Landfill Gas

Your topic is Landfill Gas.

Your committee will present fifth.

Please read through the steps carefully and remember your ultimate goal is to reduce waste.

Product: A PowerPoint Presentation

- ✓ **Each committee will present their findings using PowerPoint and YouTube video(s).**
- ✓ **The slides have been prepared for you. You need to fill in the information. Everything in *italics* is to be replaced by your committee.**
- ✓ **You need to know the information on the slides. Use an index card so you face the Summit audience, not the screen.**
- ✓ **The Landfill Gas presentation will be no less than 10 minutes and no longer than 20 minutes. (Other committees may have more than one presentation with 10 minutes for each presentation)**

1. Elect a Chairman of your committee. Your Chairman will be in charge of the group's presentation to the rest of the class. This will include delegating parts of the presentation.

Successful Chairing for a Successful Committee

Chairs must be good listeners, good communicators, and good organizers.

Successful Chairs:

✔ Successful group discussions require planning and participation by all:

- The Chair asks questions and gets help from their committee.

✔ The Chair's job is to keep all committee members involved by making sure each member:

- has a country/topic
- has filled in all of his or her slides
- listens to the other members' findings
- joins in on the final committee opinions and solutions (Remember, the 6th grade is focusing on how to reduce, or create less, trash)

✔ Praise members' good work in writing and verbally

✔ Maintain a sense of humor

✔ Communicate often. Few people respond to a general invitation; a personal request usually brings faster results.

✔ Check in with members until tasks are accomplished; then praise committee member(s) (privately and publicly) for a job well done.

✔Document all your sources as required by your teacher.

2. Target learning standard: How do biases interfere with critical thinking? Be aware assumptions shape people's thinking.

Understanding the problem on a global scale requires an understanding of differences in cultures around the globe. You must understand community values before you can suggest community solutions.

Be aware assumptions shape people's thinking. Look at your research as facts and try not to develop a conclusion until you are finished researching. How do biases (assumptions) interfere with critical thinking?

PowerPoint Directions

Slide #1 – Title Slide

This slide introduces the committee members and Chairperson. The directions are on the slide in *italics*. Type in the information needed, and then erase the *italic* directions.

Slide #2 – What is Landfill Gas

This slide answers the question "What is Landfill Gas?" Provide a number of bullet points that describe what landfill gas is, where it comes from, and how it's made. Add an extra slide if you need more room. Use the information below to help you.

So What Exactly Is Landfill Gas?

Landfill gas is defined as all of the gases generated from landfilled waste. About half of it is composed of methane. The rest is mainly carbon dioxide with about 1% non-methane organic compounds (NMOCs). Methane is the main component of natural gas and is highly explosive. Methane is a greenhouse gas that is about 23 times more effective than carbon dioxide at trapping heat in our atmosphere.

Landfill gas is only produced by the biodegradable (can be decomposed by living things) components of waste. These include, in order of abundance: paper, yard trimmings, food scraps, wood, leather and textiles. These organic (meaning alive or once alive) components make up over 70% of our waste. The remaining 30% of trash is non-biodegradable materials - mainly plastics, metals and glass.

Carbon dioxide and methane are produced in landfills by bacterial decomposition of biodegradable organic material. In the shallow layers where air is able to circulate freely, the waste gas produced is carbon dioxide. However, in landfills that are covered, or in deep layers of landfills, organic material decomposes anaerobically (without oxygen). In this case, the bacteria produce methane.

One ton of garbage can make over 14,000 cubic feet of methane over the period of 10 to 15 years, and it will continue to produce smaller amounts for up to 100 years. Over a decade, that ton of garbage can produce more than 100 times its volume in methane.

Although methane occurs naturally in wetlands, permafrost, bodies of water, and wildfires, anthropogenic (man-made) causes account for over 50% of total global methane production. Landfills are the fourth largest contributor to anthropogenic methane after agricultural soils (especially rice paddies), livestock digestion (think cow burps), and natural gas and oil systems. Worldwide, landfills contribute to about 17% of man-made methane, while in America landfill emissions account for close to 37%.

