

How Are Greenhouse Gas Emissions Different From Criteria Pollutant Emissions?

Transportation sources are significant contributors to both greenhouse gases (GHG) and criteria pollutants. Greenhouse gases accumulate in the atmosphere, causing climate change, while criteria pollutants directly impact public health and welfare. This factsheet provides more details on these differences.¹

GREENHOUSE GASES

GHG are compounds that trap heat in the earth's atmosphere, leading to excess warming of the planet. The increasing global temperatures are disrupting long-term climate patterns and leading to impacts including rising sea levels, increasing ice melt, changes in plant blooming times and habitable zones, increased flooding and droughts, and increased wildfires. These impacts are identified by the National Climate Assessment.²

Transportation sources are now the largest sector of U.S. GHG emissions, accounting for 28.5% of the emissions in 2021. From 1990 to 2021, total transportation emissions from fossil fuel combustion increased by 19.4%. Greenhouse gases persist for a long time in the earth's atmosphere and impacts are felt globally. GHG emissions from transportation consist of:

1. **Carbon dioxide (CO₂)**, the primary greenhouse gas emitted by passenger and freight vehicles. CO₂ made up 97 percent of transportation GHG emissions in the United States in 2021.
2. **Methane (CH₄) and nitrous oxide (N₂O)** are the other components of GHG emissions from motor vehicle exhaust. They made up about 1 percent of transportation GHG emissions in the United States in 2021.
3. **Fluorinated gases** from refrigerants are also released from transportation sources. They made up about 2 percent of transportation GHG emissions in the United States in 2021.³

CRITERIA POLLUTANTS

Criteria pollutants are a group of air pollutants for which the U.S. Environmental Protection Agency (EPA) sets National Ambient Air Quality Standards (NAAQS), following the requirements of the Clean Air Act.⁴ The EPA sets national guidelines ("criteria") for permissible levels of the following criteria pollutants, based on their human health and/or environmental impacts. These pollutants include: carbon monoxide (CO), nitrogen dioxide (NO₂), ground-level ozone (O₃), sulfur dioxide (SO₂), lead (Pb), and particulate matter (PM). EPA designates areas as nonattainment if the concentrations of a particular pollutant exceed the NAAQS. Attainment areas are areas that meet (or attain) the NAAQS. Maintenance areas are areas that were designated nonattainment, but later re-designated attainment. Transportation conformity requirements apply to nonattainment and maintenance areas.

ADDRESSING GREENHOUSE GASES AND CRITERIA POLLUTANTS

Despite their differences, many strategies to reduce criteria pollutants from the transportation sector also help reduce GHG. Adoption of electric or other zero-emission technologies, improved engine technology, and reduced vehicle activity all contribute to the reduction of GHG and criteria pollutants.

¹ A third category of pollutant is mobile-source air toxics (such as benzene), which are known to cause adverse health impacts, but for which EPA has not set a concentration threshold.

² <https://nca2023.globalchange.gov/>

³ EPA (2023). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2021. U.S. Environmental Protection Agency, EPA 430-R-23-002. <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2021>.

⁴ <https://www.epa.gov/criteria-air-pollutants>

KEY DIFFERENCES BETWEEN GREENHOUSE GASES AND CRITERIA POLLUTANTS

CHARACTERISTIC	GREENHOUSE GASES	CRITERIA POLLUTANTS
 Pollutants	CO ₂ , CH ₄ , N ₂ O, and fluorinated gases	CO, NO ₂ , O ₃ , SO ₂ , Pb, and PM
 Longevity	Persist in the atmosphere for decades to centuries .	Most persist for minutes to days before removal by chemical and physical processes in the air.
 Scale of Impact	Global impacts include increasing global temperatures, changing precipitation patterns, and other changes to natural climate systems.	Local to regional impacts on human health and welfare. High concentrations also lead to crop and building damage.
 Concentration	Well mixed throughout the lower atmosphere. GHG concentrations and impacts do not vary significantly based on local conditions or weather patterns.	Strong regional changes in concentrations. For some air pollutants, high concentrations may form near roadways, shown in "hot spot" analysis.
 Scope of Analysis	Lifecycle emissions (including tailpipe)	Tailpipe emissions
 Measures	Measured by cumulative concentration of emissions globally over time.	Measured by local concentration snapshots .
 Standards	No concentration standard. Emissions targets are set with the aim of limiting warming to a manageable level.	Federal and State regulations on acceptable concentrations of pollutants in the air to protect human health – Emissions standards have also been established for motor vehicles and other sources to reduce emissions and lower ambient concentrations.
 Controls	CO ₂ emissions can be reduced by reducing carbon-based fuel consumption . This can be achieved by switching to low-carbon fuels or electric vehicles, improving vehicle fuel economy, or reducing vehicle travel. Additionally, agencies can use low-carbon construction materials and maintenance practices.	Vehicle emissions control technologies can reduce criteria pollutant emissions. Strategies such as switching to electric vehicles, reducing vehicle idling and delay, and reducing vehicle travel also reduce criteria pollutant emissions.

Every Day Counts-7 Integrating GHG Assessment and Reduction Targets in Transportation Planning website:
https://www.planning.dot.gov/planning/topic_GHG.aspx.