



\***Definition and examples** for carbon dioxide gas, methane gas, and nitrous oxide gas.

\***2. There are many different types of greenhouse gases. What are the top six greenhouse gases?**

\***Chart for the Week:** Percent Contribution of Different Gases to the Greenhouse Effect

## Greenhouse Gases – Information Page –

Most scientists believe that human activity is altering the composition of the atmosphere by increasing the concentration of greenhouse gases (GHGs). Greenhouse gases occur naturally in the atmosphere and their presence results in what atmospheric scientists call the **greenhouse effect**. It is important to remember that the greenhouse effect is what keeps the earth warm enough to be habitable. The current concern is directed at an **enhanced** greenhouse effect, one that would put more heat-absorbing gases into the atmosphere, thereby increasing global temperatures. The enhanced greenhouse effect has been linked to increased GHG emissions from human activities.

Nitrogen (78%) and oxygen (21%) constitute 99% of the dry atmosphere. The rest of the gases, including GHGs, are collectively classified as "trace" gases due to their low concentrations.

The recent attention given to the greenhouse effect and global warming is based on the recorded increases in concentrations of some of the greenhouse gases due to human activity. Of particular interest are water vapor, carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, and ozone. With the exception of chlorofluorocarbons, all of these gases occur naturally and are also produced by human activity.

**1. Water vapor (H<sub>2</sub>O)** is the most important GHG on the planet. Unlike most of the other atmospheric gases, water vapor is considered to be a 'variable' gas; that is, the percentage of water vapor in the atmosphere can vary greatly depending on the location and source of the air. For example, over the tropical oceans, water vapor may account for 4% of the total volume of gases, while over deserts or at high altitudes, it may be nearly absent. Water vapor absorbs heat readily. When discussing global warming, however, people often don't consider water vapor. Why not? The main reason is that human activity is not directly changing water vapor content. However, we do directly influence other GHGs. Although other GHGs are individually less important than water vapor, increasing their concentrations may affect global climate in significant and measurable ways.

**2. Carbon dioxide (CO<sub>2</sub>)** is considered the most important human-influenced GHG and is a non-poisonous gas that is a normal part of our atmosphere. For example, it is naturally a part of photosynthesis. Scientific measurements reveal an unmistakable global increase that is rapid and escalating. This increase arises primarily from the burning of fossil fuels (motorized vehicles, electric power plants, and homes heated with gas or oil) and the burning and clearing of forested land for agricultural purposes.

**3. Methane (CH<sub>4</sub>)** is largely a product of natural biologic processes, but its output can be accelerated by human activities. CH<sub>4</sub> is emitted from the decay of organic matter in waterlogged soils (for example, wetlands and rice paddies), from the animal digestion and burning fossil fuels. For example, cows produce a large amount of methane through belching and flatulence (passing gas!). The additions from human activities include the expansion of rice agriculture, the increased number of livestock, the increased number of landfills, and leakage from natural gas pipelines.

**4. Chlorofluorocarbons (CFCs)** have no natural source; they are produced entirely by human activity. CFCs have historically been used widely as refrigerants in air conditioners, refrigerators, freezers, and heat pumps. They are found in some foam plastics and used in some electronics manufacturing. Even though CFC production has been vastly reduced, these compounds remain in the atmosphere for a long time; we shall see their effects as GHGs for many years.

**5. Nitrous oxide ( $N_2O$ )** is a naturally occurring GHG made from bacteria. However, amounts have increased significantly in recent years due to human activity. For example,  $N_2O$  is emitted from coal-burning power plants and can be released from the breakdown of fertilizers in the soil.

**6. Ozone ( $O_3$ )** is also a greenhouse gas. It is important not to confuse the presence of the ozone in the stratosphere (a good thing) with the presence of ozone in the troposphere (a bad thing). In the troposphere, ozone can be a major component of urban smog– damaging crops and aggravating respiratory problems as well as enhancing the greenhouse effect.

The concentrations of these GHG are increasing (although, thanks to recent global agreements, CFCs are being largely eliminated and their concentrations have begun to drop in the lower atmosphere). The emissions are not uniformly distributed globally. Most of the emissions come from the more developed countries, where power generation, power consumption, and living standards are highest.

