0.007	283.293	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.177	0.246	0.230	0.002	0.010	0.009	363.177	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	11.768	0.505	0.750	0.005	0.023	0.020	725.318	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.215	0.124	0.116	0.002	0.004	0.004	272.583	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.249	0.193	0.271	0.003	0.006	0.006	374.275	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.596	0.428	4.373	0.012	0.112	0.103	1436.836	0.029
	NA	MC	Motorcycles	13.106	2.095	0.817	0.003	0.028	0.024	398.231	0.056
Virgin Islands	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.081	0.219	0.132	0.002	0.004	0.004	294.824	0.020
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.016	0.237	0.218	0.003	0.005	0.005	377.645	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.706	0.599	0.633	0.005	0.010	0.009	756.919	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.720	0.102	0.109	0.002	0.004	0.004	290.328	0.007
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.988	0.130	0.250	0.003	0.006	0.005	397.195	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	0.933	0.143	2.162	0.012	0.098	0.090	1440.368	0.025
	NA	MC	Motorcycles	12.657	2.558	0.619	0.003	0.023	0.021	388.449	0.055

Table 5-22. On-Road Vehicle Emission Factors – 2023 (cont.)

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Virginia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.749	0.210	0.145	0.002	0.006	0.005	292.445	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.559	0.241	0.244	0.002	0.008	0.007	375.707	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	12.737	0.542	0.746	0.005	0.019	0.017	758.624	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.391	0.095	0.112	0.002	0.004	0.004	284.283	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.572	0.175	0.269	0.003	0.006	0.006	390.113	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.449	0.355	3.816	0.012	0.113	0.104	1463.547	0.028
Washington	NA	MC	Motorcycles	12.525	2.395	0.737	0.003	0.027	0.024	396.449	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.734	0.208	0.148	0.002	0.006	0.006	289.771	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.505	0.237	0.245	0.002	0.008	0.007	372.870	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	13.261	0.542	0.788	0.005	0.021	0.019	751.845	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.270	0.105	0.113	0.002	0.004	0.004	280.729	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.409	0.187	0.272	0.003	0.007	0.006	385.871	0.008
West Virginia	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.451	0.361	3.964	0.012	0.113	0.104	1446.579	0.028
	NA	MC	Motorcycles	13.115	2.304	0.811	0.003	0.028	0.025	398.308	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.893	0.226	0.157	0.002	0.006	0.006	284.686	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.697	0.252	0.259	0.002	0.008	0.007	365.819	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	12.250	0.522	0.739	0.005	0.020	0.018	736.763	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.319	0.105	0.115	0.002	0.004	0.004	275.904	0.008
Wisconsin	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.426	0.178	0.270	0.003	0.006	0.006	378.993	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.542	0.399	4.122	0.012	0.111	0.102	1448.065	0.029
	NA	MC	Motorcycles	12.969	2.322	0.773	0.003	0.027	0.024	396.913	0.056
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.927	0.240	0.155	0.002	0.007	0.006	289.168	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.647	0.264	0.253	0.002	0.010	0.009	370.533	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	12.609	0.529	0.756	0.005	0.022	0.020	739.816	0.044
Wyoming	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.254	0.118	0.113	0.002	0.004	0.004	278.737	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.335	0.193	0.269	0.003	0.006	0.006	382.203	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.436	0.362	3.914	0.012	0.111	0.102	1433.200	0.028
	NA	MC	Motorcycles	12.969	2.170	0.792	0.003	0.027	0.024	398.213	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.209	0.263	0.176	0.002	0.008	0.007	285.706	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.971	0.281	0.284	0.002	0.010	0.009	366.676	0.022
Wyoming	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	12.520	0.510	0.790	0.005	0.024	0.021	738.198	0.043
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.287	0.124	0.119	0.002	0.004	0.004	275.004	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.379	0.196	0.282	0.003	0.006	0.006	377.649	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.846	0.522	5.131	0.012	0.117	0.108	1480.453	0.031
	NA	MC	Motorcycles	13.315	2.316	0.869	0.003	0.028	0.025	399.574	0.056

Table 5-23. On-Road Vehicle Emission Factors – 2024

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Alabama	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.658	0.200	0.127	0.002	0.005	0.004	284.022	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.427	0.226	0.214	0.002	0.007	0.006	364.476	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	11.921	0.529	0.647	0.005	0.016	0.014	756.458	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.383	0.082	0.105	0.002	0.004	0.004	277.717	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.387	0.143	0.234	0.003	0.006	0.006	376.719	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.310	0.301	3.263	0.012	0.098	0.090	1458.059	0.028
	NA	MC	Motorcycles	12.625	2.642	0.697	0.003	0.026	0.023	393.585	0.055
Alaska	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.079	0.263	0.155	0.002	0.008	0.007	282.387	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.633	0.278	0.241	0.002	0.011	0.010	361.935	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.442	0.493	0.727	0.005	0.026	0.023	740.912	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.117	0.140	0.109	0.002	0.004	0.004	270.335	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.016	0.201	0.243	0.003	0.006	0.006	367.197	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.558	0.419	4.237	0.012	0.102	0.093	1442.609	0.029
	NA	MC	Motorcycles	13.406	1.947	0.855	0.003	0.028	0.025	401.484	0.055
Arizona	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.644	0.192	0.122	0.002	0.004	0.004	289.692	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.382	0.216	0.210	0.002	0.006	0.005	373.082	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.551	0.561	0.714	0.005	0.016	0.014	784.643	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.580	0.073	0.113	0.002	0.004	0.004	284.229	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.716	0.140	0.257	0.003	0.006	0.006	386.418	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.446	0.345	3.841	0.013	0.102	0.094	1511.321	0.028
	NA	MC	Motorcycles	12.252	3.094	0.793	0.002	0.025	0.022	394.130	0.054
Arkansas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.832	0.204	0.137	0.002	0.005	0.004	278.057	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.609	0.227	0.228	0.002	0.007	0.006	358.182	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.259	0.505	0.665	0.005	0.017	0.015	748.166	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.407	0.088	0.109	0.002	0.004	0.004	271.380	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.425	0.149	0.242	0.003	0.006	0.006	369.361	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.464	0.366	3.709	0.012	0.098	0.091	1463.847	0.029
	NA	MC	Motorcycles	12.706	2.498	0.736	0.003	0.026	0.023	395.457	0.056
Colorado	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.653	0.211	0.140	0.002	0.006	0.006	282.338	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.322	0.233	0.228	0.002	0.009	0.008	363.581	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.724	0.513	0.728	0.005	0.021	0.019	753.460	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.252	0.105	0.109	0.002	0.004	0.004	273.599	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.236	0.171	0.246	0.003	0.006	0.006	372.456	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.332	0.320	3.607	0.012	0.099	0.091	1440.104	0.028
	NA	MC	Motorcycles	13.050	2.571	0.826	0.003	0.028	0.025	398.284	0.055
Connecticut	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.407	0.183	0.120	0.002	0.006	0.005	282.029	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.044	0.207	0.200	0.002	0.008	0.007	364.700	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.934	0.503	0.710	0.005	0.021	0.019	759.778	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.294	0.100	0.107	0.002	0.004	0.004	273.744	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.331	0.171	0.244	0.003	0.006	0.006	373.841	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.049	0.212	2.801	0.012	0.094	0.086	1413.592	0.026
	NA	MC	Motorcycles	12.358	2.241	0.768	0.003	0.028	0.025	399.073	0.055
Delaware	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.330	0.184	0.121	0.002	0.005	0.005	285.589	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	2.881	0.202	0.198	0.002	0.007	0.006	365.905	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.841	0.504	0.686	0.005	0.016	0.014	750.759	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.224	0.094	0.103	0.002	0.004	0.004	277.937	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.159	0.156	0.230	0.003	0.006	0.006	376.812	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	0.917	0.156	2.383	0.012	0.093	0.085	1396.693	0.025
	NA	MC	Motorcycles	12.220	2.251	0.742	0.003	0.025	0.022	394.253	0.054
District of Columbia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.333	0.176	0.113	0.002	0.005	0.005	297.355	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	2.947	0.203	0.188	0.003	0.007	0.006	382.408	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.772	0.552	0.708	0.005	0.017	0.015	792.552	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.293	0.089	0.100	0.002	0.004	0.004	289.751	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.316	0.160	0.229	0.003	0.006	0.006	394.073	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.005	0.174	2.498	0.012	0.102	0.093	1464.049	0.026
	NA	MC	Motorcycles	12.229	2.471	0.707	0.003	0.026	0.023	394.733	0.052

**Table 5-23. On-Road Vehicle Emission Factors – 2024 (cont.)**

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Florida	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.798	0.193	0.116	0.002	0.005	0.004	298.076	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.682	0.231	0.202	0.003	0.006	0.005	382.657	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.927	0.597	0.629	0.005	0.015	0.013	800.872	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.598	0.065	0.101	0.002	0.004	0.004	292.927	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.733	0.131	0.229	0.003	0.006	0.006	397.292	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.266	0.264	2.913	0.013	0.102	0.094	1518.432	0.027
	NA	MC	Motorcycles	12.531	2.970	0.617	0.003	0.026	0.023	392.029	0.053
Georgia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.496	0.187	0.123	0.002	0.005	0.005	280.064	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.225	0.214	0.207	0.002	0.007	0.006	360.586	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	11.693	0.511	0.652	0.005	0.017	0.015	752.590	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.401	0.084	0.107	0.002	0.004	0.004	273.637	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.423	0.146	0.239	0.003	0.006	0.006	372.200	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.385	0.333	3.492	0.012	0.098	0.090	1459.220	0.028
	NA	MC	Motorcycles	12.578	2.533	0.713	0.003	0.027	0.024	394.993	0.056
Hawaii	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.749	0.188	0.117	0.002	0.004	0.004	289.757	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.588	0.222	0.204	0.002	0.006	0.005	372.231	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.423	0.576	0.637	0.005	0.013	0.012	776.024	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.493	0.060	0.101	0.002	0.004	0.004	284.988	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.564	0.124	0.227	0.003	0.006	0.006	386.747	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	0.988	0.162	2.334	0.012	0.095	0.087	1451.985	0.026
	NA	MC	Motorcycles	12.595	2.782	0.667	0.003	0.025	0.022	391.543	0.054
Idaho	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.748	0.219	0.145	0.002	0.006	0.006	279.675	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.381	0.236	0.233	0.002	0.008	0.007	358.787	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.287	0.494	0.719	0.005	0.019	0.017	739.196	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.197	0.111	0.110	0.002	0.004	0.004	270.649	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.115	0.171	0.244	0.003	0.006	0.006	367.530	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.458	0.371	3.957	0.012	0.099	0.091	1440.405	0.029
	NA	MC	Motorcycles	13.083	2.367	0.846	0.003	0.027	0.024	397.182	0.055
Illinois	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.577	0.194	0.123	0.002	0.006	0.005	292.203	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.278	0.229	0.208	0.003	0.008	0.007	376.361	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.349	0.538	0.698	0.005	0.019	0.017	779.470	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.272	0.099	0.103	0.002	0.004	0.004	283.700	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.291	0.170	0.234	0.003	0.006	0.006	386.313	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.049	0.203	2.697	0.012	0.099	0.091	1443.467	0.026
	NA	MC	Motorcycles	12.312	2.406	0.726	0.003	0.026	0.023	397.131	0.053
Indiana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.716	0.206	0.135	0.002	0.006	0.005	285.891	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.417	0.233	0.222	0.002	0.008	0.007	366.527	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.423	0.515	0.684	0.005	0.018	0.016	755.570	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.233	0.102	0.105	0.002	0.004	0.004	277.469	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.186	0.165	0.235	0.003	0.006	0.006	376.385	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.350	0.323	3.487	0.012	0.100	0.092	1449.326	0.028
	NA	MC	Motorcycles	12.845	2.362	0.752	0.003	0.027	0.024	396.189	0.054
Iowa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.933	0.233	0.148	0.002	0.006	0.006	279.067	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.588	0.250	0.237	0.002	0.008	0.008	357.987	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.184	0.489	0.688	0.005	0.020	0.017	737.809	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.221	0.111	0.108	0.002	0.004	0.004	269.897	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.143	0.170	0.239	0.003	0.006	0.006	366.569	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.489	0.384	3.902	0.012	0.099	0.091	1444.231	0.029
	NA	MC	Motorcycles	12.967	2.221	0.789	0.003	0.026	0.023	397.314	0.056
Kansas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.853	0.214	0.142	0.002	0.006	0.005	279.719	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.586	0.238	0.233	0.002	0.008	0.007	359.719	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.429	0.502	0.686	0.005	0.018	0.016	745.723	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.318	0.098	0.108	0.002	0.004	0.004	271.927	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.297	0.160	0.241	0.003	0.006	0.006	369.772	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.325	0.317	3.449	0.012	0.097	0.089	1438.770	0.028
	NA	MC	Motorcycles	12.788	2.401	0.766	0.003	0.027	0.023	396.248	0.056

**Table 5-23. On-Road Vehicle Emission Factors – 2024 (cont.)**

State	Fuel Type	Vehicle Type	Emission Factors (g/mi)								
			Criteria Pollutants and Ozone Precursors								
			CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>	
Kentucky	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.771	0.203	0.138	0.002	0.005	0.005	277.051	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.525	0.228	0.229	0.002	0.007	0.006	356.960	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	11.788	0.487	0.663	0.005	0.018	0.016	745.456	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.338	0.096	0.110	0.002	0.004	0.004	269.533	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.332	0.158	0.244	0.003	0.006	0.006	367.018	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.600	0.420	4.117	0.012	0.101	0.093	1470.236	0.029
	NA	MC	Motorcycles	12.561	2.338	0.752	0.003	0.026	0.023	397.007	0.056
Louisiana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.722	0.195	0.123	0.002	0.005	0.004	285.051	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.544	0.224	0.209	0.002	0.006	0.006	366.669	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.036	0.542	0.633	0.005	0.016	0.014	767.593	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.527	0.076	0.106	0.002	0.004	0.004	279.385	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.609	0.139	0.237	0.003	0.006	0.006	379.551	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.387	0.327	3.364	0.012	0.099	0.091	1484.772	0.028
	NA	MC	Motorcycles	12.581	2.724	0.667	0.003	0.027	0.024	393.845	0.055
Maine	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.668	0.232	0.145	0.002	0.007	0.006	272.794	0.020
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.231	0.243	0.228	0.002	0.009	0.008	350.381	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	11.022	0.463	0.679	0.005	0.021	0.018	720.209	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.134	0.120	0.110	0.002	0.004	0.004	262.985	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	2.999	0.175	0.241	0.003	0.006	0.005	357.949	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.493	0.390	4.009	0.012	0.098	0.090	1421.183	0.029
	NA	MC	Motorcycles	12.877	2.022	0.817	0.003	0.028	0.024	397.966	0.057
Maryland	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.408	0.183	0.121	0.002	0.005	0.005	281.475	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.035	0.206	0.201	0.002	0.008	0.007	363.249	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.364	0.501	0.687	0.005	0.019	0.017	757.141	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.343	0.094	0.107	0.002	0.004	0.004	273.941	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.376	0.161	0.243	0.003	0.006	0.006	373.430	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.177	0.257	3.084	0.012	0.095	0.088	1431.233	0.027
	NA	MC	Motorcycles	12.271	2.305	0.748	0.003	0.027	0.024	397.368	0.055
Massachusetts	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.401	0.189	0.123	0.002	0.006	0.005	280.834	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	2.984	0.214	0.202	0.002	0.008	0.007	362.234	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.625	0.489	0.706	0.005	0.021	0.018	751.396	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.249	0.105	0.107	0.002	0.004	0.004	272.171	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.240	0.172	0.242	0.003	0.006	0.006	371.018	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.194	0.269	3.184	0.012	0.096	0.088	1420.215	0.027
	NA	MC	Motorcycles	12.379	2.174	0.782	0.003	0.027	0.024	398.730	0.055
Michigan	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.831	0.217	0.142	0.002	0.007	0.006	283.861	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.569	0.247	0.235	0.002	0.009	0.008	364.774	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.333	0.507	0.697	0.005	0.021	0.019	753.214	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.226	0.109	0.106	0.002	0.004	0.004	274.741	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.190	0.174	0.239	0.003	0.006	0.006	373.461	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.358	0.331	3.574	0.012	0.099	0.091	1442.860	0.028
	NA	MC	Motorcycles	12.973	2.256	0.778	0.003	0.028	0.025	398.080	0.055
Minnesota	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.892	0.235	0.145	0.002	0.007	0.007	281.052	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.554	0.257	0.235	0.002	0.010	0.009	360.753	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.110	0.514	0.694	0.005	0.023	0.020	740.005	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.187	0.118	0.107	0.002	0.004	0.004	271.040	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.109	0.179	0.239	0.003	0.006	0.006	368.346	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.201	0.278	3.218	0.012	0.095	0.087	1407.444	0.027
	NA	MC	Motorcycles	13.231	2.222	0.793	0.003	0.028	0.025	398.479	0.055
Mississippi	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.659	0.201	0.128	0.002	0.005	0.004	279.754	0.020
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.415	0.223	0.213	0.002	0.006	0.006	359.362	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	11.702	0.520	0.636	0.005	0.015	0.013	745.640	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.389	0.081	0.106	0.002	0.004	0.004	273.653	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.378	0.141	0.234	0.003	0.006	0.005	371.584	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.284	0.294	3.201	0.012	0.096	0.088	1444.736	0.028
	NA	MC	Motorcycles	12.639	2.609	0.698	0.003	0.026	0.023	393.229	0.056

**Table 5-23. On-Road Vehicle Emission Factors – 2024 (cont.)**

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Missouri	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.738	0.202	0.135	0.002	0.005	0.005	274.579	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.455	0.225	0.224	0.002	0.007	0.006	354.727	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	12.169	0.484	0.674	0.005	0.019	0.017	741.123	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.366	0.098	0.110	0.002	0.004	0.004	266.997	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.377	0.160	0.246	0.003	0.006	0.006	364.403	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.353	0.330	3.533	0.012	0.095	0.088	1435.793	0.028
	NA	MC	Motorcycles	12.504	2.292	0.762	0.003	0.027	0.024	397.636	0.057
Montana	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.945	0.240	0.157	0.002	0.007	0.006	274.440	0.020
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.576	0.251	0.249	0.002	0.009	0.008	352.449	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	11.814	0.469	0.710	0.005	0.021	0.018	726.864	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.172	0.121	0.112	0.002	0.004	0.004	264.619	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.061	0.176	0.247	0.003	0.006	0.006	360.024	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.621	0.438	4.414	0.012	0.100	0.092	1444.788	0.030
	NA	MC	Motorcycles	13.162	2.204	0.864	0.003	0.027	0.024	398.308	0.057
Nebraska	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.953	0.229	0.148	0.002	0.006	0.005	278.579	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.664	0.249	0.241	0.002	0.008	0.007	358.282	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	12.142	0.489	0.693	0.005	0.020	0.018	743.991	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.287	0.108	0.110	0.002	0.004	0.004	269.773	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.255	0.169	0.245	0.003	0.006	0.006	367.010	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.605	0.426	4.209	0.012	0.101	0.093	1465.405	0.029
	NA	MC	Motorcycles	12.935	2.325	0.794	0.003	0.027	0.024	398.110	0.056
Nevada	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.493	0.194	0.124	0.002	0.005	0.004	290.551	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.161	0.218	0.210	0.002	0.007	0.006	373.552	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	13.203	0.557	0.742	0.005	0.017	0.015	778.424	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.393	0.085	0.109	0.002	0.004	0.004	283.823	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.445	0.152	0.249	0.003	0.006	0.006	385.591	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.369	0.319	3.682	0.013	0.102	0.094	1487.046	0.028
	NA	MC	Motorcycles	12.758	2.995	0.816	0.003	0.026	0.023	394.850	0.054
New Hampshire	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.400	0.201	0.125	0.002	0.006	0.006	278.820	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	2.914	0.217	0.200	0.002	0.009	0.008	357.991	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	12.097	0.478	0.696	0.005	0.020	0.018	735.430	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.172	0.112	0.107	0.002	0.004	0.004	269.529	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.082	0.173	0.239	0.003	0.006	0.006	366.333	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.244	0.292	3.335	0.012	0.095	0.088	1408.567	0.027
	NA	MC	Motorcycles	12.559	2.100	0.800	0.003	0.027	0.023	397.541	0.055
New Jersey	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.417	0.186	0.125	0.002	0.006	0.005	273.992	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	2.950	0.196	0.200	0.002	0.007	0.007	353.708	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	11.498	0.449	0.676	0.005	0.020	0.017	742.309	0.043
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.318	0.100	0.111	0.002	0.004	0.004	266.177	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.311	0.160	0.249	0.003	0.006	0.006	363.093	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.768	0.487	4.615	0.012	0.104	0.095	1484.406	0.030
	NA	MC	Motorcycles	12.245	2.099	0.785	0.003	0.026	0.023	398.242	0.057
New Mexico	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.705	0.213	0.141	0.002	0.005	0.005	278.452	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.393	0.231	0.234	0.002	0.007	0.006	358.099	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	12.148	0.499	0.714	0.005	0.018	0.016	744.616	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.299	0.095	0.112	0.002	0.004	0.004	270.990	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.267	0.156	0.249	0.003	0.006	0.006	368.431	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.550	0.401	4.184	0.012	0.101	0.093	1463.835	0.029
	NA	MC	Motorcycles	12.768	2.687	0.835	0.003	0.026	0.023	396.035	0.056
New York	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.334	0.186	0.118	0.002	0.006	0.005	283.719	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	2.859	0.203	0.190	0.002	0.008	0.007	365.109	0.022
	Gasoline	HDTV	Heavy-Duty Vehicles (8,501 + lbs)	12.472	0.506	0.699	0.005	0.020	0.018	754.636	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.231	0.103	0.105	0.002	0.004	0.004	275.170	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.205	0.169	0.238	0.003	0.006	0.006	374.421	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.154	0.251	3.046	0.012	0.096	0.089	1421.509	0.027
	NA	MC	Motorcycles	12.599	2.245	0.766	0.003	0.027	0.024	397.512	0.054



**Table 5-23. On-Road Vehicle Emission Factors – 2024 (cont.)**

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
North Carolina	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.591	0.196	0.128	0.002	0.005	0.005	282.123	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.332	0.224	0.216	0.002	0.007	0.006	362.624	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	11.964	0.523	0.664	0.005	0.017	0.015	751.641	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.325	0.087	0.105	0.002	0.004	0.004	275.267	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.313	0.150	0.236	0.003	0.006	0.006	373.996	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.176	0.254	3.012	0.012	0.095	0.088	1430.802	0.027
	NA	MC	Motorcycles	12.682	2.546	0.721	0.003	0.027	0.024	394.686	0.055
North Dakota	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.039	0.261	0.153	0.002	0.008	0.007	275.882	0.020
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.651	0.272	0.242	0.002	0.011	0.010	353.753	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	11.489	0.489	0.688	0.005	0.024	0.021	725.255	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.157	0.129	0.110	0.002	0.004	0.004	264.929	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.034	0.183	0.243	0.003	0.006	0.005	360.244	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.514	0.402	4.081	0.012	0.098	0.090	1428.797	0.029
	NA	MC	Motorcycles	13.318	2.112	0.829	0.003	0.028	0.025	399.074	0.057
Ohio	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.608	0.199	0.130	0.002	0.006	0.005	285.573	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.273	0.225	0.213	0.002	0.008	0.007	366.656	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.537	0.520	0.691	0.005	0.019	0.017	756.286	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.233	0.102	0.104	0.002	0.004	0.004	277.094	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.195	0.167	0.235	0.003	0.006	0.006	376.333	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.231	0.279	3.202	0.012	0.098	0.090	1434.984	0.027
	NA	MC	Motorcycles	12.939	2.370	0.755	0.003	0.027	0.024	396.617	0.054
Oklahoma	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.827	0.206	0.136	0.002	0.005	0.005	283.089	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.600	0.232	0.228	0.002	0.007	0.006	363.765	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.622	0.522	0.677	0.005	0.017	0.015	756.204	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.386	0.088	0.107	0.002	0.004	0.004	276.208	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.399	0.151	0.239	0.003	0.006	0.006	375.145	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.353	0.321	3.443	0.012	0.098	0.090	1459.522	0.028
	NA	MC	Motorcycles	12.723	2.595	0.737	0.003	0.026	0.023	394.912	0.055
Oregon	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.512	0.195	0.136	0.002	0.006	0.005	276.468	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.125	0.213	0.219	0.002	0.007	0.007	355.376	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.176	0.487	0.702	0.005	0.018	0.016	733.778	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.170	0.102	0.108	0.002	0.004	0.004	268.405	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.080	0.163	0.240	0.003	0.006	0.006	364.978	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.349	0.328	3.617	0.012	0.097	0.090	1420.884	0.028
	NA	MC	Motorcycles	12.923	2.252	0.823	0.003	0.027	0.024	396.407	0.056
Pacific Islands	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.530	0.190	0.126	0.002	0.005	0.005	281.955	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.213	0.215	0.211	0.002	0.007	0.006	362.909	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.375	0.509	0.679	0.005	0.018	0.016	754.426	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.305	0.091	0.106	0.002	0.004	0.004	274.700	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.302	0.156	0.239	0.003	0.006	0.006	373.658	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.315	0.308	3.410	0.012	0.098	0.090	1446.111	0.028
	NA	MC	Motorcycles	12.522	2.434	0.750	0.003	0.026	0.023	396.038	0.055
Pennsylvania	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.445	0.190	0.124	0.002	0.006	0.005	283.639	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.073	0.214	0.205	0.002	0.008	0.007	364.638	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.161	0.504	0.689	0.005	0.020	0.017	755.049	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.253	0.102	0.106	0.002	0.004	0.004	275.243	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.229	0.167	0.239	0.003	0.006	0.006	374.168	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.384	0.337	3.609	0.012	0.100	0.092	1450.536	0.028
	NA	MC	Motorcycles	12.721	2.311	0.760	0.003	0.027	0.024	397.283	0.055
Puerto Rico	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.087	0.192	0.114	0.002	0.004	0.004	299.517	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	4.091	0.234	0.202	0.003	0.006	0.005	385.972	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	14.205	0.619	0.618	0.005	0.015	0.013	814.837	0.046
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.813	0.057	0.101	0.002	0.004	0.004	295.020	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	4.066	0.126	0.230	0.003	0.006	0.006	401.303	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.067	0.185	2.360	0.013	0.098	0.090	1518.992	0.026
	NA	MC	Motorcycles	12.597	3.083	0.597	0.003	0.026	0.023	392.362	0.053

**Table 5-23. On-Road Vehicle Emission Factors – 2024 (cont.)**

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Rhode Island	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.413	0.187	0.121	0.002	0.006	0.005	285.328	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.025	0.210	0.200	0.002	0.008	0.007	368.067	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.925	0.505	0.709	0.005	0.021	0.018	764.466	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.258	0.102	0.105	0.002	0.004	0.004	276.866	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.271	0.171	0.240	0.003	0.006	0.006	377.407	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.207	0.268	3.169	0.012	0.098	0.090	1438.270	0.027
	NA	MC	Motorcycles	12.352	2.256	0.761	0.003	0.027	0.024	398.363	0.054
South Carolina	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.700	0.199	0.130	0.002	0.005	0.004	282.339	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.501	0.227	0.220	0.002	0.007	0.006	363.156	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	11.761	0.524	0.651	0.005	0.017	0.015	758.703	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.415	0.083	0.107	0.002	0.004	0.004	275.963	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.448	0.146	0.239	0.003	0.006	0.006	375.004	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.508	0.378	3.769	0.012	0.101	0.093	1481.637	0.029
	NA	MC	Motorcycles	12.659	2.632	0.706	0.003	0.027	0.024	394.876	0.055
South Dakota	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.920	0.237	0.150	0.002	0.007	0.006	274.386	0.020
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.615	0.253	0.242	0.002	0.009	0.008	353.074	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	11.331	0.481	0.682	0.005	0.022	0.020	732.017	0.043
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.241	0.118	0.112	0.002	0.004	0.004	264.719	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.170	0.176	0.248	0.003	0.006	0.006	360.642	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.662	0.453	4.428	0.012	0.101	0.093	1456.880	0.030
	NA	MC	Motorcycles	13.148	2.238	0.814	0.003	0.028	0.025	399.047	0.057
Tennessee	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.592	0.192	0.127	0.002	0.005	0.005	282.800	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.318	0.219	0.212	0.002	0.007	0.006	363.864	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.079	0.519	0.668	0.005	0.018	0.016	758.033	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.361	0.090	0.107	0.002	0.004	0.004	275.720	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.380	0.154	0.239	0.003	0.006	0.006	374.878	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.418	0.346	3.609	0.012	0.100	0.092	1465.404	0.028
	NA	MC	Motorcycles	12.746	2.543	0.727	0.003	0.027	0.024	395.863	0.055
Texas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.543	0.179	0.116	0.002	0.005	0.004	284.128	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.288	0.206	0.198	0.002	0.006	0.005	366.364	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.373	0.527	0.649	0.005	0.016	0.014	769.208	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.551	0.076	0.108	0.002	0.004	0.004	278.448	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.660	0.141	0.242	0.003	0.006	0.006	379.014	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.274	0.285	3.165	0.012	0.097	0.089	1471.257	0.027
	NA	MC	Motorcycles	12.100	2.668	0.687	0.003	0.026	0.023	394.642	0.055
Utah	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.652	0.204	0.134	0.002	0.006	0.005	286.573	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.359	0.231	0.223	0.002	0.008	0.008	369.150	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	13.096	0.533	0.742	0.005	0.021	0.019	766.116	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.290	0.103	0.109	0.002	0.004	0.004	278.040	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.305	0.171	0.247	0.003	0.006	0.006	378.539	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.280	0.297	3.473	0.012	0.099	0.091	1450.867	0.027
	NA	MC	Motorcycles	13.054	2.611	0.827	0.003	0.028	0.025	398.002	0.054
Vermont	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.460	0.218	0.131	0.002	0.007	0.006	273.399	0.020
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	2.954	0.226	0.205	0.002	0.009	0.008	351.240	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	11.112	0.469	0.680	0.005	0.021	0.019	723.006	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.157	0.121	0.110	0.002	0.004	0.004	263.499	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.036	0.176	0.242	0.003	0.006	0.006	358.689	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.524	0.403	4.083	0.012	0.098	0.090	1428.450	0.029
	NA	MC	Motorcycles	12.993	2.087	0.815	0.003	0.027	0.024	398.287	0.057
Virgin Islands	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.903	0.201	0.116	0.002	0.004	0.003	284.310	0.020
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.733	0.216	0.192	0.002	0.005	0.004	364.972	0.021
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	12.981	0.558	0.571	0.005	0.010	0.009	754.607	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.646	0.059	0.103	0.002	0.004	0.004	280.493	0.007
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.725	0.114	0.223	0.003	0.006	0.005	380.414	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	0.863	0.126	1.950	0.012	0.086	0.079	1432.544	0.025
	NA	MC	Motorcycles	12.563	2.563	0.618	0.003	0.023	0.021	388.503	0.056

**Table 5-23. On-Road Vehicle Emission Factors – 2024 (cont.)**

State	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				CO	VOC	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>	NH <sub>3</sub>
Virginia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.592	0.194	0.130	0.002	0.005	0.005	282.119	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.314	0.221	0.217	0.002	0.007	0.006	363.255	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	12.051	0.503	0.675	0.005	0.018	0.016	756.289	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.328	0.093	0.107	0.002	0.004	0.004	274.735	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.338	0.157	0.240	0.003	0.006	0.006	373.812	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.376	0.331	3.539	0.012	0.099	0.091	1455.347	0.028
	NA	MC	Motorcycles	12.425	2.385	0.736	0.003	0.027	0.024	396.503	0.055
Washington	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.576	0.192	0.133	0.002	0.006	0.005	279.570	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.263	0.218	0.219	0.002	0.008	0.007	360.554	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	12.551	0.503	0.714	0.005	0.020	0.018	749.522	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.211	0.102	0.107	0.002	0.004	0.004	271.322	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.186	0.169	0.243	0.003	0.006	0.006	369.786	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.378	0.337	3.677	0.012	0.099	0.091	1438.460	0.028
	NA	MC	Motorcycles	13.008	2.297	0.809	0.003	0.028	0.025	398.363	0.055
West Virginia	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.726	0.209	0.140	0.002	0.006	0.005	274.675	0.020
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.442	0.231	0.231	0.002	0.008	0.007	353.726	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	11.569	0.485	0.669	0.005	0.019	0.017	734.451	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.258	0.102	0.109	0.002	0.004	0.004	266.662	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.203	0.161	0.242	0.003	0.006	0.006	363.174	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.470	0.375	3.840	0.012	0.098	0.090	1439.717	0.029
	NA	MC	Motorcycles	12.863	2.313	0.771	0.003	0.027	0.024	396.969	0.056
Wisconsin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	2.754	0.222	0.139	0.002	0.007	0.006	279.040	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.392	0.243	0.225	0.002	0.009	0.008	358.340	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	11.903	0.490	0.684	0.005	0.021	0.019	737.491	0.044
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.194	0.115	0.108	0.002	0.004	0.004	269.430	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.116	0.176	0.240	0.003	0.006	0.006	366.280	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.364	0.338	3.631	0.012	0.097	0.090	1425.068	0.028
	NA	MC	Motorcycles	12.853	2.161	0.790	0.003	0.027	0.024	398.268	0.056
Wyoming	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	3.025	0.244	0.158	0.002	0.007	0.006	275.721	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	3.704	0.259	0.254	0.002	0.009	0.008	354.626	0.022
	Gasoline	HDBGV	Heavy-Duty Vehicles (8,501 + lbs)	11.832	0.474	0.717	0.005	0.023	0.020	735.844	0.043
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	2.227	0.121	0.114	0.002	0.004	0.004	265.836	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	3.159	0.179	0.252	0.003	0.006	0.006	361.946	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.772	0.494	4.821	0.012	0.104	0.095	1471.672	0.031
	NA	MC	Motorcycles	13.198	2.309	0.867	0.003	0.028	0.025	399.630	0.057

**Table 5-24. EMFAC County-Specific On-Road Vehicle Composite EFs – 2020 POV**

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ALAMEDA	All Vehicles	0.289	0.004	2.398	0.340	0.058	0.025	409.802	0.025
ALPINE	All Vehicles	0.354	0.004	2.885	0.405	0.059	0.025	407.641	0.025
AMADOR	All Vehicles	0.461	0.004	3.128	0.513	0.057	0.025	383.152	0.025
BUTTE	All Vehicles	0.401	0.004	2.964	0.467	0.057	0.025	413.769	0.025
CALAVERAS	All Vehicles	0.473	0.004	3.406	0.553	0.058	0.026	403.001	0.025
COLUSA	All Vehicles	0.337	0.004	2.500	0.372	0.058	0.025	415.310	0.025
CONTRA COSTA	All Vehicles	0.288	0.004	2.380	0.335	0.057	0.025	401.036	0.025
DEL NORTE	All Vehicles	0.456	0.004	3.171	0.508	0.057	0.025	409.840	0.025
EL DORADO	All Vehicles	0.353	0.004	2.759	0.429	0.058	0.025	400.233	0.023
FRESNO	All Vehicles	0.306	0.004	2.452	0.363	0.056	0.024	405.086	0.025
GLENN	All Vehicles	0.348	0.004	2.647	0.413	0.058	0.025	419.263	0.025
HUMBOLDT	All Vehicles	0.431	0.004	3.007	0.479	0.056	0.025	396.962	0.025
IMPERIAL	All Vehicles	0.318	0.004	2.645	0.422	0.057	0.025	412.826	0.025
INYO	All Vehicles	0.349	0.004	2.769	0.448	0.059	0.026	430.052	0.025
KERN	All Vehicles	0.308	0.004	2.506	0.352	0.057	0.025	420.456	0.025
KINGS	All Vehicles	0.312	0.004	2.444	0.352	0.057	0.025	410.854	0.025
LAKE	All Vehicles	0.475	0.004	3.390	0.572	0.057	0.026	406.770	0.025
LASSEN	All Vehicles	0.400	0.004	3.075	0.484	0.059	0.026	419.968	0.025
LOS ANGELES	All Vehicles	0.291	0.004	2.586	0.358	0.061	0.027	434.657	0.025
MADERA	All Vehicles	0.331	0.004	2.704	0.383	0.057	0.025	422.829	0.025
MARIN	All Vehicles	0.292	0.004	2.459	0.362	0.059	0.025	409.896	0.025
MARIPOSA	All Vehicles	0.504	0.004	3.563	0.594	0.058	0.026	410.009	0.025
MENDOCINO	All Vehicles	0.410	0.004	2.946	0.472	0.058	0.025	403.114	0.025
MERCED	All Vehicles	0.346	0.004	2.712	0.371	0.056	0.024	415.193	0.025
MODOC	All Vehicles	0.429	0.004	3.381	0.509	0.060	0.027	453.021	0.025
MONO	All Vehicles	0.371	0.004	3.031	0.434	0.058	0.025	419.603	0.025
MONTEREY	All Vehicles	0.369	0.004	2.763	0.375	0.058	0.025	423.837	0.025
NAPA	All Vehicles	0.325	0.004	2.525	0.353	0.058	0.025	396.435	0.025
NEVADA	All Vehicles	0.399	0.004	2.907	0.444	0.056	0.024	397.072	0.025

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ORANGE	All Vehicles	0.252	0.004	2.303	0.328	0.060	0.026	414.720	0.025
PLACER	All Vehicles	0.294	0.004	2.433	0.348	0.057	0.025	402.118	0.025
PLUMAS	All Vehicles	0.469	0.004	3.546	0.544	0.059	0.027	434.836	0.025
RIVERSIDE	All Vehicles	0.278	0.004	2.345	0.326	0.057	0.025	403.841	0.025
SACRAMENTO	All Vehicles	0.318	0.004	2.493	0.375	0.057	0.025	404.335	0.025
SAN BENITO	All Vehicles	0.338	0.004	2.485	0.352	0.056	0.025	404.973	0.025
SAN BERNARDINO	All Vehicles	0.297	0.004	2.478	0.328	0.057	0.025	408.934	0.025
SAN DIEGO	All Vehicles	0.294	0.004	2.369	0.336	0.059	0.026	422.294	0.025
SAN FRANCISCO	All Vehicles	0.262	0.004	2.457	0.364	0.060	0.027	434.720	0.025
SAN JOAQUIN	All Vehicles	0.307	0.004	2.444	0.358	0.056	0.024	404.727	0.025
SAN LUIS OBISPO	All Vehicles	0.350	0.004	2.517	0.389	0.057	0.025	395.182	0.025
SAN MATEO	All Vehicles	0.252	0.004	2.296	0.311	0.062	0.027	414.540	0.025
SANTA BARBARA	All Vehicles	0.372	0.004	2.530	0.366	0.058	0.026	391.586	0.025
SANTA CLARA	All Vehicles	0.288	0.004	2.356	0.332	0.058	0.025	403.473	0.025
SANTA CRUZ	All Vehicles	0.406	0.004	2.942	0.442	0.058	0.026	409.944	0.025
SHASTA	All Vehicles	0.369	0.004	2.780	0.435	0.058	0.026	425.734	0.025
SIERRA	All Vehicles	0.418	0.004	3.288	0.493	0.060	0.027	444.487	0.025
SISKIYOU	All Vehicles	0.407	0.004	3.264	0.508	0.058	0.026	447.009	0.025
SOLANO	All Vehicles	0.304	0.004	2.442	0.338	0.057	0.025	417.659	0.025
SONOMA	All Vehicles	0.345	0.004	2.770	0.417	0.058	0.026	408.795	0.025
STANISLAUS	All Vehicles	0.319	0.004	2.629	0.403	0.056	0.025	409.824	0.025
SUTTER	All Vehicles	0.326	0.004	2.543	0.401	0.056	0.025	399.070	0.025
TEHAMA	All Vehicles	0.373	0.004	2.792	0.418	0.058	0.025	424.050	0.025
TRINITY	All Vehicles	0.434	0.005	3.498	0.537	0.060	0.027	473.020	0.025
TULARE	All Vehicles	0.334	0.004	2.587	0.390	0.056	0.024	402.431	0.025
TUOLUMNE	All Vehicles	0.458	0.004	3.354	0.559	0.057	0.025	409.343	0.025
VENTURA	All Vehicles	0.297	0.004	2.507	0.386	0.059	0.025	406.042	0.025
YOLO	All Vehicles	0.275	0.004	2.353	0.345	0.057	0.025	401.953	0.025
YUBA	All Vehicles	0.394	0.004	2.737	0.405	0.056	0.025	397.053	0.025

**Table 5-25. EMFAC County-Specific On-Road Vehicle Composite EFs – 2021 POV**

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ALAMEDA	All Vehicles	0.252	0.004	2.086	0.301	0.053	0.023	369.054	0.024
ALPINE	All Vehicles	0.305	0.004	2.489	0.357	0.054	0.023	363.473	0.024
AMADOR	All Vehicles	0.404	0.004	2.774	0.469	0.053	0.023	353.812	0.024
BUTTE	All Vehicles	0.347	0.004	2.597	0.419	0.053	0.023	379.287	0.024
CALAVERAS	All Vehicles	0.415	0.004	3.020	0.504	0.054	0.024	371.318	0.024
COLUSA	All Vehicles	0.291	0.004	2.166	0.329	0.053	0.023	374.016	0.024
CONTRA COSTA	All Vehicles	0.251	0.004	2.077	0.297	0.053	0.023	362.563	0.024
DEL NORTE	All Vehicles	0.399	0.004	2.806	0.461	0.053	0.024	377.309	0.024
EL DORADO	All Vehicles	0.307	0.004	2.434	0.390	0.053	0.023	363.254	0.023
FRESNO	All Vehicles	0.267	0.004	2.139	0.323	0.052	0.023	369.378	0.024
GLENN	All Vehicles	0.299	0.004	2.290	0.366	0.053	0.023	378.552	0.024
HUMBOLDT	All Vehicles	0.375	0.004	2.658	0.436	0.053	0.023	365.665	0.024
IMPERIAL	All Vehicles	0.273	0.004	2.289	0.374	0.053	0.023	372.164	0.024
INYO	All Vehicles	0.301	0.004	2.399	0.400	0.054	0.023	385.895	0.024
KERN	All Vehicles	0.270	0.004	2.193	0.313	0.053	0.023	382.721	0.024
KINGS	All Vehicles	0.272	0.004	2.132	0.313	0.053	0.023	374.000	0.024
LAKE	All Vehicles	0.413	0.004	2.984	0.520	0.053	0.024	376.016	0.024
LASSEN	All Vehicles	0.343	0.004	2.682	0.434	0.054	0.024	378.549	0.024
LOS ANGELES	All Vehicles	0.247	0.004	2.216	0.314	0.055	0.024	383.835	0.024
MADERA	All Vehicles	0.287	0.004	2.330	0.337	0.053	0.023	385.353	0.024
MARIN	All Vehicles	0.251	0.004	2.132	0.320	0.054	0.023	366.298	0.024
MARIPOSA	All Vehicles	0.443	0.004	3.167	0.543	0.054	0.024	379.335	0.024
MENDOCINO	All Vehicles	0.356	0.004	2.583	0.426	0.053	0.023	367.952	0.024
MERCED	All Vehicles	0.301	0.004	2.371	0.331	0.052	0.023	383.077	0.024
MODOC	All Vehicles	0.367	0.004	2.928	0.453	0.055	0.024	406.234	0.024
MONO	All Vehicles	0.321	0.004	2.645	0.388	0.053	0.023	378.043	0.024
MONTEREY	All Vehicles	0.319	0.004	2.416	0.334	0.054	0.024	387.563	0.024
NAPA	All Vehicles	0.282	0.004	2.194	0.313	0.053	0.023	358.675	0.024
NEVADA	All Vehicles	0.351	0.004	2.589	0.406	0.052	0.023	366.629	0.024

