What Is Methane?

• Methane is an odorless, colorless, tasteless gas that is lighter than air.
• It is the main component in natural gas and is also present in many coal formations. When methane burns it produces a great amount of heat, which makes it very useful as a fuel source.
• In sufficient amounts of oxygen, methane burns to give off carbon dioxide and water.

Methane As A Greenhouse Gas

Atmospheric methane is an important greenhouse gas, with an ability to trap heat that is 28 times greater than carbon dioxide.

• Since the Industrial Revolution, the amount of methane in the atmosphere has more than doubled.
• Methane is responsible for about 20 percent of the Greenhouse warming.

(See Fact Sheets on Greenhouse Effect and Climate Change.)

How Is Methane Produced?

Most of Earth’s methane is produced by living organisms.

• Methane is produced by single celled organisms, which are similar to bacteria. Since they produce methane, they are called methanogens.
• Methanogens produce energy for living without oxygen. This process produces the methane.
• Methanogens live in many places, from wetlands, to sediments below the seafloor, and to the digestive tracts of cattle, termites and some people. They avoid places that have oxygen.

The Methane Cycle

• There are many sources that release methane into the atmosphere. There are also sinks, or ways that methane is stored or destroyed.
• In an ideal world, methane sources would be balanced with methane sinks, however, the amount of methane is rising due to human activities.
• About 60% of the current methane released from land to the atmosphere is the result of human activities.
• Methane concentrations have more than doubled over the past 200 years.
Human Sources

Today, about 60 percent of the methane in the atmosphere comes from sources scientists think of as human caused.

Landfills
- Methane is generated in landfills as waste is broken down by methanogens, where there is no oxygen.
- Globally, trash releases over 10 percent of all methane generated by humans
- Landfill methane can be decreased by reducing the methane-generating materials going into landfills.
  - reducing food waste
  - turning the remaining food and yard waste into compost, rather than sending it to landfills

Fossil Fuels
- Fossil fuels were formed by the breakdown of of buried dead organisms from long ago.
- Methane is the main part of natural gas. Methane is released when it is made, stored, and shipped.
- Because natural gas is often found with oil and coal, it is also released when these are being produced.
- The energy sector contributes about a third of the annual methane budget.

Livestock
- Domesticated livestock produce large amounts of methane as part of their normal digestion.
- There are 1.4 billion cattle in the world, and that number is growing as demand for beef and dairy increases; together with other grazing animals, they contribute over a quarter of the annual methane budget.

Wastewater Treatment
- When wastewater from sewage is treated to remove contaminants, methane can be produced if the wastewater is treated without oxygen (an ideal place for methanogens) and if the methane produced is released to the atmosphere.
Rice Cultivation
- Methane is produced during flooded rice cultivation by methanogens in the soil.

Biomass Burning
- Methane is released during burning are a result of incomplete combustion and huge amounts can be produced during:
  - large scale burning of woodlands and grasslands for land clearing.
  - the burning of agricultural waste due to its generally high water content.
  - wood burning for domestic fuel and for charcoal production
- Biomass burning as an alternative to fossil fuels can be used effectively by avoiding incomplete combustion. It can have a much lower greenhouse gas impact compared to coal, oil and gas-fired power stations.

Natural Storage
Anything that absorbs more greenhouse gases than it gives off is called a sink. In a sense it stores the greenhouse gas.

Atmosphere
- The main way that methane is removed from the atmosphere is when oxygen and hydrogen (OH⁻) naturally combine with methane and break it down to form water vapor and carbon dioxide. This is the main sink for methane.
- Methane remains in the atmosphere for about 8 years until it is cycled out by this process.

Methanotrophs in soils
- Soil methane is also consumed by some microbes, called methanotrophs.
- They use methane as a source of energy, breaking it down with oxygen and giving off carbon dioxide and water.
- Forest soils act as good sinks for atmospheric methane because soils are moist, which is ideal for methanotrophs, and it is easy for them to absorb the methane directly from the air.
- Methanotrophs can also live in wetlands, marshes, rice paddies, landfills, lakes, oceans, and streams but they generally need oxygen to survive.

More Resources
Methane, Explained - National Geographic

Municipal Solid Waste And Greenhouse Gases - Government of Canada

Compost Council of Canada
http://www.compost.org/

Methane, Climate Change and Waste Management in Canada - Canadian Institute for Environmental Law and Policy
http://cielap.org/pdf/Methane.pdf

Landfills Have A Huge Greenhouse Gas Problem - Ensiia / University of Minnesota’s Institute on the Environment
https://ensia.com/features/methane-landfills/

Global Methane Emissions and Mitigation Opportunities - Global Methane Initiative

Food Waste Management + Climate Action - National Zero Waste Council of Canada