United States Environmental Protection Agency

Greenhouse Gas Emissions

Overview of Greenhouse Gases

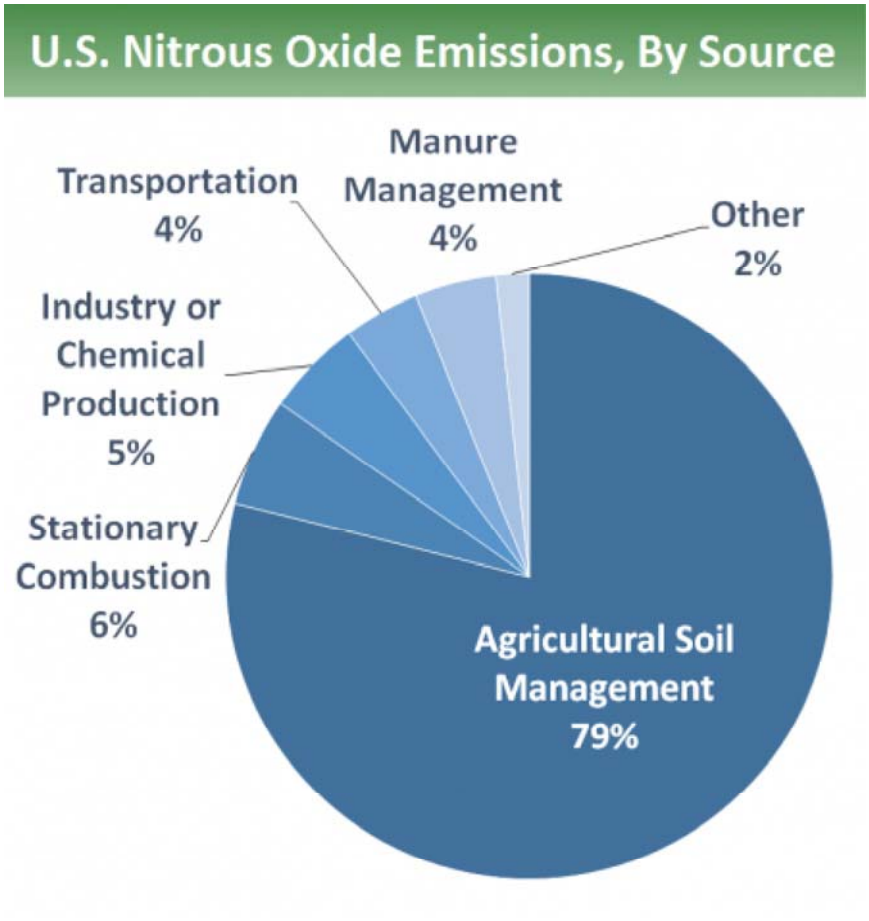
Nitrous Oxide Emissions

Properties of Nitrous Oxide

Chemical Formula: N_2O
Lifetime in Atmosphere: 114 years
Global Warming Potential (100-year): 298

In 2014, nitrous oxide (N_2O) accounted for about 6 percent of all U.S. greenhouse gas emissions from human activities. Nitrous oxide is naturally present in the atmosphere as part of the Earth's nitrogen cycle, and has a variety of natural sources. However, human activities such as agriculture, fossil fuel combustion, wastewater management, and industrial processes are increasing the amount of N_2O in the atmosphere. Nitrous oxide molecules stay in the atmosphere for an average of 114 years before being removed by a sink or destroyed through chemical reactions. The impact of 1 pound of N_2O on warming the atmosphere is almost 300 times that of 1 pound of carbon dioxide.

Globally, about 40 percent of total N_2O emissions come from human activities.[1] Nitrous oxide is emitted from agriculture, transportation, and industry activities, described below.



Note: All emission estimates from the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014*.

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Agriculture. Nitrous oxide is emitted when people add nitrogen to the soil through the use of synthetic fertilizers. Agricultural soil management is the largest source of N_2O emissions in the United States, accounting for about 79 percent of total U.S. N_2O emissions in 2014. Nitrous oxide is also emitted during the breakdown of nitrogen in livestock manure and urine, which contributed to 4 percent of N_2O emissions in 2014.

- **Transportation.** Nitrous oxide is emitted when transportation fuels are burned. Motor vehicles, including passenger cars and trucks, are the primary source of N_2O emissions from transportation. The amount of N_2O emitted from transportation depends on the type of fuel and vehicle technology, maintenance, and operating practices.
- **Industry.** Nitrous oxide is generated as a byproduct during the production of nitric acid, which is used to make synthetic commercial fertilizer, and in the production of adipic acid, which is used to make fibers, like nylon, and other synthetic products.