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ORANGE	All Vehicles	0.216	0.004	1.989	0.289	0.054	0.023	366.928	0.031
PLACER	All Vehicles	0.256	0.004	2.138	0.312	0.053	0.023	363.453	0.024
PLUMAS	All Vehicles	0.405	0.004	3.097	0.489	0.054	0.024	395.037	0.024
RIVERSIDE	All Vehicles	0.240	0.004	2.036	0.289	0.053	0.023	364.190	0.024
SACRAMENTO	All Vehicles	0.276	0.004	2.186	0.336	0.053	0.023	367.914	0.024
SAN BENITO	All Vehicles	0.296	0.004	2.180	0.315	0.052	0.023	370.411	0.024
SAN BERNARDINO	All Vehicles	0.257	0.004	2.149	0.291	0.053	0.023	368.780	0.024
SAN DIEGO	All Vehicles	0.252	0.004	2.059	0.298	0.054	0.023	376.955	0.024
SAN FRANCISCO	All Vehicles	0.226	0.004	2.134	0.323	0.054	0.024	386.436	0.024
SAN JOAQUIN	All Vehicles	0.266	0.004	2.125	0.317	0.052	0.023	368.085	0.024
SAN LUIS OBISPO	All Vehicles	0.302	0.004	2.209	0.350	0.053	0.023	359.306	0.024
SAN MATEO	All Vehicles	0.213	0.004	1.964	0.271	0.055	0.023	359.273	0.024
SANTA BARBARA	All Vehicles	0.320	0.003	2.212	0.327	0.054	0.023	357.203	0.024
SANTA CLARA	All Vehicles	0.249	0.004	2.048	0.294	0.053	0.023	362.774	0.024
SANTA CRUZ	All Vehicles	0.348	0.004	2.579	0.397	0.054	0.024	375.255	0.024
SHASTA	All Vehicles	0.319	0.004	2.413	0.388	0.053	0.023	384.044	0.024
SIERRA	All Vehicles	0.355	0.004	2.843	0.438	0.054	0.024	397.231	0.024
SISKIYOU	All Vehicles	0.352	0.004	2.840	0.454	0.054	0.024	403.938	0.024
SOLANO	All Vehicles	0.265	0.004	2.130	0.300	0.052	0.023	378.989	0.024
SONOMA	All Vehicles	0.296	0.004	2.404	0.370	0.053	0.023	370.137	0.024
STANISLAUS	All Vehicles	0.277	0.004	2.296	0.359	0.052	0.023	374.967	0.024
SUTTER	All Vehicles	0.283	0.004	2.216	0.357	0.052	0.023	362.874	0.024
TEHAMA	All Vehicles	0.322	0.004	2.424	0.371	0.053	0.023	383.436	0.024
TRINITY	All Vehicles	0.372	0.004	3.024	0.478	0.055	0.024	424.854	0.024
TULARE	All Vehicles	0.289	0.004	2.255	0.347	0.052	0.023	368.175	0.024
TUOLUMNE	All Vehicles	0.400	0.004	2.964	0.509	0.053	0.024	377.360	0.024
VENTURA	All Vehicles	0.254	0.004	2.175	0.343	0.053	0.023	363.585	0.024
YOLO	All Vehicles	0.240	0.004	2.061	0.309	0.052	0.023	364.284	0.024
YUBA	All Vehicles	0.338	0.004	2.386	0.362	0.053	0.023	362.923	0.024

**Table 5-26. EMFAC County Specific On-Road Vehicle Composite EFs – 2022 POV**

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ALAMEDA	All Vehicles	0.223	0.003	1.839	0.270	0.049	0.021	334.946	0.024
ALPINE	All Vehicles	0.268	0.003	2.176	0.321	0.049	0.021	326.256	0.024
AMADOR	All Vehicles	0.352	0.003	2.479	0.432	0.050	0.022	327.781	0.024
BUTTE	All Vehicles	0.301	0.003	2.294	0.379	0.049	0.021	348.803	0.024
CALAVERAS	All Vehicles	0.365	0.003	2.701	0.464	0.050	0.022	343.243	0.024
COLUSA	All Vehicles	0.251	0.003	1.900	0.296	0.049	0.021	338.847	0.024
CONTRA COSTA	All Vehicles	0.221	0.003	1.834	0.268	0.049	0.021	330.144	0.024
DEL NORTE	All Vehicles	0.351	0.003	2.505	0.423	0.050	0.022	348.443	0.024
EL DORADO	All Vehicles	0.268	0.003	2.172	0.359	0.049	0.021	331.741	0.022
FRESNO	All Vehicles	0.235	0.003	1.889	0.292	0.049	0.021	339.509	0.024
GLENN	All Vehicles	0.259	0.003	2.006	0.329	0.049	0.021	343.673	0.024
HUMBOLDT	All Vehicles	0.327	0.003	2.372	0.401	0.049	0.021	338.272	0.024
IMPERIAL	All Vehicles	0.238	0.003	2.002	0.338	0.048	0.021	337.869	0.024
INYO	All Vehicles	0.262	0.003	2.103	0.362	0.049	0.021	348.163	0.024
KERN	All Vehicles	0.239	0.003	1.941	0.283	0.049	0.021	351.212	0.024
KINGS	All Vehicles	0.240	0.003	1.879	0.282	0.049	0.021	342.228	0.024
LAKE	All Vehicles	0.358	0.003	2.649	0.478	0.050	0.022	348.958	0.024
LASSEN	All Vehicles	0.296	0.003	2.362	0.395	0.049	0.022	342.837	0.024
LOS ANGELES	All Vehicles	0.213	0.003	1.923	0.279	0.049	0.021	341.171	0.024
MADERA	All Vehicles	0.252	0.004	2.052	0.303	0.049	0.021	354.934	0.024
MARIN	All Vehicles	0.218	0.003	1.872	0.287	0.049	0.021	329.422	0.024
MARIPOSA	All Vehicles	0.390	0.003	2.830	0.500	0.051	0.022	351.779	0.024
MENDOCINO	All Vehicles	0.310	0.003	2.289	0.389	0.049	0.021	337.388	0.024
MERCED	All Vehicles	0.265	0.004	2.089	0.297	0.049	0.021	355.090	0.024
MODOC	All Vehicles	0.317	0.004	2.566	0.408	0.050	0.022	366.278	0.024
MONO	All Vehicles	0.282	0.003	2.333	0.350	0.049	0.021	342.427	0.024
MONTEREY	All Vehicles	0.276	0.004	2.136	0.301	0.050	0.022	356.613	0.024
NAPA	All Vehicles	0.248	0.003	1.929	0.281	0.049	0.021	327.049	0.024
NEVADA	All Vehicles	0.309	0.003	2.325	0.375	0.049	0.021	339.923	0.024

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ORANGE	All Vehicles	0.186	0.003	1.738	0.259	0.049	0.021	326.995	0.024
PLACER	All Vehicles	0.224	0.003	1.900	0.283	0.048	0.021	330.416	0.024
PLUMAS	All Vehicles	0.350	0.004	2.728	0.444	0.050	0.022	360.271	0.024
RIVERSIDE	All Vehicles	0.210	0.003	1.792	0.261	0.048	0.021	330.402	0.024
SACRAMENTO	All Vehicles	0.243	0.003	1.940	0.305	0.049	0.021	337.257	0.024
SAN BENITO	All Vehicles	0.260	0.003	1.927	0.285	0.048	0.021	340.951	0.024
SAN BERNARDINO	All Vehicles	0.225	0.003	1.884	0.261	0.048	0.021	334.763	0.024
SAN DIEGO	All Vehicles	0.219	0.003	1.803	0.267	0.049	0.021	338.586	0.024
SAN FRANCISCO	All Vehicles	0.197	0.003	1.877	0.290	0.049	0.022	346.486	0.024
SAN JOAQUIN	All Vehicles	0.233	0.003	1.876	0.286	0.048	0.021	338.089	0.024
SAN LUIS OBISPO	All Vehicles	0.260	0.003	1.958	0.318	0.049	0.021	328.137	0.024
SAN MATEO	All Vehicles	0.184	0.003	1.709	0.241	0.048	0.021	314.862	0.024
SANTA BARBARA	All Vehicles	0.274	0.003	1.955	0.296	0.050	0.021	327.418	0.024
SANTA CLARA	All Vehicles	0.219	0.003	1.806	0.265	0.049	0.021	328.917	0.024
SANTA CRUZ	All Vehicles	0.297	0.003	2.275	0.359	0.050	0.022	344.172	0.024
SHASTA	All Vehicles	0.276	0.003	2.123	0.350	0.049	0.021	348.837	0.024
SIERRA	All Vehicles	0.304	0.003	2.490	0.395	0.049	0.022	357.278	0.024
SISKIYOU	All Vehicles	0.309	0.004	2.497	0.411	0.049	0.022	367.098	0.024
SOLANO	All Vehicles	0.234	0.003	1.879	0.270	0.048	0.021	346.134	0.024
SONOMA	All Vehicles	0.254	0.003	2.109	0.332	0.049	0.021	337.038	0.024
STANISLAUS	All Vehicles	0.243	0.003	2.026	0.324	0.049	0.021	345.114	0.024
SUTTER	All Vehicles	0.248	0.003	1.956	0.324	0.048	0.021	332.308	0.024
TEHAMA	All Vehicles	0.279	0.003	2.129	0.333	0.049	0.021	348.738	0.024
TRINITY	All Vehicles	0.323	0.004	2.648	0.431	0.050	0.022	383.568	0.024
TULARE	All Vehicles	0.253	0.003	1.988	0.313	0.049	0.021	339.039	0.024
TUOLUMNE	All Vehicles	0.350	0.003	2.639	0.467	0.050	0.022	348.908	0.024
VENTURA	All Vehicles	0.220	0.003	1.905	0.308	0.049	0.021	326.675	0.024
YOLO	All Vehicles	0.212	0.003	1.828	0.280	0.049	0.021	332.917	0.024
YUBA	All Vehicles	0.291	0.003	2.102	0.328	0.049	0.021	333.425	0.024

**Table 5-27. EMFAC County-Specific On-Road Vehicle Composite EFs – 2023 POV**

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ALAMEDA	All Vehicles	0.202	0.003	1.639	0.246	0.045	0.019	308.448	0.024
ALPINE	All Vehicles	0.239	0.003	1.929	0.293	0.045	0.019	295.285	0.024
AMADOR	All Vehicles	0.311	0.003	2.231	0.402	0.047	0.020	304.658	0.024
BUTTE	All Vehicles	0.264	0.003	2.045	0.347	0.046	0.020	322.165	0.024
CALAVERAS	All Vehicles	0.324	0.003	2.430	0.431	0.047	0.021	318.482	0.024
COLUSA	All Vehicles	0.220	0.003	1.688	0.270	0.045	0.019	309.076	0.024
CONTRA COSTA	All Vehicles	0.199	0.003	1.638	0.244	0.045	0.019	304.014	0.024
DEL NORTE	All Vehicles	0.310	0.003	2.254	0.391	0.047	0.020	322.630	0.024
EL DORADO	All Vehicles	0.237	0.003	1.958	0.333	0.046	0.020	304.798	0.022
FRESNO	All Vehicles	0.211	0.003	1.686	0.266	0.046	0.019	315.218	0.024
GLENN	All Vehicles	0.226	0.003	1.777	0.299	0.045	0.019	313.693	0.024
HUMBOLDT	All Vehicles	0.289	0.003	2.133	0.372	0.046	0.020	313.829	0.024
IMPERIAL	All Vehicles	0.211	0.003	1.772	0.309	0.045	0.019	309.320	0.024
INYO	All Vehicles	0.232	0.003	1.863	0.332	0.045	0.019	315.834	0.024
KERN	All Vehicles	0.216	0.003	1.738	0.258	0.046	0.019	325.891	0.024
KINGS	All Vehicles	0.216	0.003	1.675	0.257	0.045	0.019	317.014	0.024
LAKE	All Vehicles	0.314	0.003	2.370	0.443	0.047	0.020	325.010	0.024
LASSEN	All Vehicles	0.259	0.003	2.103	0.363	0.046	0.020	311.887	0.024
LOS ANGELES	All Vehicles	0.187	0.003	1.689	0.252	0.044	0.019	306.526	0.024
MADERA	All Vehicles	0.226	0.003	1.829	0.275	0.046	0.020	330.452	0.024
MARIN	All Vehicles	0.193	0.003	1.663	0.262	0.045	0.019	299.057	0.024
MARIPOSA	All Vehicles	0.346	0.003	2.548	0.465	0.048	0.021	326.934	0.024
MENDOCINO	All Vehicles	0.273	0.003	2.048	0.360	0.046	0.020	311.001	0.024
MERCED	All Vehicles	0.238	0.003	1.860	0.270	0.046	0.020	332.520	0.024
MODOC	All Vehicles	0.277	0.003	2.269	0.372	0.046	0.020	331.754	0.024
MONO	All Vehicles	0.250	0.003	2.079	0.321	0.045	0.019	312.006	0.024
MONTEREY	All Vehicles	0.241	0.003	1.908	0.275	0.046	0.020	329.928	0.024
NAPA	All Vehicles	0.223	0.003	1.716	0.255	0.046	0.019	301.688	0.024
NEVADA	All Vehicles	0.276	0.003	2.106	0.349	0.046	0.020	316.692	0.024

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ORANGE	All Vehicles	0.164	0.003	1.536	0.235	0.044	0.019	294.215	0.024
PLACER	All Vehicles	0.200	0.003	1.706	0.260	0.045	0.019	302.411	0.024
PLUMAS	All Vehicles	0.307	0.003	2.425	0.408	0.046	0.020	330.018	0.024
RIVERSIDE	All Vehicles	0.187	0.003	1.595	0.238	0.045	0.019	302.585	0.024
SACRAMENTO	All Vehicles	0.219	0.003	1.740	0.281	0.046	0.020	311.695	0.024
SAN BENITO	All Vehicles	0.231	0.003	1.723	0.261	0.045	0.019	316.342	0.024
SAN BERNARDINO	All Vehicles	0.201	0.003	1.671	0.237	0.045	0.019	306.747	0.024
SAN DIEGO	All Vehicles	0.195	0.003	1.596	0.242	0.045	0.019	306.941	0.024
SAN FRANCISCO	All Vehicles	0.176	0.003	1.669	0.264	0.045	0.020	314.164	0.024
SAN JOAQUIN	All Vehicles	0.209	0.003	1.674	0.261	0.045	0.019	313.793	0.024
SAN LUIS OBISPO	All Vehicles	0.227	0.003	1.752	0.292	0.045	0.019	301.087	0.024
SAN MATEO	All Vehicles	0.163	0.003	1.507	0.218	0.043	0.018	279.696	0.024
SANTA BARBARA	All Vehicles	0.238	0.003	1.745	0.271	0.046	0.020	301.614	0.024
SANTA CLARA	All Vehicles	0.197	0.003	1.611	0.242	0.045	0.019	302.132	0.024
SANTA CRUZ	All Vehicles	0.256	0.003	2.028	0.328	0.046	0.020	317.171	0.024
SHASTA	All Vehicles	0.242	0.003	1.887	0.320	0.045	0.019	318.595	0.024
SIERRA	All Vehicles	0.264	0.003	2.201	0.360	0.045	0.020	322.764	0.024
SISKIYOU	All Vehicles	0.274	0.003	2.219	0.376	0.046	0.020	335.621	0.024
SOLANO	All Vehicles	0.211	0.003	1.676	0.246	0.045	0.019	319.691	0.024
SONOMA	All Vehicles	0.223	0.003	1.869	0.301	0.046	0.020	308.857	0.024
STANISLAUS	All Vehicles	0.218	0.003	1.807	0.296	0.046	0.020	320.813	0.024
SUTTER	All Vehicles	0.223	0.003	1.749	0.297	0.045	0.019	307.204	0.024
TEHAMA	All Vehicles	0.246	0.003	1.892	0.303	0.045	0.019	319.205	0.024
TRINITY	All Vehicles	0.284	0.003	2.337	0.393	0.046	0.020	348.263	0.024
TULARE	All Vehicles	0.227	0.003	1.772	0.285	0.046	0.019	315.134	0.024
TUOLUMNE	All Vehicles	0.309	0.003	2.363	0.432	0.047	0.021	323.396	0.024
VENTURA	All Vehicles	0.195	0.003	1.686	0.280	0.045	0.019	296.111	0.024
YOLO	All Vehicles	0.192	0.003	1.639	0.258	0.045	0.019	306.915	0.024
YUBA	All Vehicles	0.253	0.003	1.871	0.300	0.046	0.020	307.594	0.024

**Table 5-28. EMFAC County-Specific On-Road Vehicle Composite EFs – 2024 POV**

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ALAMEDA	All Vehicles	0.188	0.003	1.473	0.227	0.042	0.018	281.589	0.023
ALPINE	All Vehicles	0.218	0.003	1.721	0.269	0.041	0.017	266.925	0.023
AMADOR	All Vehicles	0.282	0.003	2.019	0.377	0.044	0.019	283.243	0.023
BUTTE	All Vehicles	0.239	0.003	1.837	0.321	0.043	0.019	297.294	0.023
CALAVERAS	All Vehicles	0.293	0.003	2.199	0.402	0.044	0.019	295.524	0.023
COLUSA	All Vehicles	0.201	0.003	1.511	0.250	0.041	0.018	282.015	0.023
CONTRA COSTA	All Vehicles	0.183	0.003	1.473	0.226	0.042	0.018	277.976	0.023
DEL NORTE	All Vehicles	0.278	0.003	2.040	0.366	0.044	0.019	298.851	0.023
EL DORADO	All Vehicles	0.215	0.003	1.775	0.312	0.042	0.018	279.907	0.022
FRESNO	All Vehicles	0.195	0.003	1.515	0.247	0.043	0.018	290.564	0.023
GLENN	All Vehicles	0.205	0.003	1.588	0.276	0.042	0.018	286.525	0.023
HUMBOLDT	All Vehicles	0.260	0.003	1.929	0.348	0.043	0.019	290.985	0.023
IMPERIAL	All Vehicles	0.192	0.003	1.591	0.288	0.042	0.018	283.409	0.023
INYO	All Vehicles	0.209	0.003	1.663	0.309	0.041	0.018	286.438	0.023
KERN	All Vehicles	0.200	0.003	1.567	0.239	0.043	0.018	300.267	0.023
KINGS	All Vehicles	0.200	0.003	1.507	0.238	0.042	0.018	291.865	0.023
LAKE	All Vehicles	0.283	0.003	2.133	0.414	0.044	0.019	302.994	0.023
LASSEN	All Vehicles	0.230	0.003	1.884	0.338	0.042	0.018	284.049	0.023
LOS ANGELES	All Vehicles	0.171	0.003	1.503	0.232	0.040	0.017	276.244	0.023
MADERA	All Vehicles	0.208	0.003	1.665	0.257	0.043	0.019	307.749	0.023
MARIN	All Vehicles	0.176	0.003	1.488	0.241	0.041	0.017	270.581	0.023
MARIPOSA	All Vehicles	0.311	0.003	2.301	0.434	0.045	0.020	303.707	0.023
MENDOCINO	All Vehicles	0.247	0.003	1.845	0.336	0.043	0.018	286.526	0.023
MERCED	All Vehicles	0.219	0.003	1.673	0.249	0.044	0.019	309.610	0.023
MODOC	All Vehicles	0.246	0.003	2.023	0.343	0.042	0.018	300.759	0.023
MONO	All Vehicles	0.227	0.003	1.865	0.297	0.041	0.018	284.220	0.023
MONTEREY	All Vehicles	0.220	0.003	1.718	0.254	0.044	0.019	305.417	0.023
NAPA	All Vehicles	0.204	0.003	1.536	0.235	0.042	0.018	275.718	0.023
NEVADA	All Vehicles	0.252	0.003	1.920	0.328	0.043	0.019	294.688	0.023

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ORANGE	All Vehicles	0.150	0.003	1.366	0.217	0.040	0.017	264.429	0.023
PLACER	All Vehicles	0.184	0.003	1.542	0.242	0.041	0.018	276.403	0.023
PLUMAS	All Vehicles	0.274	0.003	2.171	0.379	0.043	0.019	302.390	0.023
RIVERSIDE	All Vehicles	0.172	0.003	1.436	0.222	0.041	0.018	276.278	0.023
SACRAMENTO	All Vehicles	0.201	0.003	1.573	0.262	0.043	0.018	286.729	0.023
SAN BENITO	All Vehicles	0.214	0.003	1.553	0.242	0.043	0.018	293.029	0.023
SAN BERNARDINO	All Vehicles	0.184	0.003	1.498	0.219	0.041	0.018	280.922	0.023
SAN DIEGO	All Vehicles	0.178	0.003	1.423	0.223	0.041	0.017	277.246	0.023
SAN FRANCISCO	All Vehicles	0.162	0.003	1.495	0.244	0.041	0.018	284.019	0.023
SAN JOAQUIN	All Vehicles	0.193	0.003	1.503	0.241	0.042	0.018	288.856	0.023
SAN LUIS OBISPO	All Vehicles	0.205	0.003	1.579	0.271	0.042	0.018	276.424	0.023
SAN MATEO	All Vehicles	0.146	0.002	1.343	0.201	0.039	0.016	248.554	0.023
SANTA BARBARA	All Vehicles	0.217	0.003	1.570	0.251	0.043	0.018	278.231	0.023
SANTA CLARA	All Vehicles	0.182	0.003	1.449	0.224	0.041	0.018	275.652	0.023
SANTA CRUZ	All Vehicles	0.232	0.003	1.824	0.304	0.043	0.019	292.848	0.023
SHASTA	All Vehicles	0.221	0.003	1.691	0.296	0.042	0.018	291.061	0.023
SIERRA	All Vehicles	0.234	0.003	1.956	0.332	0.041	0.018	291.621	0.023
SISKIYOU	All Vehicles	0.248	0.003	1.987	0.349	0.042	0.018	306.252	0.023
SOLANO	All Vehicles	0.195	0.003	1.504	0.226	0.042	0.018	293.101	0.023
SONOMA	All Vehicles	0.202	0.003	1.670	0.277	0.042	0.018	282.664	0.023
STANISLAUS	All Vehicles	0.200	0.003	1.626	0.274	0.043	0.018	296.075	0.023
SUTTER	All Vehicles	0.205	0.003	1.576	0.276	0.042	0.018	282.816	0.023
TEHAMA	All Vehicles	0.224	0.003	1.694	0.279	0.042	0.018	291.942	0.023
TRINITY	All Vehicles	0.256	0.003	2.083	0.362	0.042	0.019	316.327	0.023
TULARE	All Vehicles	0.207	0.003	1.593	0.264	0.043	0.018	290.845	0.023
TUOLUMNE	All Vehicles	0.278	0.003	2.130	0.403	0.044	0.019	299.910	0.023
VENTURA	All Vehicles	0.177	0.003	1.507	0.259	0.041	0.017	268.153	0.023
YOLO	All Vehicles	0.177	0.003	1.481	0.240	0.042	0.018	281.565	0.023
YUBA	All Vehicles	0.227	0.003	1.677	0.277	0.043	0.019	283.820	0.023



**Table 5-29. EMFAC County-Specific On-Road Vehicle Composite EFs – 2020 GOV**

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ALAMEDA	All Vehicles	0.878	0.006	1.183	0.164	0.078	0.038	585.666	0.022
ALPINE	All Vehicles	1.035	0.006	1.561	0.221	0.079	0.038	598.114	0.022
AMADOR	All Vehicles	1.485	0.005	1.983	0.347	0.089	0.047	525.831	0.022
BUTTE	All Vehicles	1.266	0.006	1.770	0.270	0.085	0.045	592.541	0.022
CALAVERAS	All Vehicles	1.491	0.005	2.243	0.363	0.092	0.050	542.835	0.022
COLUSA	All Vehicles	1.118	0.006	1.378	0.206	0.083	0.042	601.945	0.022
CONTRA COSTA	All Vehicles	0.899	0.005	1.182	0.163	0.079	0.039	561.575	0.022
DEL NORTE	All Vehicles	1.429	0.005	1.960	0.333	0.090	0.049	524.607	0.022
EL DORADO	All Vehicles	1.167	0.005	1.483	0.224	0.083	0.042	524.221	0.022
FRESNO	All Vehicles	0.964	0.006	1.283	0.195	0.080	0.040	590.229	0.022
GLENN	All Vehicles	1.144	0.006	1.485	0.228	0.083	0.043	597.573	0.022
HUMBOLDT	All Vehicles	1.367	0.005	1.745	0.298	0.084	0.044	550.984	0.022
IMPERIAL	All Vehicles	0.922	0.006	1.553	0.237	0.079	0.039	580.130	0.022
INYO	All Vehicles	1.070	0.006	1.527	0.253	0.080	0.039	586.782	0.022
KERN	All Vehicles	0.967	0.006	1.277	0.184	0.078	0.039	613.754	0.022
KINGS	All Vehicles	0.997	0.006	1.362	0.194	0.078	0.039	605.968	0.022
LAKE	All Vehicles	1.472	0.005	2.023	0.366	0.088	0.048	542.398	0.022
LASSEN	All Vehicles	1.280	0.005	1.770	0.298	0.087	0.045	529.930	0.022
LOS ANGELES	All Vehicles	0.836	0.006	1.378	0.161	0.081	0.040	574.877	0.022
MADERA	All Vehicles	1.028	0.006	1.565	0.223	0.080	0.040	610.916	0.022
MARIN	All Vehicles	0.848	0.005	1.162	0.174	0.079	0.038	544.276	0.022
MARIPOSA	All Vehicles	1.553	0.005	2.254	0.396	0.089	0.047	522.381	0.022
MENDOCINO	All Vehicles	1.333	0.006	1.750	0.294	0.086	0.045	579.129	0.022
MERCED	All Vehicles	1.056	0.006	1.599	0.224	0.080	0.041	617.569	0.022
MODOC	All Vehicles	1.370	0.006	1.967	0.306	0.090	0.048	574.006	0.022
MONO	All Vehicles	1.098	0.006	1.581	0.238	0.079	0.039	599.634	0.022
MONTEREY	All Vehicles	1.121	0.006	1.573	0.218	0.085	0.044	585.404	0.022
NAPA	All Vehicles	1.036	0.005	1.341	0.192	0.082	0.041	560.044	0.022
NEVADA	All Vehicles	1.268	0.006	1.628	0.240	0.081	0.042	577.946	0.022

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ORANGE	All Vehicles	0.723	0.005	1.135	0.139	0.081	0.039	538.141	0.022
PLACER	All Vehicles	0.946	0.005	1.187	0.166	0.078	0.039	564.238	0.022
PLUMAS	All Vehicles	1.450	0.005	2.168	0.342	0.086	0.046	563.325	0.022
RIVERSIDE	All Vehicles	0.859	0.005	1.233	0.152	0.078	0.038	568.254	0.022
SACRAMENTO	All Vehicles	1.078	0.005	1.310	0.190	0.082	0.042	571.254	0.022
SAN BENITO	All Vehicles	1.081	0.006	1.350	0.199	0.078	0.039	605.714	0.022
SAN BERNARDINO	All Vehicles	0.894	0.006	1.315	0.170	0.078	0.038	574.584	0.022
SAN DIEGO	All Vehicles	0.931	0.006	1.223	0.175	0.083	0.041	580.352	0.022
SAN FRANCISCO	All Vehicles	0.734	0.006	1.137	0.154	0.079	0.039	589.732	0.022
SAN JOAQUIN	All Vehicles	0.967	0.006	1.229	0.186	0.079	0.040	586.056	0.022
SAN LUIS OBISPO	All Vehicles	1.181	0.005	1.325	0.207	0.084	0.044	544.593	0.022
SAN MATEO	All Vehicles	0.677	0.005	1.031	0.142	0.079	0.038	528.822	0.022
SANTA BARBARA	All Vehicles	1.202	0.005	1.377	0.215	0.090	0.047	557.574	0.022
SANTA CLARA	All Vehicles	0.877	0.005	1.200	0.166	0.080	0.039	568.603	0.022
SANTA CRUZ	All Vehicles	1.281	0.005	1.634	0.244	0.091	0.049	567.050	0.022
SHASTA	All Vehicles	1.218	0.006	1.539	0.233	0.083	0.043	612.795	0.022
SIERRA	All Vehicles	1.294	0.005	1.890	0.291	0.082	0.042	553.271	0.022
SISKIYOU	All Vehicles	1.194	0.006	1.851	0.291	0.082	0.042	641.464	0.022
SOLANO	All Vehicles	0.962	0.006	1.197	0.175	0.078	0.039	600.380	0.022
SONOMA	All Vehicles	1.047	0.005	1.487	0.230	0.086	0.045	559.125	0.022
STANISLAUS	All Vehicles	0.983	0.006	1.407	0.208	0.080	0.040	581.639	0.022
SUTTER	All Vehicles	1.000	0.006	1.407	0.206	0.080	0.040	578.491	0.022
TEHAMA	All Vehicles	1.197	0.006	1.563	0.230	0.083	0.043	621.024	0.022
TRINITY	All Vehicles	1.296	0.006	2.062	0.311	0.085	0.044	640.763	0.022
TULARE	All Vehicles	1.023	0.006	1.477	0.219	0.081	0.041	576.295	0.022
TUOLUMNE	All Vehicles	1.425	0.005	2.038	0.351	0.087	0.046	528.147	0.022
VENTURA	All Vehicles	0.888	0.005	1.282	0.168	0.081	0.040	535.951	0.022
YOLO	All Vehicles	0.825	0.005	1.136	0.170	0.078	0.038	553.889	0.022
YUBA	All Vehicles	1.351	0.005	1.614	0.246	0.086	0.045	542.394	0.022

**Table 5-30. EMFAC County-Specific On-Road Vehicle Composite EFs – 2021 GOV**

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ALAMEDA	All Vehicles	0.797	0.005	1.030	0.143	0.073	0.035	548.387	0.022
ALPINE	All Vehicles	0.933	0.005	1.354	0.195	0.073	0.035	553.722	0.022
AMADOR	All Vehicles	1.310	0.005	1.747	0.313	0.082	0.043	491.048	0.022
BUTTE	All Vehicles	1.121	0.005	1.544	0.237	0.078	0.040	554.004	0.022
CALAVERAS	All Vehicles	1.323	0.005	1.981	0.327	0.084	0.046	506.544	0.022
COLUSA	All Vehicles	0.992	0.005	1.190	0.178	0.076	0.038	558.608	0.022
CONTRA COSTA	All Vehicles	0.807	0.005	1.031	0.143	0.074	0.036	523.972	0.022
DEL NORTE	All Vehicles	1.266	0.005	1.724	0.299	0.083	0.045	486.015	0.022
EL DORADO	All Vehicles	1.026	0.005	1.303	0.201	0.077	0.038	485.012	0.022
FRESNO	All Vehicles	0.869	0.005	1.118	0.170	0.074	0.037	556.390	0.022
GLENN	All Vehicles	1.014	0.005	1.275	0.197	0.076	0.038	553.489	0.022
HUMBOLDT	All Vehicles	1.208	0.005	1.538	0.269	0.078	0.040	514.486	0.022
IMPERIAL	All Vehicles	0.816	0.005	1.345	0.208	0.073	0.035	538.412	0.022
INYO	All Vehicles	0.946	0.005	1.324	0.225	0.074	0.036	540.755	0.022
KERN	All Vehicles	0.877	0.006	1.123	0.161	0.073	0.036	579.068	0.022
KINGS	All Vehicles	0.903	0.006	1.191	0.169	0.073	0.036	571.686	0.022
LAKE	All Vehicles	1.298	0.005	1.762	0.328	0.081	0.043	509.040	0.022
LASSEN	All Vehicles	1.112	0.005	1.530	0.265	0.079	0.040	483.109	0.022
LOS ANGELES	All Vehicles	0.731	0.005	1.174	0.138	0.074	0.036	526.529	0.022
MADERA	All Vehicles	0.925	0.006	1.343	0.193	0.075	0.037	573.423	0.022
MARIN	All Vehicles	0.748	0.005	1.010	0.153	0.073	0.035	501.593	0.022
MARIPOSA	All Vehicles	1.386	0.005	1.991	0.359	0.083	0.043	487.561	0.022
MENDOCINO	All Vehicles	1.174	0.005	1.530	0.262	0.079	0.041	539.361	0.022
MERCED	All Vehicles	0.953	0.006	1.396	0.195	0.075	0.037	585.858	0.022
MODOC	All Vehicles	1.191	0.005	1.691	0.269	0.081	0.043	522.040	0.022
MONO	All Vehicles	0.977	0.005	1.383	0.212	0.073	0.035	555.604	0.022
MONTEREY	All Vehicles	0.996	0.005	1.381	0.193	0.079	0.040	549.894	0.022
NAPA	All Vehicles	0.929	0.005	1.160	0.168	0.077	0.038	522.305	0.022
NEVADA	All Vehicles	1.133	0.005	1.455	0.217	0.075	0.038	546.128	0.022

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ORANGE	All Vehicles	0.633	0.005	0.975	0.121	0.074	0.035	491.464	0.022
PLACER	All Vehicles	0.845	0.005	1.045	0.145	0.073	0.036	528.059	0.022
PLUMAS	All Vehicles	1.271	0.005	1.885	0.305	0.078	0.041	521.586	0.022
RIVERSIDE	All Vehicles	0.762	0.005	1.073	0.134	0.073	0.035	529.332	0.022
SACRAMENTO	All Vehicles	0.958	0.005	1.143	0.167	0.076	0.038	533.345	0.022
SAN BENITO	All Vehicles	0.987	0.005	1.193	0.176	0.073	0.036	574.764	0.022
SAN BERNARDINO	All Vehicles	0.799	0.005	1.145	0.149	0.073	0.035	535.883	0.022
SAN DIEGO	All Vehicles	0.820	0.005	1.063	0.152	0.076	0.037	533.627	0.022
SAN FRANCISCO	All Vehicles	0.658	0.005	0.994	0.135	0.074	0.035	546.981	0.022
SAN JOAQUIN	All Vehicles	0.866	0.005	1.071	0.162	0.074	0.036	550.012	0.022
SAN LUIS OBISPO	All Vehicles	1.036	0.005	1.160	0.183	0.078	0.040	505.875	0.022
SAN MATEO	All Vehicles	0.591	0.005	0.891	0.123	0.073	0.035	482.226	0.022
SANTA BARBARA	All Vehicles	1.053	0.005	1.201	0.189	0.083	0.042	520.852	0.022
SANTA CLARA	All Vehicles	0.785	0.005	1.045	0.145	0.074	0.036	528.763	0.022
SANTA CRUZ	All Vehicles	1.112	0.005	1.424	0.215	0.083	0.044	526.848	0.022
SHASTA	All Vehicles	1.082	0.005	1.330	0.203	0.077	0.039	569.763	0.022
SIERRA	All Vehicles	1.109	0.005	1.628	0.256	0.074	0.038	502.580	0.022
SISKIYOU	All Vehicles	1.067	0.006	1.612	0.258	0.075	0.038	596.198	0.022
SOLANO	All Vehicles	0.869	0.005	1.046	0.153	0.072	0.035	562.769	0.022
SONOMA	All Vehicles	0.918	0.005	1.279	0.200	0.079	0.040	516.404	0.022
STANISLAUS	All Vehicles	0.881	0.005	1.226	0.182	0.074	0.037	547.431	0.022
SUTTER	All Vehicles	0.898	0.005	1.221	0.179	0.074	0.037	542.835	0.022
TEHAMA	All Vehicles	1.067	0.006	1.350	0.200	0.077	0.039	578.211	0.022
TRINITY	All Vehicles	1.141	0.006	1.778	0.274	0.078	0.040	591.054	0.022
TULARE	All Vehicles	0.915	0.005	1.275	0.190	0.075	0.038	541.483	0.022
TUOLUMNE	All Vehicles	1.265	0.005	1.788	0.317	0.081	0.042	490.994	0.022
VENTURA	All Vehicles	0.779	0.005	1.102	0.146	0.074	0.036	493.223	0.022
YOLO	All Vehicles	0.744	0.005	0.993	0.149	0.073	0.035	521.553	0.022
YUBA	All Vehicles	1.176	0.005	1.381	0.215	0.080	0.040	501.127	0.022

**Table 5-31. EMFAC County-Specific On-Road Vehicle Composite EFs – 2022 GOV**

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ALAMEDA	All Vehicles	0.726	0.005	0.904	0.124	0.067	0.031	520.956	0.022
ALPINE	All Vehicles	0.852	0.005	1.188	0.174	0.068	0.031	515.879	0.022
AMADOR	All Vehicles	1.128	0.004	1.538	0.281	0.074	0.037	458.393	0.022
BUTTE	All Vehicles	0.980	0.005	1.346	0.206	0.071	0.035	518.895	0.022
CALAVERAS	All Vehicles	1.158	0.005	1.755	0.294	0.077	0.040	473.077	0.022
COLUSA	All Vehicles	0.862	0.005	1.034	0.153	0.068	0.033	520.622	0.022
CONTRA COSTA	All Vehicles	0.726	0.005	0.907	0.125	0.069	0.032	495.256	0.022
DEL NORTE	All Vehicles	1.121	0.004	1.527	0.272	0.077	0.040	451.044	0.022
EL DORADO	All Vehicles	0.894	0.004	1.153	0.180	0.070	0.034	450.335	0.022
FRESNO	All Vehicles	0.783	0.005	0.982	0.148	0.069	0.032	531.558	0.022
GLENN	All Vehicles	0.889	0.005	1.103	0.171	0.069	0.033	514.690	0.022
HUMBOLDT	All Vehicles	1.053	0.005	1.362	0.242	0.071	0.035	480.848	0.022
IMPERIAL	All Vehicles	0.725	0.005	1.174	0.186	0.067	0.032	504.714	0.022
INYO	All Vehicles	0.841	0.005	1.160	0.201	0.067	0.032	500.877	0.022
KERN	All Vehicles	0.796	0.005	0.995	0.140	0.068	0.032	552.824	0.022
KINGS	All Vehicles	0.820	0.005	1.050	0.147	0.068	0.032	544.508	0.022
LAKE	All Vehicles	1.119	0.005	1.537	0.292	0.073	0.037	478.516	0.022
LASSEN	All Vehicles	0.959	0.004	1.332	0.237	0.071	0.036	441.760	0.022
LOS ANGELES	All Vehicles	0.640	0.005	1.010	0.118	0.068	0.031	489.038	0.022
MADERA	All Vehicles	0.833	0.005	1.174	0.168	0.069	0.033	545.729	0.022
MARIN	All Vehicles	0.661	0.005	0.887	0.135	0.067	0.031	466.833	0.022
MARIPOSA	All Vehicles	1.222	0.004	1.758	0.326	0.076	0.039	454.774	0.022
MENDOCINO	All Vehicles	1.025	0.005	1.345	0.235	0.071	0.036	503.752	0.022
MERCED	All Vehicles	0.863	0.005	1.221	0.169	0.069	0.033	561.446	0.022
MODOC	All Vehicles	1.038	0.005	1.471	0.240	0.073	0.038	476.783	0.022
MONO	All Vehicles	0.879	0.005	1.223	0.191	0.067	0.032	517.598	0.022
MONTEREY	All Vehicles	0.861	0.005	1.213	0.168	0.072	0.035	518.317	0.022
NAPA	All Vehicles	0.834	0.005	1.012	0.146	0.070	0.033	494.983	0.022
NEVADA	All Vehicles	1.003	0.005	1.301	0.194	0.069	0.034	516.838	0.022

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ORANGE	All Vehicles	0.552	0.004	0.844	0.105	0.068	0.031	455.551	0.022
PLACER	All Vehicles	0.746	0.005	0.925	0.126	0.067	0.032	496.443	0.022
PLUMAS	All Vehicles	1.104	0.005	1.643	0.272	0.071	0.036	483.419	0.022
RIVERSIDE	All Vehicles	0.677	0.005	0.945	0.118	0.067	0.031	498.762	0.022
SACRAMENTO	All Vehicles	0.854	0.005	1.007	0.146	0.070	0.034	504.506	0.022
SAN BENITO	All Vehicles	0.890	0.005	1.054	0.154	0.067	0.032	547.927	0.022
SAN BERNARDINO	All Vehicles	0.716	0.005	1.004	0.131	0.067	0.032	505.715	0.022
SAN DIEGO	All Vehicles	0.724	0.005	0.922	0.131	0.069	0.033	497.062	0.022
SAN FRANCISCO	All Vehicles	0.581	0.005	0.877	0.118	0.069	0.032	513.479	0.022
SAN JOAQUIN	All Vehicles	0.776	0.005	0.940	0.140	0.068	0.032	524.128	0.022
SAN LUIS OBISPO	All Vehicles	0.885	0.005	1.017	0.159	0.070	0.034	470.294	0.022
SAN MATEO	All Vehicles	0.519	0.004	0.782	0.107	0.067	0.031	447.555	0.022
SANTA BARBARA	All Vehicles	0.893	0.005	1.048	0.163	0.075	0.036	487.480	0.022
SANTA CLARA	All Vehicles	0.704	0.005	0.918	0.126	0.068	0.032	498.769	0.022
SANTA CRUZ	All Vehicles	0.933	0.005	1.237	0.186	0.075	0.037	489.380	0.022
SHASTA	All Vehicles	0.949	0.005	1.159	0.175	0.069	0.034	532.318	0.022
SIERRA	All Vehicles	0.952	0.004	1.416	0.228	0.067	0.033	458.317	0.022
SISKIYOU	All Vehicles	0.959	0.005	1.417	0.231	0.069	0.034	557.307	0.022
SOLANO	All Vehicles	0.787	0.005	0.921	0.133	0.067	0.032	533.297	0.022
SONOMA	All Vehicles	0.788	0.005	1.103	0.173	0.071	0.035	480.445	0.022
STANISLAUS	All Vehicles	0.791	0.005	1.075	0.158	0.069	0.033	521.177	0.022
SUTTER	All Vehicles	0.809	0.005	1.069	0.155	0.068	0.033	514.640	0.022
TEHAMA	All Vehicles	0.941	0.005	1.174	0.172	0.069	0.034	540.788	0.022
TRINITY	All Vehicles	1.008	0.005	1.554	0.243	0.070	0.035	547.813	0.022
TULARE	All Vehicles	0.819	0.005	1.112	0.165	0.069	0.033	514.772	0.022
TUOLUMNE	All Vehicles	1.109	0.004	1.573	0.286	0.074	0.038	456.300	0.022
VENTURA	All Vehicles	0.682	0.004	0.952	0.127	0.068	0.032	458.766	0.022
YOLO	All Vehicles	0.674	0.005	0.875	0.130	0.069	0.032	498.224	0.022
YUBA	All Vehicles	1.017	0.004	1.191	0.186	0.072	0.036	465.188	0.022

