

ALUMINATOR: (on cover)

Ann Arbor's two closed landfills produce about 200,000 cubic feet of landfill gas every day. About half of this amount is methane gas which is produced by the anaerobic decomposition of organic matter in the sealed landfill. The methane gas floats up through the landfill until reaching the plastic and clay liners at the top that trap it. The gas then flows between the spaces in the gravel layer and is sucked into a landfill gas collection pipe and directed to an on-site engine to create energy.

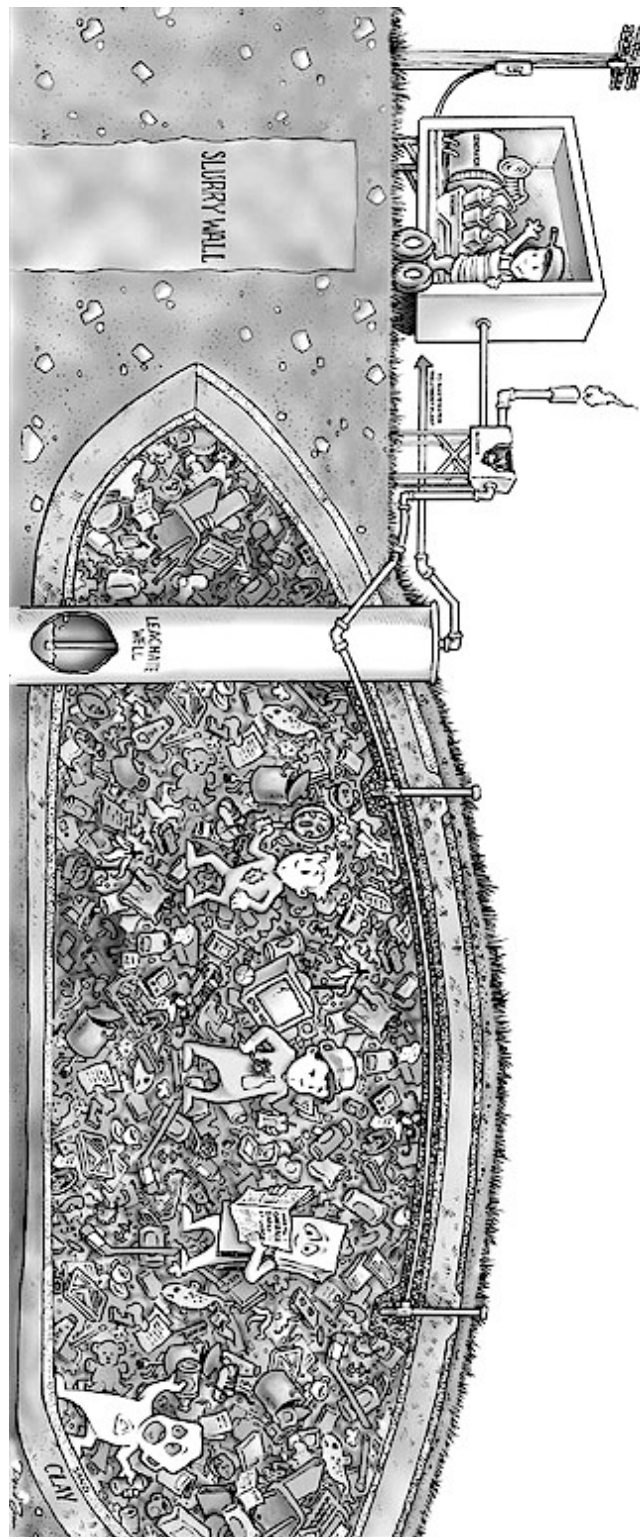
The Phase I of Ann Arbor landfill used about two miles of one-foot diameter pipe to collect the landfill gas. A blower unit draws the gas from the landfill and compresses it into a uniform density in order to provide a constant flow of methane fuel, which is used to operate electricity-producing engines. Occasionally the gas is burnt in a flare if the engines are off-line.

Burning the landfill gas in a flare or engine has the benefit of breaking down the methane into more simple molecules of carbon dioxide and water. Methane is considered a greenhouse gas, which many scientists believe is creating a global warming trend. Methane gas has 23 times the heat trapping potential of carbon dioxide.

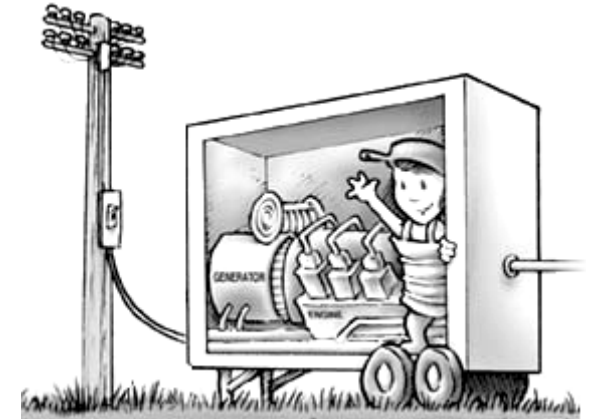
Ann Arbor's electricity-generating station is made of one stainless steel boat engine (reciprocating V-8). The mechanical energy of the rotating engine shaft is converted into electrical energy in the generator, which works by spinning a coil of wires in a magnetic field, creating an alternating current (AC). This engine generates enough electricity to power about 300 homes (that's 3,400 MWh/year)!