Nitrous oxide emissions occur naturally through many sources associated with the nitrogen cycle, which is the natural circulation of nitrogen among the atmosphere, plants, animals, and microorganisms that live in soil and water. Nitrogen takes on a variety of chemical forms

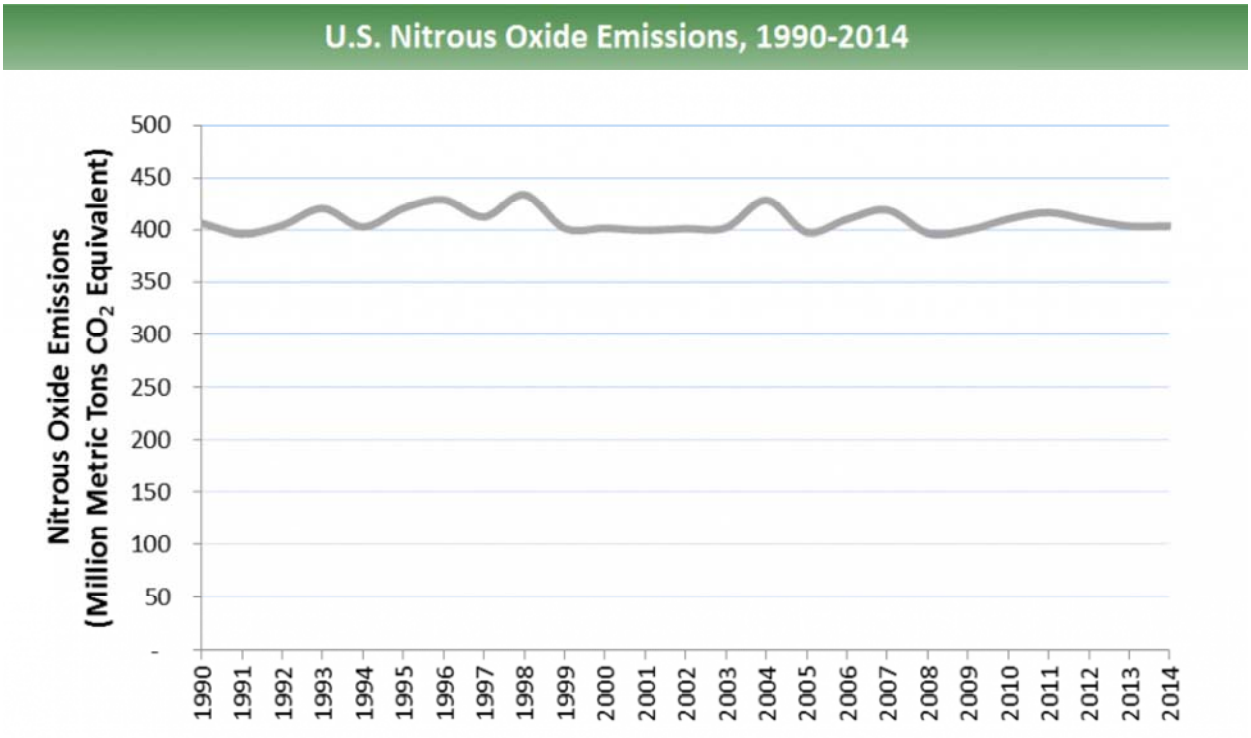
throughout the nitrogen cycle, including N_2O. Natural emissions of N_2O are mainly from bacteria breaking down nitrogen in soils and the oceans. Nitrous oxide is removed from the atmosphere when it is absorbed by certain types of bacteria or destroyed by ultraviolet radiation or chemical reactions.

To find out more about the role of N_2O in warming the atmosphere and its sources, visit the Causes of Climate Change page and the Climate Change Indicators page in the Science section.

Emissions and Trends

Nitrous oxide (N_2O) emissions in the United States have decreased by 1 percent between 1990 and 2014. This decrease in emissions is due in part to a decrease in emissions from mobile combustion resulting from emission control standards for on-road vehicles. Nitrous oxide emissions from agricultural soils have varied during this period and were about 5 percent higher in 2014 than in 1990.

Going forward, N_2O emissions are projected to increase by 5 percent between 2005 and 2020, driven largely by increases in emissions from agricultural activities.[2]



Note: All emission estimates from the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2014*.

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Reducing Nitrous Oxide Emissions

There are a number of ways to reduce emissions of nitrous oxide (N_2O), discussed below.

Examples of Reduction Opportunities for Nitrous Oxide Emissions	
Emissions Source	**Examples of How Emissions Can be Reduced**
Agriculture	The application of fertilizers accounts for the majority of N_2O emissions. Emissions can be reduced by reducing nitrogen-based fertilizer applications and applying fertilizers more efficiently,[3] as well as following better manure management practices.
Transportation	• Nitrous oxide is a byproduct of fuel combustion, so reducing mobile fuel consumption in motor vehicles can reduce transportation emissions. • Additionally, the introduction of pollution control technologies, such as catalytic converters to reduce exhaust pollutants from passenger cars, can also reduce emissions of N_2O.
Industry	• Nitrous oxide is generally emitted from industry through fossil fuel combustion, so technological upgrades and fuel switching are effective ways to reduce industry emissions of N_2O. • Production of adipic acid results in N_2O emissions that can be reduced through technological upgrades.

References

[1] EPA (2010). *Methane and Nitrous Oxide Emissions from Natural Sources*. U.S. Environmental Protection Agency, Washington, DC, USA.

[2] U.S. Department of State (2010). *Fifth Climate Action Report to the UN Framework Convention on Climate Change: Projected Greenhouse Gas Emissions* (10 pp, 577 K, About PDF). U.S. Department of State, Washington, DC, USA.

[3] EPA (2005). *Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture*. U.S. Environmental Protection Agency, Washington, DC, USA.

Last updated on October 6, 2016