**Table 5-32. EMFAC County-Specific On-Road Vehicle Composite EFs – 2023 GOV**

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ALAMEDA	All Vehicles	0.685	0.005	0.813	0.108	0.065	0.030	516.539	0.022
ALPINE	All Vehicles	0.789	0.005	1.069	0.160	0.064	0.030	486.224	0.022
AMADOR	All Vehicles	0.990	0.004	1.368	0.256	0.068	0.033	428.936	0.022
BUTTE	All Vehicles	0.865	0.005	1.192	0.183	0.066	0.032	488.715	0.022
CALAVERAS	All Vehicles	1.027	0.004	1.567	0.268	0.071	0.036	443.095	0.022
COLUSA	All Vehicles	0.761	0.005	0.920	0.135	0.063	0.030	489.946	0.022
CONTRA COSTA	All Vehicles	0.675	0.005	0.815	0.110	0.066	0.030	483.771	0.022
DEL NORTE	All Vehicles	0.994	0.004	1.366	0.249	0.071	0.037	419.000	0.022
EL DORADO	All Vehicles	0.791	0.004	1.033	0.163	0.065	0.031	421.177	0.022
FRESNO	All Vehicles	0.728	0.005	0.884	0.131	0.066	0.030	521.505	0.022
GLENN	All Vehicles	0.779	0.005	0.973	0.150	0.064	0.030	481.838	0.022
HUMBOLDT	All Vehicles	0.929	0.004	1.219	0.222	0.066	0.032	450.650	0.022
IMPERIAL	All Vehicles	0.656	0.005	1.048	0.169	0.064	0.029	481.234	0.022
INYO	All Vehicles	0.759	0.005	1.035	0.184	0.063	0.030	467.211	0.022
KERN	All Vehicles	0.744	0.005	0.905	0.125	0.066	0.030	542.214	0.022
KINGS	All Vehicles	0.765	0.005	0.950	0.131	0.066	0.030	534.670	0.022
LAKE	All Vehicles	0.971	0.004	1.354	0.264	0.068	0.033	450.765	0.022
LASSEN	All Vehicles	0.839	0.004	1.177	0.216	0.065	0.032	405.464	0.022
LOS ANGELES	All Vehicles	0.578	0.004	0.889	0.104	0.063	0.028	465.432	0.022
MADERA	All Vehicles	0.771	0.005	1.052	0.148	0.067	0.031	533.779	0.022
MARIN	All Vehicles	0.602	0.004	0.792	0.121	0.063	0.029	443.935	0.022
MARIPOSA	All Vehicles	1.084	0.004	1.566	0.299	0.071	0.035	424.113	0.022
MENDOCINO	All Vehicles	0.906	0.005	1.201	0.214	0.066	0.032	473.557	0.022
MERCED	All Vehicles	0.803	0.005	1.095	0.150	0.067	0.032	553.650	0.022
MODOC	All Vehicles	0.911	0.004	1.292	0.217	0.067	0.034	437.035	0.022
MONO	All Vehicles	0.799	0.005	1.098	0.175	0.063	0.030	486.025	0.022
MONTEREY	All Vehicles	0.754	0.005	1.081	0.149	0.067	0.031	491.929	0.022
NAPA	All Vehicles	0.777	0.005	0.900	0.128	0.067	0.031	485.240	0.022
NEVADA	All Vehicles	0.900	0.005	1.180	0.177	0.065	0.031	492.724	0.022

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ORANGE	All Vehicles	0.497	0.004	0.742	0.093	0.063	0.028	431.572	0.022
PLACER	All Vehicles	0.672	0.005	0.835	0.112	0.063	0.029	471.878	0.022
PLUMAS	All Vehicles	0.969	0.004	1.446	0.247	0.065	0.032	449.482	0.022
RIVERSIDE	All Vehicles	0.613	0.005	0.854	0.106	0.064	0.029	479.749	0.022
SACRAMENTO	All Vehicles	0.785	0.005	0.902	0.130	0.067	0.031	486.455	0.022
SAN BENITO	All Vehicles	0.807	0.005	0.952	0.137	0.064	0.030	529.122	0.022
SAN BERNARDINO	All Vehicles	0.658	0.005	0.901	0.117	0.064	0.029	487.174	0.022
SAN DIEGO	All Vehicles	0.659	0.005	0.816	0.115	0.065	0.030	473.464	0.022
SAN FRANCISCO	All Vehicles	0.536	0.005	0.783	0.104	0.065	0.029	495.186	0.022
SAN JOAQUIN	All Vehicles	0.718	0.005	0.846	0.123	0.066	0.030	513.246	0.022
SAN LUIS OBISPO	All Vehicles	0.762	0.004	0.903	0.141	0.064	0.030	439.011	0.022
SAN MATEO	All Vehicles	0.473	0.004	0.699	0.095	0.063	0.028	425.159	0.022
SANTA BARBARA	All Vehicles	0.770	0.004	0.928	0.143	0.069	0.032	458.518	0.022
SANTA CLARA	All Vehicles	0.654	0.005	0.824	0.111	0.065	0.030	487.832	0.022
SANTA CRUZ	All Vehicles	0.795	0.004	1.088	0.163	0.067	0.032	456.505	0.022
SHASTA	All Vehicles	0.839	0.005	1.029	0.155	0.064	0.031	500.941	0.022
SIERRA	All Vehicles	0.828	0.004	1.248	0.206	0.062	0.030	419.624	0.022
SISKIYOU	All Vehicles	0.874	0.005	1.268	0.211	0.065	0.032	525.683	0.022
SOLANO	All Vehicles	0.735	0.005	0.832	0.117	0.064	0.030	521.327	0.022
SONOMA	All Vehicles	0.694	0.004	0.966	0.151	0.066	0.031	452.608	0.022
STANISLAUS	All Vehicles	0.731	0.005	0.963	0.140	0.066	0.031	509.234	0.022
SUTTER	All Vehicles	0.748	0.005	0.959	0.138	0.065	0.030	498.983	0.022
TEHAMA	All Vehicles	0.837	0.005	1.044	0.152	0.065	0.031	510.286	0.022
TRINITY	All Vehicles	0.902	0.005	1.374	0.220	0.066	0.032	512.126	0.022
TULARE	All Vehicles	0.753	0.005	0.992	0.145	0.066	0.031	500.898	0.022
TUOLUMNE	All Vehicles	0.979	0.004	1.390	0.261	0.068	0.034	424.398	0.022
VENTURA	All Vehicles	0.615	0.004	0.837	0.112	0.064	0.029	436.030	0.022
YOLO	All Vehicles	0.630	0.005	0.786	0.116	0.066	0.030	484.628	0.022
YUBA	All Vehicles	0.888	0.004	1.043	0.165	0.067	0.032	433.274	0.022

**Table 5-33. EMFAC County-Specific On-Road Vehicle Composite EFs – 2024 GOV**

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ALAMEDA	All Vehicles	0.672	0.005	0.741	0.101	0.062	0.028	488.204	0.021
ALPINE	All Vehicles	0.746	0.004	0.970	0.149	0.060	0.028	451.535	0.021
AMADOR	All Vehicles	0.909	0.004	1.234	0.240	0.064	0.031	402.091	0.021
BUTTE	All Vehicles	0.808	0.004	1.069	0.168	0.062	0.030	457.467	0.021
CALAVERAS	All Vehicles	0.936	0.004	1.412	0.250	0.066	0.033	413.975	0.021
COLUSA	All Vehicles	0.721	0.004	0.831	0.125	0.059	0.028	457.759	0.021
CONTRA COSTA	All Vehicles	0.647	0.004	0.740	0.102	0.063	0.029	454.341	0.021
DEL NORTE	All Vehicles	0.896	0.004	1.233	0.232	0.066	0.034	389.349	0.021
EL DORADO	All Vehicles	0.724	0.004	0.938	0.153	0.061	0.029	391.602	0.021
FRESNO	All Vehicles	0.704	0.005	0.804	0.122	0.063	0.029	493.171	0.021
GLENN	All Vehicles	0.732	0.004	0.874	0.138	0.060	0.028	448.653	0.021
HUMBOLDT	All Vehicles	0.850	0.004	1.102	0.208	0.062	0.030	420.603	0.021
IMPERIAL	All Vehicles	0.621	0.004	0.948	0.157	0.060	0.028	449.729	0.021
INYO	All Vehicles	0.705	0.004	0.931	0.172	0.059	0.028	432.133	0.021
KERN	All Vehicles	0.720	0.005	0.831	0.117	0.062	0.029	512.442	0.021
KINGS	All Vehicles	0.740	0.005	0.867	0.122	0.062	0.029	505.604	0.021
LAKE	All Vehicles	0.896	0.004	1.213	0.246	0.064	0.031	426.328	0.021
LASSEN	All Vehicles	0.750	0.004	1.051	0.201	0.060	0.030	372.139	0.021
LOS ANGELES	All Vehicles	0.554	0.004	0.800	0.096	0.059	0.026	432.904	0.021
MADERA	All Vehicles	0.742	0.005	0.968	0.138	0.063	0.029	506.148	0.021
MARIN	All Vehicles	0.568	0.004	0.717	0.112	0.059	0.027	412.223	0.021
MARIPOSA	All Vehicles	0.985	0.004	1.405	0.279	0.067	0.033	395.713	0.021
MENDOCINO	All Vehicles	0.837	0.004	1.084	0.200	0.062	0.030	442.090	0.021
MERCED	All Vehicles	0.776	0.005	0.994	0.138	0.064	0.030	525.898	0.021
MODOC	All Vehicles	0.817	0.004	1.148	0.200	0.061	0.031	400.178	0.021
MONO	All Vehicles	0.744	0.004	0.993	0.164	0.059	0.028	451.140	0.021
MONTEREY	All Vehicles	0.716	0.005	0.983	0.139	0.064	0.030	465.903	0.021
NAPA	All Vehicles	0.741	0.004	0.810	0.118	0.063	0.029	454.662	0.021
NEVADA	All Vehicles	0.842	0.005	1.079	0.167	0.062	0.029	464.507	0.021

County	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>2</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
ORANGE	All Vehicles	0.472	0.004	0.664	0.086	0.059	0.026	399.249	0.021
PLACER	All Vehicles	0.641	0.004	0.764	0.105	0.060	0.028	442.939	0.021
PLUMAS	All Vehicles	0.877	0.004	1.288	0.229	0.060	0.030	417.810	0.021
RIVERSIDE	All Vehicles	0.588	0.004	0.783	0.100	0.060	0.027	449.140	0.021
SACRAMENTO	All Vehicles	0.742	0.004	0.821	0.122	0.063	0.029	457.045	0.021
SAN BENITO	All Vehicles	0.785	0.005	0.871	0.129	0.061	0.028	504.486	0.021
SAN BERNARDINO	All Vehicles	0.632	0.004	0.821	0.109	0.061	0.028	457.462	0.021
SAN DIEGO	All Vehicles	0.626	0.004	0.734	0.106	0.061	0.028	439.131	0.021
SAN FRANCISCO	All Vehicles	0.519	0.004	0.715	0.098	0.062	0.027	465.105	0.021
SAN JOAQUIN	All Vehicles	0.692	0.005	0.772	0.115	0.062	0.029	483.773	0.021
SAN LUIS OBISPO	All Vehicles	0.705	0.004	0.819	0.132	0.060	0.029	409.854	0.021
SAN MATEO	All Vehicles	0.439	0.004	0.638	0.090	0.059	0.026	392.068	0.021
SANTA BARBARA	All Vehicles	0.727	0.004	0.843	0.134	0.066	0.030	432.087	0.021
SANTA CLARA	All Vehicles	0.633	0.004	0.750	0.104	0.061	0.028	458.249	0.021
SANTA CRUZ	All Vehicles	0.738	0.004	0.982	0.151	0.064	0.030	427.862	0.021
SHASTA	All Vehicles	0.791	0.004	0.927	0.143	0.060	0.029	468.428	0.021
SIERRA	All Vehicles	0.738	0.004	1.109	0.191	0.057	0.028	383.922	0.021
SISKIYOU	All Vehicles	0.817	0.005	1.142	0.196	0.061	0.029	488.712	0.021
SOLANO	All Vehicles	0.710	0.005	0.757	0.109	0.061	0.028	490.699	0.021
SONOMA	All Vehicles	0.651	0.004	0.864	0.139	0.062	0.029	421.064	0.021
STANISLAUS	All Vehicles	0.700	0.005	0.876	0.130	0.063	0.029	480.425	0.021
SUTTER	All Vehicles	0.717	0.004	0.870	0.128	0.062	0.029	469.534	0.021
TEHAMA	All Vehicles	0.790	0.005	0.939	0.140	0.061	0.029	477.194	0.021
TRINITY	All Vehicles	0.834	0.005	1.233	0.204	0.061	0.030	474.902	0.021
TULARE	All Vehicles	0.717	0.005	0.898	0.134	0.063	0.029	471.474	0.021
TUOLUMNE	All Vehicles	0.889	0.004	1.244	0.243	0.064	0.032	395.053	0.021
VENTURA	All Vehicles	0.579	0.004	0.750	0.103	0.059	0.027	404.653	0.021
YOLO	All Vehicles	0.610	0.004	0.716	0.108	0.063	0.028	458.489	0.021
YUBA	All Vehicles	0.812	0.004	0.928	0.151	0.063	0.030	404.061	0.021

**Table 5-34. EMFAC County-Specific On-Road Vehicle EFs – 2020**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Alameda	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.102	0.003	1.298	0.139	0.056	0.023	341.262	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.178	0.004	1.713	0.222	0.056	0.023	424.719	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.298	0.007	2.110	0.313	0.066	0.028	661.424	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.158	0.002	0.316	0.025	0.066	0.034	258.667	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.084	0.003	0.177	0.023	0.061	0.030	339.492	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.405	0.011	0.728	0.143	0.151	0.085	1214.961	0.027
	NA	MC	Motorcycles	1.526	0.003	29.074	4.962	0.023	0.011	283.486	0.053
Alpine	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.115	0.003	1.485	0.141	0.057	0.024	334.851	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.262	0.004	2.292	0.327	0.057	0.024	421.786	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.394	0.006	2.785	0.502	0.066	0.028	646.550	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.139	0.002	0.290	0.018	0.060	0.028	234.260	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.032	0.003	0.149	0.017	0.054	0.024	307.170	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.952	0.012	1.040	0.145	0.157	0.085	1308.164	0.027
	NA	MC	Motorcycles	1.683	0.003	32.964	5.362	0.023	0.011	289.072	0.053
Amador	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.133	0.003	1.557	0.176	0.052	0.022	310.033	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.393	0.004	3.065	0.504	0.054	0.023	412.400	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.500	0.007	3.463	0.808	0.066	0.028	676.114	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.264	0.002	0.290	0.025	0.065	0.035	221.499	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.276	0.003	0.246	0.029	0.067	0.038	291.638	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	5.481	0.010	1.082	0.258	0.198	0.120	1018.262	0.027
	NA	MC	Motorcycles	1.513	0.003	29.257	5.526	0.022	0.010	258.486	0.053
Butte	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.118	0.003	1.493	0.160	0.052	0.022	332.213	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.326	0.004	2.670	0.391	0.055	0.023	444.364	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.424	0.007	3.021	0.509	0.066	0.028	684.128	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.215	0.002	0.334	0.029	0.066	0.035	241.721	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.207	0.003	0.252	0.036	0.071	0.041	325.730	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.711	0.011	1.053	0.210	0.177	0.105	1214.468	0.027
	NA	MC	Motorcycles	1.520	0.003	30.462	6.118	0.023	0.011	279.378	0.053
Calaveras	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.137	0.003	1.685	0.194	0.053	0.022	331.564	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.419	0.004	3.473	0.521	0.054	0.023	433.665	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.516	0.007	3.676	0.797	0.065	0.028	686.844	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.286	0.002	0.443	0.037	0.070	0.039	252.465	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.298	0.003	0.427	0.068	0.091	0.060	331.369	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	5.431	0.010	1.168	0.256	0.191	0.115	1008.658	0.027
	NA	MC	Motorcycles	1.508	0.003	30.522	6.255	0.022	0.010	274.079	0.053
Colusa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.096	0.003	1.237	0.131	0.055	0.023	341.128	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.230	0.004	1.988	0.284	0.056	0.023	433.567	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.317	0.007	2.279	0.358	0.064	0.027	659.273	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.157	0.002	0.286	0.021	0.062	0.031	242.095	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.087	0.003	0.171	0.025	0.062	0.032	308.610	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.372	0.012	1.021	0.191	0.171	0.101	1294.651	0.027
	NA	MC	Motorcycles	1.546	0.003	29.297	5.186	0.023	0.010	283.499	0.053
Contra Costa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.096	0.003	1.249	0.132	0.055	0.023	334.225	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.175	0.004	1.694	0.214	0.055	0.023	420.937	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.298	0.006	2.145	0.306	0.063	0.027	638.662	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.133	0.002	0.268	0.020	0.062	0.031	248.793	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.069	0.003	0.156	0.019	0.058	0.028	335.528	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.523	0.011	0.789	0.162	0.160	0.090	1125.223	0.027
	NA	MC	Motorcycles	1.525	0.003	29.373	4.980	0.022	0.010	281.199	0.053
Del Norte	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.135	0.003	1.535	0.168	0.053	0.022	342.941	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.405	0.004	2.943	0.489	0.054	0.023	448.180	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.425	0.007	2.772	0.552	0.062	0.026	663.167	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.294	0.002	0.471	0.040	0.070	0.040	261.486	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.351	0.003	0.545	0.077	0.097	0.066	357.503	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	5.157	0.008	1.147	0.240	0.182	0.106	876.832	0.027
	NA	MC	Motorcycles	1.566	0.003	32.982	5.979	0.022	0.011	288.992	0.053

**Table 5-34. EMFAC County-Specific On-Road Vehicle EFs – 2020 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
El Dorado	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.103	0.003	1.385	0.129	0.055	0.023	336.861	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.238	0.004	2.153	0.301	0.054	0.023	426.888	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.361	0.006	2.647	0.436	0.064	0.027	655.216	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.204	0.002	0.329	0.025	0.065	0.033	256.168	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.094	0.003	0.181	0.022	0.058	0.028	325.582	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.557	0.009	1.014	0.227	0.179	0.104	948.405	0.027
	NA	MC	Motorcycles	1.584	0.003	32.468	6.571	0.023	0.011	289.051	0.053
Fresno	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.090	0.003	1.174	0.127	0.054	0.022	332.460	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.213	0.004	1.893	0.276	0.054	0.023	422.321	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.308	0.006	2.209	0.345	0.063	0.026	641.291	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.115	0.002	0.211	0.016	0.058	0.028	224.217	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.098	0.003	0.159	0.022	0.060	0.031	302.363	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.712	0.012	0.839	0.156	0.163	0.093	1277.579	0.027
	NA	MC	Motorcycles	1.534	0.003	30.128	5.059	0.022	0.010	278.818	0.053
Glenn	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.100	0.003	1.327	0.137	0.054	0.023	342.176	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.244	0.004	2.144	0.320	0.056	0.024	444.552	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.350	0.007	2.607	0.424	0.065	0.027	672.860	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.133	0.002	0.327	0.025	0.062	0.031	242.958	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.093	0.003	0.226	0.030	0.063	0.033	317.949	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.446	0.012	1.034	0.198	0.171	0.101	1241.594	0.027
	NA	MC	Motorcycles	1.539	0.003	30.112	5.786	0.023	0.011	287.539	0.053
Humboldt	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.134	0.003	1.516	0.170	0.052	0.022	325.182	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.340	0.004	2.598	0.433	0.054	0.023	424.283	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.424	0.006	2.819	0.575	0.062	0.026	643.943	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.481	0.002	0.494	0.045	0.077	0.046	259.122	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.218	0.003	0.264	0.034	0.066	0.037	322.590	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	5.116	0.010	1.117	0.229	0.179	0.106	1082.650	0.027
	NA	MC	Motorcycles	1.589	0.003	32.422	5.756	0.022	0.011	281.319	0.053
Imperial	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.097	0.003	1.337	0.158	0.055	0.023	345.793	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.261	0.004	2.413	0.383	0.055	0.023	434.428	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.321	0.006	2.541	0.446	0.063	0.026	618.103	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.162	0.002	0.239	0.022	0.065	0.034	229.524	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.117	0.003	0.159	0.024	0.064	0.034	305.865	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.403	0.011	0.843	0.101	0.153	0.085	1204.296	0.027
	NA	MC	Motorcycles	1.462	0.003	27.071	5.091	0.022	0.010	270.316	0.053
Inyo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.108	0.004	1.384	0.153	0.056	0.024	360.501	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.254	0.004	2.204	0.369	0.056	0.024	452.491	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.392	0.007	2.912	0.572	0.067	0.028	701.081	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.187	0.002	0.371	0.030	0.068	0.035	260.298	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.058	0.003	0.186	0.023	0.058	0.028	336.598	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.108	0.011	1.046	0.177	0.160	0.090	1149.347	0.027
	NA	MC	Motorcycles	1.585	0.003	31.791	5.862	0.023	0.011	294.689	0.053
Kern	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.094	0.003	1.226	0.128	0.055	0.023	350.946	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.211	0.004	1.863	0.262	0.054	0.023	430.911	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.301	0.007	2.173	0.327	0.063	0.026	661.006	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.127	0.002	0.282	0.021	0.062	0.031	256.718	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.077	0.003	0.166	0.021	0.057	0.028	332.391	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.745	0.013	0.904	0.153	0.157	0.090	1330.450	0.027
	NA	MC	Motorcycles	1.537	0.003	31.544	4.968	0.022	0.010	285.695	0.053
Kings	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.087	0.003	1.182	0.120	0.055	0.023	339.072	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.224	0.004	2.018	0.280	0.054	0.023	423.913	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.289	0.006	2.157	0.331	0.063	0.026	642.058	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.110	0.002	0.261	0.019	0.060	0.029	225.809	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.118	0.003	0.201	0.028	0.063	0.033	304.842	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.825	0.013	0.907	0.153	0.155	0.089	1340.464	0.027
NA	MC	Motorcycles	1.518	0.003	28.321	4.856	0.022	0.010	278.058	0.053	

**Table 5-34. EMFAC County-Specific On-Road Vehicle EFs – 2020 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Lake	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.168	0.003	1.896	0.212	0.052	0.022	336.246	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.383	0.004	3.023	0.529	0.054	0.023	437.981	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.519	0.007	3.648	0.784	0.064	0.028	676.272	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.395	0.002	0.484	0.049	0.080	0.049	249.922	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.268	0.003	0.322	0.042	0.071	0.042	314.889	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	5.434	0.010	1.135	0.271	0.192	0.118	1011.229	0.027
	NA	MC	Motorcycles	1.546	0.003	32.349	6.453	0.022	0.011	281.786	0.053
Lassen	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.117	0.004	1.492	0.156	0.055	0.023	354.038	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.303	0.004	2.551	0.415	0.056	0.024	453.867	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.473	0.007	3.488	0.679	0.066	0.028	703.337	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.220	0.003	0.453	0.032	0.065	0.033	266.441	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.227	0.003	0.381	0.054	0.078	0.047	341.558	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.798	0.008	1.104	0.235	0.175	0.102	889.039	0.027
	NA	MC	Motorcycles	1.640	0.003	34.464	6.156	0.023	0.011	303.193	0.053
Los Angeles	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.101	0.004	1.453	0.134	0.059	0.025	377.537	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.203	0.004	2.092	0.229	0.058	0.025	451.220	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.314	0.007	2.466	0.311	0.068	0.029	669.865	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.141	0.003	0.410	0.034	0.072	0.038	280.537	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.083	0.003	0.235	0.031	0.064	0.032	365.032	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.165	0.010	0.639	0.109	0.155	0.085	1076.357	0.027
	NA	MC	Motorcycles	1.509	0.003	27.657	5.473	0.024	0.011	299.437	0.053
Madera	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.094	0.003	1.327	0.126	0.053	0.022	342.530	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.254	0.004	2.359	0.328	0.055	0.023	449.788	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.361	0.007	2.677	0.395	0.067	0.028	682.118	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.134	0.002	0.360	0.026	0.060	0.030	239.713	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.135	0.003	0.253	0.033	0.062	0.032	334.054	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.874	0.012	0.910	0.165	0.161	0.093	1275.984	0.027
	NA	MC	Motorcycles	1.498	0.003	29.328	5.034	0.022	0.010	283.604	0.053
Marin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.111	0.003	1.348	0.153	0.057	0.024	350.130	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.180	0.004	1.663	0.235	0.056	0.023	428.817	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.299	0.007	2.081	0.321	0.066	0.028	669.378	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.185	0.003	0.342	0.026	0.069	0.036	277.932	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.062	0.003	0.167	0.019	0.058	0.027	360.838	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.283	0.009	0.733	0.158	0.156	0.087	998.716	0.027
	NA	MC	Motorcycles	1.573	0.003	30.770	5.204	0.023	0.011	290.598	0.053
Mariposa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.153	0.003	1.804	0.195	0.053	0.022	336.500	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.435	0.004	3.414	0.585	0.054	0.024	451.881	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.649	0.007	4.786	0.915	0.066	0.029	712.617	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.336	0.002	0.527	0.049	0.076	0.045	260.725	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.098	0.003	0.258	0.034	0.061	0.033	317.301	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	5.797	0.008	1.197	0.274	0.203	0.120	882.615	0.027
	NA	MC	Motorcycles	1.526	0.003	32.733	6.544	0.022	0.011	280.259	0.053
Mendocino	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.126	0.003	1.491	0.164	0.054	0.023	330.559	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.321	0.004	2.571	0.428	0.054	0.023	423.370	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.424	0.006	2.916	0.598	0.064	0.027	655.478	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.436	0.002	0.477	0.045	0.080	0.047	259.507	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.440	0.003	0.391	0.046	0.077	0.046	339.224	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.832	0.011	1.085	0.207	0.176	0.104	1193.586	0.027
	NA	MC	Motorcycles	1.569	0.003	31.181	5.656	0.022	0.011	280.605	0.053
Merced	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.098	0.003	1.276	0.127	0.052	0.022	332.271	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.284	0.004	2.433	0.333	0.054	0.023	440.342	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.375	0.007	2.710	0.388	0.064	0.027	663.116	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.152	0.002	0.301	0.022	0.058	0.029	228.672	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.184	0.003	0.265	0.038	0.067	0.038	314.564	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.894	0.013	0.906	0.156	0.159	0.091	1348.591	0.027
	NA	MC	Motorcycles	1.497	0.003	29.361	4.633	0.022	0.010	276.890	0.053



**Table 5-34. EMFAC County-Specific On-Road Vehicle EFs – 2020 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Modoc	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.127	0.004	1.654	0.162	0.057	0.024	384.255	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.329	0.005	2.836	0.413	0.057	0.025	488.738	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.548	0.007	4.200	0.787	0.067	0.029	741.952	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.235	0.003	0.628	0.049	0.072	0.040	292.451	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.270	0.004	0.459	0.071	0.088	0.056	398.526	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	5.096	0.009	1.125	0.237	0.177	0.103	950.382	0.027
	NA	MC	Motorcycles	1.685	0.003	36.916	6.691	0.024	0.011	327.650	0.053
Mono	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.118	0.003	1.441	0.142	0.056	0.023	344.828	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.280	0.004	2.274	0.344	0.056	0.024	439.772	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.432	0.007	3.060	0.577	0.065	0.028	678.055	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.263	0.003	0.454	0.037	0.072	0.040	266.115	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.154	0.003	0.244	0.026	0.058	0.028	348.402	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.093	0.012	1.045	0.164	0.156	0.087	1234.421	0.027
	NA	MC	Motorcycles	1.728	0.003	37.681	5.903	0.023	0.011	306.018	0.053
Monterey	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.119	0.003	1.472	0.150	0.054	0.023	351.428	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.287	0.004	2.366	0.304	0.054	0.023	449.602	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.374	0.007	2.587	0.370	0.064	0.027	682.026	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.221	0.002	0.473	0.041	0.071	0.040	261.453	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.100	0.003	0.264	0.034	0.061	0.032	336.736	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.240	0.011	0.891	0.189	0.186	0.109	1156.166	0.027
	NA	MC	Motorcycles	1.523	0.003	29.009	4.741	0.022	0.010	291.193	0.053
Napa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.100	0.003	1.286	0.128	0.054	0.023	325.183	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.217	0.004	1.976	0.260	0.055	0.023	422.257	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.368	0.007	2.542	0.397	0.067	0.028	683.880	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.162	0.002	0.297	0.024	0.066	0.034	247.419	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.096	0.003	0.171	0.020	0.059	0.028	332.296	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.013	0.011	0.840	0.181	0.173	0.099	1126.881	0.027
	NA	MC	Motorcycles	1.537	0.003	29.470	4.926	0.023	0.010	276.433	0.053
Nevada	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.119	0.003	1.419	0.151	0.053	0.022	324.457	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.311	0.004	2.377	0.334	0.052	0.022	420.444	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.433	0.006	2.903	0.478	0.062	0.026	646.090	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.256	0.002	0.360	0.028	0.066	0.035	248.836	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.220	0.003	0.250	0.030	0.063	0.034	314.920	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.739	0.012	1.117	0.214	0.170	0.100	1232.650	0.027
	NA	MC	Motorcycles	1.595	0.003	33.491	6.288	0.022	0.011	279.378	0.053
Orange	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.086	0.004	1.269	0.119	0.058	0.024	354.181	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.159	0.004	1.737	0.200	0.057	0.024	436.340	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.256	0.007	2.005	0.259	0.069	0.029	664.138	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.102	0.002	0.317	0.023	0.065	0.032	258.981	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.064	0.003	0.191	0.024	0.061	0.029	352.532	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.773	0.009	0.515	0.093	0.158	0.086	951.326	0.027
	NA	MC	Motorcycles	1.492	0.003	26.887	5.228	0.023	0.011	288.408	0.053
Placer	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.097	0.003	1.315	0.128	0.056	0.023	340.198	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.165	0.004	1.652	0.212	0.054	0.023	409.693	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.286	0.006	2.157	0.319	0.062	0.026	629.111	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.170	0.002	0.291	0.022	0.064	0.032	248.595	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.059	0.003	0.139	0.016	0.054	0.025	308.994	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.754	0.011	0.919	0.177	0.163	0.093	1170.977	0.027
	NA	MC	Motorcycles	1.555	0.003	30.497	5.392	0.022	0.010	279.546	0.053
Plumas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.138	0.004	1.748	0.177	0.055	0.024	360.556	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.392	0.005	3.266	0.482	0.056	0.024	471.183	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.584	0.007	4.500	0.837	0.066	0.029	706.251	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.259	0.003	0.581	0.046	0.073	0.041	281.293	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.166	0.003	0.360	0.046	0.065	0.035	363.201	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	5.379	0.009	1.167	0.258	0.182	0.111	971.592	0.027
NA	MC	Motorcycles	1.622	0.003	35.307	6.641	0.023	0.011	307.862	0.053	

**Table 5-34. EMFAC County-Specific On-Road Vehicle EFs – 2020 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Riverside	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.083	0.003	1.181	0.114	0.055	0.023	338.429	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.184	0.004	1.853	0.226	0.055	0.023	419.186	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.262	0.006	2.024	0.278	0.063	0.026	597.717	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.082	0.002	0.209	0.015	0.059	0.028	231.789	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.059	0.003	0.127	0.017	0.057	0.027	303.129	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.336	0.011	0.787	0.103	0.156	0.088	1181.349	0.027
	NA	MC	Motorcycles	1.501	0.003	27.774	4.915	0.023	0.010	280.299	0.053
Sacramento	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.100	0.003	1.368	0.145	0.054	0.023	333.927	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.188	0.004	1.889	0.252	0.054	0.023	419.929	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.323	0.007	2.382	0.361	0.065	0.028	673.861	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.152	0.002	0.290	0.023	0.061	0.031	232.470	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.193	0.003	0.252	0.031	0.064	0.034	335.275	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.186	0.011	0.828	0.177	0.172	0.098	1153.961	0.027
	NA	MC	Motorcycles	1.501	0.003	28.583	5.438	0.022	0.010	277.340	0.053
San Benito	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.098	0.003	1.238	0.121	0.054	0.022	327.134	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.233	0.004	1.954	0.286	0.054	0.023	416.806	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.339	0.006	2.320	0.371	0.063	0.027	651.492	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.230	0.002	0.335	0.026	0.065	0.034	240.563	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.054	0.003	0.151	0.021	0.056	0.027	298.354	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.211	0.013	1.001	0.162	0.160	0.094	1351.080	0.027
	NA	MC	Motorcycles	1.562	0.003	29.327	4.703	0.023	0.010	281.566	0.053
San Bernardino	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.089	0.003	1.232	0.116	0.055	0.023	341.158	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.211	0.004	1.984	0.257	0.055	0.023	425.870	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.310	0.006	2.289	0.321	0.064	0.027	626.104	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.121	0.002	0.253	0.020	0.062	0.030	237.985	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.081	0.003	0.156	0.021	0.060	0.029	316.736	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.408	0.011	0.788	0.105	0.154	0.086	1178.082	0.027
	NA	MC	Motorcycles	1.528	0.003	29.110	4.541	0.022	0.010	278.282	0.053
San Diego	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.086	0.003	1.154	0.119	0.056	0.024	348.549	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.191	0.004	1.799	0.235	0.057	0.024	447.521	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.284	0.007	2.057	0.297	0.067	0.028	686.000	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.126	0.003	0.306	0.022	0.064	0.032	270.313	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.095	0.003	0.202	0.025	0.064	0.032	366.947	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.612	0.010	0.798	0.172	0.167	0.095	1103.470	0.027
	NA	MC	Motorcycles	1.537	0.003	29.404	4.951	0.023	0.011	293.871	0.053
San Francisco	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.099	0.004	1.383	0.142	0.059	0.025	373.780	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.157	0.004	1.701	0.211	0.056	0.024	442.133	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.246	0.007	1.857	0.249	0.072	0.030	702.281	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.123	0.003	0.472	0.032	0.068	0.034	296.552	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.069	0.004	0.271	0.031	0.060	0.028	384.597	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.822	0.011	0.527	0.125	0.156	0.085	1129.533	0.027
	NA	MC	Motorcycles	1.578	0.003	30.371	5.834	0.023	0.011	308.036	0.053
San Joaquin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.093	0.003	1.173	0.125	0.054	0.022	331.982	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.201	0.004	1.790	0.255	0.054	0.023	419.720	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.318	0.006	2.232	0.354	0.062	0.026	636.692	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.139	0.002	0.222	0.017	0.058	0.028	232.493	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.085	0.003	0.144	0.019	0.058	0.029	315.444	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.751	0.012	0.849	0.164	0.164	0.094	1244.812	0.027
	NA	MC	Motorcycles	1.560	0.003	31.219	5.165	0.023	0.010	285.547	0.053
San Luis Obispo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.100	0.003	1.245	0.131	0.054	0.023	326.782	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.226	0.004	1.883	0.269	0.054	0.023	414.200	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.349	0.006	2.353	0.373	0.064	0.027	649.331	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.163	0.002	0.300	0.023	0.064	0.033	249.837	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.110	0.003	0.196	0.025	0.061	0.032	318.397	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.629	0.010	0.995	0.225	0.184	0.110	1066.833	0.027
NA	MC	Motorcycles	1.589	0.003	30.971	5.810	0.023	0.011	282.842	0.053	

Table 5-34. EMFAC County-Specific On-Road Vehicle EFs – 2020 (cont.)

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
San Mateo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.109	0.004	1.431	0.156	0.064	0.027	378.165	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.144	0.004	1.513	0.185	0.057	0.024	406.417	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.231	0.006	1.771	0.249	0.067	0.028	642.337	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.134	0.003	0.290	0.021	0.072	0.035	286.454	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.063	0.003	0.145	0.018	0.060	0.028	338.518	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.599	0.009	0.550	0.133	0.154	0.083	977.836	0.027
	NA	MC	Motorcycles	1.527	0.003	27.276	4.358	0.023	0.011	283.611	0.053
Santa Barbara	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.115	0.003	1.342	0.151	0.054	0.022	322.110	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.265	0.004	2.045	0.291	0.053	0.022	405.772	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.365	0.006	2.410	0.372	0.071	0.030	647.403	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.160	0.002	0.260	0.020	0.062	0.031	237.332	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.107	0.003	0.163	0.021	0.059	0.030	306.811	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.636	0.011	0.879	0.213	0.211	0.124	1154.226	0.027
	NA	MC	Motorcycles	1.544	0.003	28.172	4.603	0.022	0.010	269.792	0.053
Santa Clara	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.097	0.003	1.280	0.129	0.056	0.023	335.103	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.181	0.004	1.773	0.223	0.056	0.023	419.619	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.296	0.006	2.153	0.313	0.065	0.028	640.665	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.122	0.002	0.258	0.020	0.062	0.030	242.117	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.072	0.003	0.157	0.020	0.060	0.029	331.129	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.404	0.011	0.728	0.153	0.160	0.090	1152.172	0.027
	NA	MC	Motorcycles	1.515	0.003	27.508	4.822	0.023	0.010	279.451	0.053
Santa Cruz	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.132	0.003	1.597	0.162	0.053	0.023	334.638	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.303	0.004	2.457	0.333	0.055	0.023	436.029	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.405	0.007	2.769	0.418	0.065	0.027	667.696	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.287	0.003	0.487	0.042	0.074	0.042	267.033	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.171	0.003	0.287	0.040	0.068	0.038	336.852	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.844	0.010	0.919	0.227	0.208	0.126	1100.433	0.027
	NA	MC	Motorcycles	1.588	0.003	31.421	6.121	0.023	0.011	292.311	0.053
Shasta	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.103	0.003	1.359	0.140	0.055	0.023	346.682	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.262	0.004	2.242	0.324	0.056	0.024	444.803	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.390	0.007	2.795	0.464	0.066	0.028	689.266	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.192	0.002	0.367	0.028	0.065	0.034	252.924	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.116	0.003	0.225	0.030	0.063	0.032	326.187	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.702	0.012	1.058	0.200	0.174	0.103	1287.128	0.027
	NA	MC	Motorcycles	1.582	0.003	32.336	6.305	0.023	0.011	292.627	0.053
Sierra	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.125	0.004	1.621	0.158	0.057	0.024	376.210	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.320	0.005	2.774	0.395	0.057	0.025	478.088	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.509	0.007	4.030	0.729	0.067	0.029	712.426	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.112	0.003	0.537	0.032	0.060	0.029	281.006	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.042	0.003	0.241	0.031	0.053	0.023	330.946	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.952	0.009	1.172	0.252	0.172	0.103	930.154	0.027
	NA	MC	Motorcycles	1.667	0.003	35.777	6.560	0.024	0.011	320.627	0.053
Siskiyou	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.128	0.004	1.587	0.167	0.056	0.024	366.064	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.330	0.005	2.704	0.428	0.056	0.024	467.202	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.499	0.007	3.737	0.708	0.066	0.028	706.577	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.317	0.003	0.573	0.045	0.074	0.041	285.661	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.184	0.003	0.365	0.050	0.073	0.041	369.403	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.368	0.013	1.115	0.168	0.159	0.090	1323.551	0.027
	NA	MC	Motorcycles	1.671	0.003	36.764	6.577	0.023	0.011	314.154	0.053
Solano	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.097	0.003	1.195	0.124	0.054	0.023	341.314	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.188	0.004	1.701	0.236	0.055	0.023	435.158	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.309	0.007	2.115	0.338	0.065	0.027	678.815	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.144	0.002	0.289	0.022	0.062	0.031	255.390	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.068	0.003	0.150	0.018	0.056	0.027	337.319	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.765	0.012	0.902	0.166	0.156	0.089	1246.950	0.027
	NA	MC	Motorcycles	1.558	0.003	31.942	4.874	0.022	0.010	291.037	0.053

Table 5-34. EMFAC County-Specific On-Road Vehicle EFs – 2020 (cont.)