Further readings:

EPA – sources and emissions: http://epa.gov/climatechange/ghgemissions/gases/ch4.html

Solid Waste Production: http://kanat.jsc.vsc.edu/student/cassese/main.htm#Ref_SD

Window on State Government – Landfill Gas:
http://www.window.state.tx.us/specialrpt/energy/renewable/landfill.php

Slide #3 - Potential Risks

Insert bullet points and brief explanations regarding the risks of uncaptured landfill gas.

Because methane is lighter than air, it will rise up through the landfill and into the atmosphere. Once above ground it can cause a host of problems:

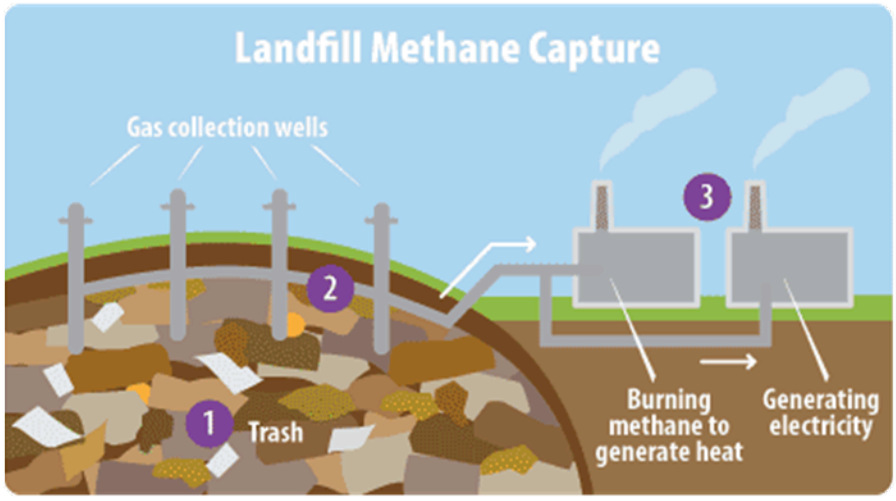
- Environmental - As a potent greenhouse gas, methane in landfill gas contributes to climate change. While the issue of climate change is still hotly contested, it must be recognized this process could potentially be damaging for world ecosystems.
- Toxicity - The free release of landfill gas contains hundreds of non-methane organic compounds. Some of these toxic contaminants include benzene, toluene, chloroform, vinyl chloride, carbon tetrachloride, mercury, and even radioactive elements. These compounds can cause cancer and other health problems in nearby communities.
- Fire and explosion - Methane can cause fires or explosions at the landfill site and even in nearby structures as the gas migrates. It is explosive even at low concentrations, and in America has caused over 40 explosions or fires including 10 accidents or deaths in previous decades.

Once a landfill fire has started, it can be very difficult to extinguish and is sometimes left to burn itself out.

Slide #4 - Landfill Gas Reclamation

For this slide you will insert YouTube video(s). Your intent here is to provide a thorough, yet concise video describing the process of Landfill Gas to Energy. Remember, you have a time limit of approximately 6 min. If you know how to use parts of a video, do so, if not choose the best one(s) that fits your message. The videos can be found below. Remember, the authors of these videos have a bias - they are promoting their product or their opinion.

Landfill methane can be captured to generate electricity, produce heat, power vehicles, or be purified for use in natural gas pipelines - turning a potential problem into a benefit. Spurred by environmental regulations and renewable energy credits, many landfills have begun to tap this valuable resource. In the United States, over 500 landfill gas-to-energy projects are currently operating, producing over 1500 MW (Mega-Watts) of electric power, or enough to power almost 350,000 homes. Capturing methane before it gets into the atmosphere also helps reduce the negative consequences of climate change, toxicity, and fires.



http://epa.gov/climatechange/kids/solutions/technologies/methane.html

1. Trash decomposes (or rots) in landfills, creating methane gas.
2. Methane rises to the top of the landfill and is collected in pipes.
3. The methane is burned to produce heat or generate electricity.

