**Greenhouse Effect**

Glass greenhouses allow gardeners to grow plants in places that are normally too cold for them. The glass house allows the sunlight to pass through and heat the ground inside but then traps the heat from leaving. The gases in our atmosphere work much the same way so scientists have deemed this the **greenhouse effect**. In the greenhouse effect for Earth the sunlight (visible light and ultraviolet) passes through our atmosphere made of many gases and reaches the surface where it is absorbed and turned into heat. This heat then reradiates off the planet as infrared radiation or IR heating the air molecules. Some of the air molecules are excellent at absorbing the infrared heat and bouncing it back toward Earth. Eventually some of the heat IR energy does escape Earth’s atmosphere and go back out to space. The thicker the layer of these heat trapping greenhouse gases the more heat is trapped and reradiated back toward Earth.

The greenhouse effect is a natural result of the heat trapping gases in the atmosphere. Without these gases our planet would be much like the moon that has no atmosphere and reaches an average temperature of -18 degrees Celsius with night time temperatures dipping into below -100 degrees Celsius and the daytime temperatures soaring above 100 degrees Celsius. So if the greenhouse is natural why the fuss? The amount of these gases that are in our atmosphere have been increasing due to human activities at a very rapid rate like adding multiple blankets on the Earth when it was already hot.

Gases that contribute to the greenhouse effect include:

**Water vapor (H2O).** The most abundant greenhouse gas, but importantly, it acts as a feedback to the climate. Water vapor increases as the Earth's atmosphere warms due to more evaporation, but so does the possibility of clouds and precipitation, cooling the planet and making these some of the most important feedback mechanisms to the greenhouse effect.

**Carbon dioxide (CO2).** A minor but very important component of the atmosphere, carbon dioxide is released through natural processes such as respiration and volcano eruptions and through human activities such as deforestation, land use changes, and burning fossil fuels. Humans have increased atmospheric CO2 concentration by more than a third since the Industrial Revolution began.

**Methane (CH4).** A hydrocarbon gas produced both through natural sources and human activities, including the decomposition of wastes in landfills, agriculture, and especially rice cultivation, as well as ruminant digestion and manure management associated with domestic livestock. On a molecule-for-molecule basis, methane is a far more active greenhouse gas than carbon dioxide, but also one which is much less abundant in the atmosphere.

**Nitrous oxide (NO2).** A powerful greenhouse gas produced by soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning.

**Chlorofluorocarbons (CFCs).** Synthetic compounds entirely of industrial origin used in a number of applications, but now largely regulated in production and release to the atmosphere by international agreement for their ability to contribute to destruction of the ozone layer. They are also greenhouse gases. On Earth, human activities are changing the natural greenhouse. Over the last century the burning of fossil fuels like coal and oil has increased the concentration of atmospheric carbon dioxide (CO2). This happens because the coal or oil burning process combines carbon with oxygen in the air to make CO2. To a lesser extent, the clearing of land for agriculture, industry, and other human activities has increased concentrations of greenhouse gases.

The consequences of changing the natural atmospheric greenhouse are difficult to predict, but certain effects seem likely: On average, Earth will become warmer. Warmer conditions will probably lead to more evaporation and precipitation overall, but individual regions will vary, some becoming wetter and others dryer. A stronger greenhouse effect will warm the oceans and partially melt glaciers and other ice, increasing sea level. Ocean water also will expand if it warms, contributing further to sea level rise. Meanwhile, some crops and other plants may respond favorably to increased atmospheric CO2, growing more vigorously and using water more efficiently. At the same time, higher temperatures and shifting climate patterns may change the areas where crops grow best and affect the makeup of natural plant communities.

In its Fourth Assessment Report, the Intergovernmental Panel on Climate Change, a group of 1,300 independent scientific experts from countries all over the world under the auspices of the United Nations, concluded there's a more than 90 percent probability that human activities over the past 50 years have warmed our planet. The industrial activities that our modern civilization depends upon have raised atmospheric carbon dioxide levels from 280 parts per million to 400 parts per million in the last 150 years. The panel also concluded there's a better than 90 percent probability that human-produced greenhouse gases such as carbon dioxide, methane and nitrous oxide have caused much of the observed increase in Earth's temperatures over the past 50 years. They said the rate of increase in global warming due to these gases is very likely to be unprecedented within the past 10,000 years or more. The panel's full Summary for Policymakers report is online at **[http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4\_syr\_spm.pdf](http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf" \t "_blank)**.