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Sonoma	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.112	0.003	1.403	0.145	0.053	0.022	331.289	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.247	0.004	2.212	0.316	0.056	0.024	439.248	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.388	0.007	2.721	0.458	0.067	0.029	692.016	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.243	0.002	0.385	0.032	0.069	0.038	262.956	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.140	0.003	0.240	0.033	0.068	0.037	354.543	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.944	0.010	0.875	0.200	0.182	0.106	1040.586	0.027
	NA	MC	Motorcycles	1.580	0.003	32.026	5.795	0.023	0.011	292.108	0.053
Stanislaus	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.095	0.003	1.274	0.132	0.053	0.022	333.629	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.227	0.004	2.107	0.296	0.054	0.023	431.749	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.333	0.007	2.415	0.376	0.065	0.027	660.973	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.135	0.002	0.319	0.023	0.059	0.029	233.727	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.107	0.003	0.216	0.029	0.061	0.032	317.351	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.745	0.011	0.858	0.168	0.163	0.094	1192.686	0.027
	NA	MC	Motorcycles	1.553	0.003	31.316	5.914	0.023	0.011	288.830	0.053
Sutter	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.098	0.003	1.301	0.135	0.054	0.022	324.787	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.240	0.004	2.092	0.291	0.055	0.023	415.852	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.332	0.006	2.398	0.388	0.063	0.027	640.981	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.131	0.002	0.232	0.018	0.059	0.029	219.901	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.120	0.003	0.177	0.024	0.061	0.031	298.966	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.784	0.012	0.922	0.169	0.162	0.093	1233.946	0.027
	NA	MC	Motorcycles	1.538	0.003	28.579	5.861	0.023	0.011	276.421	0.053
Tehama	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.104	0.003	1.316	0.132	0.054	0.023	341.948	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.281	0.004	2.285	0.323	0.056	0.024	444.630	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.388	0.007	2.726	0.448	0.065	0.028	679.113	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.191	0.002	0.365	0.029	0.065	0.034	250.577	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.168	0.003	0.281	0.041	0.072	0.042	334.587	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.532	0.012	1.062	0.190	0.167	0.098	1321.788	0.027
	NA	MC	Motorcycles	1.604	0.003	32.882	5.956	0.023	0.011	294.083	0.053
Trinity	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.130	0.004	1.697	0.166	0.057	0.025	393.847	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.370	0.005	3.136	0.459	0.058	0.025	501.541	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.478	0.007	3.639	0.679	0.066	0.029	734.002	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.270	0.003	0.703	0.060	0.080	0.048	305.051	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.184	0.004	0.414	0.057	0.074	0.043	377.603	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.747	0.012	1.109	0.194	0.168	0.097	1225.692	0.027
	NA	MC	Motorcycles	1.659	0.003	37.194	7.081	0.024	0.012	331.814	0.053
Tulare	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.090	0.003	1.188	0.123	0.053	0.022	326.972	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.266	0.004	2.272	0.323	0.054	0.023	424.718	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.335	0.006	2.439	0.363	0.062	0.026	632.719	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.126	0.002	0.217	0.018	0.058	0.029	217.214	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.112	0.003	0.184	0.027	0.064	0.035	299.837	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.842	0.011	0.879	0.171	0.166	0.096	1205.848	0.027
	NA	MC	Motorcycles	1.530	0.003	29.358	5.390	0.022	0.010	277.490	0.053
Tuolumne	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.142	0.003	1.689	0.191	0.052	0.022	335.999	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.376	0.004	3.049	0.506	0.055	0.024	446.529	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.566	0.007	4.186	0.794	0.065	0.028	691.783	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.288	0.002	0.457	0.037	0.068	0.038	249.655	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.246	0.003	0.340	0.043	0.069	0.039	331.143	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	5.240	0.009	1.135	0.256	0.191	0.113	903.248	0.027
	NA	MC	Motorcycles	1.560	0.003	33.448	6.649	0.023	0.011	286.279	0.053
Ventura	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.094	0.003	1.272	0.126	0.056	0.023	338.989	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.203	0.004	1.956	0.245	0.057	0.024	433.959	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.318	0.006	2.319	0.338	0.067	0.028	647.357	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.129	0.002	0.320	0.024	0.064	0.032	254.487	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.111	0.003	0.222	0.029	0.065	0.033	349.129	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.371	0.009	0.630	0.106	0.157	0.087	958.425	0.027
	NA	MC	Motorcycles	1.562	0.003	29.815	6.201	0.023	0.011	294.288	0.053

**Table 5-34. EMFAC County-Specific On-Road Vehicle EFs – 2020 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Yolo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.087	0.003	1.154	0.116	0.055	0.023	338.358	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.179	0.004	1.692	0.241	0.054	0.023	415.429	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.276	0.006	1.979	0.308	0.063	0.027	643.122	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.167	0.002	0.265	0.019	0.063	0.031	250.471	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.098	0.003	0.155	0.019	0.059	0.029	324.423	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.156	0.010	0.684	0.141	0.158	0.087	1098.200	0.027
	NA	MC	Motoreycles	1.533	0.003	30.360	5.211	0.022	0.010	280.680	0.053
Yuba	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.102	0.003	1.316	0.125	0.052	0.021	320.761	0.023
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.292	0.004	2.404	0.341	0.055	0.023	429.877	0.024
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.408	0.006	2.911	0.459	0.064	0.027	646.296	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.162	0.002	0.267	0.022	0.060	0.030	221.871	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.213	0.003	0.224	0.027	0.060	0.032	292.332	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	5.161	0.010	1.050	0.234	0.194	0.113	1048.186	0.027
	NA	MC	Motoreycles	1.526	0.003	29.709	5.412	0.022	0.010	273.122	0.053

Table 5-35. EMFAC County-Specific On-Road Vehicle EFs – 2021

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Alameda	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.084	0.003	1.109	0.119	0.051	0.021	304.761	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.147	0.004	1.467	0.194	0.051	0.021	378.382	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.247	0.006	1.800	0.274	0.060	0.025	589.884	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.124	0.002	0.279	0.021	0.060	0.030	234.977	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.070	0.003	0.165	0.020	0.056	0.027	313.484	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.136	0.011	0.691	0.124	0.144	0.079	1192.757	0.027
	NA	MC	Motorcycles	1.377	0.003	25.846	4.478	0.021	0.010	256.297	0.054
Alpine	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.094	0.003	1.260	0.121	0.051	0.021	295.369	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.214	0.004	1.941	0.287	0.051	0.022	373.073	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.328	0.006	2.367	0.449	0.060	0.025	573.870	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.106	0.002	0.257	0.015	0.054	0.025	211.892	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.031	0.003	0.148	0.016	0.052	0.023	287.352	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.617	0.012	1.002	0.130	0.148	0.078	1255.381	0.027
	NA	MC	Motorcycles	1.504	0.003	29.103	4.804	0.021	0.010	258.999	0.054
Amador	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.112	0.003	1.348	0.154	0.049	0.020	286.170	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.341	0.004	2.694	0.458	0.050	0.021	380.168	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.431	0.006	3.031	0.751	0.060	0.026	614.837	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.217	0.002	0.259	0.022	0.061	0.032	206.888	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.230	0.003	0.216	0.025	0.063	0.034	277.408	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.862	0.009	0.978	0.222	0.181	0.107	961.871	0.027
	NA	MC	Motorcycles	1.394	0.002	26.746	5.172	0.020	0.009	238.911	0.054
Butte	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.098	0.003	1.290	0.137	0.049	0.021	306.264	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.272	0.004	2.301	0.344	0.051	0.022	402.266	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.360	0.006	2.610	0.454	0.060	0.025	613.476	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.175	0.002	0.308	0.025	0.061	0.032	227.555	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.170	0.003	0.229	0.032	0.066	0.037	307.631	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.226	0.011	0.983	0.181	0.162	0.094	1167.495	0.027
	NA	MC	Motorcycles	1.386	0.003	27.399	5.663	0.021	0.010	255.697	0.054
Calaveras	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.114	0.003	1.447	0.167	0.050	0.021	303.445	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.365	0.004	3.056	0.473	0.051	0.022	400.856	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.447	0.006	3.213	0.740	0.060	0.026	626.047	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.236	0.002	0.402	0.032	0.064	0.035	232.634	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.247	0.003	0.377	0.058	0.082	0.053	312.047	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.855	0.009	1.073	0.225	0.175	0.103	952.197	0.027
	NA	MC	Motorcycles	1.396	0.003	28.025	5.863	0.020	0.010	253.977	0.054
Colusa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.079	0.003	1.058	0.112	0.050	0.021	306.140	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.187	0.004	1.680	0.246	0.051	0.021	386.079	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.266	0.006	1.952	0.319	0.058	0.024	588.807	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.123	0.002	0.253	0.018	0.057	0.028	221.855	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.069	0.003	0.152	0.021	0.058	0.029	286.890	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.926	0.012	0.963	0.164	0.158	0.090	1243.466	0.027
	NA	MC	Motorcycles	1.390	0.003	26.010	4.702	0.020	0.009	255.536	0.054
Contra Costa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.080	0.003	1.074	0.113	0.050	0.021	300.549	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.144	0.004	1.454	0.188	0.051	0.021	376.980	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.250	0.006	1.846	0.271	0.058	0.024	573.483	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.104	0.002	0.238	0.017	0.057	0.028	228.354	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.059	0.003	0.147	0.017	0.055	0.026	312.552	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.198	0.010	0.740	0.142	0.152	0.083	1091.847	0.027
	NA	MC	Motorcycles	1.377	0.003	26.118	4.501	0.020	0.010	254.346	0.054
Del Norte	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.111	0.003	1.314	0.145	0.050	0.021	315.022	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.348	0.004	2.572	0.441	0.051	0.022	412.383	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.369	0.006	2.445	0.512	0.058	0.025	611.231	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.243	0.002	0.433	0.035	0.065	0.036	246.204	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.290	0.003	0.472	0.065	0.086	0.057	335.836	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.614	0.008	1.059	0.216	0.168	0.096	816.096	0.027
NA	MC	Motorcycles	1.448	0.003	30.158	5.564	0.021	0.010	267.547	0.054	

Table 5-35. EMFAC County-Specific On-Road Vehicle EFs – 2021 (cont.)

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
El Dorado	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.085	0.003	1.186	0.110	0.050	0.021	302.676	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.203	0.004	1.880	0.272	0.050	0.021	388.785	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.309	0.006	2.310	0.398	0.059	0.025	592.407	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.159	0.002	0.290	0.021	0.059	0.029	232.114	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.080	0.003	0.172	0.020	0.055	0.027	307.831	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.027	0.008	0.918	0.196	0.163	0.093	891.288	0.027
	NA	MC	Motorcycles	1.447	0.003	29.361	6.079	0.021	0.010	264.481	0.054
Fresno	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.074	0.003	1.016	0.110	0.050	0.021	301.487	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.175	0.004	1.619	0.243	0.050	0.021	381.540	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.259	0.006	1.904	0.309	0.057	0.024	577.012	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.089	0.002	0.188	0.014	0.055	0.026	210.894	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.080	0.003	0.143	0.019	0.057	0.028	286.583	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.393	0.012	0.795	0.133	0.153	0.085	1247.540	0.027
	NA	MC	Motorcycles	1.380	0.002	26.724	4.592	0.020	0.009	251.473	0.054
Glenn	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.082	0.003	1.135	0.118	0.050	0.021	310.237	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.197	0.004	1.800	0.276	0.051	0.022	395.097	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.293	0.006	2.219	0.376	0.059	0.025	598.253	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.107	0.002	0.300	0.021	0.057	0.028	225.903	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.074	0.003	0.202	0.026	0.058	0.029	296.101	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.993	0.011	0.971	0.171	0.158	0.090	1190.983	0.027
	NA	MC	Motorcycles	1.389	0.003	26.843	5.269	0.021	0.010	260.024	0.054
Humboldt	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.111	0.003	1.302	0.147	0.049	0.021	299.077	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.290	0.004	2.269	0.393	0.050	0.021	389.631	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.365	0.006	2.473	0.533	0.058	0.025	590.181	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.390	0.002	0.434	0.038	0.070	0.041	239.997	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.187	0.003	0.244	0.030	0.062	0.034	308.597	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.554	0.010	1.031	0.200	0.164	0.095	1022.756	0.027
	NA	MC	Motorcycles	1.459	0.003	29.481	5.349	0.020	0.010	258.948	0.054
Imperial	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.080	0.003	1.149	0.136	0.050	0.021	310.110	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.215	0.004	2.053	0.336	0.051	0.021	388.211	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.270	0.005	2.185	0.402	0.058	0.024	555.234	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.127	0.002	0.209	0.018	0.060	0.030	210.148	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.094	0.003	0.141	0.020	0.059	0.030	282.996	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.055	0.011	0.810	0.089	0.144	0.077	1157.273	0.027
	NA	MC	Motorcycles	1.310	0.002	23.900	4.610	0.020	0.009	242.799	0.054
Inyo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.088	0.003	1.174	0.131	0.051	0.021	320.963	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.210	0.004	1.876	0.327	0.051	0.022	404.354	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.331	0.006	2.496	0.519	0.061	0.026	627.289	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.148	0.002	0.328	0.025	0.061	0.031	235.903	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.050	0.003	0.177	0.021	0.055	0.026	312.525	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.669	0.010	0.983	0.156	0.148	0.082	1091.655	0.027
	NA	MC	Motorcycles	1.427	0.003	28.250	5.330	0.021	0.010	265.834	0.054
Kern	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.078	0.003	1.059	0.110	0.050	0.021	315.739	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.174	0.004	1.605	0.229	0.050	0.021	390.266	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.255	0.006	1.890	0.295	0.058	0.024	597.773	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.101	0.002	0.253	0.018	0.057	0.028	236.461	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.065	0.003	0.156	0.019	0.055	0.026	314.000	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.442	0.012	0.867	0.131	0.148	0.082	1299.789	0.027
	NA	MC	Motorcycles	1.388	0.003	28.037	4.521	0.020	0.009	258.572	0.054
Kings	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.072	0.003	1.022	0.103	0.050	0.021	305.979	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.184	0.004	1.727	0.244	0.050	0.021	382.979	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.243	0.006	1.862	0.297	0.057	0.024	576.128	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.085	0.002	0.240	0.017	0.055	0.026	210.548	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.098	0.003	0.187	0.025	0.059	0.030	287.525	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.517	0.012	0.871	0.132	0.146	0.081	1311.088	0.027
	NA	MC	Motorcycles	1.364	0.002	25.164	4.423	0.020	0.009	250.984	0.054

Table 5-35. EMFAC County-Specific On-Road Vehicle EFs – 2021 (cont.)

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Lake	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.141	0.003	1.636	0.185	0.050	0.021	311.164	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.324	0.004	2.609	0.477	0.050	0.022	402.640	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.447	0.006	3.181	0.727	0.060	0.025	617.654	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.329	0.002	0.436	0.042	0.073	0.044	234.766	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.220	0.003	0.287	0.036	0.066	0.037	302.273	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.836	0.009	1.037	0.236	0.176	0.105	966.337	0.027
	NA	MC	Motorcycles	1.424	0.003	29.532	6.034	0.021	0.010	260.188	0.054
Lassen	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.096	0.003	1.273	0.134	0.051	0.021	318.141	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.252	0.004	2.185	0.369	0.051	0.022	408.566	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.404	0.006	3.013	0.623	0.060	0.026	632.909	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.173	0.002	0.408	0.027	0.059	0.030	243.618	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.174	0.003	0.325	0.045	0.069	0.039	315.937	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.212	0.008	1.002	0.208	0.159	0.091	821.079	0.027
	NA	MC	Motorcycles	1.487	0.003	30.912	5.638	0.021	0.010	275.276	0.054
Los Angeles	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.081	0.003	1.213	0.113	0.053	0.022	328.564	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.165	0.004	1.762	0.197	0.052	0.022	397.388	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.258	0.006	2.083	0.269	0.061	0.026	593.043	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.108	0.002	0.354	0.027	0.063	0.032	247.451	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.070	0.003	0.220	0.028	0.058	0.028	330.076	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.804	0.010	0.583	0.091	0.145	0.077	1032.766	0.027
	NA	MC	Motorcycles	1.352	0.003	24.511	4.918	0.021	0.010	268.732	0.054
Madera	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.078	0.003	1.137	0.108	0.050	0.021	312.699	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.207	0.004	1.978	0.284	0.051	0.021	403.595	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.303	0.006	2.284	0.352	0.062	0.026	614.070	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.107	0.002	0.326	0.022	0.056	0.027	223.023	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.111	0.003	0.231	0.029	0.058	0.029	310.214	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.544	0.012	0.866	0.141	0.152	0.085	1247.611	0.027
	NA	MC	Motorcycles	1.355	0.003	25.911	4.523	0.020	0.009	255.558	0.054
Marin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.091	0.003	1.141	0.130	0.051	0.021	309.046	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.148	0.004	1.430	0.208	0.051	0.021	382.835	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.248	0.006	1.781	0.283	0.061	0.025	599.185	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.148	0.002	0.301	0.022	0.062	0.031	248.994	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.054	0.003	0.159	0.017	0.055	0.025	334.903	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.924	0.009	0.678	0.138	0.146	0.079	952.898	0.027
	NA	MC	Motorcycles	1.412	0.003	27.201	4.682	0.021	0.010	261.419	0.054
Mariposa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.127	0.003	1.552	0.168	0.050	0.021	311.062	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.377	0.004	2.992	0.532	0.051	0.022	417.446	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.574	0.007	4.235	0.853	0.062	0.027	657.796	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.283	0.002	0.486	0.043	0.070	0.041	244.399	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.085	0.003	0.252	0.031	0.059	0.031	308.715	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	5.204	0.008	1.100	0.244	0.186	0.108	825.483	0.027
	NA	MC	Motorcycles	1.424	0.003	30.289	6.157	0.021	0.010	261.743	0.054
Mendocino	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.103	0.003	1.273	0.141	0.050	0.021	299.493	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.271	0.004	2.224	0.385	0.051	0.021	385.761	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.363	0.006	2.537	0.551	0.059	0.025	596.105	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.354	0.002	0.417	0.038	0.072	0.042	237.271	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.367	0.003	0.343	0.040	0.070	0.041	316.469	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.304	0.011	1.009	0.180	0.161	0.093	1135.007	0.027
	NA	MC	Motorcycles	1.432	0.003	28.154	5.218	0.021	0.010	256.604	0.054
Merced	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.082	0.003	1.115	0.111	0.049	0.021	307.506	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.234	0.004	2.085	0.291	0.050	0.021	400.304	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.318	0.006	2.352	0.347	0.058	0.025	600.413	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.120	0.002	0.288	0.020	0.055	0.027	218.531	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.147	0.003	0.241	0.033	0.062	0.034	300.272	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.585	0.012	0.870	0.134	0.150	0.084	1322.827	0.027
	NA	MC	Motorcycles	1.354	0.002	26.129	4.236	0.020	0.009	251.782	0.054



**Table 5-35. EMFAC County-Specific On-Road Vehicle EFs – 2021 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Modoc	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.103	0.003	1.402	0.138	0.052	0.022	342.985	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.272	0.004	2.406	0.363	0.052	0.023	437.554	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.466	0.007	3.626	0.717	0.061	0.027	665.710	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.182	0.003	0.565	0.042	0.065	0.035	266.170	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.214	0.003	0.415	0.061	0.077	0.047	365.102	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.481	0.008	1.023	0.207	0.161	0.092	880.868	0.027
	NA	MC	Motorcycles	1.525	0.003	32.954	6.075	0.021	0.010	296.423	0.054
Mono	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.096	0.003	1.230	0.121	0.051	0.021	307.853	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.233	0.004	1.954	0.306	0.051	0.022	394.795	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.367	0.006	2.646	0.524	0.060	0.025	607.060	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.207	0.002	0.394	0.031	0.065	0.035	240.225	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.128	0.003	0.227	0.023	0.055	0.026	324.162	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.691	0.011	0.994	0.144	0.144	0.079	1177.794	0.027
	NA	MC	Motorcycles	1.560	0.003	33.578	5.353	0.021	0.010	276.676	0.054
Monterey	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.098	0.003	1.269	0.129	0.050	0.021	319.509	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.239	0.004	2.050	0.269	0.050	0.021	409.552	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.318	0.006	2.252	0.333	0.059	0.025	616.636	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.179	0.002	0.432	0.035	0.065	0.036	242.682	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.087	0.003	0.258	0.032	0.058	0.030	322.746	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.803	0.011	0.826	0.164	0.173	0.098	1116.388	0.027
	NA	MC	Motorcycles	1.377	0.003	25.821	4.301	0.020	0.010	263.548	0.054
Napa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.083	0.003	1.104	0.109	0.050	0.021	293.555	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.178	0.004	1.683	0.228	0.051	0.021	377.923	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.309	0.006	2.173	0.353	0.061	0.025	610.683	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.130	0.002	0.265	0.021	0.060	0.030	226.623	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.081	0.003	0.160	0.018	0.055	0.026	310.574	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.644	0.010	0.784	0.158	0.161	0.090	1092.185	0.027
	NA	MC	Motorcycles	1.384	0.002	26.169	4.449	0.020	0.009	249.637	0.054
Nevada	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.097	0.003	1.211	0.129	0.050	0.021	295.307	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.269	0.004	2.108	0.306	0.050	0.021	390.140	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.377	0.006	2.561	0.440	0.058	0.024	593.672	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.202	0.002	0.318	0.024	0.060	0.031	228.367	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.189	0.003	0.233	0.027	0.060	0.032	303.520	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.266	0.011	1.048	0.185	0.156	0.090	1182.162	0.027
	NA	MC	Motorcycles	1.472	0.003	30.660	5.890	0.021	0.010	258.419	0.054
Orange	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.070	0.003	1.073	0.101	0.052	0.022	310.399	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.130	0.004	1.478	0.175	0.052	0.022	383.749	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.213	0.006	1.717	0.229	0.062	0.026	589.109	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.079	0.002	0.279	0.019	0.058	0.028	231.498	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.055	0.003	0.179	0.022	0.056	0.026	317.724	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.454	0.009	0.466	0.079	0.148	0.078	911.552	0.027
	NA	MC	Motorcycles	1.335	0.003	23.793	4.698	0.021	0.010	258.429	0.054
Placer	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.080	0.003	1.126	0.110	0.051	0.021	302.823	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.137	0.004	1.435	0.188	0.050	0.021	370.128	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.243	0.006	1.874	0.285	0.057	0.024	567.914	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.132	0.002	0.255	0.018	0.058	0.029	224.671	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.052	0.003	0.135	0.015	0.052	0.024	291.622	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.381	0.011	0.857	0.151	0.153	0.085	1132.107	0.027
	NA	MC	Motorcycles	1.413	0.003	27.398	4.941	0.020	0.010	254.715	0.054
Plumas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.113	0.003	1.483	0.150	0.051	0.022	324.895	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.331	0.004	2.811	0.431	0.052	0.022	428.621	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.502	0.006	3.912	0.770	0.061	0.026	640.382	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.210	0.002	0.529	0.040	0.066	0.036	256.777	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.144	0.003	0.348	0.043	0.061	0.033	344.675	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.751	0.009	1.058	0.224	0.164	0.098	915.265	0.027
NA	MC	Motorcycles	1.483	0.003	31.928	6.102	0.021	0.010	281.609	0.054	

**Table 5-35. EMFAC County-Specific On-Road Vehicle EFs – 2021 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Riverside	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.069	0.003	1.017	0.099	0.051	0.021	302.952	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.152	0.004	1.583	0.198	0.051	0.021	375.141	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.219	0.005	1.738	0.247	0.058	0.024	536.590	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.065	0.002	0.189	0.013	0.055	0.025	212.947	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.050	0.003	0.120	0.015	0.054	0.025	281.953	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.993	0.011	0.749	0.090	0.147	0.081	1141.654	0.027
	NA	MC	Motorcycles	1.339	0.002	24.502	4.427	0.020	0.009	250.843	0.054
Sacramento	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.083	0.003	1.180	0.126	0.050	0.021	302.759	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.156	0.004	1.631	0.224	0.050	0.021	379.342	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.271	0.006	2.050	0.322	0.060	0.025	603.638	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.118	0.002	0.260	0.019	0.057	0.028	216.825	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.154	0.003	0.223	0.027	0.059	0.031	311.466	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.762	0.011	0.769	0.153	0.160	0.089	1113.845	0.027
	NA	MC	Motorcycles	1.362	0.002	25.632	4.967	0.020	0.010	252.251	0.054
San Benito	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.082	0.003	1.087	0.106	0.050	0.021	297.662	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.191	0.004	1.683	0.251	0.050	0.021	377.339	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.285	0.006	2.006	0.334	0.058	0.024	584.134	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.181	0.002	0.307	0.023	0.060	0.030	222.288	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.048	0.003	0.153	0.020	0.053	0.025	286.437	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.899	0.013	0.971	0.144	0.151	0.086	1329.386	0.027
	NA	MC	Motorcycles	1.398	0.003	26.021	4.301	0.020	0.009	253.235	0.054
San Bernardino	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.074	0.003	1.062	0.100	0.051	0.021	305.722	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.173	0.004	1.696	0.224	0.051	0.021	380.546	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.259	0.006	1.967	0.283	0.059	0.025	560.602	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.094	0.002	0.228	0.017	0.057	0.027	218.860	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.067	0.003	0.147	0.019	0.056	0.027	294.557	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.090	0.011	0.752	0.092	0.146	0.079	1143.735	0.027
	NA	MC	Motorcycles	1.364	0.002	25.596	4.101	0.020	0.009	249.064	0.054
San Diego	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.071	0.003	0.999	0.102	0.051	0.021	310.206	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.157	0.004	1.542	0.206	0.052	0.022	395.135	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.234	0.006	1.752	0.260	0.061	0.025	606.763	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.098	0.002	0.278	0.019	0.058	0.028	244.199	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.079	0.003	0.188	0.023	0.058	0.029	333.233	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.216	0.010	0.736	0.147	0.156	0.086	1060.993	0.027
	NA	MC	Motorcycles	1.371	0.003	25.850	4.481	0.021	0.010	262.927	0.054
San Francisco	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.080	0.003	1.165	0.120	0.053	0.022	324.860	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.130	0.004	1.474	0.187	0.051	0.022	394.534	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.205	0.006	1.607	0.219	0.066	0.028	627.117	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.097	0.002	0.416	0.027	0.060	0.030	260.791	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.061	0.003	0.260	0.029	0.056	0.026	353.870	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.561	0.010	0.489	0.108	0.149	0.079	1095.914	0.027
	NA	MC	Motorcycles	1.412	0.003	26.889	5.266	0.021	0.010	275.717	0.054
San Joaquin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.077	0.003	1.017	0.109	0.050	0.021	301.340	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.164	0.004	1.533	0.223	0.050	0.021	377.271	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.265	0.006	1.917	0.315	0.057	0.024	569.635	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.106	0.002	0.197	0.014	0.055	0.026	217.352	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.070	0.003	0.131	0.017	0.055	0.027	296.242	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.403	0.011	0.799	0.140	0.153	0.086	1212.485	0.027
	NA	MC	Motorcycles	1.398	0.003	27.421	4.664	0.020	0.009	256.456	0.054
San Luis Obispo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.083	0.003	1.071	0.113	0.050	0.021	294.887	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.188	0.004	1.632	0.240	0.050	0.021	376.557	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.297	0.006	2.042	0.335	0.059	0.025	586.579	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.133	0.002	0.272	0.020	0.059	0.029	229.043	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.094	0.003	0.182	0.023	0.058	0.029	301.869	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.088	0.010	0.906	0.194	0.168	0.098	1010.081	0.027
	NA	MC	Motorcycles	1.437	0.003	27.695	5.325	0.021	0.010	256.395	0.054

Table 5-35. EMFAC County-Specific On-Road Vehicle EFs – 2021 (cont.)

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
San Mateo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.086	0.003	1.166	0.130	0.054	0.023	315.767	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.118	0.004	1.306	0.162	0.051	0.021	358.634	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.188	0.006	1.512	0.216	0.061	0.026	566.665	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.096	0.002	0.235	0.016	0.060	0.028	241.170	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.052	0.003	0.133	0.016	0.055	0.026	306.008	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.295	0.009	0.500	0.115	0.144	0.076	934.125	0.027
	NA	MC	Motorcycles	1.362	0.003	23.971	3.879	0.021	0.010	253.435	0.054
Santa Barbara	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.094	0.003	1.145	0.129	0.050	0.021	291.488	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.222	0.004	1.772	0.259	0.050	0.021	369.837	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.310	0.006	2.090	0.334	0.065	0.027	585.629	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.130	0.002	0.235	0.017	0.057	0.028	219.414	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.092	0.003	0.153	0.019	0.056	0.028	292.512	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.091	0.010	0.791	0.178	0.193	0.110	1100.374	0.027
	NA	MC	Motorcycles	1.395	0.002	25.196	4.207	0.020	0.009	244.443	0.054
Santa Clara	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.079	0.003	1.092	0.110	0.051	0.021	299.145	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.149	0.004	1.523	0.196	0.051	0.021	373.729	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.245	0.006	1.841	0.275	0.060	0.025	573.305	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.095	0.002	0.229	0.016	0.057	0.027	221.308	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.061	0.003	0.146	0.018	0.056	0.026	305.278	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.083	0.011	0.682	0.132	0.150	0.082	1117.395	0.027
	NA	MC	Motorcycles	1.362	0.002	24.422	4.350	0.020	0.009	251.733	0.054
Santa Cruz	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.109	0.003	1.378	0.140	0.050	0.021	306.829	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.253	0.004	2.126	0.296	0.051	0.022	397.036	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.343	0.006	2.399	0.373	0.059	0.025	602.433	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.237	0.002	0.454	0.038	0.068	0.038	247.613	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.145	0.003	0.276	0.037	0.064	0.035	320.890	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.229	0.010	0.817	0.191	0.187	0.110	1038.350	0.027
	NA	MC	Motorcycles	1.436	0.003	28.193	5.636	0.021	0.010	265.421	0.054
Shasta	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.084	0.003	1.157	0.119	0.050	0.021	311.607	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.215	0.004	1.901	0.282	0.051	0.022	397.254	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.325	0.006	2.378	0.411	0.060	0.025	612.855	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.150	0.002	0.327	0.024	0.059	0.030	231.420	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.095	0.003	0.207	0.027	0.058	0.029	304.710	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.229	0.012	0.994	0.173	0.160	0.092	1239.625	0.027
	NA	MC	Motorcycles	1.429	0.003	28.895	5.779	0.021	0.010	264.776	0.054
Sierra	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.102	0.003	1.374	0.135	0.052	0.022	334.269	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.265	0.004	2.356	0.348	0.052	0.022	427.256	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.430	0.006	3.477	0.662	0.061	0.026	637.022	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.089	0.002	0.491	0.028	0.055	0.025	255.605	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.041	0.003	0.245	0.031	0.051	0.023	312.053	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.266	0.008	1.055	0.217	0.154	0.090	855.560	0.027
	NA	MC	Motorcycles	1.504	0.003	31.782	5.927	0.021	0.010	289.262	0.054
Siskiyou	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.104	0.003	1.346	0.142	0.051	0.022	327.925	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.274	0.004	2.311	0.380	0.052	0.022	420.156	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.424	0.006	3.233	0.645	0.060	0.026	634.978	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.252	0.002	0.512	0.038	0.066	0.036	259.571	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.150	0.003	0.333	0.043	0.066	0.036	341.993	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.964	0.012	1.067	0.148	0.148	0.082	1269.873	0.027
	NA	MC	Motorcycles	1.516	0.003	32.896	5.997	0.021	0.010	285.145	0.054
Solano	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.081	0.003	1.032	0.107	0.050	0.021	309.115	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.154	0.004	1.453	0.206	0.051	0.021	390.022	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.258	0.006	1.808	0.299	0.060	0.025	605.664	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.114	0.002	0.257	0.019	0.057	0.028	236.489	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.058	0.003	0.142	0.017	0.054	0.025	316.127	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.449	0.011	0.859	0.144	0.146	0.082	1216.697	0.027
	NA	MC	Motorcycles	1.404	0.003	28.351	4.415	0.020	0.009	262.604	0.054

Table 5-35. EMFAC County-Specific On-Road Vehicle EFs – 2021 (cont.)

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Sonoma	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.092	0.003	1.207	0.125	0.050	0.021	302.251	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.203	0.004	1.879	0.276	0.051	0.022	391.716	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.325	0.006	2.333	0.407	0.061	0.026	617.017	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.197	0.002	0.345	0.028	0.063	0.034	243.384	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.116	0.003	0.218	0.029	0.062	0.033	328.950	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.496	0.009	0.796	0.172	0.168	0.096	995.056	0.027
	NA	MC	Motorcycles	1.421	0.003	28.405	5.246	0.021	0.010	263.188	0.054
Stanislaus	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.079	0.003	1.106	0.114	0.050	0.021	305.485	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.187	0.004	1.804	0.259	0.050	0.021	390.351	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.281	0.006	2.086	0.337	0.059	0.025	593.873	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.106	0.002	0.300	0.020	0.055	0.027	221.179	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.088	0.003	0.206	0.027	0.057	0.029	301.476	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.406	0.011	0.807	0.144	0.153	0.085	1162.808	0.027
	NA	MC	Motorcycles	1.399	0.003	27.804	5.392	0.021	0.010	261.117	0.054
Sutter	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.081	0.003	1.120	0.117	0.050	0.021	294.933	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.196	0.004	1.778	0.254	0.050	0.021	373.147	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.280	0.006	2.066	0.348	0.058	0.024	573.804	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.102	0.002	0.209	0.015	0.055	0.026	205.455	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.098	0.003	0.159	0.021	0.057	0.029	280.547	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.456	0.011	0.875	0.146	0.152	0.084	1202.993	0.027
	NA	MC	Motorcycles	1.391	0.002	25.575	5.355	0.021	0.010	250.773	0.054
Tehama	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.085	0.003	1.128	0.112	0.050	0.021	309.090	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.229	0.004	1.932	0.280	0.051	0.022	396.777	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.324	0.006	2.327	0.397	0.059	0.025	603.358	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.151	0.002	0.328	0.024	0.060	0.030	231.131	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.135	0.003	0.249	0.035	0.066	0.036	310.561	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.102	0.012	1.007	0.164	0.155	0.089	1276.881	0.027
	NA	MC	Motorcycles	1.449	0.003	29.328	5.423	0.021	0.010	266.202	0.054
Trinity	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.105	0.003	1.433	0.141	0.052	0.022	350.603	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.307	0.004	2.664	0.405	0.053	0.023	448.995	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.402	0.007	3.101	0.614	0.060	0.026	658.048	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.219	0.003	0.636	0.052	0.072	0.042	277.765	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.145	0.003	0.378	0.050	0.066	0.037	349.095	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.240	0.011	1.042	0.169	0.154	0.087	1167.269	0.027
	NA	MC	Motorcycles	1.500	0.003	33.149	6.437	0.022	0.011	299.833	0.054
Tulare	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.075	0.003	1.028	0.107	0.049	0.020	299.660	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.219	0.004	1.925	0.280	0.050	0.021	383.317	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.284	0.006	2.108	0.326	0.057	0.024	571.917	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.097	0.002	0.194	0.015	0.055	0.027	206.660	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.093	0.003	0.163	0.023	0.060	0.031	284.390	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.489	0.011	0.827	0.147	0.155	0.087	1171.266	0.027
	NA	MC	Motorcycles	1.382	0.002	26.301	4.914	0.020	0.009	251.421	0.054
Tuolumne	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.117	0.003	1.446	0.164	0.049	0.021	310.199	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.322	0.004	2.650	0.458	0.051	0.022	409.879	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.496	0.006	3.710	0.740	0.060	0.026	634.830	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.236	0.002	0.421	0.033	0.063	0.034	235.448	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.202	0.003	0.308	0.038	0.064	0.035	314.431	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.694	0.008	1.044	0.228	0.175	0.102	847.946	0.027
	NA	MC	Motorcycles	1.444	0.003	30.666	6.206	0.021	0.010	265.337	0.054
Ventura	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.077	0.003	1.090	0.108	0.051	0.021	303.131	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.166	0.004	1.660	0.213	0.052	0.022	384.316	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.265	0.006	1.975	0.297	0.060	0.025	574.323	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.102	0.002	0.294	0.021	0.058	0.028	231.700	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.093	0.003	0.207	0.026	0.060	0.030	318.778	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.991	0.009	0.577	0.092	0.147	0.079	923.227	0.027
	NA	MC	Motorcycles	1.402	0.003	26.518	5.636	0.021	0.010	265.297	0.054

**Table 5-35. EMFAC County-Specific On-Road Vehicle EFs – 2021 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Yolo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.071	0.003	0.987	0.099	0.050	0.021	302.514	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.149	0.004	1.463	0.213	0.050	0.021	375.531	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.233	0.006	1.711	0.276	0.058	0.024	577.073	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.129	0.002	0.231	0.016	0.057	0.028	227.750	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.081	0.003	0.143	0.017	0.055	0.027	304.835	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.887	0.010	0.635	0.120	0.151	0.081	1079.417	0.027
	NA	MC	Motoreycles	1.389	0.003	27.177	4.770	0.020	0.009	254.912	0.054
Yuba	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.084	0.003	1.136	0.108	0.049	0.020	296.919	0.022
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.238	0.004	2.028	0.297	0.050	0.021	387.060	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.345	0.006	2.504	0.409	0.058	0.025	579.599	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.129	0.002	0.244	0.019	0.056	0.028	211.384	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.165	0.003	0.194	0.023	0.057	0.029	278.798	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.547	0.009	0.952	0.204	0.177	0.101	986.006	0.027
	NA	MC	Motoreycles	1.390	0.002	26.826	4.997	0.020	0.009	249.405	0.054

Table 5-36. EMFAC County-Specific On-Road Vehicle EFs – 2022

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Alameda	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.071	0.003	0.965	0.104	0.046	0.019	273.616	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.123	0.003	1.277	0.174	0.047	0.019	338.999	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.207	0.005	1.545	0.244	0.055	0.023	529.087	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.100	0.002	0.251	0.018	0.054	0.027	214.075	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.061	0.003	0.155	0.018	0.053	0.025	289.865	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.888	0.011	0.632	0.094	0.134	0.068	1194.222	0.027
	NA	MC	Motorcycles	1.247	0.002	23.157	4.081	0.019	0.009	232.422	0.054
Alpine	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.078	0.003	1.093	0.106	0.046	0.019	262.235	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.178	0.003	1.669	0.257	0.047	0.020	332.047	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.274	0.005	1.980	0.406	0.054	0.023	511.152	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.084	0.002	0.232	0.013	0.050	0.022	192.264	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.029	0.003	0.147	0.016	0.049	0.021	266.824	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.345	0.011	0.965	0.113	0.138	0.070	1212.177	0.027
	NA	MC	Motorcycles	1.350	0.002	25.920	4.357	0.019	0.009	232.823	0.054
Amador	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.096	0.003	1.189	0.137	0.046	0.019	265.862	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.299	0.003	2.386	0.421	0.047	0.020	351.168	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.371	0.006	2.609	0.703	0.056	0.024	560.060	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.181	0.002	0.235	0.020	0.057	0.029	193.607	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.198	0.002	0.196	0.023	0.060	0.032	264.258	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.175	0.009	0.838	0.171	0.157	0.087	904.828	0.027
	NA	MC	Motorcycles	1.285	0.002	24.509	4.859	0.018	0.009	220.879	0.054
Butte	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.083	0.003	1.131	0.120	0.047	0.019	283.697	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.230	0.004	1.995	0.307	0.047	0.020	365.080	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.304	0.005	2.212	0.407	0.055	0.023	550.141	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.144	0.002	0.285	0.022	0.057	0.029	214.451	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.144	0.003	0.211	0.028	0.061	0.033	290.720	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.715	0.011	0.882	0.139	0.143	0.077	1122.018	0.027
	NA	MC	Motorcycles	1.267	0.002	24.849	5.261	0.019	0.009	233.987	0.054
Calaveras	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.097	0.003	1.268	0.147	0.047	0.020	279.468	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.320	0.004	2.711	0.434	0.048	0.021	371.214	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.388	0.006	2.798	0.693	0.056	0.024	571.224	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.197	0.002	0.368	0.028	0.059	0.031	214.815	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.210	0.003	0.343	0.051	0.075	0.047	295.590	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.252	0.008	0.955	0.181	0.154	0.087	896.835	0.027
	NA	MC	Motorcycles	1.292	0.002	25.782	5.520	0.019	0.009	235.382	0.054
Colusa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.066	0.003	0.924	0.099	0.046	0.019	276.535	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.155	0.003	1.444	0.219	0.047	0.020	346.063	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.225	0.005	1.669	0.288	0.053	0.022	526.914	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.099	0.002	0.228	0.015	0.053	0.025	204.310	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.058	0.003	0.142	0.019	0.054	0.026	267.767	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.433	0.011	0.864	0.122	0.137	0.073	1194.962	0.027
	NA	MC	Motorcycles	1.254	0.002	23.264	4.312	0.018	0.009	230.894	0.054
Contra Costa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.068	0.003	0.941	0.100	0.046	0.019	271.912	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.121	0.003	1.267	0.169	0.047	0.019	339.280	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.211	0.005	1.581	0.243	0.053	0.022	516.516	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.083	0.002	0.216	0.015	0.052	0.025	210.450	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.052	0.003	0.139	0.016	0.051	0.024	291.011	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.900	0.010	0.675	0.112	0.141	0.072	1080.665	0.027
	NA	MC	Motorcycles	1.247	0.002	23.400	4.108	0.019	0.009	230.722	0.054
Del Norte	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.094	0.003	1.148	0.128	0.047	0.020	290.886	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.302	0.004	2.268	0.403	0.048	0.020	380.402	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.320	0.006	2.132	0.479	0.054	0.023	563.037	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.203	0.002	0.403	0.031	0.061	0.033	232.066	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.247	0.003	0.422	0.057	0.079	0.050	317.385	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.109	0.007	0.968	0.190	0.153	0.086	759.015	0.027
	NA	MC	Motorcycles	1.339	0.002	27.638	5.199	0.019	0.009	247.565	0.054

Table 5-36. EMFAC County-Specific On-Road Vehicle EFs – 2022 (cont.)

