

Metro Waste Authority's *Ecoville Simulation*



Teacher's Guide

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Introduction

Thank you for introducing your students to the complex world of safe and smart waste disposal through Metro Waste Authority's Ecoville Simulation. This fun, interactive simulation will not only give students a peek into the kinds of decisions that go into safe and smart disposal, but will also help them learn about Metro Waste Authority's various environmental stewardship and education efforts. This allows for rich analysis of some of the ways in which humans impact the environment through not only the waste we produce, but also the ways in which we work together to mitigate negative impacts that result from the waste stream. This simulation also helps players review the guidelines for Metro Waste Authority's programs, including our recycling and hazardous waste guidelines.

Knowledge about the waste stream is critically important to the development of informed, empowered, and engaged citizens. For decades, society has deliberately drawn a curtain to keep ourselves from thinking about what happens to materials when we are done with them, particularly when it comes to garbage. Terms like "throw it away", "toss it", and "chuck it" demonstrate the deliberate nature of our language, which keeps us from having to think about end-stage destinations for the waste we all generate.

Who is Metro Waste Authority?

Metro Waste Authority is a quasi-governmental solid waste agency overseen by a board of directors made up of elected officials from our member communities. Our mission is to provide answers for safe and smart waste disposal and recycling. Whether it's garbage, recycling, yard waste, or hazardous waste, we know where it should go and have the resources to help. In order to provide solutions for these various waste materials, Metro Waste Authority operates several facilities across Polk County, including:

- Metro Park East Landfill – Mitchellville, Iowa
- Metro Recycling Facility – Grimes, Iowa
- Metro Hazardous Waste Drop-Off – Bondurant, Iowa
- Metro Transfer Stations – Des Moines, Iowa and Grimes, Iowa

Metro Waste Authority also operates the Metro Park West Landfill in Greene County, and collaborates with other agencies to provide satellite hazardous waste drop-offs in counties across Central Iowa. In addition to providing options for safe, smart waste disposal, Metro Waste Authority is also deeply committed to education and environmental stewardship. As part of this commitment, Metro Waste Authority provides resources like this simulation, as well as a wealth of other classroom resources, learning spaces, and educational programming.

What to expect in Metro Waste Authority's Ecoville Simulation



By engaging in this simulation, players will develop an enhanced understanding of what it takes to manage solid waste in a safe, smart manner. While doing so, they will learn more about Metro Waste Authority's programs and guidelines, building a knowledge base that will help them contribute to a safe, smart, and sustainable system.

The goal for players is to make decisions that yield high environmental, public perception, and economic scores, all while having a greater understanding of the behind-the-scenes processes that enable the responsible management and disposal of solid waste. It will become clear through game play that not every decision is a good one, and that it is not always feasible to make decisions that are popular, environmentally beneficial, and economically feasible all at once.

A single game playthrough can take between 8-20 minutes and is largely dependent on the decisions the player makes.

There are 6 categories players will learn about if they complete the simulation. Those categories are:

- Contracting and landfilling
- Recycling
- Compost and yard waste
- Demanufacturing
- Methane recovery
- Hazardous waste

As the agency grows and expands, the player is still responsible for decision making from programs and facilities established earlier.

Included in this guide are basic background on gameplay, as well as important background information, including vocabulary, that may be beneficial to know as you play and facilitate gameplay with students. This information will also be useful as you address important science and societal topics, like human impact on the environment.