Landfill Gas/Methane to Energy Videos:

***** Landfill Gas to Energy (LFGTE): How It's Done 4:25
http://www.youtube.com/watch?v=w1RKMMpRRHY

**** Landfill Gas To Energy Overview 4:24
http://www.youtube.com/watch?v=YY8BiVilLyw&feature=related

***** Landfill Gas-to-Energy Project – Aquatera 3:22
http://www.youtube.com/watch?v=0DxXm19qQvg

**** How a waste-to-energy plant works 5:01
http://www.youtube.com/watch?v=lmtOuAed5nM&feature=related

**** Landfill Energy 2:31
http://www.youtube.com/watch?v=YiUxsf4u-nU&feature=related

****Landfill Methane Generation Explained 4:55
http://www.youtube.com/watch?v=-XZQvYpx3QQ

**** Turning Landfill Gas into Energy 3:30
http://www.youtube.com/watch?v=lXV9WOQaAVM&feature=related

**** Lifecycle Of Waste 5:47
http://www.youtube.com/watch?v=211su80MESk

**** Trash of a Human Lifetime 2:59
http://www.youtube.com/watch?v=ULruDnfw0AI&feature=relmfu

Slide #5 - Committee Opinions

Use this slide to summarize your committee's opinions about landfill gas and the solutions for dealing with it. Please refer to the following paragraph and reading link before drawing your conclusion(s). Are there negative consequences to capturing landfill gas and turning it into energy? Do the risks outweigh the benefits? Remember your learning objectives**: How do biases interfere with critical thinking? Be aware that assumptions shape people's thinking.** Do the authors of the article have an agenda that affects their stance?

While turning waste methane into energy sources seems like a win-win situation, there are some rarely talked about potential hazards associated with burning or combusting landfill gas. The non-methane organic compounds (NMOCs) present in landfill methane can recombine into highly toxic compounds such as dioxins and furans when burned. These are among the most toxic chemicals ever studied. Without properly filtering out the NMOCs, the benefits of a free energy source may be outweighed. Please read through this report for more information: http://www.energyjustice.net/lfg/

Slide #6 - Solutions

Strategies for lowering methane production start with the three R's (Reduce, Reuse, and Recycle) + COMPOST. The amount of waste that ends up in landfills represents only a small portion of the resources needed to produce that waste in the first place. For every ton of municipal waste, more than 70 tons of resources in the form of manufacturing, mining, oil and gas exploration, agricultural, coal combustion, and other discards are produced.

Though reclaiming methane from landfills can be an effective use of this byproduct, reducing the amount of organic waste in the first place can have a much greater impact. Rather than transporting kitchen waste to a landfill, individuals can compost those scraps, turning it into a valuable natural fertilizer. Well-aerated compost decomposes aerobically (with oxygen), which produces carbon dioxide (CO_2) rather than methane. This means it has less of a greenhouse gas effect. Using worms to digest kitchen and yard waste can also be a quick and effective way of creating good quality garden compost.

Vocabulary

- Aerobic - living, active, or occurring only in the presence of oxygen
- Anaerobic - Able to live, grow, or take place where free oxygen is not present
- Anthropogenic - Caused or influenced by humans
- Biodegradable - Capable of being decomposed by bacteria or other living organisms
- Compost - A mixture of decaying organic matter, as from leaves and manure, used to improve soil and provide nutrients
- Landfill - A system of trash and garbage disposal in which the waste is buried between layers of earth to build up low-lying land
- Methane (CH_4) - An inflammable, explosive gas produced from anaerobic decomposition of organic matter. It is the main constituent of natural gas.
- Organic – Of, relating to, or derived from living organisms
- Reclamation - the recovery of useful substances from waste products