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
El Dorado	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.072	0.003	1.039	0.097	0.047	0.019	274.482	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.175	0.004	1.663	0.250	0.047	0.020	355.577	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.268	0.005	2.014	0.368	0.054	0.023	538.110	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.126	0.002	0.261	0.018	0.054	0.026	211.567	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.069	0.003	0.166	0.019	0.052	0.025	291.326	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.516	0.008	0.812	0.159	0.146	0.080	839.388	0.027
	NA	MC	Motorcycles	1.326	0.002	26.717	5.672	0.019	0.009	242.761	0.054
Fresno	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.064	0.003	0.898	0.098	0.046	0.019	275.283	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.147	0.003	1.409	0.218	0.047	0.019	346.816	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.219	0.005	1.633	0.279	0.053	0.022	520.200	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.071	0.002	0.173	0.012	0.052	0.024	199.046	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.068	0.003	0.133	0.017	0.054	0.026	272.392	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.091	0.012	0.729	0.098	0.140	0.072	1240.808	0.027
	NA	MC	Motorcycles	1.245	0.002	23.870	4.202	0.018	0.008	227.379	0.054
Glenn	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.069	0.003	0.991	0.104	0.047	0.019	282.918	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.162	0.003	1.536	0.244	0.047	0.020	353.294	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.246	0.005	1.882	0.337	0.053	0.022	532.897	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.088	0.002	0.279	0.019	0.054	0.026	210.746	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.061	0.003	0.186	0.023	0.054	0.026	276.217	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.531	0.011	0.881	0.133	0.139	0.075	1143.017	0.027
	NA	MC	Motorcycles	1.256	0.002	24.059	4.829	0.019	0.009	235.450	0.054
Humboldt	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.094	0.003	1.142	0.130	0.047	0.019	277.078	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.251	0.004	2.004	0.362	0.047	0.020	358.965	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.316	0.005	2.157	0.500	0.054	0.023	541.656	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.318	0.002	0.386	0.033	0.064	0.036	222.695	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.163	0.003	0.230	0.028	0.059	0.031	294.803	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.976	0.009	0.923	0.162	0.144	0.080	964.665	0.027
	NA	MC	Motorcycles	1.341	0.002	26.885	4.987	0.019	0.009	238.415	0.054
Imperial	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.068	0.003	1.001	0.121	0.046	0.019	279.727	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.181	0.003	1.768	0.300	0.047	0.020	349.271	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.226	0.005	1.832	0.365	0.053	0.022	500.340	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.103	0.002	0.186	0.016	0.055	0.027	193.180	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.080	0.002	0.129	0.018	0.055	0.027	262.838	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.747	0.011	0.769	0.075	0.132	0.067	1125.389	0.027
	NA	MC	Motorcycles	1.179	0.002	21.311	4.216	0.018	0.008	218.785	0.054
Inyo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.074	0.003	1.016	0.115	0.047	0.019	287.462	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.176	0.004	1.620	0.296	0.047	0.020	363.173	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.279	0.006	2.105	0.475	0.055	0.023	563.067	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.120	0.002	0.295	0.021	0.055	0.028	214.604	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.045	0.003	0.170	0.019	0.051	0.024	290.430	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.288	0.010	0.918	0.133	0.134	0.071	1041.348	0.027
	NA	MC	Motorcycles	1.289	0.002	25.271	4.887	0.019	0.009	240.365	0.054
Kern	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.066	0.003	0.930	0.097	0.047	0.019	286.142	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.146	0.004	1.403	0.205	0.047	0.020	355.870	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.218	0.005	1.630	0.268	0.053	0.022	541.792	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.082	0.002	0.231	0.016	0.053	0.026	218.829	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.057	0.003	0.150	0.018	0.052	0.025	297.153	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.156	0.012	0.808	0.098	0.135	0.070	1289.261	0.027
	NA	MC	Motorcycles	1.258	0.002	25.132	4.140	0.018	0.008	234.741	0.054
Kings	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.061	0.003	0.899	0.092	0.046	0.019	277.178	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.155	0.003	1.501	0.218	0.047	0.020	347.409	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.205	0.005	1.604	0.269	0.052	0.022	516.715	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.069	0.002	0.221	0.015	0.052	0.024	196.243	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.084	0.003	0.176	0.022	0.055	0.028	270.954	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.228	0.012	0.812	0.100	0.133	0.069	1298.959	0.027
NA	MC	Motorcycles	1.228	0.002	22.458	4.041	0.018	0.008	226.480	0.054	

Table 5-36. EMFAC County-Specific On-Road Vehicle EFs – 2022 (cont.)

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Lake	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.121	0.003	1.435	0.165	0.047	0.020	289.512	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.278	0.004	2.277	0.435	0.047	0.020	371.641	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.386	0.006	2.750	0.681	0.055	0.024	565.115	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.278	0.002	0.399	0.037	0.068	0.040	221.489	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.187	0.003	0.264	0.032	0.062	0.034	291.302	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.172	0.009	0.894	0.180	0.152	0.086	921.327	0.027
	NA	MC	Motorcycles	1.313	0.002	27.032	5.660	0.019	0.009	240.330	0.054
Lassen	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.080	0.003	1.109	0.118	0.047	0.020	287.771	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.213	0.004	1.897	0.334	0.047	0.020	369.389	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.344	0.006	2.537	0.575	0.055	0.023	570.786	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.138	0.002	0.372	0.024	0.054	0.027	223.438	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.141	0.003	0.292	0.038	0.062	0.035	294.470	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.653	0.007	0.897	0.176	0.141	0.079	757.939	0.027
	NA	MC	Motorcycles	1.351	0.002	27.855	5.197	0.019	0.009	250.191	0.054
Los Angeles	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.067	0.003	1.029	0.098	0.047	0.020	286.783	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.137	0.003	1.510	0.174	0.047	0.020	352.083	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.214	0.005	1.753	0.235	0.056	0.023	527.349	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.085	0.002	0.312	0.023	0.056	0.028	218.815	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.061	0.003	0.207	0.025	0.053	0.026	299.423	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.473	0.010	0.513	0.067	0.133	0.065	1011.840	0.027
	NA	MC	Motorcycles	1.215	0.002	21.866	4.458	0.019	0.009	241.498	0.054
Madera	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.066	0.003	1.006	0.096	0.047	0.020	288.419	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.172	0.004	1.703	0.252	0.047	0.020	365.664	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.257	0.005	1.958	0.316	0.057	0.024	554.769	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.087	0.002	0.308	0.020	0.053	0.025	210.984	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.094	0.003	0.221	0.027	0.055	0.027	292.583	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.230	0.012	0.800	0.107	0.138	0.072	1237.266	0.027
	NA	MC	Motorcycles	1.227	0.002	23.243	4.135	0.018	0.008	231.845	0.054
Marin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.076	0.003	0.986	0.114	0.047	0.019	274.448	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.124	0.003	1.247	0.187	0.047	0.019	343.221	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.209	0.005	1.530	0.254	0.055	0.023	538.617	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.120	0.002	0.267	0.019	0.055	0.028	222.921	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.048	0.003	0.152	0.016	0.051	0.024	309.547	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.602	0.009	0.613	0.112	0.134	0.069	924.585	0.027
	NA	MC	Motorcycles	1.272	0.002	24.233	4.257	0.019	0.009	235.818	0.054
Mariposa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.109	0.003	1.360	0.147	0.047	0.020	289.177	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.329	0.004	2.637	0.487	0.048	0.021	385.897	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.502	0.006	3.629	0.797	0.058	0.025	607.418	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.240	0.002	0.452	0.039	0.066	0.038	229.053	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.077	0.003	0.249	0.030	0.057	0.029	299.930	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.598	0.007	0.986	0.206	0.167	0.094	769.427	0.027
	NA	MC	Motorcycles	1.329	0.002	28.070	5.806	0.019	0.010	244.489	0.054
Mendocino	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.087	0.003	1.109	0.124	0.047	0.019	273.097	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.232	0.003	1.946	0.352	0.047	0.020	352.877	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.312	0.005	2.197	0.513	0.055	0.023	543.029	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.290	0.002	0.369	0.033	0.065	0.037	217.509	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.313	0.003	0.308	0.036	0.065	0.037	296.416	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.775	0.010	0.911	0.143	0.141	0.077	1080.131	0.027
	NA	MC	Motorcycles	1.308	0.002	25.529	4.841	0.019	0.009	234.880	0.054
Merced	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.070	0.003	0.987	0.098	0.047	0.019	285.483	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.195	0.004	1.800	0.258	0.047	0.020	365.081	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.269	0.005	2.004	0.311	0.054	0.023	543.070	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.097	0.002	0.272	0.018	0.053	0.025	209.089	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.122	0.003	0.224	0.030	0.059	0.031	286.989	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.290	0.012	0.808	0.099	0.137	0.071	1316.904	0.027
	NA	MC	Motorcycles	1.228	0.002	23.426	3.869	0.018	0.008	228.728	0.054



**Table 5-36. EMFAC County-Specific On-Road Vehicle EFs – 2022 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Modoc	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.086	0.003	1.213	0.121	0.047	0.020	308.206	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.229	0.004	2.078	0.326	0.048	0.021	393.898	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.396	0.006	3.049	0.657	0.056	0.024	598.664	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.146	0.002	0.517	0.036	0.059	0.031	243.555	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.176	0.003	0.387	0.054	0.070	0.041	337.064	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.934	0.008	0.923	0.177	0.145	0.081	817.293	0.027
	NA	MC	Motorcycles	1.383	0.003	29.587	5.545	0.019	0.009	268.666	0.054
Mono	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.081	0.003	1.070	0.106	0.047	0.020	276.554	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.197	0.004	1.702	0.277	0.047	0.020	355.920	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.313	0.005	2.264	0.482	0.054	0.023	544.911	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.166	0.002	0.349	0.026	0.058	0.031	217.764	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.108	0.003	0.214	0.022	0.052	0.024	301.529	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.357	0.011	0.942	0.124	0.133	0.070	1130.326	0.027
	NA	MC	Motorcycles	1.412	0.002	30.114	4.883	0.019	0.009	250.738	0.054
Monterey	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.083	0.003	1.113	0.114	0.047	0.020	292.689	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.203	0.004	1.796	0.243	0.047	0.020	375.503	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.272	0.006	1.951	0.302	0.054	0.023	559.027	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.148	0.002	0.401	0.031	0.060	0.032	226.499	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.078	0.003	0.254	0.030	0.056	0.028	309.240	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.296	0.010	0.722	0.122	0.153	0.081	1077.915	0.027
	NA	MC	Motorcycles	1.249	0.002	23.180	3.924	0.019	0.009	239.212	0.054
Napa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.070	0.003	0.968	0.096	0.046	0.019	266.640	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.149	0.003	1.454	0.204	0.047	0.019	339.911	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.260	0.005	1.854	0.317	0.055	0.023	546.358	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.107	0.002	0.240	0.018	0.055	0.028	208.287	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.070	0.003	0.152	0.016	0.052	0.025	289.860	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.300	0.010	0.708	0.123	0.148	0.077	1086.952	0.027
	NA	MC	Motorcycles	1.252	0.002	23.409	4.055	0.019	0.009	226.125	0.054
Nevada	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.082	0.003	1.058	0.113	0.046	0.019	271.024	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.235	0.004	1.884	0.284	0.047	0.020	362.487	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.328	0.005	2.216	0.407	0.054	0.023	546.223	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.161	0.002	0.285	0.020	0.055	0.028	210.308	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.165	0.003	0.220	0.025	0.057	0.030	292.227	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.785	0.011	0.953	0.144	0.138	0.075	1134.836	0.027
	NA	MC	Motorcycles	1.359	0.002	28.127	5.533	0.019	0.009	239.058	0.054
Orange	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.059	0.003	0.924	0.088	0.047	0.019	273.504	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.109	0.003	1.276	0.156	0.047	0.020	339.232	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.180	0.005	1.473	0.205	0.056	0.024	524.660	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.063	0.002	0.250	0.016	0.052	0.025	207.529	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.049	0.003	0.168	0.020	0.051	0.024	287.287	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.153	0.008	0.403	0.058	0.137	0.068	894.944	0.027
	NA	MC	Motorcycles	1.198	0.002	21.209	4.263	0.019	0.009	232.111	0.054
Placer	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.068	0.003	0.983	0.097	0.046	0.019	271.317	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.116	0.003	1.265	0.170	0.047	0.019	336.137	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.207	0.005	1.624	0.258	0.053	0.022	514.277	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.105	0.002	0.227	0.016	0.053	0.026	203.873	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.046	0.003	0.132	0.014	0.050	0.023	274.980	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.999	0.010	0.770	0.114	0.137	0.071	1097.661	0.027
	NA	MC	Motorcycles	1.288	0.002	24.761	4.561	0.019	0.009	232.545	0.054
Plumas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.095	0.003	1.286	0.131	0.047	0.020	294.797	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.282	0.004	2.443	0.391	0.048	0.021	390.796	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.430	0.006	3.300	0.712	0.056	0.024	581.169	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.173	0.002	0.487	0.035	0.060	0.032	235.312	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.127	0.003	0.338	0.040	0.058	0.030	326.350	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.137	0.008	0.935	0.182	0.144	0.082	861.379	0.027
NA	MC	Motorcycles	1.357	0.003	28.955	5.625	0.019	0.009	257.582	0.054	

**Table 5-36. EMFAC County-Specific On-Road Vehicle EFs – 2022 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Riverside	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.059	0.003	0.894	0.088	0.046	0.019	272.312	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.128	0.003	1.378	0.177	0.047	0.019	337.331	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.186	0.005	1.501	0.223	0.053	0.022	482.705	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.053	0.002	0.173	0.011	0.051	0.023	195.938	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.044	0.002	0.114	0.014	0.051	0.023	262.166	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.675	0.011	0.696	0.072	0.135	0.069	1121.979	0.027
	NA	MC	Motorcycles	1.198	0.002	21.750	4.022	0.018	0.008	224.769	0.054
Sacramento	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.071	0.003	1.038	0.113	0.047	0.019	276.289	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.132	0.003	1.429	0.202	0.047	0.019	344.524	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.230	0.005	1.765	0.291	0.055	0.023	542.902	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.094	0.002	0.239	0.016	0.053	0.026	203.185	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.127	0.003	0.203	0.024	0.056	0.028	290.798	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.380	0.010	0.694	0.117	0.147	0.076	1096.156	0.027
	NA	MC	Motorcycles	1.239	0.002	23.126	4.577	0.019	0.009	229.799	0.054
San Benito	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.070	0.003	0.965	0.096	0.047	0.019	275.539	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.159	0.003	1.462	0.225	0.047	0.020	344.026	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.241	0.005	1.735	0.303	0.053	0.022	524.935	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.146	0.002	0.279	0.020	0.055	0.028	205.667	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.043	0.003	0.151	0.019	0.051	0.024	273.591	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.550	0.012	0.904	0.112	0.136	0.072	1310.661	0.027
	NA	MC	Motorcycles	1.259	0.002	23.247	3.931	0.018	0.008	228.309	0.054
San Bernardino	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.063	0.003	0.928	0.089	0.046	0.019	275.230	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.145	0.003	1.467	0.199	0.047	0.020	341.951	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.218	0.005	1.677	0.253	0.054	0.022	503.112	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.076	0.002	0.207	0.014	0.052	0.025	201.840	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.058	0.003	0.139	0.017	0.052	0.025	274.098	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.798	0.011	0.704	0.074	0.135	0.069	1128.726	0.027
	NA	MC	Motorcycles	1.222	0.002	22.734	3.725	0.018	0.008	223.569	0.054
San Diego	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.061	0.003	0.873	0.090	0.047	0.019	277.413	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.131	0.003	1.328	0.183	0.047	0.020	350.234	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.195	0.005	1.483	0.230	0.055	0.023	538.433	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.079	0.002	0.250	0.016	0.053	0.025	221.197	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.067	0.003	0.174	0.021	0.054	0.026	303.326	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.858	0.010	0.656	0.111	0.142	0.073	1041.089	0.027
	NA	MC	Motorcycles	1.229	0.002	22.986	4.071	0.019	0.009	235.789	0.054
San Francisco	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.067	0.003	1.002	0.104	0.047	0.020	284.511	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.110	0.004	1.298	0.169	0.047	0.020	354.222	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.174	0.006	1.411	0.198	0.060	0.025	564.389	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.078	0.002	0.370	0.023	0.053	0.026	230.094	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.054	0.003	0.249	0.026	0.052	0.024	325.223	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.275	0.010	0.430	0.080	0.141	0.070	1081.043	0.027
	NA	MC	Motorcycles	1.268	0.002	23.955	4.791	0.019	0.009	247.572	0.054
San Joaquin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.065	0.003	0.898	0.097	0.046	0.019	275.777	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.137	0.003	1.334	0.199	0.047	0.019	342.086	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.223	0.005	1.644	0.283	0.052	0.022	511.963	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.084	0.002	0.179	0.012	0.052	0.024	204.875	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.059	0.003	0.123	0.015	0.053	0.025	280.148	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.078	0.011	0.726	0.103	0.140	0.072	1204.243	0.027
	NA	MC	Motorcycles	1.260	0.002	24.462	4.260	0.018	0.009	231.627	0.054
San Luis Obispo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.070	0.003	0.942	0.100	0.046	0.019	267.898	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.160	0.003	1.434	0.218	0.047	0.019	343.771	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.254	0.005	1.765	0.303	0.054	0.023	530.550	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.110	0.002	0.248	0.018	0.054	0.027	209.824	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.081	0.003	0.171	0.021	0.055	0.027	285.625	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.493	0.009	0.782	0.147	0.145	0.079	953.773	0.027
NA	MC	Motorcycles	1.301	0.002	24.881	4.910	0.019	0.009	232.726	0.054	

**Table 5-36. EMFAC County-Specific On-Road Vehicle EFs – 2022 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
San Mateo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.069	0.003	0.969	0.111	0.046	0.019	265.365	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.099	0.003	1.152	0.146	0.047	0.019	319.622	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.157	0.005	1.313	0.192	0.055	0.023	504.906	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.072	0.002	0.196	0.013	0.051	0.024	204.009	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.045	0.003	0.125	0.015	0.051	0.023	278.015	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.029	0.009	0.439	0.088	0.134	0.066	914.506	0.027
	NA	MC	Motorcycles	1.222	0.002	21.321	3.504	0.019	0.009	227.696	0.054
Santa Barbara	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.079	0.003	0.997	0.114	0.046	0.019	265.365	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.189	0.003	1.559	0.235	0.047	0.019	338.849	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.264	0.005	1.804	0.303	0.060	0.025	531.425	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.106	0.002	0.215	0.015	0.053	0.026	203.144	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.080	0.003	0.146	0.017	0.054	0.026	278.547	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.466	0.010	0.658	0.125	0.168	0.088	1047.665	0.027
	NA	MC	Motorcycles	1.263	0.002	22.637	3.869	0.018	0.008	221.736	0.054
Santa Clara	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.067	0.003	0.952	0.097	0.046	0.019	268.868	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.126	0.003	1.330	0.177	0.047	0.019	334.948	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.206	0.005	1.584	0.246	0.055	0.023	515.755	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.076	0.002	0.207	0.014	0.052	0.025	203.104	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.053	0.003	0.138	0.016	0.052	0.024	281.828	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.786	0.010	0.616	0.101	0.139	0.070	1105.851	0.027
	NA	MC	Motorcycles	1.230	0.002	21.863	3.966	0.019	0.009	227.588	0.054
Santa Cruz	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.092	0.003	1.208	0.123	0.047	0.020	282.306	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.215	0.004	1.856	0.267	0.047	0.020	362.107	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.291	0.005	2.057	0.334	0.054	0.023	543.997	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.198	0.002	0.419	0.034	0.062	0.034	228.793	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.126	0.003	0.264	0.034	0.060	0.032	304.404	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.541	0.009	0.675	0.137	0.160	0.087	977.799	0.027
	NA	MC	Motorcycles	1.299	0.002	25.318	5.181	0.019	0.009	240.491	0.054
Shasta	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.070	0.003	1.008	0.104	0.047	0.019	282.238	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.180	0.004	1.641	0.251	0.047	0.020	357.364	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.274	0.005	2.013	0.368	0.054	0.023	547.211	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.119	0.002	0.296	0.020	0.054	0.027	212.891	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.081	0.003	0.196	0.024	0.055	0.027	285.527	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.736	0.011	0.897	0.131	0.141	0.075	1194.958	0.027
	NA	MC	Motorcycles	1.295	0.002	25.980	5.333	0.019	0.009	240.264	0.054
Sierra	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.086	0.003	1.190	0.118	0.047	0.020	299.307	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.223	0.004	2.036	0.313	0.048	0.020	384.257	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.363	0.006	2.914	0.603	0.055	0.024	572.100	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.073	0.002	0.455	0.025	0.051	0.023	233.561	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.039	0.003	0.249	0.030	0.049	0.022	294.156	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.669	0.007	0.942	0.181	0.135	0.077	787.807	0.027
	NA	MC	Motorcycles	1.362	0.003	28.479	5.411	0.019	0.009	261.938	0.054
Siskiyou	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.087	0.003	1.165	0.125	0.047	0.020	295.771	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.232	0.004	2.004	0.343	0.048	0.020	379.576	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.359	0.006	2.709	0.590	0.055	0.024	572.145	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.203	0.002	0.463	0.033	0.060	0.032	236.592	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.127	0.003	0.311	0.039	0.060	0.033	317.853	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.609	0.012	1.012	0.124	0.135	0.071	1224.608	0.027
	NA	MC	Motorcycles	1.377	0.003	29.594	5.500	0.019	0.009	259.191	0.054
Solano	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.069	0.003	0.908	0.095	0.047	0.019	281.442	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.129	0.003	1.261	0.184	0.047	0.019	351.289	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.217	0.005	1.550	0.268	0.054	0.023	541.899	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.093	0.002	0.234	0.016	0.053	0.026	219.647	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.051	0.003	0.136	0.016	0.051	0.023	296.402	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.150	0.011	0.795	0.111	0.134	0.070	1204.765	0.027
NA	MC	Motorcycles	1.268	0.002	25.304	4.023	0.018	0.009	237.399	0.054	

**Table 5-36. EMFAC County-Specific On-Road Vehicle EFs – 2022 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Sonoma	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.079	0.003	1.061	0.110	0.047	0.020	277.426	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.170	0.003	1.618	0.246	0.047	0.020	350.821	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.274	0.005	1.969	0.365	0.056	0.023	551.547	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.162	0.002	0.313	0.024	0.058	0.031	225.712	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.099	0.003	0.202	0.026	0.058	0.030	305.106	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.013	0.009	0.683	0.128	0.148	0.079	961.047	0.027
	NA	MC	Motorcycles	1.282	0.002	25.344	4.784	0.019	0.009	237.659	0.054
Stanislaus	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.067	0.003	0.978	0.102	0.047	0.019	281.079	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.156	0.004	1.564	0.231	0.047	0.020	354.421	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.238	0.005	1.791	0.304	0.054	0.023	533.683	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.085	0.002	0.281	0.018	0.052	0.025	209.739	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.076	0.003	0.198	0.025	0.055	0.027	286.655	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.087	0.011	0.736	0.109	0.140	0.073	1153.527	0.027
	NA	MC	Motorcycles	1.264	0.002	24.873	4.938	0.019	0.009	236.239	0.054
Sutter	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.069	0.003	0.984	0.103	0.046	0.019	269.473	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.164	0.003	1.538	0.226	0.047	0.019	336.997	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.237	0.005	1.772	0.315	0.053	0.022	514.350	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.082	0.002	0.192	0.013	0.052	0.024	192.460	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.082	0.002	0.147	0.018	0.054	0.027	263.440	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.147	0.011	0.807	0.111	0.139	0.072	1187.532	0.027
	NA	MC	Motorcycles	1.261	0.002	23.026	4.940	0.019	0.009	227.867	0.054
Tehama	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.072	0.003	0.986	0.099	0.047	0.019	281.158	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.191	0.004	1.660	0.247	0.047	0.020	356.240	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.271	0.005	1.963	0.354	0.053	0.022	537.550	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.121	0.002	0.298	0.021	0.055	0.028	213.828	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.113	0.003	0.228	0.031	0.060	0.033	289.261	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.652	0.012	0.919	0.126	0.137	0.073	1234.787	0.027
	NA	MC	Motorcycles	1.312	0.002	26.309	4.978	0.019	0.009	241.338	0.054
Trinity	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.088	0.003	1.235	0.123	0.047	0.020	313.984	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.259	0.004	2.301	0.363	0.048	0.021	403.903	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.340	0.006	2.643	0.563	0.055	0.024	591.208	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.182	0.002	0.583	0.046	0.066	0.038	253.663	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.122	0.003	0.358	0.045	0.061	0.033	324.845	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.780	0.011	0.964	0.140	0.138	0.074	1114.517	0.027
	NA	MC	Motorcycles	1.358	0.003	29.699	5.883	0.020	0.010	271.322	0.054
Tulare	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.064	0.003	0.910	0.095	0.046	0.019	276.031	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.183	0.003	1.664	0.248	0.047	0.020	347.919	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.241	0.005	1.805	0.295	0.052	0.022	516.670	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.078	0.002	0.179	0.013	0.052	0.025	196.573	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.079	0.003	0.150	0.021	0.057	0.029	269.437	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.153	0.011	0.754	0.111	0.142	0.074	1157.574	0.027
	NA	MC	Motorcycles	1.250	0.002	23.558	4.509	0.018	0.008	227.827	0.054
Tuolumne	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.099	0.003	1.264	0.145	0.047	0.020	288.315	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.279	0.004	2.325	0.419	0.048	0.020	376.684	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.433	0.006	3.197	0.691	0.056	0.024	582.528	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.193	0.002	0.392	0.029	0.059	0.031	222.323	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.170	0.003	0.287	0.034	0.060	0.032	299.289	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.130	0.007	0.933	0.191	0.156	0.088	792.774	0.027
	NA	MC	Motorcycles	1.337	0.002	28.165	5.813	0.019	0.009	245.839	0.054
Ventura	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.065	0.003	0.948	0.095	0.047	0.019	271.572	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.138	0.003	1.425	0.189	0.047	0.020	340.803	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.222	0.005	1.676	0.263	0.054	0.023	509.277	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.083	0.002	0.266	0.018	0.053	0.026	210.629	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.079	0.003	0.192	0.023	0.055	0.027	290.585	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.640	0.009	0.509	0.071	0.136	0.069	907.357	0.027
	NA	MC	Motorcycles	1.261	0.002	23.685	5.144	0.019	0.009	238.948	0.054

**Table 5-36. EMFAC County-Specific On-Road Vehicle EFs – 2022 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Yolo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.060	0.003	0.862	0.087	0.046	0.019	272.491	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.126	0.003	1.285	0.192	0.047	0.019	341.422	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.199	0.005	1.485	0.251	0.053	0.022	519.263	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.102	0.002	0.205	0.014	0.052	0.025	208.134	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.069	0.003	0.134	0.015	0.052	0.025	286.449	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.641	0.010	0.569	0.088	0.141	0.071	1084.062	0.027
	NA	MC	Motoreycles	1.262	0.002	24.461	4.395	0.018	0.009	231.862	0.054
Yuba	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.071	0.003	1.002	0.096	0.046	0.019	276.311	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.198	0.003	1.736	0.263	0.047	0.020	350.425	0.023
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.292	0.005	2.133	0.368	0.053	0.022	520.234	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.106	0.002	0.228	0.017	0.054	0.026	202.151	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.134	0.003	0.175	0.020	0.054	0.027	266.275	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.957	0.009	0.840	0.163	0.157	0.085	931.279	0.027
	NA	MC	Motoreycles	1.268	0.002	24.294	4.635	0.018	0.009	227.784	0.054

**Table 5-37. EMFAC County-Specific On-Road Vehicle EFs – 2023**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Alameda	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.061	0.002	0.853	0.093	0.043	0.018	246.941	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.105	0.003	1.126	0.158	0.043	0.018	305.584	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.177	0.005	1.352	0.222	0.050	0.021	477.277	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.082	0.002	0.229	0.016	0.050	0.024	195.564	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.053	0.003	0.148	0.017	0.049	0.023	268.980	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.757	0.012	0.620	0.064	0.137	0.065	1280.924	0.027
	NA	MC	Motorcycles	1.133	0.002	20.881	3.747	0.017	0.008	211.149	0.054
Alpine	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.067	0.002	0.959	0.095	0.042	0.018	234.364	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.152	0.003	1.466	0.236	0.043	0.018	297.832	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.231	0.005	1.666	0.373	0.049	0.021	457.367	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.068	0.002	0.214	0.012	0.046	0.021	175.443	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.028	0.002	0.145	0.015	0.046	0.020	249.098	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.132	0.011	0.962	0.103	0.135	0.068	1185.574	0.027
	NA	MC	Motorcycles	1.215	0.002	23.256	3.992	0.017	0.008	209.861	0.054
Amador	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.084	0.002	1.062	0.124	0.044	0.018	248.031	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.264	0.003	2.128	0.392	0.044	0.019	325.403	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.326	0.005	2.289	0.668	0.051	0.022	511.280	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.153	0.002	0.215	0.017	0.053	0.027	181.540	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.173	0.002	0.182	0.021	0.057	0.030	252.606	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.660	0.008	0.733	0.134	0.141	0.075	852.083	0.027
	NA	MC	Motorcycles	1.185	0.002	22.496	4.579	0.017	0.008	204.073	0.054
Butte	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.071	0.003	1.008	0.108	0.044	0.018	263.911	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.197	0.003	1.744	0.278	0.044	0.018	332.612	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.262	0.005	1.919	0.372	0.050	0.021	494.542	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.120	0.002	0.265	0.020	0.053	0.027	201.902	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.125	0.003	0.199	0.026	0.058	0.031	275.763	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.292	0.010	0.821	0.109	0.132	0.068	1084.703	0.027
	NA	MC	Motorcycles	1.158	0.002	22.597	4.893	0.017	0.008	214.074	0.054
Calaveras	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.085	0.003	1.126	0.132	0.044	0.018	258.618	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.283	0.003	2.414	0.402	0.045	0.019	345.005	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.341	0.005	2.459	0.657	0.051	0.022	522.234	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.166	0.002	0.341	0.025	0.055	0.029	198.701	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.184	0.003	0.318	0.046	0.070	0.043	280.953	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.774	0.008	0.864	0.149	0.140	0.076	846.188	0.027
	NA	MC	Motorcycles	1.195	0.002	23.750	5.187	0.017	0.008	218.073	0.054
Colusa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.058	0.002	0.819	0.089	0.043	0.018	251.102	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.131	0.003	1.261	0.198	0.043	0.018	312.375	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.192	0.005	1.448	0.264	0.048	0.020	473.083	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.080	0.002	0.209	0.013	0.048	0.023	188.576	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.050	0.002	0.135	0.017	0.050	0.024	251.122	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.044	0.011	0.822	0.094	0.128	0.065	1160.966	0.027
	NA	MC	Motorcycles	1.134	0.002	20.915	3.974	0.017	0.008	208.893	0.054
Contra Costa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.059	0.002	0.837	0.090	0.043	0.018	247.173	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.104	0.003	1.119	0.154	0.043	0.018	306.931	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.181	0.005	1.386	0.222	0.049	0.020	466.983	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.068	0.002	0.198	0.013	0.049	0.023	194.250	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.046	0.003	0.134	0.015	0.048	0.022	271.602	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.719	0.011	0.652	0.084	0.141	0.069	1131.058	0.027
	NA	MC	Motorcycles	1.132	0.002	21.087	3.774	0.017	0.008	209.579	0.054
Del Norte	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.081	0.003	1.014	0.114	0.044	0.018	269.648	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.265	0.003	2.018	0.373	0.045	0.019	351.920	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.281	0.005	1.892	0.455	0.050	0.021	518.671	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.172	0.002	0.379	0.029	0.057	0.031	218.604	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.216	0.003	0.387	0.051	0.073	0.046	301.712	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.656	0.007	0.886	0.167	0.139	0.077	703.780	0.027
	NA	MC	Motorcycles	1.237	0.002	25.388	4.858	0.018	0.008	228.923	0.054

**Table 5-37. EMFAC County-Specific On-Road Vehicle EFs – 2023 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
El Dorado	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.062	0.002	0.925	0.088	0.043	0.018	250.594	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.153	0.003	1.487	0.233	0.044	0.018	326.828	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.236	0.005	1.788	0.346	0.050	0.021	490.838	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.102	0.002	0.238	0.016	0.049	0.024	193.558	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.062	0.003	0.161	0.018	0.050	0.024	276.366	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.115	0.008	0.728	0.129	0.133	0.069	798.739	0.027
	NA	MC	Motorcycles	1.217	0.002	24.413	5.301	0.017	0.008	223.146	0.054
Fresno	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.056	0.002	0.806	0.089	0.043	0.018	252.486	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.125	0.003	1.241	0.198	0.043	0.018	317.082	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.187	0.005	1.426	0.256	0.048	0.020	470.205	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.059	0.002	0.162	0.011	0.049	0.023	188.130	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.059	0.002	0.126	0.015	0.051	0.025	259.930	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.903	0.012	0.716	0.072	0.140	0.068	1286.034	0.027
	NA	MC	Motorcycles	1.125	0.002	21.411	3.866	0.016	0.008	205.692	0.054
Glenn	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.060	0.003	0.879	0.093	0.043	0.018	259.124	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.137	0.003	1.331	0.220	0.043	0.018	317.814	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.209	0.005	1.620	0.307	0.048	0.020	475.980	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.074	0.002	0.262	0.017	0.050	0.024	196.809	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.053	0.002	0.177	0.021	0.051	0.024	259.111	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.108	0.010	0.825	0.103	0.129	0.066	1103.379	0.027
	NA	MC	Motorcycles	1.137	0.002	21.655	4.446	0.017	0.008	213.259	0.054
Humboldt	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.081	0.003	1.018	0.117	0.044	0.018	257.768	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.220	0.003	1.782	0.337	0.044	0.019	331.407	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.277	0.005	1.906	0.476	0.050	0.021	497.317	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.259	0.002	0.346	0.028	0.059	0.032	206.644	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.144	0.003	0.219	0.025	0.056	0.029	281.972	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.510	0.009	0.848	0.135	0.132	0.070	912.942	0.027
	NA	MC	Motorcycles	1.231	0.002	24.561	4.646	0.017	0.008	219.223	0.054
Imperial	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.059	0.003	0.885	0.110	0.043	0.018	253.661	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.155	0.003	1.542	0.274	0.043	0.018	316.402	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.193	0.004	1.577	0.337	0.049	0.020	452.642	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.085	0.002	0.169	0.013	0.051	0.025	178.303	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.069	0.002	0.121	0.016	0.052	0.025	245.522	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.507	0.011	0.773	0.067	0.129	0.063	1121.434	0.027
	NA	MC	Motorcycles	1.063	0.002	19.108	3.891	0.016	0.007	197.386	0.054
Inyo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.064	0.003	0.893	0.103	0.043	0.018	258.726	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.151	0.003	1.415	0.272	0.043	0.018	327.909	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.241	0.005	1.825	0.444	0.051	0.021	507.085	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.098	0.002	0.268	0.018	0.050	0.025	195.724	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.040	0.003	0.166	0.018	0.048	0.022	270.726	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.991	0.009	0.885	0.117	0.127	0.066	1001.278	0.027
	NA	MC	Motorcycles	1.165	0.002	22.707	4.497	0.017	0.008	217.459	0.054
Kern	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.058	0.003	0.829	0.088	0.043	0.018	260.779	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.126	0.003	1.244	0.187	0.044	0.018	326.794	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.188	0.005	1.434	0.247	0.049	0.021	492.466	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.068	0.002	0.214	0.014	0.049	0.024	203.178	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.051	0.003	0.146	0.016	0.050	0.023	282.567	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.978	0.013	0.812	0.076	0.136	0.067	1333.140	0.027
	NA	MC	Motorcycles	1.142	0.002	22.636	3.810	0.017	0.008	213.343	0.054
Kings	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.053	0.002	0.802	0.083	0.043	0.018	252.538	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.132	0.003	1.321	0.198	0.043	0.018	317.555	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.176	0.005	1.398	0.247	0.048	0.020	465.007	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.057	0.002	0.208	0.013	0.049	0.023	183.460	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.074	0.002	0.170	0.021	0.053	0.026	256.710	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.044	0.013	0.819	0.077	0.135	0.067	1347.830	0.027
NA	MC	Motorcycles	1.109	0.002	20.148	3.716	0.016	0.008	204.680	0.054	

**Table 5-37. EMFAC County-Specific On-Road Vehicle EFs – 2023 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Lake	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.105	0.003	1.275	0.149	0.045	0.019	270.532	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.241	0.003	1.999	0.401	0.045	0.019	344.422	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.338	0.005	2.416	0.647	0.051	0.022	518.221	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.238	0.002	0.369	0.033	0.063	0.036	209.536	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.162	0.003	0.251	0.029	0.059	0.032	282.410	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.624	0.008	0.787	0.138	0.136	0.073	877.120	0.027
	NA	MC	Motorcycles	1.211	0.002	24.817	5.327	0.018	0.008	222.024	0.054
Lassen	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.069	0.003	0.981	0.106	0.043	0.018	261.670	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.183	0.003	1.665	0.308	0.044	0.019	335.538	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.300	0.005	2.215	0.544	0.050	0.021	516.244	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.113	0.002	0.344	0.021	0.050	0.024	205.547	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.119	0.003	0.272	0.034	0.058	0.031	276.551	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.207	0.007	0.811	0.152	0.128	0.070	700.484	0.027
	NA	MC	Motorcycles	1.228	0.002	25.201	4.807	0.017	0.008	227.553	0.054
Los Angeles	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.057	0.002	0.885	0.086	0.042	0.017	251.758	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.116	0.003	1.315	0.156	0.043	0.018	314.432	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.182	0.005	1.513	0.212	0.051	0.021	471.791	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.069	0.002	0.282	0.019	0.049	0.024	194.631	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.054	0.003	0.198	0.023	0.049	0.024	273.503	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.254	0.010	0.480	0.047	0.130	0.060	1029.002	0.027
	NA	MC	Motorcycles	1.094	0.002	19.602	4.069	0.017	0.008	217.253	0.054
Madera	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.058	0.003	0.903	0.087	0.044	0.018	267.437	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.146	0.003	1.488	0.227	0.044	0.018	333.594	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.220	0.005	1.702	0.288	0.052	0.022	502.499	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.073	0.002	0.295	0.018	0.050	0.024	200.140	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.082	0.003	0.215	0.025	0.052	0.025	277.522	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.030	0.012	0.794	0.082	0.138	0.069	1280.719	0.027
	NA	MC	Motorcycles	1.114	0.002	20.928	3.794	0.017	0.008	210.466	0.054
Marin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.065	0.002	0.866	0.101	0.042	0.018	245.273	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.106	0.003	1.101	0.172	0.043	0.018	309.475	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.179	0.005	1.343	0.233	0.051	0.021	486.531	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.099	0.002	0.240	0.017	0.050	0.025	199.707	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.043	0.003	0.145	0.015	0.048	0.022	286.075	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.386	0.009	0.575	0.089	0.129	0.063	932.086	0.027
	NA	MC	Motorcycles	1.149	0.002	21.739	3.897	0.017	0.008	213.214	0.054
Mariposa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.094	0.003	1.205	0.131	0.045	0.019	269.936	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.289	0.004	2.335	0.450	0.045	0.019	357.341	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.447	0.006	3.217	0.758	0.054	0.023	560.936	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.208	0.002	0.426	0.036	0.062	0.035	215.408	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.070	0.003	0.248	0.028	0.055	0.028	291.031	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	4.084	0.007	0.894	0.178	0.152	0.083	714.997	0.027
	NA	MC	Motorcycles	1.239	0.002	26.036	5.499	0.018	0.009	228.101	0.054
Mendocino	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.075	0.002	0.982	0.112	0.043	0.018	250.413	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.202	0.003	1.719	0.326	0.044	0.019	324.338	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.272	0.005	1.933	0.486	0.050	0.021	496.042	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.240	0.002	0.332	0.028	0.059	0.033	200.107	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.271	0.003	0.282	0.032	0.061	0.034	278.988	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.348	0.010	0.852	0.116	0.131	0.068	1035.824	0.027
	NA	MC	Motorcycles	1.196	0.002	23.243	4.509	0.017	0.008	215.143	0.054
Merced	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.061	0.003	0.887	0.089	0.044	0.018	266.040	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.166	0.003	1.571	0.233	0.044	0.018	334.925	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.231	0.005	1.737	0.283	0.049	0.021	491.780	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.081	0.002	0.260	0.016	0.050	0.024	200.150	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.104	0.003	0.213	0.027	0.056	0.029	275.791	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.111	0.013	0.814	0.075	0.139	0.069	1371.203	0.027
	NA	MC	Motorcycles	1.114	0.002	21.074	3.547	0.017	0.008	207.723	0.054



**Table 5-37. EMFAC County-Specific On-Road Vehicle EFs – 2023 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Modoc	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.074	0.003	1.066	0.108	0.043	0.018	278.385	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.195	0.004	1.808	0.297	0.044	0.019	356.394	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.342	0.005	2.604	0.613	0.051	0.022	539.767	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.119	0.002	0.481	0.032	0.054	0.028	223.689	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.150	0.003	0.368	0.049	0.064	0.037	313.715	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.470	0.007	0.840	0.152	0.131	0.072	758.461	0.027
	NA	MC	Motorcycles	1.255	0.002	26.681	5.078	0.018	0.009	243.638	0.054
Mono	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.070	0.002	0.945	0.095	0.043	0.018	249.804	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.169	0.003	1.496	0.255	0.043	0.018	322.506	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.271	0.005	1.978	0.451	0.050	0.021	491.028	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.137	0.002	0.316	0.023	0.053	0.027	198.242	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.093	0.003	0.204	0.020	0.049	0.023	281.032	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.079	0.010	0.922	0.110	0.127	0.066	1095.309	0.027
	NA	MC	Motorcycles	1.280	0.002	27.157	4.488	0.017	0.008	227.506	0.054
Monterey	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.072	0.003	0.991	0.103	0.044	0.018	269.396	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.175	0.003	1.591	0.223	0.044	0.019	346.227	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.236	0.005	1.717	0.279	0.050	0.021	508.229	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.125	0.002	0.377	0.028	0.056	0.030	211.926	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.070	0.003	0.252	0.029	0.053	0.027	296.932	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.891	0.010	0.648	0.088	0.140	0.069	1049.167	0.027
	NA	MC	Motorcycles	1.135	0.002	20.913	3.598	0.017	0.008	217.351	0.054
Napa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.061	0.002	0.861	0.087	0.043	0.018	243.332	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.127	0.003	1.272	0.185	0.043	0.018	307.292	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.223	0.005	1.607	0.289	0.050	0.021	491.272	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.089	0.002	0.220	0.016	0.051	0.025	191.864	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.061	0.003	0.145	0.015	0.049	0.023	271.068	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.111	0.011	0.677	0.091	0.147	0.072	1144.823	0.027
	NA	MC	Motorcycles	1.135	0.002	21.067	3.721	0.017	0.008	205.181	0.054
Nevada	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.070	0.002	0.941	0.101	0.044	0.018	250.218	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.208	0.003	1.695	0.265	0.044	0.019	337.664	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.290	0.005	1.966	0.385	0.050	0.021	503.497	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.130	0.002	0.258	0.017	0.051	0.025	193.923	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.146	0.003	0.210	0.023	0.055	0.028	281.958	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.408	0.010	0.901	0.115	0.129	0.067	1101.958	0.027
	NA	MC	Motorcycles	1.255	0.002	25.879	5.207	0.018	0.008	221.228	0.054
Orange	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.050	0.002	0.806	0.078	0.042	0.017	242.394	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.093	0.003	1.117	0.142	0.042	0.018	301.983	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.154	0.005	1.286	0.187	0.051	0.021	469.386	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.051	0.002	0.227	0.014	0.047	0.022	186.775	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.043	0.002	0.160	0.018	0.047	0.022	261.374	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.949	0.009	0.361	0.040	0.133	0.061	909.033	0.027
	NA	MC	Motorcycles	1.078	0.002	19.013	3.898	0.017	0.008	208.849	0.054
Placer	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.059	0.002	0.870	0.087	0.043	0.018	244.436	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.101	0.003	1.130	0.157	0.043	0.018	306.859	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.180	0.005	1.434	0.239	0.049	0.020	467.559	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.086	0.002	0.206	0.014	0.049	0.023	185.606	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.042	0.002	0.130	0.014	0.048	0.022	259.885	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.713	0.010	0.724	0.087	0.131	0.064	1080.579	0.027
	NA	MC	Motorcycles	1.176	0.002	22.487	4.229	0.017	0.008	212.549	0.054
Plumas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.082	0.003	1.134	0.117	0.044	0.019	268.996	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.244	0.004	2.134	0.359	0.044	0.019	357.805	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.375	0.005	2.857	0.673	0.051	0.022	528.232	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.145	0.002	0.453	0.031	0.055	0.029	216.352	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.109	0.003	0.327	0.036	0.054	0.027	309.441	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.645	0.008	0.839	0.150	0.129	0.071	812.306	0.027
NA	MC	Motorcycles	1.242	0.002	26.379	5.220	0.018	0.009	235.863	0.054	