For more information visit: www.a2gov.org/energy.

The mural was sponsored in part by the State of Michigan Dept. of Consumer & Industry Affairs. The mural was illustrated and painted by David Zinn. The landfill gas to energy project was constructed by a joint effort between the City of Ann Arbor, Detroit Edison, DTE-Biomass Energy Systems, and Michigan Co-Generation Systems. The facility is owned by the City of Ann Arbor and operated by Michigan Cogeneration Systems.



REFUSE INTO POWER!



The Refuse into Power Mural speaks!
Meet the Waste Watcher characters & see
what they're doing in the mural.

Illustrations by David Zinn

www.a2gov.org/energy

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COMPOST KID:

I'm looking through a microscope to see the landfill microbes (tiny living things) such as fungi and bacteria.

Microbes use organic (or biodegradable) materials for food, such as paper, leaves, and kitchen scraps.



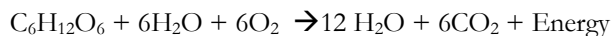
Microbes play an important part in the decomposition (or composting) of organic materials. In a standard compost pile - either at home or in a large municipal setting, the microbes transform yard wastes into a rich, crumbly soil-like compost (also called humus). The above ground compost microbes live in aerobic conditions, meaning "with air."

Landfill microbes live in "anaerobic" conditions, which means "without air." **Why is there very little air in a landfill?** (Hint: Look at Juggernaut's description of landfill design.)

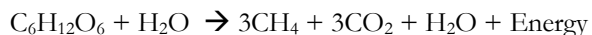
The lack of air in the landfill also slows down the rate of decomposition. **How do we know that decomposition occurs slowly in a landfill?** (Hint: This ties in with Pulpster's discoveries about being able to read old, buried newspapers.)

Anaerobic decomposition creates methane gas as a byproduct.

The formula for aerobic (with air) respiration creates water, carbon dioxide (CO₂) and energy:



The formula for anaerobic (without air) respiration also creates methane gas (CH₄):



The captured methane gas can be used as a fuel (see ALUMINATOR).

BOTTLE ROCKETEER:

I'm holding a "juice pouch" made of thin plastic. It is not easily recyclable or biodegradable, but it does not take up much space in a landfill once it is thrown away. Our consumer choices contribute to overall waste. **How many beverages do you estimate that you drink in a year? List some of the choices you have for beverage containers. Which of these are refillable, recyclable, refundable, or disposable? Which containers seem to be the least wasteful?**



Each Ann Arborite discards an average of 4.7 pounds of waste each day from home - not counting school, workplace, or restaurant waste. (This weight is close to the national U.S. Environmental Protection Agency average, incidentally.) We each have the ability to choose to separate recyclables and compostables from our trash - and to reduce waste in the first place.

THE PULPSTER:

I'm able to read an old newspaper that was buried in the landfill in 1950s and was dug up 40 years later when people uncovered part of the landfill to work on the landfill gas-to-energy project.

Why hasn't this newspaper decomposed? These buried materials decompose very slowly because landfills are designed to seal off air, moisture, light and organisms that would ordinarily help breakdown organic, biodegradable materials - such as paper, grass clippings and other food and garden wastes. Over the 8 year operation of this landfill the buried organic matter dropped dramatically. Since 1988 City yard wastes are composted.



Since 1991, all Ann Arbor residents receive weekly recycling collection, which diverted lots of paper from the landfill. Based on these actions, there is now less organic, paper material being added to area landfills. **How does increasing paper recycling reduce the amount of landfill methane produced?**

JUGGERNAUT:

I'm the first Waste Watcher you meet in the Refuse-Into-Power mural. I'm standing on the bottom of the drawing of the Ann Arbor Phase II landfill, which started being used in 1984. It closed in 1992 after filling up 37 acres, 50 feet high with 820,000 tons of garbage in just 8 years!



As a safety measure, all landfills are made with layers of clay, plastic, and sand to seal off the bottom and top. Then, all stray liquids, also called "leachate," are trapped in a well and removed. Ann Arbor's leachate is treated at the municipal Wastewater Treatment Plant.

Why do you think I'm amazed at finding these objects in the city's landfill? What else can you do with a glass bottle instead of throwing it out?

I hope you suggested recycling! Recycling saves landfill space and also conserves resources and energy. **What types of things can you recycle at home and school?** (Hint: lots of information is posted online at www.a2gov.org/recycle).

What is this full aerosol can of bug spray doing here? Toxic materials don't belong in a landfill! They should be used up or taken to the Home Toxics Center for disposal in a hazardous waste landfill. As a way to reduce toxic waste, we can look for less toxic materials to use in the future. For example, try a fly swatter for flies or cream of tartar to stop ants. More Home Toxics reduction practices and collection information is posted by Washtenaw County at: <http://recycle.eWashtenaw.org>.

Look over the objects on the mural walls. What discards could have been reduced, reused, or recycled?