

Western Engineering Outreach

Toxic Popcorn Challenge

Grades 6-8

Meet Today's ENG HERO!



Jose Herrera – Professor

Dr. Herrera's research works to bridge the gaps between materials science, surface science, heterogeneous catalysis and environmental engineering. He is also currently conducting research involving a new blend of diesel fuel that would burn much cleaner than our current petrol and diesel fuels. To learn more about Dr. Herrera and his research, visit:

https://www.eng.uwo.ca/chemical/faculty/herrera_j/index.html

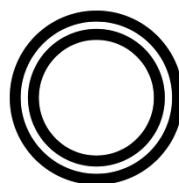
Learning Goal:

- Students will learn about toxic waste
- Students will consider waste removal strategies
- Investigate the importance of new waste management technologies
- Curriculum Connections: Grade 6: Biodiversity; Grade 7: Interactions in the Environment

Materials Needed:

Today's activity is a design challenge. Here is a list of suggested materials, but whatever you have on hand can be used for this activity.

- Popcorn kernels
- Hula hoop
- Rope or string
- Plastic containers
- Tape



- Cardboard
- Popsicle Sticks
- Long dowels or paper towel rolls
- Tire tubes or rope or large elastic bands



Engineering and Science Connections:

Today we will learn of the dangers of toxic waste and apply the engineering process to successfully solve a challenge/problem with the use of limited resources.

Toxic Waste

Though factories make a lot of products that we use, they also make a lot of harmful products. Toxic waste are poisonous by-products due to industries like manufacturing farming, construction, automotive, labs, and hospitals. Toxic waste consists of heavy metals, radiation, dangerous biological things like pathogens, and other toxic chemicals and materials. It can travel through air, soil, and water, affecting both plants and animals alike. These are extremely bad for our health and the health of the planet. It can lead to cancers and a wide variety of health problems.

We also produce hazardous waste in our homes, like batteries, computer equipment, old paint, car oil, pesticides, and prescription drugs. These types of waste will have special collection centres and should not be disposed of in regular garbages. This is because the chemicals and materials in these products can harm animals and the environment if they end up in a landfill.

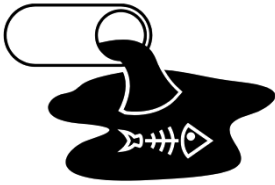


Nuclear Waste

You've probably heard toxic waste brought up as an argument against nuclear energy. Nuclear waste is radioactive but generally stable and can be safely isolated or diluted to reduce its level of radioactivity over time. Sometimes, this is achieved by burying barrels of waste underground. Endeavours like these require a lot of creative engineers!

Unlike other forms of thermal electricity generation, however, all the waste produced by nuclear energy is regulated and is not allowed to cause pollution or harm the environment.

Toxic Waste and the Environment



When this waste goes into bodies of water, it can poison marine organisms, and can kill plants if they come in contact with it. Organisms' genetic makeups can change and many ecosystems can be greatly disrupted due to these harmful chemicals.

Toxic waste used to be dumped into streams, rivers, and oceans, or buried in landfills underground. This became illegal when new environmental laws were passed and so there are specialized vehicles used and places that waste must go to safely decompose.

Video Recommendation: How It's Made: Toxic waste disposal

<https://www.youtube.com/watch?v=8LRg-7V5srk&t=15s>

In the above video, watch how industrial toxic waste is disposed of in underground facilities!

Activity:

Before you start, think about the following questions:

- Why is it necessary to engineer toxic waste management solutions?
- Why is it a good idea to dispose of hazardous waste in an underground facility?

Toxic Popcorn

A factory has just created some extremely hazardous popcorn kernels that have affected a 4-ft radius, and the toxicity levels are high right up to the ceiling. If the popcorn is not moved within 1.5 hours to an area that it can safely decompose, the toxicity will spread throughout the entirety of London! Your task is to move it into a safe container into which it can safely decompose while the vehicles to move it to a safe place are mobilized.

Conditions:

- No one may cross the "cylinder of toxic air" with any part of the body
- Popcorn and containers cannot cross the barrier of the cylinder; only the arms of your design
- If you spill any kernels, the popcorn explodes!

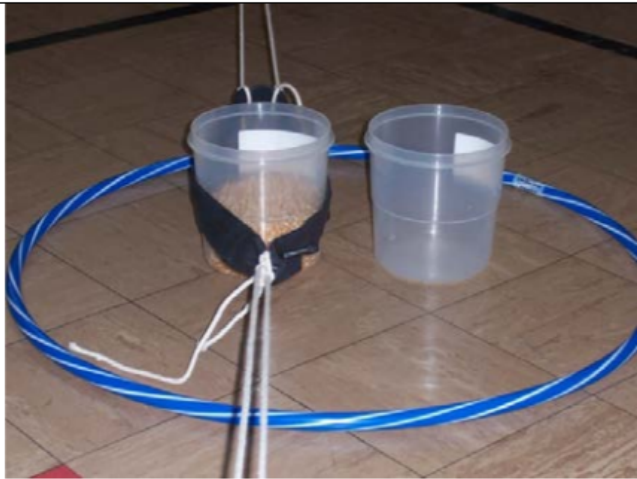
Design Challenge - You must design a machine / device of some sort that can pour / put the toxic popcorn to a safe container for decomposition. You may not cross the boundaries that indicate the toxic area (as you may die). You must transfer the popcorn kernels from one container to the other without entering the toxic area.

TOXIC POPCORN CHALLENGE



Toxic Area Set-Up

- Fill the lipped container about $\frac{3}{4}$ way with popcorn kernels
- Place the hula hoop as a radial barrier around the plastic containers (think of this as the base of the cylinder of toxic air)



The above are example of solutions using tension (left) and compression (right). You may use these designs as inspiration for your own toxic popcorn removal solutions. Some designs may require help from friends or family members to operate.

Debrief



- Which device was most successful/spilt the least popcorn? What made it work well?
- How could you have improved your design?

What Did You Learn?



- What is toxic waste?
- How is toxic waste produced industrially? In your home?
- Why can't this waste go into regular garbages and landfills?
- How do nuclear power plants and other industries currently deal with toxic waste?

Future Learning



- Try another design! If you used a tension solution in your first design, attempt it with a compression solution.
- Create a device that removes the toxic waste container from inside the hula hoop after it has been transferred into the 'safe' container.

Share your creations!

We would love to see what you made. Email us at discover@uwo.ca or tag us on social media.

Instagram: @westernueng

Twitter: @westernueng

Facebook: @westernueng

Thanks for discovering with us!