**Table 5-37. EMFAC County-Specific On-Road Vehicle EFs – 2023 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Riverside	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.051	0.002	0.796	0.081	0.043	0.018	246.041	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.110	0.003	1.217	0.162	0.043	0.018	305.492	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.160	0.004	1.315	0.205	0.049	0.020	436.295	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.045	0.002	0.161	0.010	0.047	0.021	180.895	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.039	0.002	0.111	0.013	0.048	0.022	245.033	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.439	0.011	0.692	0.060	0.132	0.064	1136.391	0.027
	NA	MC	Motorcycles	1.075	0.002	19.431	3.688	0.016	0.008	201.842	0.054
Sacramento	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.062	0.003	0.928	0.103	0.043	0.018	253.358	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.113	0.003	1.269	0.186	0.043	0.018	314.639	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.198	0.005	1.549	0.268	0.050	0.021	489.877	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.077	0.002	0.223	0.015	0.050	0.024	190.785	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.107	0.003	0.189	0.021	0.052	0.026	272.916	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.137	0.011	0.649	0.089	0.141	0.069	1111.451	0.027
	NA	MC	Motorcycles	1.129	0.002	20.968	4.247	0.017	0.008	209.561	0.054
San Benito	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.062	0.002	0.869	0.088	0.044	0.018	250.862	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.135	0.003	1.288	0.206	0.044	0.018	315.995	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.207	0.005	1.517	0.279	0.048	0.020	473.692	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.120	0.002	0.257	0.018	0.051	0.025	190.935	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.040	0.002	0.151	0.018	0.050	0.023	262.404	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.239	0.012	0.883	0.085	0.131	0.066	1312.664	0.027
	NA	MC	Motorcycles	1.136	0.002	20.883	3.614	0.017	0.008	206.321	0.054
San Bernardino	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.054	0.002	0.821	0.080	0.043	0.018	249.029	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.124	0.003	1.287	0.181	0.043	0.018	309.458	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.187	0.004	1.461	0.231	0.049	0.021	453.691	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.063	0.002	0.192	0.013	0.049	0.023	186.777	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.051	0.002	0.133	0.016	0.049	0.023	256.309	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.594	0.011	0.700	0.062	0.134	0.065	1147.738	0.027
	NA	MC	Motorcycles	1.098	0.002	20.305	3.404	0.016	0.007	201.020	0.054
San Diego	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.053	0.002	0.773	0.081	0.043	0.018	249.341	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.111	0.003	1.158	0.166	0.042	0.018	312.301	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.166	0.005	1.281	0.207	0.049	0.021	480.108	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.064	0.002	0.228	0.014	0.048	0.023	200.799	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.058	0.003	0.163	0.019	0.049	0.024	277.578	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.624	0.010	0.617	0.084	0.138	0.067	1057.670	0.027
	NA	MC	Motorcycles	1.104	0.002	20.540	3.719	0.017	0.008	211.758	0.054
San Francisco	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.058	0.002	0.875	0.092	0.042	0.018	250.641	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.095	0.003	1.158	0.156	0.043	0.018	320.006	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.151	0.005	1.260	0.183	0.055	0.023	511.521	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.064	0.002	0.333	0.020	0.047	0.023	203.384	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.049	0.003	0.240	0.024	0.048	0.022	299.212	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.116	0.011	0.378	0.051	0.137	0.062	1115.071	0.027
	NA	MC	Motorcycles	1.141	0.002	21.460	4.380	0.017	0.008	222.832	0.054
San Joaquin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.057	0.003	0.805	0.088	0.043	0.018	253.514	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.117	0.003	1.176	0.181	0.043	0.018	312.208	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.191	0.005	1.434	0.258	0.048	0.020	461.639	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.068	0.002	0.166	0.011	0.049	0.023	193.497	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.052	0.003	0.117	0.014	0.050	0.024	265.880	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.875	0.012	0.707	0.075	0.139	0.068	1248.035	0.027
	NA	MC	Motorcycles	1.138	0.002	21.921	3.914	0.017	0.008	209.341	0.054
San Luis Obispo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.061	0.002	0.839	0.090	0.043	0.018	244.650	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.138	0.003	1.273	0.201	0.043	0.018	315.305	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.221	0.005	1.557	0.280	0.050	0.021	481.834	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.092	0.002	0.228	0.016	0.050	0.024	192.004	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.071	0.003	0.163	0.019	0.052	0.026	270.996	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.008	0.009	0.690	0.112	0.130	0.067	903.515	0.027
	NA	MC	Motorcycles	1.181	0.002	22.465	4.541	0.017	0.008	211.541	0.054

**Table 5-37. EMFAC County-Specific On-Road Vehicle EFs – 2023 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
San Mateo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.058	0.002	0.818	0.097	0.040	0.016	225.088	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.086	0.003	1.033	0.135	0.043	0.018	287.550	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.135	0.004	1.168	0.177	0.050	0.021	453.686	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.055	0.002	0.169	0.010	0.044	0.020	173.895	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.040	0.002	0.119	0.013	0.047	0.022	254.338	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.860	0.009	0.396	0.064	0.130	0.060	925.958	0.027
	NA	MC	Motorcycles	1.101	0.002	19.109	3.196	0.017	0.008	205.117	0.054
Santa Barbara	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.068	0.002	0.882	0.103	0.043	0.018	242.796	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.163	0.003	1.386	0.216	0.044	0.018	312.071	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.229	0.005	1.591	0.280	0.056	0.023	483.510	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.088	0.002	0.198	0.013	0.049	0.024	188.230	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.070	0.003	0.139	0.016	0.051	0.025	265.482	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.985	0.009	0.566	0.085	0.152	0.075	1002.586	0.027
	NA	MC	Motorcycles	1.146	0.002	20.430	3.573	0.017	0.008	201.383	0.054
Santa Clara	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.058	0.002	0.843	0.087	0.043	0.018	243.067	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.108	0.003	1.177	0.162	0.043	0.018	302.161	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.177	0.005	1.393	0.225	0.050	0.021	466.485	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.062	0.002	0.191	0.012	0.048	0.023	187.005	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.047	0.002	0.133	0.015	0.048	0.023	261.175	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.613	0.011	0.593	0.073	0.139	0.066	1161.696	0.027
	NA	MC	Motorcycles	1.114	0.002	19.693	3.643	0.017	0.008	206.168	0.054
Santa Cruz	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.080	0.003	1.075	0.111	0.044	0.019	261.022	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.185	0.003	1.638	0.244	0.044	0.019	331.901	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.252	0.005	1.803	0.306	0.050	0.021	493.371	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.166	0.002	0.388	0.030	0.057	0.031	211.311	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.109	0.003	0.253	0.030	0.056	0.029	289.306	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.010	0.009	0.561	0.095	0.140	0.070	924.045	0.027
	NA	MC	Motorcycles	1.178	0.002	22.844	4.780	0.017	0.008	218.238	0.054
Shasta	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.061	0.003	0.892	0.093	0.043	0.018	256.830	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.153	0.003	1.434	0.228	0.043	0.018	323.191	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.234	0.005	1.740	0.336	0.049	0.021	490.220	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.096	0.002	0.273	0.018	0.050	0.024	196.218	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.070	0.003	0.188	0.022	0.052	0.025	268.483	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.319	0.011	0.846	0.102	0.132	0.068	1160.588	0.027
	NA	MC	Motorcycles	1.174	0.002	23.450	4.939	0.017	0.008	218.142	0.054
Sierra	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.073	0.003	1.042	0.106	0.043	0.018	269.229	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.190	0.003	1.775	0.285	0.044	0.019	347.264	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.313	0.005	2.535	0.564	0.051	0.022	515.594	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.061	0.002	0.427	0.023	0.047	0.021	213.750	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.038	0.003	0.253	0.029	0.047	0.021	278.078	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.194	0.007	0.854	0.154	0.121	0.067	727.459	0.027
	NA	MC	Motorcycles	1.233	0.002	25.618	4.932	0.017	0.008	237.185	0.054
Siskiyou	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.075	0.003	1.025	0.111	0.043	0.018	268.229	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.199	0.003	1.754	0.314	0.044	0.019	344.595	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.310	0.005	2.335	0.552	0.050	0.022	517.192	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.167	0.002	0.424	0.029	0.054	0.029	216.302	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.109	0.003	0.295	0.035	0.056	0.030	296.823	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.327	0.011	0.998	0.109	0.130	0.067	1194.401	0.027
	NA	MC	Motorcycles	1.252	0.002	26.745	5.058	0.018	0.009	235.752	0.054
Solano	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.060	0.003	0.810	0.086	0.043	0.018	257.457	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.110	0.003	1.109	0.167	0.043	0.018	318.242	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.186	0.005	1.349	0.244	0.049	0.021	487.072	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.077	0.002	0.216	0.014	0.050	0.024	204.568	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.045	0.003	0.132	0.015	0.048	0.022	279.095	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.972	0.012	0.788	0.085	0.135	0.067	1254.337	0.027
	NA	MC	Motorcycles	1.147	0.002	22.712	3.687	0.017	0.008	214.965	0.054

Table 5-37. EMFAC County-Specific On-Road Vehicle EFs – 2023 (cont.)

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Sonoma	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.068	0.003	0.946	0.099	0.044	0.018	255.830	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.145	0.003	1.408	0.222	0.043	0.018	315.702	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.234	0.005	1.700	0.333	0.051	0.021	494.729	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.134	0.002	0.287	0.021	0.054	0.028	209.462	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.085	0.003	0.189	0.023	0.053	0.027	283.739	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.668	0.009	0.606	0.094	0.137	0.068	946.453	0.027
	NA	MC	Motorcycles	1.158	0.002	22.728	4.379	0.017	0.008	214.844	0.054
Stanislaus	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.059	0.003	0.879	0.092	0.044	0.018	259.842	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.133	0.003	1.373	0.210	0.044	0.018	323.817	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.204	0.005	1.561	0.278	0.050	0.021	480.894	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.070	0.002	0.268	0.016	0.050	0.023	199.223	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.066	0.003	0.193	0.023	0.052	0.025	273.602	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.883	0.011	0.713	0.082	0.138	0.068	1193.229	0.027
	NA	MC	Motorcycles	1.143	0.002	22.347	4.549	0.017	0.008	213.889	0.054
Sutter	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.060	0.002	0.880	0.094	0.043	0.018	247.429	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.140	0.003	1.351	0.205	0.043	0.018	306.318	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.204	0.005	1.547	0.290	0.048	0.020	462.381	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.066	0.002	0.179	0.011	0.049	0.023	180.696	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.072	0.002	0.140	0.017	0.051	0.025	248.723	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.945	0.011	0.788	0.085	0.136	0.068	1212.185	0.027
	NA	MC	Motorcycles	1.146	0.002	20.843	4.593	0.017	0.008	207.343	0.054
Tehama	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.062	0.003	0.876	0.089	0.043	0.018	257.053	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.162	0.003	1.445	0.223	0.043	0.018	321.856	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.232	0.005	1.695	0.322	0.048	0.020	480.714	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.099	0.002	0.276	0.018	0.051	0.025	198.321	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.096	0.003	0.212	0.027	0.056	0.029	270.774	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.270	0.011	0.883	0.100	0.131	0.067	1205.367	0.027
	NA	MC	Motorcycles	1.189	0.002	23.718	4.588	0.017	0.008	219.052	0.054
Trinity	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.075	0.003	1.083	0.110	0.043	0.018	282.654	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.222	0.004	1.996	0.330	0.044	0.019	365.193	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.292	0.005	2.279	0.526	0.050	0.021	532.138	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.154	0.002	0.541	0.041	0.060	0.034	232.121	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.105	0.003	0.345	0.042	0.056	0.030	304.052	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.410	0.010	0.926	0.120	0.131	0.069	1075.981	0.027
	NA	MC	Motorcycles	1.230	0.002	26.724	5.397	0.018	0.009	245.622	0.054
Tulare	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.056	0.003	0.819	0.087	0.044	0.018	255.413	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.157	0.003	1.456	0.224	0.044	0.018	317.850	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.207	0.005	1.570	0.270	0.048	0.020	467.861	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.064	0.002	0.168	0.011	0.050	0.023	187.372	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.070	0.002	0.142	0.019	0.054	0.027	256.449	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.931	0.011	0.729	0.084	0.139	0.069	1186.352	0.027
	NA	MC	Motorcycles	1.132	0.002	21.195	4.159	0.017	0.008	206.590	0.054
Tuolumne	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.085	0.003	1.121	0.130	0.045	0.019	269.180	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.242	0.003	2.042	0.386	0.044	0.019	346.800	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.383	0.005	2.819	0.657	0.052	0.022	534.584	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.160	0.002	0.369	0.026	0.055	0.028	210.334	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.147	0.003	0.274	0.032	0.057	0.030	286.245	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.657	0.007	0.837	0.160	0.141	0.077	739.618	0.027
	NA	MC	Motorcycles	1.235	0.002	25.884	5.445	0.018	0.009	227.402	0.054
Ventura	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.056	0.002	0.836	0.085	0.043	0.018	244.476	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.117	0.003	1.240	0.170	0.042	0.018	304.074	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.189	0.004	1.448	0.238	0.049	0.021	453.653	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.069	0.002	0.245	0.016	0.048	0.023	191.918	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.069	0.003	0.181	0.021	0.050	0.025	266.316	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.399	0.009	0.470	0.054	0.132	0.062	923.169	0.027
	NA	MC	Motorcycles	1.137	0.002	21.268	4.724	0.017	0.008	215.549	0.054

**Table 5-37. EMFAC County-Specific On-Road Vehicle EFs – 2023 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Yolo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.052	0.002	0.765	0.078	0.043	0.018	246.828	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.108	0.003	1.143	0.176	0.043	0.018	312.213	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.173	0.005	1.313	0.233	0.049	0.020	469.260	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.082	0.002	0.186	0.012	0.048	0.023	190.765	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.061	0.003	0.128	0.014	0.050	0.024	270.333	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.497	0.011	0.534	0.064	0.140	0.066	1117.071	0.027
	NA	MC	Motoreycles	1.149	0.002	22.153	4.087	0.017	0.008	211.368	0.054
Yuba	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.062	0.003	0.897	0.087	0.044	0.018	258.052	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.167	0.003	1.505	0.237	0.043	0.018	319.007	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.251	0.005	1.845	0.335	0.048	0.020	467.949	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.088	0.002	0.215	0.015	0.051	0.024	193.389	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.113	0.002	0.165	0.018	0.052	0.025	255.832	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.470	0.008	0.755	0.133	0.143	0.075	879.725	0.027
	NA	MC	Motoreycles	1.156	0.002	22.059	4.310	0.017	0.008	208.013	0.054

**Table 5-38. EMFAC County-Specific On-Road Vehicle EFs – 2024**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Alameda	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.054	0.002	0.761	0.085	0.039	0.016	223.089	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.092	0.003	1.005	0.147	0.039	0.016	276.241	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.154	0.004	1.191	0.206	0.046	0.019	431.439	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.067	0.002	0.210	0.014	0.045	0.022	178.489	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.047	0.002	0.142	0.015	0.046	0.022	249.689	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.740	0.012	0.616	0.062	0.135	0.064	1248.269	0.027
Alpine	NA	MC	Motorcycles	1.028	0.002	18.881	3.460	0.015	0.007	191.586	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.058	0.002	0.845	0.086	0.038	0.016	209.688	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.132	0.003	1.304	0.220	0.039	0.016	268.100	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.203	0.004	1.485	0.354	0.044	0.019	410.496	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.057	0.002	0.200	0.011	0.042	0.019	159.970	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.026	0.002	0.143	0.014	0.043	0.019	231.700	0.008
Amador	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.991	0.011	0.932	0.098	0.129	0.065	1124.188	0.027
	NA	MC	Motorcycles	1.093	0.002	20.907	3.630	0.015	0.007	188.876	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.074	0.002	0.955	0.113	0.042	0.017	231.175	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.235	0.003	1.911	0.367	0.041	0.017	301.908	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.287	0.005	1.999	0.641	0.047	0.020	465.667	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.128	0.002	0.197	0.014	0.049	0.024	169.771	0.008
Butte	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.156	0.002	0.172	0.019	0.054	0.028	241.417	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.385	0.008	0.686	0.123	0.133	0.070	804.964	0.027
	NA	MC	Motorcycles	1.091	0.002	20.671	4.316	0.016	0.007	188.288	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.063	0.002	0.907	0.098	0.042	0.017	245.469	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.172	0.003	1.542	0.255	0.040	0.017	303.422	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.227	0.004	1.656	0.343	0.045	0.019	443.159	0.045
Calaveras	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.100	0.002	0.248	0.017	0.050	0.025	189.622	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.109	0.002	0.189	0.023	0.054	0.029	260.926	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.117	0.010	0.788	0.102	0.126	0.065	1034.318	0.027
	NA	MC	Motorcycles	1.057	0.002	20.588	4.573	0.016	0.007	195.643	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.075	0.002	1.011	0.121	0.041	0.017	239.383	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.252	0.003	2.165	0.375	0.042	0.018	321.038	0.022
Colusa	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.302	0.005	2.148	0.627	0.047	0.020	477.312	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.140	0.002	0.316	0.022	0.050	0.026	183.360	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.151	0.003	0.290	0.037	0.062	0.036	266.450	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.471	0.007	0.810	0.137	0.131	0.071	793.203	0.027
	NA	MC	Motorcycles	1.105	0.002	21.901	4.878	0.016	0.008	201.810	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.051	0.002	0.734	0.083	0.039	0.016	228.226	0.021
Contra Costa	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.114	0.003	1.115	0.182	0.039	0.016	283.097	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.167	0.004	1.261	0.245	0.044	0.018	425.177	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.067	0.002	0.195	0.012	0.045	0.021	173.988	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.042	0.002	0.128	0.015	0.047	0.022	236.185	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.916	0.010	0.798	0.089	0.123	0.062	1107.500	0.027
	NA	MC	Motorcycles	1.025	0.002	18.871	3.676	0.015	0.007	188.978	0.055
Del Norte	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.052	0.002	0.750	0.083	0.040	0.016	224.674	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.090	0.003	0.998	0.143	0.039	0.016	278.441	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.158	0.004	1.218	0.206	0.045	0.019	422.642	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.056	0.002	0.184	0.011	0.045	0.021	178.954	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.041	0.002	0.129	0.014	0.045	0.021	253.446	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.635	0.010	0.637	0.080	0.137	0.067	1089.996	0.027
Del Norte	NA	MC	Motorcycles	1.027	0.002	19.065	3.486	0.015	0.007	190.240	0.055
	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.071	0.002	0.904	0.104	0.042	0.017	249.997	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.235	0.003	1.811	0.348	0.042	0.018	325.961	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.249	0.005	1.683	0.437	0.047	0.020	477.280	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.144	0.002	0.356	0.025	0.053	0.028	205.330	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.192	0.003	0.361	0.046	0.068	0.042	287.281	0.008
Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.309	0.006	0.823	0.153	0.129	0.071	651.874	0.027	
NA	MC	Motorcycles	1.142	0.002	23.380	4.565	0.016	0.008	211.517	0.055	

**Table 5-38. EMFAC County-Specific On-Road Vehicle EFs – 2024 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
El Dorado	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.055	0.002	0.829	0.080	0.040	0.017	228.849	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.135	0.003	1.342	0.220	0.041	0.017	300.740	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.210	0.004	1.590	0.330	0.046	0.019	448.315	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.085	0.002	0.220	0.014	0.045	0.022	176.986	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.055	0.002	0.158	0.016	0.048	0.022	261.926	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.862	0.007	0.680	0.118	0.124	0.065	748.494	0.027
	NA	MC	Motorcycles	1.117	0.002	22.364	4.968	0.016	0.008	205.026	0.055
Fresno	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.049	0.002	0.728	0.082	0.040	0.017	231.410	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.109	0.003	1.107	0.184	0.040	0.017	290.694	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.162	0.004	1.249	0.237	0.044	0.018	425.079	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.049	0.002	0.152	0.009	0.046	0.021	177.294	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.051	0.002	0.120	0.013	0.049	0.023	248.058	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.843	0.012	0.704	0.069	0.136	0.067	1240.143	0.027
	NA	MC	Motorcycles	1.017	0.002	19.286	3.576	0.015	0.007	186.061	0.055
Glenn	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.053	0.002	0.788	0.086	0.040	0.017	237.537	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.117	0.003	1.168	0.201	0.039	0.016	286.975	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.181	0.004	1.403	0.283	0.044	0.018	425.670	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.062	0.002	0.248	0.015	0.047	0.022	183.455	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.047	0.002	0.171	0.019	0.048	0.023	243.225	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.950	0.010	0.795	0.097	0.123	0.063	1049.456	0.027
	NA	MC	Motorcycles	1.029	0.002	19.561	4.127	0.015	0.007	193.144	0.055
Humboldt	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.072	0.002	0.915	0.108	0.042	0.017	239.840	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.194	0.003	1.597	0.317	0.041	0.017	306.156	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.244	0.005	1.683	0.458	0.047	0.020	456.139	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.211	0.002	0.312	0.024	0.053	0.029	191.277	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.128	0.003	0.210	0.024	0.054	0.028	269.068	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.232	0.008	0.798	0.123	0.123	0.066	855.989	0.027
	NA	MC	Motorcycles	1.130	0.002	22.491	4.353	0.016	0.007	201.383	0.055
Imperial	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.052	0.002	0.795	0.101	0.039	0.016	231.217	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.135	0.003	1.374	0.255	0.040	0.017	288.855	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.167	0.004	1.371	0.317	0.045	0.019	411.203	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.071	0.002	0.161	0.012	0.047	0.022	165.866	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.056	0.002	0.113	0.013	0.047	0.023	230.992	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.409	0.010	0.752	0.064	0.123	0.061	1065.562	0.027
	NA	MC	Motorcycles	0.959	0.002	17.271	3.647	0.015	0.007	178.714	0.055
Inyo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.056	0.002	0.791	0.094	0.039	0.016	233.120	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.131	0.003	1.254	0.255	0.040	0.017	296.936	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.210	0.005	1.572	0.421	0.046	0.019	456.177	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.081	0.002	0.247	0.016	0.046	0.022	178.493	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.037	0.002	0.162	0.017	0.045	0.021	252.431	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.798	0.009	0.846	0.109	0.120	0.063	942.641	0.027
	NA	MC	Motorcycles	1.053	0.002	20.477	4.180	0.015	0.007	196.649	0.055
Kern	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.051	0.002	0.745	0.081	0.040	0.017	237.597	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.110	0.003	1.119	0.174	0.041	0.017	300.979	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.164	0.004	1.263	0.229	0.045	0.019	447.979	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.057	0.002	0.202	0.013	0.046	0.021	188.262	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.046	0.003	0.145	0.016	0.048	0.022	268.817	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.915	0.012	0.798	0.074	0.132	0.066	1281.772	0.027
	NA	MC	Motorcycles	1.037	0.002	20.446	3.528	0.015	0.007	193.813	0.055
Kings	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.048	0.002	0.723	0.077	0.040	0.016	230.307	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.116	0.003	1.182	0.184	0.040	0.017	291.647	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.153	0.004	1.228	0.230	0.044	0.018	419.027	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.048	0.002	0.199	0.012	0.045	0.021	171.359	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.061	0.002	0.162	0.018	0.049	0.023	243.426	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.986	0.012	0.805	0.075	0.131	0.065	1299.373	0.027
NA	MC	Motorcycles	1.002	0.002	18.154	3.444	0.015	0.007	185.177	0.055	

Table 5-38. EMFAC County-Specific On-Road Vehicle EFs – 2024 (cont.)

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Lake	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.093	0.003	1.137	0.136	0.042	0.018	252.656	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.210	0.003	1.774	0.374	0.042	0.018	319.571	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.297	0.005	2.098	0.620	0.048	0.020	475.121	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.202	0.002	0.343	0.028	0.058	0.032	197.736	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.143	0.003	0.241	0.027	0.057	0.030	273.591	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.379	0.008	0.742	0.126	0.128	0.069	841.614	0.027
	NA	MC	Motorcycles	1.117	0.002	22.819	5.016	0.016	0.008	204.882	0.055
Lassen	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.061	0.002	0.876	0.097	0.040	0.017	238.141	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.160	0.003	1.476	0.287	0.040	0.017	305.481	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.263	0.005	1.905	0.518	0.046	0.020	467.208	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.093	0.002	0.321	0.019	0.046	0.022	188.910	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.103	0.002	0.259	0.031	0.054	0.028	260.361	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.876	0.006	0.748	0.137	0.117	0.064	645.030	0.027
	NA	MC	Motorcycles	1.116	0.002	22.880	4.479	0.016	0.007	206.945	0.055
Los Angeles	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.049	0.002	0.771	0.078	0.037	0.016	222.947	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.101	0.003	1.168	0.144	0.039	0.016	283.704	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.157	0.004	1.315	0.194	0.046	0.019	425.227	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.057	0.002	0.266	0.017	0.044	0.021	175.002	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.047	0.002	0.195	0.022	0.045	0.021	252.094	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.189	0.009	0.469	0.045	0.125	0.057	984.008	0.027
	NA	MC	Motorcycles	0.986	0.002	17.696	3.765	0.015	0.007	196.255	0.055
Madera	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.052	0.002	0.832	0.080	0.041	0.017	249.836	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.127	0.003	1.340	0.210	0.041	0.017	307.721	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.191	0.005	1.506	0.266	0.048	0.020	457.370	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.062	0.002	0.314	0.018	0.048	0.022	192.622	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.071	0.003	0.229	0.025	0.049	0.024	267.862	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.953	0.012	0.778	0.079	0.134	0.067	1233.892	0.027
	NA	MC	Motorcycles	1.010	0.002	19.088	3.575	0.015	0.007	192.733	0.055
Marin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.057	0.002	0.766	0.092	0.038	0.016	219.512	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.093	0.003	0.982	0.160	0.039	0.016	279.595	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.156	0.004	1.191	0.217	0.047	0.019	438.604	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.082	0.002	0.215	0.014	0.044	0.022	178.370	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.039	0.002	0.139	0.014	0.044	0.020	263.395	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.275	0.008	0.555	0.083	0.123	0.060	889.242	0.027
	NA	MC	Motorcycles	1.038	0.002	19.561	3.591	0.015	0.007	192.576	0.055
Mariposa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.083	0.002	1.075	0.118	0.042	0.018	251.791	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.255	0.003	2.081	0.420	0.042	0.018	330.748	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.398	0.005	2.792	0.725	0.050	0.021	517.568	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.175	0.002	0.397	0.031	0.056	0.031	200.727	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.064	0.003	0.247	0.027	0.053	0.027	281.015	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.726	0.006	0.833	0.164	0.142	0.078	666.488	0.027
	NA	MC	Motorcycles	1.152	0.002	24.126	5.176	0.017	0.008	212.231	0.055
Mendocino	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.066	0.002	0.876	0.102	0.040	0.017	229.799	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.177	0.003	1.535	0.305	0.041	0.017	298.673	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.240	0.004	1.707	0.467	0.047	0.020	452.430	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.199	0.002	0.300	0.024	0.053	0.029	183.861	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.235	0.002	0.259	0.028	0.056	0.030	262.576	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.127	0.009	0.812	0.107	0.123	0.064	977.572	0.027
	NA	MC	Motorcycles	1.094	0.002	21.229	4.226	0.016	0.007	196.999	0.055
Merced	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.054	0.002	0.807	0.082	0.042	0.017	248.256	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.144	0.003	1.397	0.214	0.041	0.017	308.919	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.199	0.004	1.510	0.259	0.045	0.019	446.203	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.068	0.002	0.259	0.015	0.048	0.022	191.728	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.088	0.003	0.210	0.024	0.053	0.026	266.104	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.057	0.013	0.801	0.073	0.135	0.067	1324.309	0.027
	NA	MC	Motorcycles	1.010	0.002	19.023	3.288	0.015	0.007	188.913	0.055



**Table 5-38. EMFAC County-Specific On-Road Vehicle EFs – 2024 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Modoc	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.065	0.002	0.945	0.098	0.040	0.017	251.602	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.170	0.003	1.595	0.274	0.040	0.017	323.231	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.297	0.005	2.213	0.580	0.046	0.020	486.872	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.098	0.002	0.450	0.028	0.048	0.024	205.236	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.122	0.003	0.346	0.041	0.055	0.030	291.896	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.134	0.007	0.777	0.138	0.121	0.066	700.016	0.027
	NA	MC	Motorcycles	1.138	0.002	24.137	4.682	0.016	0.008	220.764	0.055
Mono	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.061	0.002	0.841	0.086	0.039	0.016	226.098	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.148	0.003	1.333	0.239	0.040	0.017	293.255	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.237	0.004	1.712	0.428	0.045	0.019	443.322	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.116	0.002	0.290	0.021	0.048	0.025	180.805	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.082	0.002	0.196	0.019	0.046	0.021	262.178	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.898	0.010	0.887	0.103	0.121	0.062	1033.058	0.027
	NA	MC	Motorcycles	1.161	0.002	24.595	4.136	0.015	0.007	206.527	0.055
Monterey	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.064	0.002	0.891	0.095	0.041	0.017	247.920	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.153	0.003	1.426	0.208	0.042	0.018	320.131	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.206	0.005	1.511	0.259	0.046	0.019	461.800	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.105	0.002	0.355	0.024	0.051	0.026	197.802	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.065	0.003	0.251	0.027	0.051	0.025	284.900	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.778	0.010	0.629	0.083	0.135	0.067	1013.641	0.027
	NA	MC	Motorcycles	1.031	0.002	18.923	3.312	0.015	0.007	197.374	0.055
Napa	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.054	0.002	0.772	0.079	0.040	0.017	221.886	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.109	0.003	1.123	0.170	0.039	0.016	278.201	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.193	0.004	1.399	0.267	0.046	0.019	441.023	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.075	0.002	0.204	0.014	0.047	0.023	176.214	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.053	0.002	0.139	0.014	0.046	0.022	252.722	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.997	0.010	0.656	0.086	0.141	0.069	1099.887	0.027
	NA	MC	Motorcycles	1.027	0.002	19.002	3.426	0.015	0.007	185.866	0.055
Nevada	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.062	0.002	0.847	0.093	0.041	0.017	231.395	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.184	0.003	1.533	0.250	0.042	0.017	314.845	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.259	0.005	1.756	0.368	0.047	0.020	464.978	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.105	0.002	0.235	0.015	0.046	0.022	178.712	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.129	0.003	0.202	0.021	0.053	0.026	271.668	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.217	0.010	0.864	0.107	0.123	0.064	1045.002	0.027
	NA	MC	Motorcycles	1.160	0.002	23.875	4.904	0.016	0.008	204.781	0.055
Orange	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.044	0.002	0.706	0.071	0.038	0.016	215.419	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.081	0.003	0.986	0.132	0.038	0.016	270.300	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.134	0.004	1.125	0.174	0.046	0.019	422.291	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.043	0.002	0.212	0.012	0.042	0.020	168.265	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.038	0.002	0.154	0.016	0.043	0.020	238.293	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.874	0.008	0.350	0.038	0.128	0.059	868.521	0.027
	NA	MC	Motorcycles	0.971	0.002	17.126	3.595	0.015	0.007	188.088	0.055
Placer	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.052	0.002	0.776	0.079	0.039	0.016	220.473	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.088	0.003	1.018	0.147	0.040	0.017	280.582	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.158	0.004	1.273	0.223	0.045	0.019	425.401	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.071	0.002	0.190	0.012	0.044	0.021	168.887	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.038	0.002	0.128	0.013	0.046	0.021	245.381	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.609	0.010	0.700	0.083	0.126	0.062	1035.050	0.027
	NA	MC	Motorcycles	1.074	0.002	20.487	3.946	0.015	0.007	194.214	0.055
Plumas	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.072	0.002	1.011	0.107	0.041	0.017	245.405	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.212	0.003	1.883	0.333	0.041	0.018	327.909	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.328	0.005	2.451	0.642	0.047	0.020	480.335	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.122	0.002	0.423	0.028	0.050	0.026	198.511	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.094	0.003	0.317	0.032	0.049	0.024	292.754	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.323	0.007	0.782	0.137	0.120	0.066	764.862	0.027
NA	MC	Motorcycles	1.137	0.002	24.094	4.859	0.016	0.008	215.843	0.055	

**Table 5-38. EMFAC County-Specific On-Road Vehicle EFs – 2024 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Riverside	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.046	0.002	0.719	0.075	0.039	0.016	222.643	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.096	0.003	1.097	0.151	0.040	0.017	278.149	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.139	0.004	1.171	0.191	0.045	0.019	395.432	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.039	0.002	0.157	0.009	0.044	0.020	167.150	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.035	0.002	0.112	0.012	0.045	0.021	229.983	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.362	0.010	0.674	0.058	0.127	0.062	1085.477	0.027
	NA	MC	Motorcycles	0.964	0.002	17.401	3.424	0.015	0.007	181.480	0.055
Sacramento	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.055	0.002	0.837	0.096	0.040	0.017	232.233	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.099	0.003	1.138	0.174	0.040	0.017	287.921	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.173	0.004	1.371	0.250	0.046	0.019	442.991	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.064	0.002	0.210	0.013	0.047	0.022	178.735	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.092	0.002	0.178	0.019	0.049	0.024	256.524	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.994	0.010	0.628	0.084	0.135	0.066	1066.021	0.027
	NA	MC	Motorcycles	1.029	0.002	19.076	3.964	0.015	0.007	191.077	0.055
San Benito	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.056	0.002	0.789	0.082	0.041	0.017	230.818	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.116	0.003	1.152	0.192	0.041	0.017	291.225	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.179	0.004	1.335	0.259	0.044	0.018	427.003	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.100	0.002	0.239	0.016	0.047	0.023	177.345	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.033	0.002	0.148	0.016	0.047	0.021	251.144	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.194	0.012	0.871	0.083	0.128	0.065	1280.162	0.027
	NA	MC	Motorcycles	1.026	0.002	18.810	3.327	0.015	0.007	186.418	0.055
San Bernardino	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.048	0.002	0.738	0.074	0.039	0.016	226.334	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.108	0.003	1.153	0.167	0.040	0.017	282.282	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.162	0.004	1.283	0.213	0.045	0.019	411.432	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.053	0.002	0.189	0.012	0.045	0.021	173.419	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.045	0.002	0.135	0.015	0.046	0.022	241.073	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.522	0.010	0.682	0.060	0.129	0.063	1100.656	0.027
	NA	MC	Motorcycles	0.986	0.002	18.166	3.143	0.015	0.007	181.037	0.055
San Diego	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.047	0.002	0.689	0.075	0.039	0.016	224.228	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.097	0.003	1.023	0.153	0.038	0.016	279.550	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.143	0.004	1.114	0.190	0.045	0.019	429.249	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.053	0.002	0.209	0.013	0.044	0.020	182.005	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.051	0.002	0.154	0.017	0.045	0.022	254.427	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.519	0.010	0.598	0.079	0.133	0.065	1010.511	0.027
	NA	MC	Motorcycles	0.991	0.002	18.410	3.418	0.015	0.007	190.128	0.055
San Francisco	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.050	0.002	0.771	0.084	0.037	0.016	221.159	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.084	0.003	1.044	0.147	0.040	0.017	290.041	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.134	0.005	1.133	0.173	0.051	0.022	465.205	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.053	0.002	0.301	0.018	0.042	0.020	179.726	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.044	0.003	0.231	0.023	0.044	0.021	274.986	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.074	0.010	0.375	0.049	0.134	0.061	1082.835	0.027
	NA	MC	Motorcycles	1.028	0.002	19.284	4.030	0.015	0.007	200.556	0.055
San Joaquin	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.051	0.002	0.729	0.082	0.040	0.017	232.626	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.102	0.003	1.054	0.168	0.040	0.017	285.425	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.164	0.004	1.256	0.239	0.044	0.018	416.159	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.056	0.002	0.156	0.009	0.046	0.021	181.566	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.045	0.002	0.113	0.012	0.047	0.022	251.165	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.803	0.011	0.692	0.072	0.135	0.066	1200.759	0.027
	NA	MC	Motorcycles	1.026	0.002	19.596	3.609	0.015	0.007	188.771	0.055
San Luis Obispo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.054	0.002	0.754	0.083	0.040	0.017	223.348	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.120	0.003	1.142	0.188	0.040	0.017	289.673	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.193	0.004	1.370	0.261	0.046	0.019	437.714	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.078	0.002	0.210	0.014	0.045	0.022	174.881	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.062	0.002	0.156	0.017	0.049	0.024	256.180	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.804	0.008	0.655	0.103	0.123	0.063	855.324	0.027
NA	MC	Motorcycles	1.071	0.002	20.338	4.222	0.015	0.007	192.174	0.055	

Table 5-38. EMFAC County-Specific On-Road Vehicle EFs – 2024 (cont.)

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
San Mateo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.049	0.002	0.700	0.087	0.034	0.014	192.555	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.076	0.003	0.939	0.129	0.039	0.016	260.043	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.119	0.004	1.050	0.167	0.046	0.019	409.289	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.043	0.001	0.148	0.009	0.037	0.017	149.478	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.036	0.002	0.114	0.012	0.044	0.020	233.404	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	1.741	0.008	0.383	0.061	0.125	0.058	873.263	0.027
	NA	MC	Motorcycles	0.992	0.002	17.183	2.935	0.015	0.007	184.670	0.055
Santa Barbara	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.059	0.002	0.788	0.094	0.040	0.017	222.225	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.143	0.003	1.246	0.202	0.041	0.017	287.997	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.200	0.004	1.406	0.261	0.052	0.022	440.311	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.073	0.002	0.183	0.012	0.046	0.022	173.978	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.063	0.002	0.135	0.015	0.049	0.023	252.547	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.851	0.009	0.545	0.080	0.147	0.072	961.374	0.027
	NA	MC	Motorcycles	1.039	0.002	18.486	3.318	0.015	0.007	182.777	0.055
Santa Clara	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.051	0.002	0.754	0.080	0.039	0.016	219.923	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.095	0.003	1.054	0.151	0.039	0.016	273.504	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.154	0.004	1.230	0.209	0.046	0.019	422.829	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.051	0.002	0.178	0.011	0.044	0.021	172.139	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.042	0.002	0.127	0.014	0.045	0.021	242.164	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.557	0.011	0.583	0.070	0.135	0.064	1121.743	0.027
	NA	MC	Motorcycles	1.008	0.002	17.790	3.368	0.015	0.007	186.623	0.055
Santa Cruz	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.071	0.002	0.967	0.102	0.041	0.017	241.383	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.161	0.003	1.462	0.227	0.041	0.017	304.916	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.220	0.004	1.590	0.284	0.046	0.019	448.065	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.139	0.002	0.360	0.026	0.052	0.028	194.611	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.097	0.003	0.246	0.028	0.053	0.027	274.806	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.824	0.008	0.534	0.087	0.133	0.066	880.353	0.027
	NA	MC	Motorcycles	1.068	0.002	20.665	4.425	0.016	0.008	197.994	0.055
Shasta	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.053	0.002	0.798	0.085	0.040	0.017	233.973	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.132	0.003	1.268	0.209	0.040	0.017	293.131	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.202	0.004	1.508	0.310	0.045	0.019	439.678	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.080	0.002	0.254	0.016	0.046	0.022	180.777	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.061	0.002	0.181	0.020	0.048	0.023	252.186	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.163	0.010	0.816	0.096	0.126	0.065	1109.618	0.027
	NA	MC	Motorcycles	1.065	0.002	21.236	4.599	0.015	0.007	198.058	0.055
Sierra	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.064	0.002	0.922	0.096	0.039	0.017	242.099	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.165	0.003	1.565	0.265	0.040	0.017	314.303	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.266	0.005	2.101	0.527	0.046	0.020	463.876	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.052	0.002	0.402	0.021	0.043	0.020	195.268	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.037	0.002	0.257	0.028	0.045	0.020	263.139	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.861	0.006	0.789	0.139	0.111	0.061	669.090	0.027
	NA	MC	Motorcycles	1.116	0.002	23.130	4.566	0.016	0.008	214.513	0.055
Siskiyou	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.065	0.002	0.911	0.101	0.040	0.017	243.440	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.174	0.003	1.554	0.292	0.040	0.017	313.486	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.271	0.005	2.020	0.525	0.046	0.020	468.062	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.138	0.002	0.392	0.026	0.050	0.026	197.503	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.094	0.003	0.281	0.032	0.051	0.027	277.416	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.148	0.011	0.962	0.103	0.123	0.064	1128.559	0.027
	NA	MC	Motorcycles	1.138	0.002	24.253	4.682	0.016	0.008	214.314	0.055
Solano	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.053	0.002	0.728	0.079	0.040	0.017	235.330	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.095	0.003	0.987	0.155	0.040	0.017	289.051	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.161	0.004	1.184	0.226	0.045	0.019	438.142	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.064	0.002	0.201	0.013	0.046	0.022	190.143	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.040	0.002	0.128	0.013	0.046	0.021	262.844	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.901	0.011	0.771	0.082	0.130	0.065	1209.349	0.027
	NA	MC	Motorcycles	1.037	0.002	20.441	3.389	0.015	0.007	194.456	0.055

Table 5-38. EMFAC County-Specific On-Road Vehicle EFs – 2024 (cont.)

