

Different states of Matter at the landfill (Year 5)

Curriculum Links:

Geography

- Nil

Science

- Solids, Liquids, Gases

Topics Discussed

Organic waste and methane/leachate production in landfill cells

- Layers of landfill - what they are, why they are there
- Methane Gas and Leachate - how they are made and how we control them
- Reduction of methane and leachate over time

Mulch making process

- Solids (green waste)
- Liquid (steam from the heat)
- Gas (O₂ pumped in/CO₂ produced)
- Organic waste largest contributor to methane gas production in a landfill cell

Before you start the lesson

- Make sure you have Red/ Green and yellow bins for demonstration purpose. Alternatively, use any two bins in the classroom and label it as Red/ Green and Yellow bins
- Gather some display items (example -empty plastic bottles, cans, glass bottles, paper/cardboard)

Lesson Outline/ Teacher Resource

TOPIC: Solids, Liquids and Gases (as relates to Rubbish & Recycling)

Today we are going to discuss the how solids, liquids and gasses affect our rubbish and recycling and how we manage them.

Let us discuss the two types of bins. What goes into which bin? What could be done with green waste?

We can recycle 5 types of items - paper & cardboard, plastic, glass, steel and aluminium

Let us discuss some recycling rules. No lids-lids go into rubbish, rinse it, no plastic bags, no bagging boxing.

Play the "sorting game" -Put a pile of items in a box - students to pick up an item and put into correct bin - make into a relay if enough space

There are two toxic by-products created in a landfill cell - one is a liquid called Leachate and the other is a gas called Methane. However, before we talk about those by products, I firstly I want to explain to you what a landfill cell is.

Use the "Landfill cell" poster

A landfill cell is a big hole in the ground used for burying out rubbish. We dig these cells at our landfill sites, also known as the dump or tip. We dig a hole about the length and width of a football field and go down two stories deep into the ground. We then layer the holes with clay (because it expands and contracts without cracking) plastic, geo-textile fabric, some rocks and gravel and then two piping systems. We then fill up the cell with rubbish. When it is full, we close it off with more clay, soil and grass. Then we dig another cell for more rubbish to go into.

The first piping system is for draining the leachate. Leachate is created by rainwater mixing with the decomposing rubbish (the solids) in the landfill cell. As the water and decomposing rubbish mix, it creates a black toxic liquid that drains to the bottom of the cell. Because the cell is sealed off at the bottom to stop the leachate escaping into the soil and the water table - we need to pipe the leachate out of the cell so it doesn't fill up and overflow. We pipe the leachate out, then it is sprinkled back through the cell because it actually helps the rubbish break down, but if we get too much we have to pump it out and put it into tanks waiting for collection and disposal at a treatment plant.

We then have our second piping system to remove the methane gas. Methane gas is 25 x's more toxic than carbon dioxide and we can't just let it float out into the atmosphere. We need to treat it to remove the impurities before the clean gas is released.

What we do is pipe our methane gas to a generator to clean it by using a heating process. It is during this process where we also use the methane gas as a fuel for generating power. The burning of the methane heats water into steam that drives a turbine to create electricity that goes into the grid. This process is called Waste to Energy.

Watch the "how a landfill works" video

The solids in the landfill cell, which contributes most to the creation of methane gas, are what we call organic waste - food scraps and green waste. A better way to get rid of these items is to mulch or compost them.

Composting also uses a mix of solids, liquids and gases in its process.

Use the "How to compost" poster

Can anyone guess what the solids are? Green waste - grass clippings, tree pruning, tree stumps, and organic waste - food scraps

What about the liquid? Rain/Sprinklers. During the compost process, the mulch also generates steam as the rain/sprinklers mix with the hot mulch.

And the gas? Oxygen (air) and CO₂. Oxygen is needed to help the organic waste break down, while the actual composting process creates carbon dioxide.

Council mulches all of the green waste that is dropped to its green waste piles at the Maryborough and Hervey Bay waste facilities. First the raw green waste is chopped up very small and then it is put into what we call 'windrows' which are rows of the green waste. We then start the process of keeping the green waste moist (by rain or sprinkles), and at a set temperature (regulated by blowing oxygen through the piles from pipes). Every two weeks we turn the mulch over and continue to keep it moist and at the correct temperature. After 8 weeks, you have organically composted mulch that can be used on your gardens.

Questions for discussion

- Q. Where does our rubbish go?
- Q. What do we have to do when our landfill cell is full?
- Q. What are the two toxins created in the landfill cell?
- Q. What is the main cause of methane gas in landfill?
- Q. What is used as solids, liquid and gas in composting?