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Sonoma	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.060	0.002	0.852	0.091	0.041	0.017	236.017	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.125	0.003	1.242	0.204	0.039	0.016	284.773	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.202	0.004	1.467	0.307	0.046	0.019	444.069	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.111	0.002	0.265	0.019	0.049	0.025	193.991	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.074	0.002	0.179	0.021	0.050	0.025	263.745	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.533	0.009	0.578	0.087	0.131	0.065	903.429	0.027
	NA	MC	Motorcycles	1.045	0.002	20.444	4.029	0.015	0.007	194.074	0.055
Stanislaus	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.052	0.002	0.799	0.085	0.041	0.017	239.841	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.116	0.003	1.226	0.194	0.041	0.017	296.444	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.177	0.004	1.366	0.256	0.045	0.019	433.008	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.059	0.002	0.260	0.015	0.047	0.022	188.455	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.060	0.002	0.192	0.022	0.050	0.024	261.134	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.798	0.011	0.695	0.078	0.134	0.066	1148.543	0.027
	NA	MC	Motorcycles	1.033	0.002	20.106	4.218	0.015	0.007	193.441	0.055
Sutter	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.053	0.002	0.793	0.087	0.040	0.017	227.481	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.121	0.003	1.202	0.190	0.040	0.017	279.726	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.177	0.004	1.353	0.269	0.044	0.018	416.412	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.056	0.002	0.169	0.010	0.046	0.021	169.628	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.064	0.002	0.135	0.016	0.049	0.024	235.202	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.857	0.011	0.767	0.081	0.132	0.065	1163.408	0.027
	NA	MC	Motorcycles	1.043	0.002	18.954	4.281	0.015	0.007	188.890	0.055
Tehama	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.055	0.002	0.785	0.081	0.040	0.017	235.013	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.140	0.003	1.276	0.204	0.040	0.017	291.617	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.200	0.004	1.465	0.297	0.044	0.018	430.152	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.083	0.002	0.259	0.017	0.047	0.023	183.869	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.079	0.002	0.198	0.023	0.051	0.026	253.399	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.130	0.011	0.855	0.094	0.125	0.064	1152.691	0.027
	NA	MC	Motorcycles	1.078	0.002	21.449	4.250	0.015	0.007	198.711	0.055
Trinity	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.066	0.003	0.957	0.100	0.040	0.017	254.907	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.193	0.003	1.761	0.305	0.041	0.018	331.263	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.254	0.005	1.978	0.499	0.046	0.020	480.310	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.128	0.002	0.503	0.035	0.053	0.029	211.932	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.094	0.003	0.339	0.039	0.053	0.028	285.845	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.188	0.010	0.884	0.112	0.123	0.065	1015.656	0.027
	NA	MC	Motorcycles	1.114	0.002	24.138	4.981	0.016	0.008	222.338	0.055
Tulare	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.050	0.002	0.746	0.081	0.041	0.017	235.958	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.136	0.003	1.297	0.206	0.040	0.017	290.886	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.178	0.004	1.369	0.249	0.044	0.018	422.516	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.053	0.002	0.161	0.010	0.047	0.022	177.866	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.060	0.002	0.134	0.016	0.051	0.025	243.442	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.831	0.011	0.709	0.080	0.134	0.066	1137.714	0.027
	NA	MC	Motorcycles	1.024	0.002	19.061	3.861	0.015	0.007	186.941	0.055
Tuolumne	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.075	0.002	1.005	0.118	0.042	0.018	251.402	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.213	0.003	1.813	0.360	0.041	0.018	319.538	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.339	0.005	2.442	0.628	0.048	0.020	490.431	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.134	0.002	0.349	0.023	0.051	0.026	198.521	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.130	0.003	0.264	0.029	0.054	0.028	273.735	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.344	0.007	0.781	0.147	0.132	0.072	690.745	0.027
	NA	MC	Motorcycles	1.140	0.002	23.820	5.115	0.016	0.008	210.064	0.055
Ventura	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.050	0.002	0.744	0.078	0.039	0.016	220.716	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.102	0.003	1.096	0.156	0.039	0.016	273.036	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.163	0.004	1.255	0.217	0.044	0.019	405.776	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.057	0.002	0.232	0.014	0.044	0.021	175.252	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.060	0.002	0.174	0.019	0.046	0.023	245.004	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.284	0.008	0.452	0.051	0.126	0.060	883.082	0.027
	NA	MC	Motorcycles	1.026	0.002	19.222	4.385	0.015	0.007	194.963	0.055

**Table 5-38. EMFAC County-Specific On-Road Vehicle EFs – 2024 (cont.)**

County	Fuel Type	Vehicle Type		Emission Factors (g/mi)							
				Criteria Pollutants and Ozone Precursors							
				NO <sub>x</sub>	SO <sub>x</sub>	CO	ROG	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
Yolo	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.046	0.002	0.684	0.071	0.039	0.016	223.506	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.095	0.003	1.029	0.165	0.040	0.017	286.102	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.151	0.004	1.165	0.218	0.045	0.019	424.340	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.067	0.002	0.170	0.011	0.044	0.021	174.375	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.053	0.002	0.123	0.013	0.047	0.022	254.717	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	2.447	0.010	0.521	0.061	0.137	0.065	1084.963	0.027
	NA	MC	Motoreycles	1.046	0.002	20.134	3.819	0.015	0.007	192.681	0.055
Yuba	Gasoline	LDGV	Light-Duty Vehicles (Passenger Cars)	0.055	0.002	0.810	0.080	0.042	0.017	240.547	0.021
	Gasoline	LDGT	Light-Duty Trucks (0-8,500 lbs)	0.142	0.003	1.319	0.216	0.040	0.017	290.916	0.022
	Gasoline	HDGV	Heavy-Duty Vehicles (8,501 + lbs)	0.218	0.004	1.609	0.310	0.044	0.019	420.750	0.045
	Diesel	LDDV	Light-Duty Vehicles (Passenger Cars)	0.073	0.002	0.205	0.013	0.049	0.023	184.214	0.008
	Diesel	LDDT	Light-Duty Trucks (0-8,500 lbs)	0.097	0.002	0.157	0.017	0.050	0.024	245.405	0.008
	Diesel	HDDV	Heavy-Duty Vehicles (8,501 + lbs)	3.202	0.008	0.710	0.122	0.134	0.070	832.010	0.027
	NA	MC	Motoreycles	1.053	0.002	20.059	4.022	0.015	0.007	189.711	0.055

The values in the NH<sub>3</sub> column for EMFAC Table 5-24 through Table 5-38 reflect statewide values as calculated by MOVES2014b for the state of California.

**Table 5-39. OCONUS On-Road Composite Vehicle Emission Factors - POV**

Year	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>x</sub>	CO	VOC	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
2020	All Vehicles	0.464	0.003	4.535	0.396	0.015	0.013	413.188	0.025
2021	All Vehicles	0.416	0.003	4.274	0.367	0.013	0.012	403.017	0.024
2022	All Vehicles	0.376	0.003	4.048	0.344	0.012	0.011	392.771	0.024
2023	All Vehicles	0.342	0.003	3.828	0.323	0.011	0.010	382.461	0.024
2024	All Vehicles	0.312	0.003	3.615	0.304	0.011	0.010	372.116	0.023

**Table 5-40. OCONUS On-Road Composite Vehicle Emission Factors - GOV**

Year	Vehicle Type	Emission Factors (g/mi)							
		Criteria Pollutants and Ozone Precursors							
		NO <sub>x</sub>	SO <sub>x</sub>	CO	VOC	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	NH <sub>3</sub>
2020	All Vehicles	1.332	0.005	4.183	0.348	0.043	0.039	650.795	0.023
2021	All Vehicles	1.208	0.005	3.912	0.316	0.038	0.035	638.245	0.022
2022	All Vehicles	1.101	0.005	3.677	0.289	0.034	0.031	626.112	0.022
2023	All Vehicles	1.009	0.005	3.453	0.267	0.030	0.028	614.391	0.022
2024	All Vehicles	0.928	0.005	3.235	0.246	0.027	0.025	602.988	0.022

Table 5-41. On Road Vehicle Speciated VOC Weight Fractions

VOC	HAP	HAP						
		LDCV <sup>a</sup>	LDDV <sup>b</sup>	LDCV <sup>a</sup>	LDDV <sup>b</sup>	HDCV <sup>a</sup>	HDDV <sup>b</sup>	MC <sup>c</sup>
Acetylene		4.05%	8.02%	3.61%	8.52%	2.90%	---	---
Acetaldehyde	X	0.29%	---	1.64%	---	---	---	---
Acrolein	X	0.24%	---	0.40%	---	---	---	---
Alpha-pinene		0.06%	---	0.08%	---	---	---	---
Benzaldehyde		0.29%	---	1.19%	---	---	---	---
Benzene	X	5.89%	2.23%	5.61%	2.91%	1.91%	---	3.99%
Beta-pinene		0.03%	---	0.02%	---	---	---	---
1,3-Butadiene	X	0.57%	1.08%	0.62%	1.44%	---	---	---
Butane		0.37%	0.46%	0.41%	0.32%	24.42%	---	0.65%
1-Butene		2.22%	1.68%	2.47%	2.01%	1.21%	---	2.32%
cis-2-Butene		0.14%	0.61%	0.14%	0.77%	0.73%	---	0.48%
trans-2-Butene		0.35%	2.25%	0.30%	0.24%	0.97%	---	0.29%
Butylbenzene		---	---	---	---	0.23%	---	---
o-tert-Butyloluene		---	---	---	0.19%	---	1.09%	---
tert-Butyl-m-Xylene		---	---	---	---	0.74%	---	---
Butyraldehyde		0.04%	---	0.42%	---	---	---	---
C6 olefin		---	2.80%	---	2.23%	---	---	---
Crotonaldehyde		0.02%	---	0.06%	---	---	---	---
Cyclohexane		0.50%	---	0.32%	---	---	1.72%	0.19%
Cyclohexene		0.07%	---	0.04%	---	1.72%	0.32%	---
Cyclopentadiene		---	0.53%	---	0.24%	---	---	---
Cyclopentane		0.22%	0.57%	0.20%	0.44%	0.52%	1.09%	1.09%
Cyclopentene		0.12%	0.53%	0.12%	0.39%	0.32%	0.51%	0.31%
Cyclopentylcyclopentane		---	---	---	---	0.50%	---	---
Decane		0.25%	1.30%	0.17%	1.65%	0.12%	1.39%	---
Diethylbenzene		---	0.31%	---	0.39%	---	1.46%	---
1,2-Diethylbenzene		0.09%	0.15%	0.05%	---	0.33%	---	---
1,3-Diethylbenzene		0.29%	---	0.30%	---	0.25%	---	---
1,4-Diethylbenzene		0.12%	---	0.07%	---	---	---	---
Dimethyl Ethylbenzene		---	0.23%	---	0.29%	---	2.30%	---
2,2-Dimethylbutane		0.55%	---	0.49%	---	0.24%	1.13%	1.70%
2,3-Dimethylbutane		0.88%	0.69%	0.87%	0.53%	1.07%	0.61%	1.78%
3,3-Dimethyl-1-butene		---	0.53%	---	---	---	---	---
1,1-Dimethylcyclohexane		0.06%	---	0.06%	---	---	---	---
cis-1,2-Dimethylcyclohexane		---	---	---	---	0.32%	---	---
trans-1,2-Dimethylcyclohexane		---	0.15%	---	0.39%	---	1.50%	---
cis-1,3-Dimethylcyclohexane		---	---	---	---	---	2.07%	---
Cis-1,4-Dimethylcyclohexane		---	---	---	0.09%	0.23%	---	---
cis-1,3-Dimethylcyclopentane		---	---	---	0.68%	---	0.72%	---
Dimethylheptane		0.08%	0.88%	0.08%	1.11%	0.09%	---	---
2,5-Dimethylheptane		---	0.15%	---	0.19%	---	---	---
2,6-Dimethylheptane		---	0.23%	---	0.58%	---	---	---
2,3-Dimethylheptane		---	---	---	---	0.65%	---	---
2,5-Dimethylheptane		0.19%	---	0.18%	---	0.14%	---	---
2,6-Dimethylheptane		---	---	---	---	---	---	---
3,3-Dimethylheptane		0.05%	---	0.04%	---	---	---	---
3,5-Dimethylheptane		---	---	---	---	---	2.18%	---
4,4-Dimethylheptane		---	0.08%	---	---	---	---	---
2,3-Dimethylhexane		0.29%	---	0.36%	---	---	0.38%	---
2,4-Dimethylhexane		0.58%	0.46%	0.68%	0.23%	0.46%	0.25%	---
2,5-Dimethylhexane		0.39%	---	0.45%	---	---	0.21%	---
3,3-Dimethylhexane		---	---	---	---	---	0.11%	---
Dimethyloctane		0.08%	0.31%	0.05%	0.39%	0.08%	---	---
2,2-Dimethyloctane		---	---	---	---	---	0.43%	---
2,3-Dimethyloctane		---	---	---	---	0.57%	---	---
2,4-Dimethyloctane		---	0.15%	---	0.19%	---	2.56%	---
2,4-Dimethylpentane		0.85%	0.08%	0.90%	---	0.70%	0.22%	2.29%
2,2-Dimethylpentane		---	0.08%	---	---	---	---	---
2,3-Dimethylpentane		1.25%	0.15%	1.32%	0.44%	---	1.36%	0.95%
3,3-Dimethylpentane		---	---	---	---	---	0.59%	---
2,2-Dimethylpropane		---	0.33%	---	0.68%	---	---	---
Dipente		0.42%	---	0.33%	---	---	---	---
Dodecane		0.48%	0.50%	0.22%	0.61%	---	3.01%	---
Ethene		---	28.13%	---	30.07%	---	---	---
Ethyl tert-butyl ether		---	---	---	0.39%	---	2.98%	---
Ethylbenzene	X	2.56%	0.38%	2.28%	0.48%	0.73%	1.29%	1.99%
Ethylcyclohexane		---	---	---	---	---	7.69%	---
Ethylene		7.39%	---	6.59%	---	4.74%	---	---
3-Ethylhexane		---	0.15%	---	0.29%	---	0.70%	---
cis-1-Ethyl-2-Methylcyclopentane		---	0.15%	---	---	---	---	---
3-Ethylpentane		0.31%	---	0.27%	---	---	---	---
3-Ethyltoluene		2.02%	---	1.71%	---	0.17%	---	---
Formaldehyde	X	1.06%	---	3.37%	---	---	---	---
Glyoxal		0.03%	---	0.01%	---	---	---	---
Heptane		1.11%	0.08%	1.06%	0.19%	0.79%	0.77%	2.19%
1-Heptene		0.16%	---	0.08%	---	---	---	---
cis-2-Heptene		---	0.15%	---	---	---	---	---
trans-2-Heptene		---	0.15%	---	---	---	---	---
Trans-3-Heptene		0.03%	---	0.04%	---	---	---	---
Hexaldehyde		0.09%	---	0.11%	---	---	---	---
Hexane	X	1.51%	---	1.83%	0.19%	1.67%	2.40%	1.42%
1-Hexene		0.16%	0.94%	0.16%	0.83%	0.30%	1.77%	---
cis-2-Hexene		0.08%	0.23%	0.08%	---	0.12%	---	0.06%
trans-2-Hexene		0.14%	0.46%	0.14%	---	---	---	0.10%
cis-3-Hexene		0.02%	---	0.02%	---	---	---	---
Hexyne		---	---	---	---	0.02%	---	---
Indan		0.24%	---	0.17%	---	0.35%	---	---
Isohexane		---	---	2.66%	---	3.06%	---	---
Isopropylcyclohexane		0.04%	---	0.02%	---	---	---	---
Methylbenzaldehyde		0.02%	---	0.17%	---	---	---	---
2-Methyl-1,3-Butadiene		---	0.54%	---	0.58%	0.11%	---	---
2-Methylbutane		0.27%	0.31%	0.24%	0.39%	12.02%	---	14.59%

**Table 5-41. On Road Vehicle Speciated VOC Weight Fractions (cont.)**

VOC	HAP	LDCV <sup>a</sup>							MC <sup>c</sup>
		LDCV <sup>a</sup>	LDDV <sup>b</sup>	LDCV <sup>a</sup>	LDDV <sup>b</sup>	HDGV <sup>a</sup>	HDDV <sup>b</sup>	MC <sup>c</sup>	
2-Methyl-1-Butene		1.71%	4.20%	1.53%	2.27%	---	---	---	
2-Methyl-2-Butene		0.32%	0.23%	0.39%	---	0.12%	---	1.08%	
3-Methyl-1-Butene		6.54%	---	5.86%	---	0.15%	---	0.14%	
Methyl-tert-Butyl Ether	X	0.02%	---	0.05%	---	---	---	---	
Methylcyclohexane		0.44%	0.28%	0.40%	0.43%	0.28%	1.62%	0.43%	
Methylcyclooctane		---	---	---	---	0.36%	---	---	
Methylcyclopentane		1.10%	0.08%	1.04%	0.10%	1.21%	0.44%	1.83%	
1-Methylcyclopentene		---	0.23%	---	---	0.03%	---	---	
2-Methyldecane		---	---	---	---	0.69%	---	---	
Methylethylbenzene	X	0.19%	0.53%	0.15%	0.68%	---	2.39%	0.40%	
1-Methyl-2-Ethylbenzene		0.75%	---	0.62%	---	---	---	---	
cis-1-Methyl-3-Ethylcyclopentane		---	1.22%	---	0.74%	---	---	---	
1-Methyl-4-Ethylbenzene		0.92%	---	0.78%	---	---	---	---	
Methyl ethyl ketone		0.05%	---	0.07%	---	---	---	---	
2-Methylheptane		0.67%	0.15%	0.53%	---	0.28%	0.44%	1.61%	
3-Methylheptane		0.75%	---	0.69%	---	0.38%	0.44%	1.67%	
4-Methylheptane		0.28%	0.08%	0.28%	---	0.27%	---	---	
2-Methylhexane		1.39%	---	1.34%	---	---	0.52%	3.18%	
3-Methylhexane		1.54%	0.61%	1.38%	---	---	1.72%	2.57%	
3-Methyl-1-Hexene		---	---	---	0.58%	---	---	---	
4-Methyl-1-Hexene		0.03%	---	0.03%	---	---	---	---	
1-Methyl-2-Isopropylbenzene		0.03%	---	0.02%	---	---	---	---	
1-Methyl-3-isopropylbenzene		0.09%	---	0.06%	---	---	---	---	
1-Methyl-4-isopropylbenzene		0.02%	---	0.02%	---	---	---	---	
2-Methyloctane		0.38%	0.15%	0.23%	---	0.04%	0.92%	---	
3-Methyloctane		0.34%	0.08%	0.29%	---	0.34%	1.81%	---	
4-Methyloctane		---	---	---	---	0.42%	---	---	
2-Methylpentane		2.68%	0.28%	---	0.32%	---	3.80%	5.81%	
3-Methylpentane		1.85%	0.53%	1.80%	1.21%	1.68%	1.20%	3.48%	
3-Methyl-cis-2-Pentene		0.09%	---	0.09%	---	---	---	---	
2-Methyl-1-Pentene		0.11%	1.30%	0.11%	0.74%	---	---	0.22%	
2-Methyl-2-Pentene		0.10%	0.08%	0.08%	---	0.37%	---	---	
3-Methyl-trans-2-Pentene		0.10%	---	0.08%	---	---	0.23%	---	
4-Methyl-1-Pentene		---	0.79%	---	0.90%	---	---	---	
4-Methyl-trans-2-Pentene		---	---	---	---	---	2.62%	---	
2-Methylpropane		0.30%	0.15%	0.31%	0.19%	3.74%	---	0.20%	
2-Methyl-2-Propenal		0.04%	---	0.17%	---	---	---	---	
2-Methylpropene		---	2.29%	---	2.01%	---	---	---	
(1-methylpropyl)benzene		0.06%	---	0.04%	---	0.05%	---	---	
(2-methylpropyl)benzene		0.06%	---	0.05%	---	---	---	---	
1-Methyl-3-propylbenzene		0.16%	---	0.11%	---	0.17%	---	---	
Methylpyrene		---	---	---	---	---	1.11%	---	
Methylfluoranthene		---	---	---	---	---	---	---	
Methylpyrene		---	---	---	---	---	---	---	
Naphthalene	X	0.07%	---	0.03%	---	---	---	---	
Nonanal		---	0.53%	---	0.29%	---	---	---	
Nonane		---	0.33%	0.64%	0.24%	0.77%	0.12%	0.98%	0.56%
Nonene		---	---	0.73%	---	0.92%	---	---	---
1-Nonene		---	0.11%	0.69%	0.10%	0.29%	---	1.22%	---
trans-2-Nonene		---	---	---	---	---	0.19%	---	---
Octanal		---	0.03%	---	0.02%	---	---	---	---
Octane		---	0.60%	0.20%	0.51%	0.45%	0.26%	1.55%	0.89%
1-Octene		---	0.03%	---	0.05%	---	---	---	---
Pentane		---	0.06%	1.91%	0.08%	1.52%	5.29%	---	8.14%
1-Pentene		---	0.37%	2.98%	0.38%	3.23%	0.45%	---	0.27%
cis-2-Pentene		---	0.20%	0.15%	0.20%	---	1.06%	---	0.35%
trans-2-Pentene		---	0.39%	1.30%	0.37%	0.97%	0.89%	---	0.58%
Pentylbenzene		---	---	---	---	---	---	1.62%	---
Pentene		---	---	---	---	---	0.21%	---	---
trans-1-Phenylbutene		---	---	---	---	---	0.25%	---	---
4-Phenyl-1-Butene		---	---	---	---	---	0.28%	---	---
1,2-Propadiene		---	---	---	---	---	0.12%	---	---
Propane		---	0.24%	0.31%	0.23%	3.00%	---	---	---
Propene		---	4.23%	9.08%	4.56%	8.79%	1.71%	---	1.11%
Propionaldehyde	X	---	0.04%	---	0.11%	---	---	---	---
Propylbenzene		---	0.59%	0.20%	0.49%	0.29%	0.34%	0.51%	0.65%
Propylcyclopentane		---	---	---	---	---	---	---	---
Propyltoluene		---	---	---	---	---	---	3.37%	---
Propyne		---	---	0.38%	---	0.10%	0.26%	---	---
Styrene	X	0.13%	0.84%	0.10%	---	---	---	2.04%	0.23%
Tetramethylbenzene		---	0.26%	0.27%	0.18%	0.42%	---	14.53%	---
1,2,3,4-Tetramethylbenzene		---	0.18%	---	0.09%	---	---	---	---
1,2,4,5-Tetramethylbenzene		---	0.20%	---	0.13%	---	---	---	---
Toluene	X	11.19%	1.62%	10.57%	2.06%	3.25%	---	12.52%	---
Trimethylbenzene		---	3.28%	0.31%	2.55%	0.39%	1.57%	4.27%	1.43%
1,2,3-Trimethylbenzene		---	0.34%	0.23%	0.30%	---	0.28%	---	---
1,3,5-Trimethylbenzene		---	0.89%	---	0.78%	0.39%	1.32%	---	1.99%
2,2,3-Trimethylbutane		---	---	0.03%	---	---	---	0.23%	---
1,2,3-Trimethylcyclopentane		---	---	0.61%	---	---	---	---	---
2,2,5-Trimethylhexane		---	0.38%	0.15%	0.43%	---	0.26%	0.46%	---
2,3,5-Trimethylhexane		---	---	0.15%	---	0.19%	0.09%	---	---
2,2,4-Trimethylpentane	X	2.25%	0.94%	4.04%	0.77%	1.63%	0.24%	1.45%	---
2,3,3-Trimethylpentane		---	---	---	0.10%	0.46%	---	---	---
2,3,4-Trimethylpentane		---	0.67%	0.46%	0.92%	0.24%	0.28%	0.33%	0.71%
2,4,4-Trimethyl-1-pentene		---	0.02%	0.08%	0.04%	---	1.88%	---	---
2,4,4-Trimethyl-2-pentene		---	---	0.31%	---	---	---	---	---
Undecane		---	0.13%	1.11%	0.09%	1.40%	0.15%	2.64%	---
1-Undecene		---	---	---	---	---	0.15%	---	---
Valeraldehyde		---	0.01%	---	0.01%	---	---	---	---
Xylenes (Mixed Isomers)	X	9.50%	1.90%	8.20%	2.08%	3.02%	---	10.11%	---

- a. SOURCE: Data provided by the EPA’s SPECIATE database version 4.4.
- b. SOURCE: *Diesel Unregulated Emissions Characterization*. CRC Report No. E-75-2, Coordinating Research Council, Inc., July 2010.
- c. SOURCE: *Air Pollutant Emission Factors from New and In-Use Motorcycles*. Atmospheric Environment, April 2000.

“X” Indicates compound is a HAP

“---” Indicates No data available





**Figure 5-3. Example Data Collection Form for Privately Owned Vehicles (POVs)**

<b>Installation Name:</b>		<b>Inventory Year:</b>	
<b>Responsible Organization (Name and Office Symbol):</b>			
<b>POC (Name, Phone #, and e-mail):</b>			
<b>Question</b>		<b>Response</b>	
Can you provide a listing of all registered vehicles on base? (Y/N)? If so, be sure to include all specific information (make/model, year, etc.) about the vehicles.			
What is the estimated average number of <u>registered</u> POVs at the installation during the inventory period?			
What is the estimated percentage of <u>registered</u> vehicles which actually travel on the installation during a typical weekday (Monday - Friday)			
What is the estimated percentage of <u>registered</u> vehicles which actually travel on the installation during a typical weekend day (Saturday and Sunday)			
What is the estimated distance the average POV travels on base during a typical weekday?		___ mi/day	
What is the estimated distance the average POV travels on base during a typical weekend day?		___ mi/day	
What is the estimated number of <u>non-registered</u> POVs which travel on base during a typical weekday?			
What is the estimated number of non-registered POVs which travel on base during a typical weekend day?			
What is the estimated average model year of all POVs driven on base during the inventory year? (NOTE: This is not required if the average model years are listed below for each vehicle category)			
<b>Using registration information, provide an estimate of the percentage of <u>registered</u> POVs which fall under each of the 12 vehicle categories listed below. If possible, please provide the estimated model year for each vehicle category.</b>			
Vehicle Category	Category Description	Estimated % of Registered Vehicles	Average Model Year
LDGV	Light-Duty Gasoline Vehicles - All gasoline-powered passenger cars		
LDDV	Light-Duty Diesel Vehicles - All diesel powered-passenger cars		
LDGT	Light-Duty Gasoline Trucks - All smaller gasoline-powered trucks (0 - 8,500lbs GVWR)		
LDDT	Light-Duty Diesel Trucks - All smaller diesel-powered trucks (0 - 8,500lbs GVWR)		
HDGV	Heavy-Duty Gasoline Vehicles - All larger gasoline-powered vehicles (>8,500lbs)		
HDDV	Heavy-Duty Diesel Vehicles - All larger diesel-powered vehicles (>10,000lbs GVWR)		
MC	Motorcycles - All motorcycles (assumed to be gasoline-powered)		

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## 5.6 References

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VEMSO, “Air Force Vehicle and Equipment Management Office”

## 6.0 FUEL TRANSFER (FDSP, FLD)- EXCLUDES ON-ROAD VEHICLE REFUELING

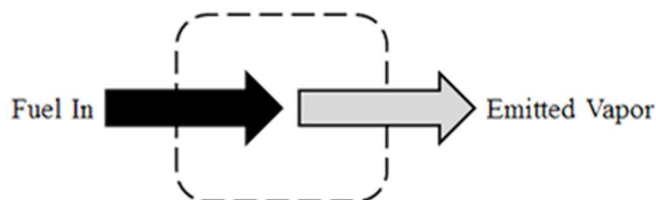
- *Fugitive Source*
- *Mobile Source* – When fuel is dispensed to mobile equipment.
- *Stationary Source*– Fuel spills and when dispensed to stationary equipment.

**\*The USAF recommends that most emissions generated during the transfer (dispensing) of fuel into *on-road* vehicles be classified as mobile emissions. However, if the regulator insists this category be included as a stationary source, subtract those emissions from the Mobile AEI, and add them to the Stationary AEI to avoid duplicate reporting. This is accomplished by manually calculating emissions generated from on-road vehicle refueling using the procedures given in this section, then subtracting those values from the emissions generated by on-road vehicles covered in the previous section. \***

### 6.1 Introduction

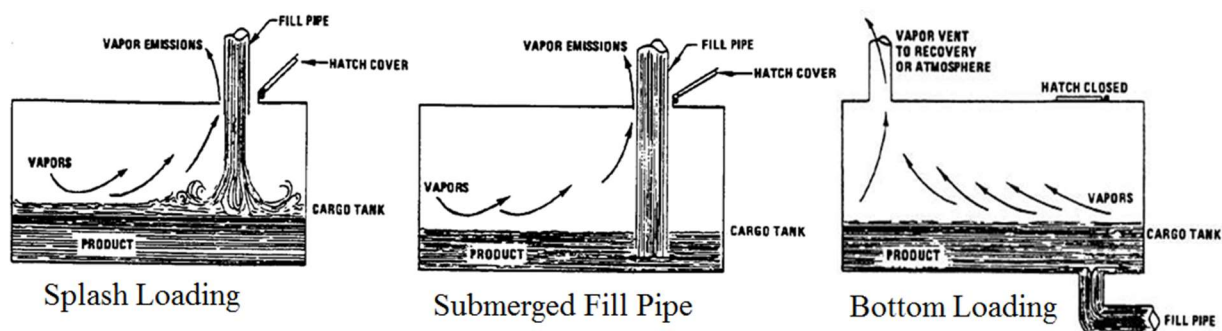
Fuel transfer includes the dispensing of fuel into *non-road* engines and equipment, aircraft, and fuel trucks. **Note that the emissions from the refueling of *VEHEs* are not addressed here since those emissions are accounted for in the EFs generated by the MOVES2014b model as explained in the previous chapter.** Emissions from fuel dispensing are the result of vapors displaced as fuel is added to the fuel tank. The amount of vapor released to the atmosphere is a function of the gas and fuel tank temperatures, the vapor pressure of the fuel, the dispensing rate, and the presence of vapor emission control devices. **The vapor that is emitted into the atmosphere is composed of both VOCs and HAPs and is considered fugitive in nature.**

Minor fuel spills are an inevitable consequence of fuel dispensing. Typically, these spills are individually insignificant though may collectively result in a substantial release of VOC and HAP emissions. **Emissions from minor spills are accounted for in the “Fuel Transfer” section of the Stationary Guide to produce a conservative emissions calculation. Emissions from significant spills, which are those spills that are reported to the Environmental or Civil Engineering Environmental office, are not addressed here, but described in the “Fuel Spills” section of the Transitory Guide.** The vapor emissions of concern from fuel dispensing operations are described by the simple control volume given in Figure 6-1.



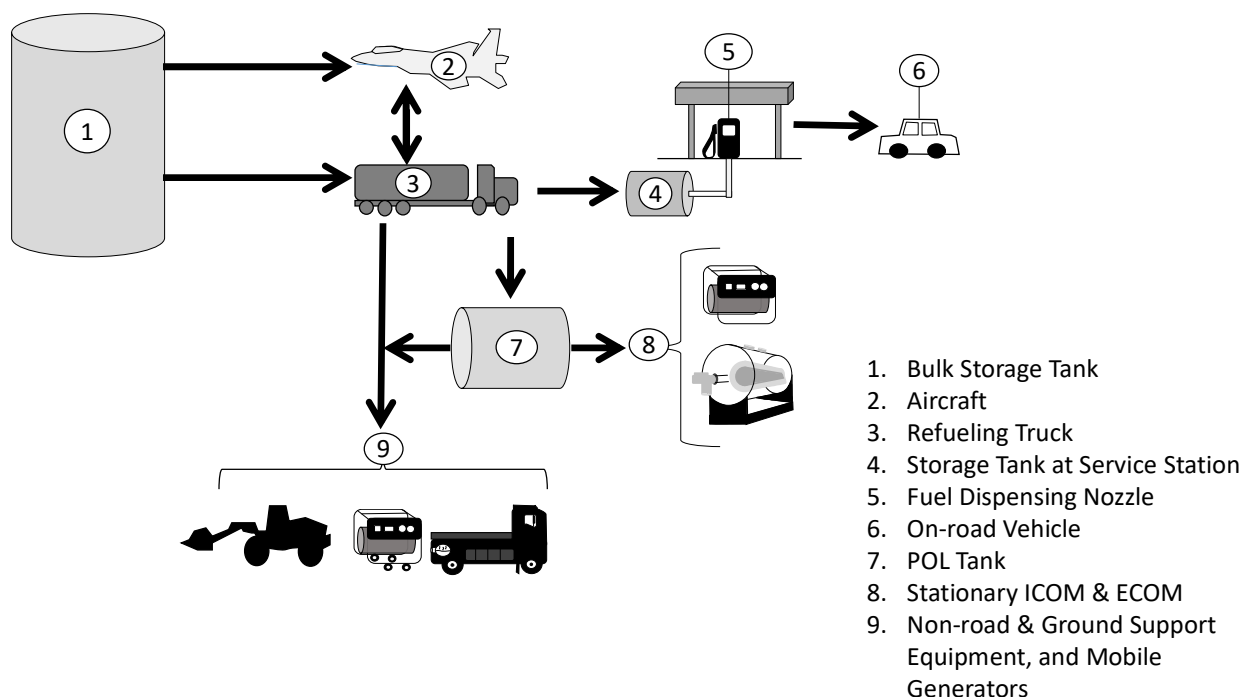
**Figure 6-1. Simple Fuel Dispensing Control Volume**

The loading method used in the fuel transfer process has a significant effect on the amount of vapor emissions generated during the transfer activity. There are two main fuel loading methods: splash loading and submerged loading. The splash loading method involves the lowering of the fill pipe into the tank **above** the liquid level. The loading of the fuel using the splash method results in significant turbulence, which increases the amount of vapor released into the atmosphere. The alternative method, submerged loading, may be further subdivided into two techniques: submerged fill pipe method and the bottom loading method. In the submerged fill pipe method, the fill pipe extends almost to the bottom of the storage tank, **below** the liquid level. In the bottom loading method, a fill pipe is permanently attached to the bottom of the storage tank. In both cases, the fill pipe is below the liquid level. Therefore, turbulence is minimized and vapor emissions are greatly reduced when compared to the splash loading method. Each method is shown in Figure 6-2.



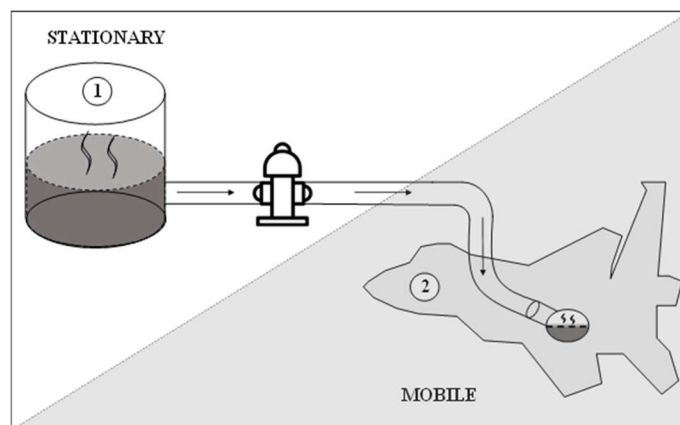
**Figure 6-2. Splash Loading, Submerged Fill Pipe, and Bottom Loading Methods**

There are several challenges to calculating evaporative emissions from fuel transfer activities. These challenges include the use of several different fuels used on base, such as gasoline, diesel, or JP-8 fuel, each with different vapor pressures. Furthermore, there are multiple destinations for fuels on base that may make it more difficult to gather data or determine what emissions are classified as mobile or stationary. To simplify how each base should calculate fuel transfer emissions, a diagram of the typical transfer methods and destinations of fuel on base is provided in Figure 6-3.



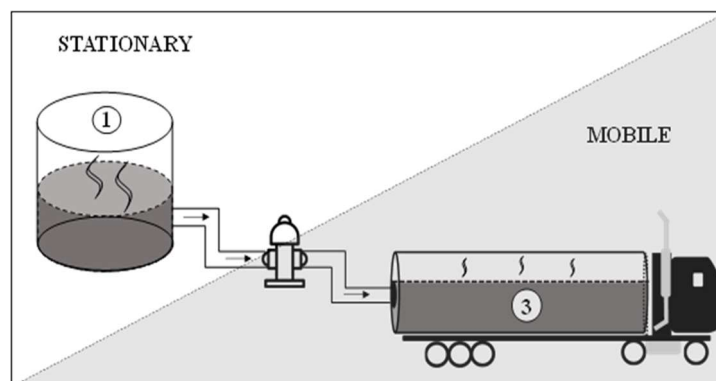
**Figure 6-3. Typical On-Base Fuel Transfer Activities and Destinations.**

Figure 6-3 shows the typical fuel transfer paths that fuel may go through at a USAF installation. The transfer of the fuel into different equipment results in the generation and release of pollutant emissions. The classification (mobile vs. stationary) of these pieces of equipment, determines whether the emissions generated are regarded as mobile or stationary sources. It is important to note that **significant** fuel spills may occur at any point in the fuel transfer process, which will contribute to VOC and HAP emissions as the fuel evaporates. However, since these are uncommon occurrences, emissions from fuel spills are addressed in the *Air Emissions Guide for Air Force Transitory Sources*. The specific pathways illustrated in Figure 6-3 are described below and categorized as either mobile (shaded) or stationary (not shaded) sources of emissions.



**1 (Bulk Storage Tank) → 2 (Aircraft)** The figure above illustrates fuel transferred to refuel an aircraft from a bulk storage tank via a hydrant system. The vapors displaced within the storage tank as the liquid level lowers or rises are known as “working losses”. The vapors generated in the space above the stored liquid are known as “breathing losses”. These emissions result in **stationary** emissions and are calculated using the equations provided in Chapter 7 of AP-42. Refer to the *Air Emissions Guide for Air Force Stationary Sources* for more information regarding the calculation of these emissions.

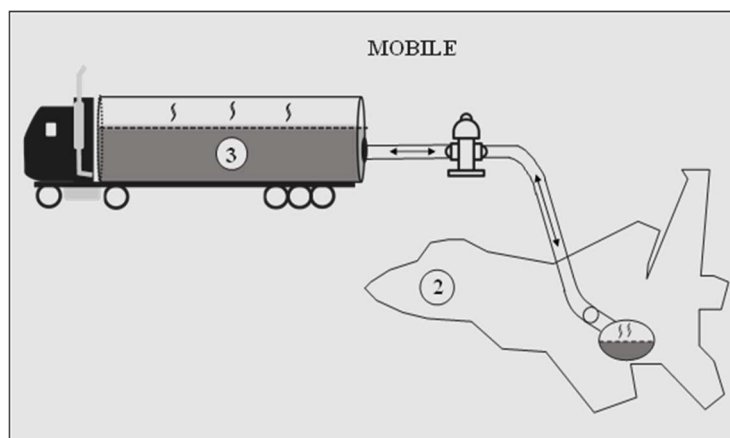
**Mobile** emissions are generated from the displaced vapor in the aircraft fuel tank. The mobile emissions should be reported in the mobile AEI and are calculated as described later in this chapter.



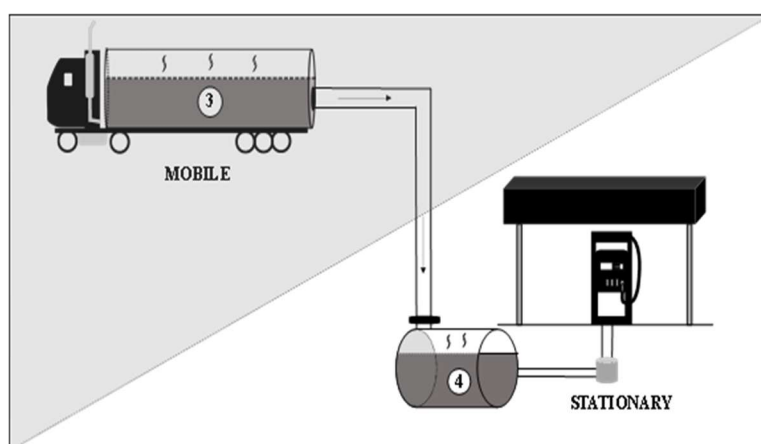
**1 (Bulk Storage Tank) → 3 (Refueling Truck)** The **stationary** source of emissions is the bulk storage tank producing working losses and breathing losses from the liquid fuel. The methodology for calculating these emissions is provided in the *Air Emissions Guide for Air Force Stationary Sources*.

The **mobile** emissions from loading fuel into refueling trucks are generated from the displaced vapor in the fuel truck. The mobile emissions should be reported in the mobile AEI and are calculated as described later in this chapter.



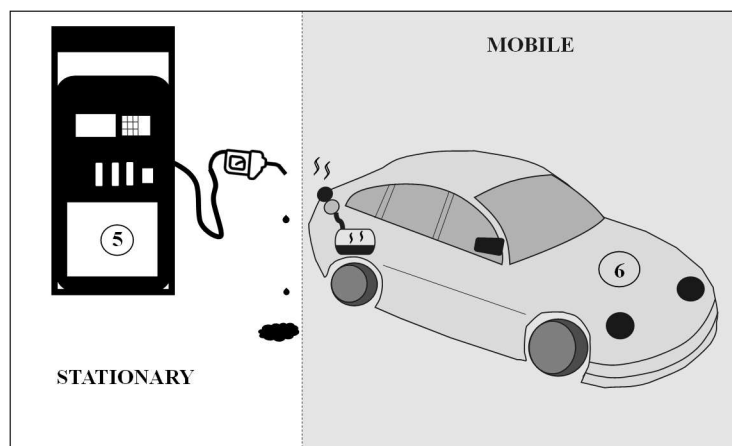


**2 (Refueling Truck) ↔ 3 (Aircraft)** The figure above illustrates the fueling and defueling of aircraft via a refueling truck. Both pieces of equipment are **mobile**, therefore all emissions generated from these activities should be reported in the mobile AEI and calculated as described later in this chapter. Emissions from both mobile pieces of equipment come from displaced vapors in the refueling truck and aircraft fuel tanks.



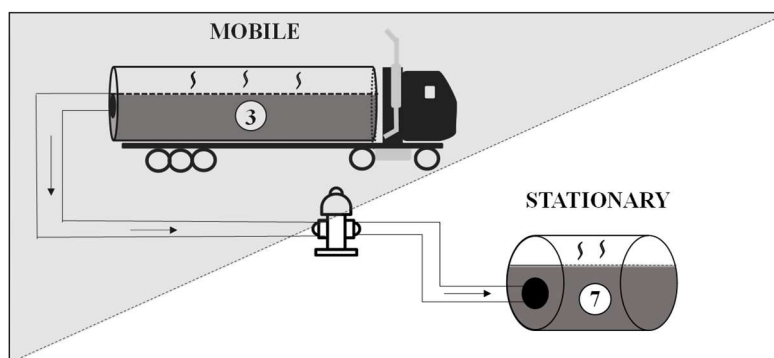
**3 (Refueling Truck) → 4 (Storage Tank and Service Station)** The figure above illustrates the loading of fuel from a refueling truck into a storage tank at a fuel service station. The **stationary** emissions from the refilling of a storage tank at a fuel dispensing location include breathing and working losses from the storage tank. The methodology for calculating these emissions is provided in the *Air Emissions Guide for Air Force Stationary Sources*.

The only substantial **mobile** emissions from the fueling of the tank via the refueling truck are generated from any significant fuel spills which are addressed in the Transitory Guide.



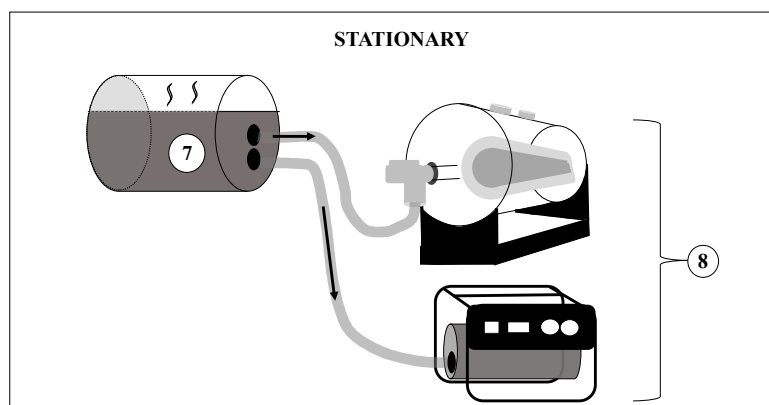
**5 (Fuel Dispensing Nozzle) → 6 (On-Road Vehicle)** The figure above illustrates the refueling of a vehicle at a service station. The **stationary** emissions are the result of the evaporation of spilled fuel from the fuel nozzle whose calculations are described in the *Air Emissions Guide for Air Force Stationary Sources*.

The **mobile** emissions are generated from the displaced vapors in the vehicle fuel tank. The displaced vapor emissions should be included in a mobile AEI and are already calculated by the MOVES model used to determine VEHE emissions. AP-42 states that the motor vehicle refueling emissions equation is incorporated into the MOBILE model, which has been integrated into the MOVES model. The MOVES2014b model is the current model used for estimating emissions for VEHEs. This version of the model allows for disabling of the refueling emissions calculation if these emissions are included in a stationary AEI, rather than in a mobile AEI. **This should only be done if the regulator insists this category be included as a stationary source. Otherwise these emissions are already accounted for in the EFs found in the “On-Road Vehicles” chapter of this Guide.**

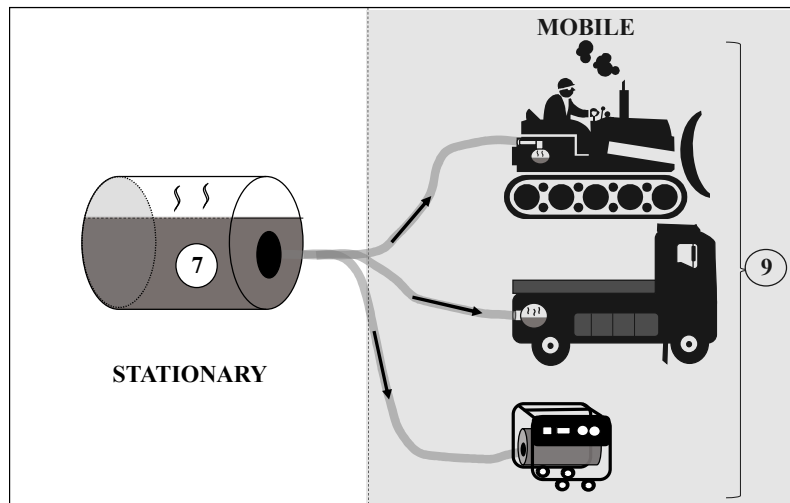


**3 (Refueling Truck) → 7 (POL Tank)** The fuel transfer pathway illustrates the loading of fuel from a refueling truck into a Petroleum, Oil, and Lubricants (POL) storage tank. The **stationary** emissions include the breathing and working losses from smaller storage tanks on base. The methodology for calculating these emissions is provided in the *Air Emissions Guide for Air Force Stationary Sources*.

Likely, the only emissions generated from the mobile source (refueling truck) are from any significant fuel spills which are addressed in the *Air Emissions Guide for Air Force Transitory Sources*.



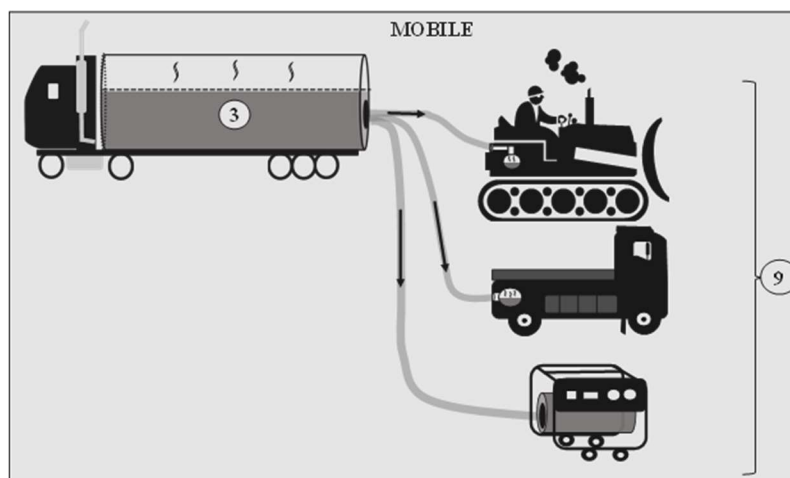
**7 (POL Tank) → 8 (Stationary ICOM/ECOM)** The figure above illustrates the loading of fuel from a storage tank into a stationary Internal Combustion (ICOM) piece of equipment, such as a generator, or External Combustion (ECOM) equipment, such as a boiler. The **stationary** emissions from the fuel outlet (the storage tank) are the result of any significant fuel spills and breathing/working losses generated. The breathing/working losses are calculated using the calculations described in Chapter 7 of AP-42 while emissions from significant fuel spills are described in the Transitory Guide. The **stationary** emissions from the fuel loading inlet (the stationary ICOM or ECOM equipment) are generated from the displaced vapor in the fuel tanks. The methodology for calculating these emissions is provided in the *Air Emissions Guide for Air Force Stationary Sources*.



### 7 (POL Tank) → 9 (Non-Road & Ground Support Equipment and Mobile Generators)

During this fuel transfer activity, fuel is moved from a storage tank to a mobile piece of equipment, such as non-road equipment, Ground Support Equipment (GSE), or a mobile generator. The **stationary** emissions from the storage tank are the result of any significant fuel spills and breathing/working losses generated. The methodology for calculating the breathing/working losses emissions is provided in Chapter 7 of AP-42 and the *Air Emissions Guide for Air Force Stationary Sources*, while fuel spill emissions are addressed in the *Air Emissions Guide for Air Force Transitory Sources*.

The **mobile** emissions from the fuel loading inlet (non-road and ground support equipment or mobile generator) are produced by the displaced vapor in the fuel tanks and should be reported in the mobile AEI. Emissions are calculated as described later in this chapter.



**3 (Refueling Trucks) → 9 (Non-Road & Ground Support Equipment and Mobile Generators)** The figure illustrates the transfer of fuel from a **mobile** fuel loading outlet

(refueling truck) into either non-road equipment, GSE, or a mobile generator, **all** of which are considered **mobile** sources. Emissions are calculated as described later in this chapter and should be reported in a mobile AEI.

## 6.2 Emission Factors

Section 5.2 of AP-42 describes both the emissions from the loading of fuel into fuel trucks and the evaporative emissions from the fueling of a gasoline vehicle. Since the emissions from fueling gasoline vehicles is covered under the MOVES2014b model, the EFs for vehicle refueling are not provided here, but may be found in Table 5.2-7 of AP-42. For non-road engines and fuel trucks, the most appropriate method for calculating emissions from fuel dispensing is to calculate the loading loss. The loading loss is the primary source of evaporative emissions from the loading of fuel. These losses are the result of organic vapors within a fuel tank that are displaced to the atmosphere as the tank is loaded with fuel. To calculate these losses, the saturation factor, the vapor pressure of the fuel, the molecular weight of the vapors, and the temperature of the bulk liquid must be known. A detailed description on how to calculate these losses is provided in the next section of this document.

The saturation factor refers to the ratio of the saturated value of the expelled vapor to the unsaturated value. These values vary based on the method of fuel loading. A tank that is filled with only one fuel, or fuels with similar characteristics, is said to be practicing “dedicated normal service.” When loading vapors are returned to the loading terminal after the fuel is unloaded to a storage tank, it is known as “dedicated vapor balance service.” Section 5.2 of AP-42 provides the saturation factors, which are provided in Table 6-1.

**Table 6-1. Fuel Loading Saturation Factors**

Loading Method	Loading Parameters	S Factor
Submerged Loading	Clean Tank	0.50
	Dedicated Normal Service	0.60
	Dedicated Vapor Balance Service	1.00
Splash Loading	Clean Tank	1.45
	Dedicated Normal Service	1.45
	Dedicated Vapor Balance Service	1.00

SOURCE: U.S. EPA. "Transportation and Marketing of Petroleum Liquids." *Compilation of Air Pollutant Emission Factors - Volume I: Stationary Point and Area Sources*. Fifth Edition. 1995. Section 5.2.

The vapor emissions resulting from fuel transfer is a function of the vapor pressure of the fuel. The vapor pressure is indicative of the evaporation rate of a liquid. The vapor pressures for each fuel and their respective vapor molecular weights are provided in Table 6-2.

**Table 6-2. Vapor Pressures for Various Fuels**

Petroleum Liquid	Vapor Molecular Weight (lb/lb-Mol)	True Vapor Pressure (psia)						
		40°F	50°F	60°F	70°F	80°F	90°F	100°F
Crude Oil RVP 5 <sup>a</sup>	50	1.80	2.30	2.80	3.40	4.00	4.80	5.70
Gas RVP 6	69	1.90	2.37	2.93	3.60	4.38	5.29	6.35
Gas RVP 7	68	2.30	2.90	3.50	4.30	5.20	6.20	7.40
Gas RVP 7.8	68	2.59	3.21	3.94	4.79	5.79	6.96	8.30
Gas RVP 8	68	2.67	3.30	4.04	4.92	5.94	7.13	8.50
Gas RVP 8.3	68	2.79	3.44	4.22	5.13	6.19	7.42	8.83
Gas RVP 9	67	3.06	3.77	4.61	5.59	6.74	8.06	9.58
Gas RVP 10	66	3.40	4.20	5.20	6.20	7.40	8.80	10.50
Gas RVP 11	65	3.87	4.75	5.77	6.96	8.34	9.92	11.74
Gas RVP 11.5	65	4.09	5.00	6.07	7.31	8.75	10.41	12.29
Gas RVP 12	64	4.29	5.24	6.36	7.65	9.15	10.86	12.82
Gas RVP 13	62	4.70	5.70	6.90	8.30	9.90	11.70	13.80
Gas RVP 13.5	62	4.93	6.01	7.26	8.71	10.38	12.29	14.46
Gas RVP 15	60	5.58	6.77	8.16	9.77	11.61	13.71	16.09
Diesel	130	3.10E-03	4.50E-03	6.50E-03	9.00E-03	1.20E-02	1.60E-02	2.20E-02
JP-8/Jet A <sup>b</sup>	130	1.58E-02	2.19E-02	3.01E-02	4.08E-02	5.48E-02	7.27E-02	9.54E-02

SOURCE (unless otherwise stated): Data taken from TANKS version 4.0.9d.

- SOURCE: U.S. EPA. "Organic Liquid Storage Tanks." *Compilation of Air Pollutant Emission Factors - Volume I: Stationary Point and Area Sources*. Fifth Edition. 1997. Section 7.1.
- SOURCE: USAF, Environmental Analysis Division. *JP-8 Volatility Study, IERA-RS-BR-SR-2001-0002*. San Antonio, 2001. Vapor pressures calculated using the composite data calculation, an average flash point temperature of 118.238°F, and atmospheric pressure of 760mm Hg. Flash point temperature the average provided by Defense Energy Support Center. "Petroleum Quality Information System." Defense Logistics Agency, 1996.

### 6.3 Control and Capture Efficiencies

Emissions from fuel dispensing may be controlled using a variety of techniques. Estimating emissions in which a control device is utilized is more challenging since the capture efficiency must also be considered. Additionally, since portions of fuel transfer are regarded as either stationary or mobile sources, using the control and capture efficiencies appropriately may be confusing. For example, in Step 1-2 in Figure 6-3 fuel is loaded from a loading terminal storage tank and into a fuel truck. The displaced vapor may be captured with a blower system and run through a vapor recovery unit before being returned to the storage tank. In this case, the capture efficiency of the truck and the control efficiency of the vapor recovery unit are used to determine the emissions from this process. The control efficiency is taken from the stationary unit,

although the emissions are classified as mobile since the emissions are the result of displaced vapor in a mobile fuel truck. Typical capture and control efficiencies are found in Table 6-3 and Table 6-4 respectively.

**Table 6-3. Typical Fuel Truck Capture Efficiencies**

Fuel Truck Capture System	Capture Efficiency (%)
Untested	70.0
EPA standards (NSPS Subpart XX) leak test	98.7
MACT-level annual leak test	99.2
Trucks with installed blower system	100.0 <sup>a</sup>

SOURCE (Unless otherwise stated): U.S. EPA. "Transportation and Marketing of Petroleum Liquids." *Compilation of Air Pollutant Emission Factors - Volume I: Stationary Point and Area Sources*. Fifth Edition. 1995. Section 5.2.

- a. SOURCE: TCEQ. "Tank Truck Loading of Crude Oil or Condensate." 2013. 14 December 2013.  
<<http://www.tceq.texas.gov/assets/public/permitting/air/NewSourceReview/oilgas/tank-truck-load.pdf>>.

**Table 6-4. Typical Fuel Transfer Control Efficiencies**

Control Techniques		Control Efficiency (%)
Flares <sup>1</sup>	Compounds $\leq$ 3 Carbon atoms	99.0
	Other Organic Compounds	98.0
Thermal Oxidizers <sup>2</sup>		99.0
Carbon Systems <sup>3</sup>		98.0
Vapor Recovery Units		100.0

SOURCE: TCEQ. "Tank Truck Loading of Crude Oil or Condensate." 2013. 14 December 2013.

<<http://www.tceq.texas.gov/assets/public/permitting/air/NewSourceReview/oilgas/tank-truck-load.pdf>>.

- a. Flares must meet 40 CFR 60.18 requirements of minimum heating value of waste gas and a maximum flare tip velocity.
- b. Must be designed for the variability of the waste gas stream and basic monitoring which consists of a temperature monitor that indicates the device is achieving a satisfactory minimum temperature.
- c. Must have an alarm system that will prevent break through.

Alternatively, EFs for the loading of fuel trucks have been developed for several fuels likely to be distributed on base. These EFs are based on an assumed temperature of 60°F and may be used as an alternative to calculate the loading loss. Table 5.2-5 of AP-42 provides these EFs, which have been reproduced here in Table 6-5.

**Table 6-5. VOC Emission Factors for Fuel Dispensing/Loading**

Loading Method	Loading Parameters	Emission Factors (lb/10 <sup>3</sup> gal)		
		Gasoline <sup>a</sup>	Diesel/No. 2 Fuel Oil	JP-8/Jet A
Submerged Loading	Dedicated Normal Service	5	0.014	0.016
	Vapor Balance Service	8	---	---
Splash Loading	Dedicated Normal Service	12	0.03	0.04
	Vapor Balance Service	8	---	---

SOURCE: U.S. EPA. "Transportation and Marketing of Petroleum Liquids." *Compilation of Air Pollutant Emission Factors - Volume I: Stationary Point and Area Sources*. Fifth Edition. 1995. Section 5.2.

a. Gasoline has an RVP of 10 psia

“---” Indicates No data available

## 6.4 Emission Calculations

Emissions of concern from fuel transferring operations are VOCs and HAPs. The volume of VOCs and HAPs emitted are directly related to the amount of VOC and HAP constituents within the fuel. Calculations of emissions of VOCs and HAPs from fuel transferring are outlined below.

### 6.4.1 VOC Emissions Calculations (Preferred Method)

The preferred method for calculating VOC emissions from the transferring of fuel is to use the fuel vapor pressure, saturation factor, temperature, and total throughput to estimate the loading loss. VOCs are calculated as follows:

$$E(\text{VOC}) = Q \times \frac{1}{1000} \times 12.46 \times \frac{S \times P \times M}{T} \times \left\{ 1 - \left[ \left( \frac{\text{Cap}}{100} \right) \times \left( \frac{\text{CE}}{100} \right) \right] \right\}$$

**Equation 6-1**

Where,

- E(VOC)** = Annual emissions of VOCs (lb/yr)
- Q** = Annual quantity of fuel transferred (gal/yr)
- 1000** = Factor converting gallons to 10<sup>3</sup> gallons (gal/10<sup>3</sup> gal)
- 12.46** = Equation constant (°R lb-mol/psia 10<sup>3</sup> gal)
- S** = Saturation factor. This is provided in Table 6-1
- P** = True vapor pressure of fuel (psia). This is provided in Table 6-2
- M** = Vapor molecular weight of the fuel (lb/lb-mol). This is provided in Table 6-2
- T** = Temperature of bulk liquid loaded (°R)
- Cap** = Capture efficiency of the loading terminal (%). This is provided in Table 6-3
- CE** = Efficiency of the control device (%). This is provided in Table 6-4
- 100** = Factor for converting a percent to a fraction (%)



A detailed control volume outlining the emissions from fuel transfer operations is provided in Figure 6-4.

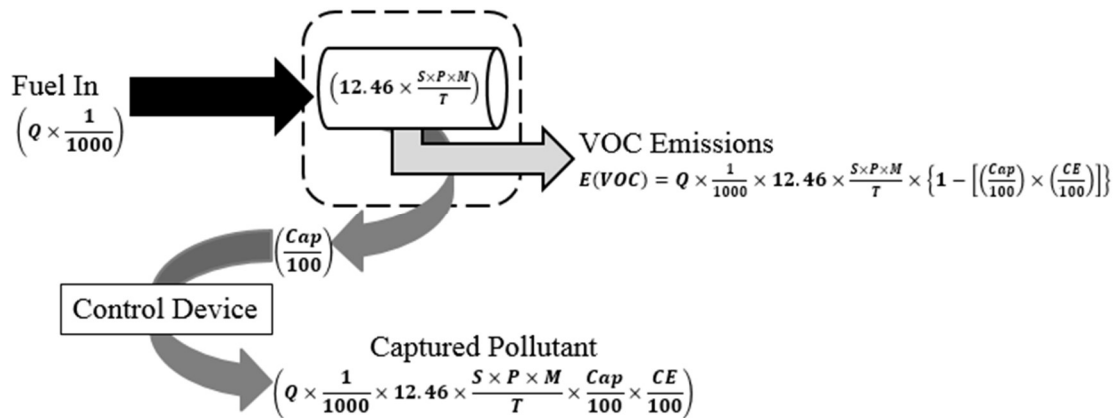


Figure 6-4. Fuel Transfer Control Volume – Preferred Method

#### 6.4.2 VOC Emissions Calculations (Emission Factor Alternative Method)

Using the EF method, the appropriate EF selected from Table 6-5 and the total quantity of fuel transferred, the emissions are calculated as follows:

$$E(VOC) = Q \times \frac{1}{1000} \times EF(VOC) \times \left\{1 - \left[\left(\frac{Cap}{100}\right) \times \left(\frac{CE}{100}\right)\right]\right\}$$

Equation 6-2

Where,

$$EF(VOC) = \text{VOC emission factor as provided in Table 6-5 (lb/10}^3 \text{ gal)}$$

A detailed control volume is provided in Figure 6-5.

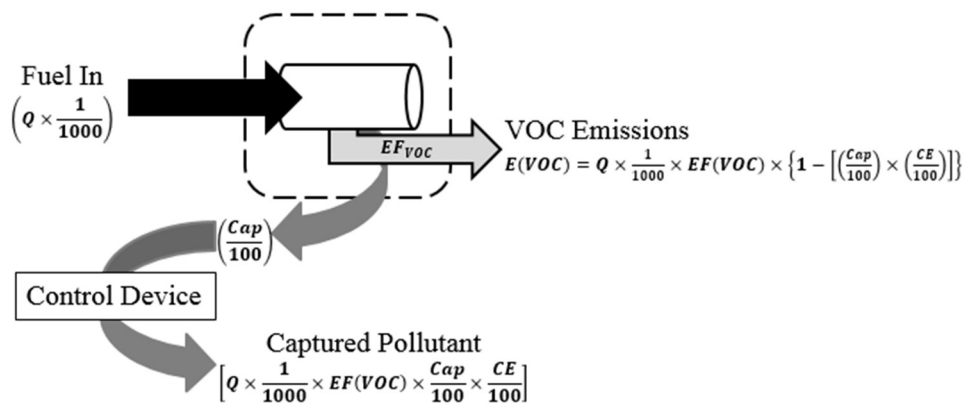


Figure 6-5. Fuel Transfer Control Volume – Emission Factor Method

### 6.4.3 HAP Emissions Calculation

The number of HAPs released into the environment from fuel transfer operations may be estimated using the total VOCs emitted, as calculated above, and the weight percent of HAPs in the fuel itself (APIMS and the Air Conformity Applicability Model, or ACAM, automatically calculate these values). Contact the fuel supplier for specific information regarding the weight percent of HAPs in fuels commonly used at USAF installations. In the absence of available data, Table 6-6 provides the typical weight percent of individual HAPs found in several fuels used at USAF installations. Using the total VOCs and weight percent HAP in the fuel, the total HAP emissions from fuel transfer operations is calculated using Equation 6-3.

$$E(HAP) = E(VOC) \times \frac{WP(HAP)}{100}$$

**Equation 6-3**

Where,

**E(HAP)** = HAP emissions from fuel dispensing (lb/yr)

**WP(HAP)** = Weight Percent HAP in the fuel (%)

**Table 6-6. Weight Percent of HAPs in Fuels commonly used at Air Force Installations**

Compound	Molecular Weight	Vapor Pressure (psi) <sup>a</sup>	Typical wt. %					
			Diesel		Gasoline		JP-8/Jet A <sup>b</sup>	
			Liquid Phase	Vapor Phase <sup>c</sup>	Liquid Phase	Vapor Phase <sup>c</sup>	Liquid Phase	Vapor Phase <sup>c</sup>
Anthracene	178.22	1.27E-07	2.82E-03 <sup>d</sup>	5.76E-08	---	---	---	---
Benzene	78.11	1.51E+00	8.00E-04	1.94E-01	1.80E+00	6.10E-01	3.36E-02	1.55E+00
1,3-Butadiene	54.09	3.61E+01	---	---	2.19E-04 <sup>d</sup>	1.78E-03	---	---
Cumene (Isopropylbenzene)	120.20	6.93E-02	---	---	5.00E-01	7.79E-03	1.80E-01	3.81E-01
Dibenzofuran	168.20	4.80E-05	1.64E-02 <sup>d</sup>	1.26E-04	---	---	---	---
Ethylbenzene	106.17	1.48E-01	1.30E-02	3.10E-01	1.40E+00	4.67E-02	1.58E-01	7.16E-01
Fluorene	166.21	1.16E-05	2.94E-02 <sup>d</sup>	5.48E-05	---	---	3.42E-03	1.21E-06
Hexane	86.17	2.44E+00	1.00E-04	3.91E-02	1.00E+00	5.48E-01	---	---
Isooctane (2,2,4-Trimethyl Pentane)	114.23	5.38E-02	---	---	4.00E+00	4.84E-02	1.22E-03	2.00E-03
Naphthalene	128.20	3.94E-03	3.39E-01 <sup>d</sup>	2.15E-01	1.74E-01 <sup>d</sup>	1.54E-04	2.66E-01	3.20E-02
Phenanthrene	178.22	2.34E-06	3.22E-02 <sup>d</sup>	1.21E-05	---	---	---	---
Phenylbenzene (1,1'-biphenyl)	154.21	3.78E-04	---	---	---	---	6.74E-02	7.79E-04
Pyrene	202.24	8.70E-08	3.62E-02 <sup>d</sup>	5.06E-07	---	---	1.24E-05	3.31E-11
Toluene	92.13	4.25E-01	3.20E-02	2.19E+00	7.00E+00	6.69E-01	2.18E-01	2.83E+00
Xylenes	106.17	1.30E-01	2.90E-01	6.06E+00	7.00E+00	2.05E-01	1.18E+00	4.69E+00

SOURCE (Unless otherwise stated): Data taken from USEPA 2005, TANKS, Version 4.09d, U.S. Environmental Protection Agency, October 2005. wt% = weight percent

- Vapor pressures of pure species used in calculations were taken at 70°F and provided either by TANKS, the Hazardous Substance Data Bank (HSDB), or were calculated using Antoine equation constants provided either by the National Institute of Standards and Technology (NIST) or Perry's Chemical Engineer's Handbook Seventh Ed., Perry, Robert H, 1997.
- SOURCE: "JP-8 Composition and Variability," Armstrong Laboratory, Environics Directorate, Environmental Research Division, May 1996. An average density of 6.71 pounds per gallon (lb/gal) was used for unit conversion.
- The vapor phase speciation data was estimated using the liquid phase speciation data and equations found in Section 7.1.4 of AP-42, Fifth Edition, Volume I last updated November 2006. Physical properties for fuels used for calculations can be found in Table 6-7.
- SOURCE: SPECIATE, Version 4.4, U.S. Environmental Protection Agency, February 2014. For diesel, profile 4673 was referenced. For gasoline, profile 8748 was referenced.

"---" No data available

**Table 6-7. Fuel Properties**

Fuel	Liquid Molecular Weight	Vapor Molecular Weight	Vapor Pressure (psia) <sup>b</sup>
JP-8/Jet A	162	130	4.08E-02 <sup>c</sup>
Diesel	188	130	9.00E-03
Gasoline <sup>a</sup>	92	66	6.20E+00

SOURCE (Unless otherwise stated): Data taken from USEPA 2005, TANKS, Version 4.09d, U.S. Environmental Protection Agency, October 2005.

- a. Based on gasoline with a Reid Vapor Pressure of 10.
- b. Based on Temperature of 70° F
- c. SOURCE: "JP-8 Volatility Study," Southwest Research Institute (SWRI), March 2001. Vapor pressures calculated using the composite data calculation, an average flash point temperature of 118.238°F, and atmospheric pressure of 760mmHg. Flash point temperature average provided by "Petroleum Quality Information System Fuels Data (2005)," Defense Logistics Agency (DLA), Defense Energy Support Center, Technology and Standardization Division, 2006.

## 6.5 Information Resources

Information regarding the annual fuel throughput may be collected from the fuel service station supervisor. The supervisor may also be able to provide specific information regarding the fuel vapor pressure and HAP constituent data. If this information is unavailable, contact the fuel supplier to gather this data for more precise emissions calculations.

## 6.6 Example Problems

### 6.6.1 Problem 1 – Preferred Method

A total of 150,000 gal of gasoline and 85,000 gal of diesel were dispensed from a POL tank into non-road equipment during the previous year. Based on the location of the installation, the gasoline used had an average Reid Vapor Pressure (RVP) of 10 and the average fuel temperature at the installation is 60°F. Calculate the total VOCs and xylene emissions.

**Step 1 – Convert the temperature to the correct units.** The temperature was given in terms of °F; however, to calculate the EFs needed, the temperature must be converted to the correct units (degrees Rankin [°R]) as follows:

$$T(^{\circ}R) = T(^{\circ}F) + 460.67$$

$$T(^{\circ}R) = 60 + 460.67 = \mathbf{520.67^{\circ}R}$$

**Step 2 – Record the vapor pressures and vapor molecular weights.** These values are needed for EF calculations and are given in Table 6-2. For RVP 10 gasoline, the molecular weight and

vapor pressure at 60°F are given as **66 lb/lb-mol** and **5.20 psia**, respectively. Similarly, for diesel, the vapor molecular weight and vapor pressure at 60°F are given as **130 lb/lb-mol** and **6.50E-03 psia** respectively.

**Step 3 – Select and record the saturation factor.** The saturation factor is a function of the load method employed. Knowing that this fuel was loaded into non-road equipment from a POL tank, it may be assumed that the fuel was splash loaded without vapor balance. This gives a saturation factor of **1.45**.

**Step 4 – Calculate emissions.** Using the data from the previous steps and Equation 6-1, the total VOCs are calculated as follows:

$$E(VOC) = Q \times \frac{1}{1000} \times 12.46 \times \frac{S \times P \times M}{T} \times \left\{ 1 - \left[ \left( \frac{Cap}{100} \right) \times \left( \frac{CE}{100} \right) \right] \right\}$$

For Gasoline:

$$E(VOC) = 150,000 \frac{gal}{yr} \times \frac{1}{1000} \left( \frac{10^3 gal}{gal} \right) \times 12.46 \left( \frac{^{\circ}R lb-mol}{psia 10^3 gal} \right) \times \frac{1.45 \times 5.20 (psia) \times 66 \left( \frac{lb}{lb-mol} \right)}{520.67^{\circ}R} \left\{ 1 - \left[ \left( \frac{0\%}{100\%} \right) \times \left( \frac{0\%}{100\%} \right) \right] \right\}$$

$$E(VOC) = 150 \left( \frac{10^3 gal}{yr} \right) \times 12.46 \left( \frac{^{\circ}R lb-mol}{psia 10^3 gal} \right) \times \frac{1.45 \times 5.20 (psia) \times 66 \left( \frac{lb}{lb-mol} \right)}{520.67^{\circ}R} \{1\}$$

$$E(VOC) = 1869 \left( \frac{^{\circ}R lb-mol}{psia yr} \right) \times 0.956 \left( \frac{psia lb}{^{\circ}R lb-mol} \right) = \mathbf{1,786.8 \frac{lb}{yr}}$$

For Diesel:

$$E(VOC) = 85,000 \frac{gal}{yr} \times \frac{1}{1000} \left( \frac{10^3 gal}{gal} \right) \times 12.46 \left( \frac{^{\circ}R lb-mol}{psia 10^3 gal} \right) \times \frac{1.45 \times 0.0065 (psia) \times 130 \left( \frac{lb}{lb-mol} \right)}{520.67^{\circ}R} \left\{ 1 - \left[ \left( \frac{0\%}{100\%} \right) \times \left( \frac{0\%}{100\%} \right) \right] \right\}$$

$$E(VOC) = 85 \left( \frac{10^3 gal}{yr} \right) \times 12.46 \left( \frac{^{\circ}R lb-mol}{psia 10^3 gal} \right) \times \frac{1.45 \times 0.0065 (psia) \times 130 \left( \frac{lb}{lb-mol} \right)}{520.67^{\circ}R} \{1\}$$

$$E(VOC) = 1059.1 \left( \frac{^{\circ}R lb-mol}{psia yr} \right) \times 0.002 \left( \frac{psia lb}{^{\circ}R lb-mol} \right) = \mathbf{2.12 \frac{lb}{yr}}$$

**Step 5 – Record xylene weight percent.** Table 6-6 states that the vapor weight percent xylene in gasoline and diesel fuel is **0.205%** and **6.06%**, respectively.

**Step 6 – Calculate xylene emissions.** Using the VOC emissions for gasoline and diesel fuel calculated in Step 4 and the vapor weight percent xylene in each fuel as recorded in Step 5, the total xylene emissions are calculated using Equation 6-3 as shown:

$$E(HAP) = E(VOC) \times \frac{WP(HAP)}{100}$$

For Gasoline:

$$E(Xylene) = 1786.8 \frac{lb}{yr} \times \frac{.205\%}{100\%}$$

$$E(Xylene) = 1786.8 \frac{lb}{yr} \times 0.00205 = \mathbf{3.66 \frac{lb}{yr}}$$

For Diesel:

$$E(Xylene) = 2.12 \frac{lb}{yr} \times \frac{6.06\%}{100\%}$$

$$E(Xylene) = 2.12 \frac{lb}{yr} \times 0.0606 = \mathbf{0.13 \frac{lb}{yr}}$$

**Step 7 – Calculate total VOC emissions.** The total VOC emissions from fuel dispensing are the sum of evaporative emissions from each fuel calculated in Step 4:

$$E(VOC) = \sum_{i=1}^n [E(VOC)_i]$$

$$E(VOC) = \left( 1786.8 \frac{lb}{yr} + 2.12 \frac{lb}{yr} \right)$$

$$\boxed{E(VOC) = \mathbf{1,788.9 \frac{lb}{yr}}}$$

**Step 8 – Calculate total xylene emissions.** The total xylene emissions from fuel dispensing are the sum of evaporative emissions from each fuel calculated in Step 6:

$$E(HAP) = \sum_{i=1}^n [E(HAP)_i]$$

$$E(Xylene) = \left( 3.66 \frac{lb}{yr} + 0.13 \frac{lb}{yr} \right)$$

$$E(\text{Xylene}) = 3.79 \frac{\text{lb}}{\text{yr}}$$

### 6.6.2 Problem 2 – Emission Factor Method

Using the same throughput for gasoline and diesel as given in Problem 1, re-calculate the VOC emissions using the EF method.

**Step 1 – Select and record appropriate EF.** Again, since the fuel was loaded into non-road equipment, the loading method is assumed to be splash loading without vapor balance. The EFs for gasoline and diesel are **12** and **0.03 lb/10<sup>3</sup> gal**, respectively.

**Step 2 – Calculate VOC emissions.** Using Equation 6-2 and the EFs as recorded in Step 1, the total VOCs emitted are calculated as follows:

$$E(\text{VOC}) = Q \times \frac{1}{1000} \times EF(\text{VOC}) \times \left\{ 1 - \left[ \left( \frac{\text{Cap}}{100} \right) \times \left( \frac{\text{CE}}{100} \right) \right] \right\}$$

For Gasoline:

$$E(\text{VOC}) = 150,000 \frac{\text{gal}}{\text{yr}} \times \frac{1}{1000} \left( \frac{10^3 \text{ gal}}{\text{gal}} \right) \times 12 \frac{\text{lb}}{10^3 \text{ gal}} \times \left\{ 1 - \left[ \left( \frac{0\%}{100\%} \right) \times \left( \frac{0\%}{100\%} \right) \right] \right\}$$

$$E(\text{VOC}) = 150 \frac{10^3 \text{ gal}}{\text{yr}} \times 12 \frac{\text{lb}}{10^3 \text{ gal}} \times \{1\} = \mathbf{1,800 \frac{\text{lb}}{\text{yr}}}$$

For Diesel:

$$E(\text{VOC}) = 85,000 \frac{\text{gal}}{\text{yr}} \times \frac{1}{1000} \left( \frac{10^3 \text{ gal}}{\text{gal}} \right) \times 0.03 \frac{\text{lb}}{10^3 \text{ gal}} \times \left\{ 1 - \left[ \left( \frac{0\%}{100\%} \right) \times \left( \frac{0\%}{100\%} \right) \right] \right\}$$

$$E(\text{VOC}) = 85 \frac{10^3 \text{ gal}}{\text{yr}} \times 0.03 \frac{\text{lb}}{10^3 \text{ gal}} \times \{1\} = \mathbf{2.55 \frac{\text{lb}}{\text{yr}}}$$

**Step 3 – Sum the VOC emissions.** Adding the calculated emissions from Step 2, the total VOCs, as determined by the EF method is calculated as follows:

$$E(\text{VOC}) = \sum_{i=1}^n [E(\text{VOC})_i]$$

$$E(\text{VOC}) = \left( 1800 \frac{\text{lb}}{\text{yr}} + 2.55 \frac{\text{lb}}{\text{yr}} \right)$$

$$E(\text{VOC}) = \mathbf{1,802.55 \frac{\text{lb}}{\text{yr}}}$$

## 6.7 References

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## APPENDIX A – EPA HAP LIST

CAS No.	Chemical/Compound
75070	Acetaldehyde
60355	Acetamide
75058	Acetonitrile
98862	Acetophenone
53963	2-Acetylaminofluorene
107028	Acrolein
79061	Acrylamide
79107	Acrylic Acid
107131	Acrylonitrile
107051	Allyl Chloride
92671	4-Aminobiphenyl
62533	Aniline
90040	o-Anisidine
1332214	Asbestos
71432	Benzene
92875	Benzidine
98077	Benzotrichloride
100447	Benzyl Chloride
92524	Biphenyl
117817	Bis(2-ethylhexyl)phthalate
542881	Bis(chloromethyl)ether
75252	Bromoform
106990	1,3-Butadiene
156627	Calcium Cyanamide
133062	Captan
63252	Carbaryl
75150	Carbon Disulfide
56235	Carbon Tetrachloride
463581	Carbonyl Sulfide
120809	Catechol
133904	Chloramben
57749	Chlordane
7782505	Chlorine
79118	Chloroacetic Acid
532274	2-Chloroacetophenone
108907	Chlorobenzene
510156	Chlorobenzilate
67663	Chloroform
107302	Chloromethyl methyl ether
126998	Chloroprene
1319773	Cresylic Acid
95487	o-Cresol
108394	m-Cresol
106445	p-Cresol
98828	Cumene
94757	2,4-D
3547044	DDE
334883	Diazomethane

CAS No.	Chemical/Compound
132649	Dibenzofurans
96128	1,2-Dibromo-3-chloropropane
84742	Dibutylphthalate
106467	1,4-Dichlorobenzene
91941	3,3-Dichlorobenzidene
111444	Dichloroethyl ether
542756	1,3-Dichloropropene
62737	Dichlorvos
111422	Diethanolamine
121697	N,N-Dimethylaniline
64675	Diethyl Sulfate
119904	3,3-Dimethoxybenzidine
60117	Dimethyl Aminoazobenzene
119937	3,3'-Dimethyl Benzidine
79447	Dimethyl Carbamoyl Chloride
68122	Dimethyl Formamide
57147	1,1-Dimethyl Hydrazine
131113	Dimethyl Phthalate
77781	Dimethyl Sulfate
534521	4,6-Dinitro-o-cresol
51285	2,4-Dinitrophenol
121142	2,4-Dinitrotoluene
123911	1,4-Dioxane
122667	1,2-Diphenylhydrazine
106898	Epichlorohydrin
106887	1,2-Epoxybutane
140885	Ethyl Acrylate
100414	Ethyl Benzene
51796	Ethyl Carbamate
75003	Ethyl Chloride
106934	Ethylene Dibromide
107062	Ethylene Dichloride
107211	Ethylene Glycol
151564	Ethylene Imine
75218	Ethylene Oxide
96457	Ethylene Thiourea
75343	Ethylidene Dichloride
50000	Formaldehyde
76448	Heptachlor
118741	Hexachlorobenzene
87683	Hexachlorobutadiene
77474	Hexachlorocyclopentadiene
67721	Hexachloroethane
822060	Hexamethylene-1,6-diisocyanate
680319	Hexamethylphosphoramide
110543	Hexane
302012	Hydrazine
7647010	Hydrochloric Acid

CAS No.	Chemical/Compound
7664393	Hydrogen Fluoride
123319	Hydroquinone
78591	Isophorone
58899	Lindane
108316	Maleic Anhydride
67561	Methanol
72435	Methoxychlor
74839	Methyl Bromide
74873	Methyl Chloride
71556	Methyl Chloroform
60344	Methyl Hydrazine
74884	Methyl Iodide
108101	Methyl Isobutyl Ketone
624839	Methyl Isocyanate
80626	Methyl Methacrylate
1634044	Methyl tert Butyl Ether
101144	4,4-Methylene bis(2-Chloroaniline)
75092	Methylene Chloride
101688	Methylene Diphenyl Diisocyanate
101779	4,4'-Methylenedianiline
91203	Naphthalene
98953	Nitrobenzene
92933	4-Nitrobiphenyl
100027	4-Nitrophenol
79469	2-Nitropropane
684935	N-Nitroso-N-Methylurea
62759	N-Nitrosodimethylamine
59892	N-Nitrosomorpholine
56382	Parathion
82688	Pentachloronitrobenzene
87865	Pentachlorophenol
108952	Phenol
106503	p-Phenylenediamine
75445	Phosgene
7803512	Phosphine
7723140	Phosphorus
85449	Phthalic Anhydride
1336363	Polychlorinated Biphenyls
1120714	1,3-Propane Sultone
57578	beta-Propiolactone
123386	Propionaldehyde
114261	Propoxur
78875	Propylene Dichloride
75569	Propylene Oxide
75558	1,2-Propenimine
91225	Quinoline
106514	Quinone
100425	Styrene

## Appendix A – EPA HAP List (cont.)

CAS No.	Chemical/Compound
100425	Styrene
96093	Styrene Oxide
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin
79345	1,1,2,2-Tetrachloroethane
127184	Tetrachloroethylene
7550450	Titanium Tetrachloride
108883	Toluene
95807	2,4-Toluene Diamine
584849	2,4-Toluene Diisocyanate
95534	o-Toluidine
8001352	Toxaphene
120821	1,2,4-Trichlorobenzene
79005	1,1,2-Trichloroethane
79016	Trichloroethylene
95954	2,4,5-Trichlorophenol

CAS No.	Chemical/Compound
88062	2,4,6-Trichlorophenol
121448	Triethylamine
1582098	Trifluralin
540841	2,2,4-Trimethylpentane
108054	Vinyl Acetate
593602	Vinyl Bromide
75014	Vinyl Chloride
75354	Vinylidene Chloride
1330207	Xylenes
95476	o-Xylene
108383	m-Xylene
106423	p-Xylene
---	Antimony Compounds
---	Arsenic Compounds
---	Beryllium Compounds

CAS No.	Chemical/Compound
---	Cadmium Compounds
---	Chromium Compounds
---	Cobalt Compounds
---	Coke Oven Emissions
---	Cyanide Compounds <sup>1</sup>
---	Glycol Ethers <sup>2</sup>
---	Lead Compounds
---	Manganese Compounds
---	Mercury Compounds
---	Fine Mineral Fibers <sup>3</sup>
---	Nickel Compounds
---	Polycyclic Organic Matter <sup>4</sup>
---	Radionuclides (including Radon) <sup>5</sup>
---	Selenium Compounds

1. X'CN where X=H' or any other group where a formal dissociation may occur. For example KCN or Ca(CN)<sub>2</sub>.
2. Includes mono- and di-ethers of ethylene glycol, diethylene glycol, and triethylene glycol R-(OCH<sub>2</sub>CH<sub>2</sub>)<sub>n</sub>-OR', where:  
 n = 1, 2, or 3;  
 R = alkyl C7 or less; or R = phenyl or alkyl substituted phenyl;  
 R' = H or alkyl C7 or less; or OR' consisting of carboxylic acid ester, sulfate, phosphate, nitrate, or sulfonate.
3. Includes mineral fiber emissions from facilities manufacturing or processing glass, rock, or slag fibers (or other mineral derived fibers) of average diameter 1 micrometer or less.
4. Includes organic compounds with more than one benzene ring, and which have a boiling point greater than or equal to 100°C.
5. A type of atom which spontaneously undergoes radioactive decay.