Vocabulary

Bale	a tightly compacted cube of sorted recyclables
Byproduct	a secondary product unintentionally produced when doing something else
Capped	(in reference to a landfill) a cover placed over a filled landfill to isolate and keep material in its place
Commodities	(in reference to recycling) materials that can be bought and sold, including fibers, plastics, and metals
Compactor	a piece of heavy equipment used to crush material
Compost	decayed organic material used as a soil enhancer
Contamination	(in reference to recycling) non-recyclable items that get mixed in with recyclable items
Decomposition	the state or process of rotting or decaying
Demufacturing	disassembling materials and recycling the components
Diversion	redirecting something to a different course or path
Dozer / bulldozer	a powerful tractor with a blade at the front for pushing and moving material
Flare	a flame used to combust excess landfill gas
Groundwater	water held underground in the soil or in rock
Hazardous waste	waste that has properties that make it dangerous, or capable of having a harmful effect on health or the environment
Landfill	a place to dispose of refuse and other waste material by burying and covering it
Leachate	water that has gathered contaminants as it has soaked through garbage at the landfill
Liner	a layer of material used to protect a surface – like the ground – from another material, like garbage
Methane	a potent greenhouse gas composed of carbon and hydrogen
Multi-stream recycling	a program in which residents sort their materials by type before the material is collected by a recycling hauler
Municipal solid waste	everyday garbage discarded by the public
Permeable	allowing liquids or gases to pass through
Recycling	waste that can be converted into a reusable material
Single-stream recycling	a program in which residents do not pre-sort their recyclables, allowing the sorting to happen at the recycling facility
Solid waste	(in reference to municipal solid waste) commonly known as garbage; everyday items that are discarded by the public
Sorting floor	a large room in which recyclables are sorted into collections of like materials
Special waste	waste that requires special additional disposal measures because of the quantity or characteristics of the waste
Tip fee	a charge based on the weight of waste being left at the landfill
Tipping floor	an enclosed floor where recycling material is tipped out of recycling trucks
Waste stream	the flow and lifecycle of waste
Windrows	a long line of material like yard waste or hay
Working face	the specific area of the landfill where garbage is being tipped out of trucks, compacted, and eventually buried
Yard waste	grass clippings, leaves, weeds, brush, branches, and other yard debris that can be composted

Game Play

General Overview

- Play begins in the player’s “office”
- A tutorial guides the player through initial overview and decision making
- Phase 1 is the Contracting + Landfill phase, where the player will start with 50,000 points
 - The current phase is noted at the bottom of the screen
 - Points are tracked in the top right corner
 - Decisions will add to or subtract from the total as decisions are made
 - There is a target point “goal” for each round
 - If the goal is not met by the end of the round, the game will end
- Blinking icons let the player know to click on a communication device for an alert
- Other icons
 - Home – returns to main screen where you can reset the game or replay mini games
 - Target – shows current score, goal score, and current environmental and public opinion scores
 - Question mark – a short pop-up tutorial
 - Environmental and public perception alerts will appear as arrows up or down on the right hand side of the screen as the player makes decisions



Background Content for The Phases

Phase 1: Contracting and Landfill

What is a landfill?

A landfill is a scientifically engineered and managed facility used to dispose of municipal solid waste. Unlike dumps, they are highly regulated and designed to protect the environment, including groundwater and air quality. At a landfill, material is spread in thin layers, compacted, and buried, eventually being “capped”, which encloses the material inside. It is then covered with soil and planted, usually with tall grasses. Landfills are monitored for decades post-closure, meaning byproducts created in the closed landfill, like methane and leachate, are still properly managed after the landfill is closed.



This photo shows the preparation of a landfill cell where garbage will be buried. In the photo, a plastic liner is being rolled out over layers of clay and gravel.

Ideal Landfill Sites

There are many factors that contribute to the makeup of an ideal landfill site. Some of those factors include:

- A site that is rich in natural clay, which helps form another protective barrier that restricts the movement of leachate and gas. Clay is a much less permeable surface, making it difficult for byproducts from the landfill to filter through and enter the groundwater.
- A site that is away from highly developed areas, where there are more opportunities for the landfilling process to impact daily life for the community.
- A site that does not take up areas rich in environmental value.

Tip Fees

Landfills are typically funded by tip fees, or the fee an individual or entity pays to “tip off” their material at the landfill. This fee is usually based on the weight of the material or the size of the vehicle.



This photo shows a vehicle being weighed on the scale at the Scale House. It will be weighed again on the way out, and will then be charged based on the weight of the material left behind.

Working Face

The working face of a landfill is where garbage is currently being tipped, compacted, and buried. This is usually a very small area in comparison to the total square footage of the landfill as a whole.



This photo shows trucks tipping off material at the working face.

Daily Cover at the Landfill

The working face needs to be covered at the end of each day as an environmental safeguard. This helps protect and contain garbage. There are different varieties of daily cover, including:

- tarping, in which a large industrial tarp is unrolled to cover the working face at the end of the day, and is re-rolled the next. The same tarp is able to be used over and over again.
- soil cover, in which soil is brought in to cover the working face at the end of the day. This layer of soil remains, and garbage will be added on top of it the following day.



This photo shows daily cover of soil being applied.

This photo shows daily cover using a tarp.

Spreading and Compaction

Landfills use dozers to spread material around so there is not too much of the same type of waste in one area. This aids in uniform decomposition over time. They also use compactors to help remove airspace from the garbage and keep the waste as compact as possible, extending the life of the landfill and reducing the risk of uneven settlement.

Diversion

The goal is always to keep as much material out of a landfill as possible, which is accomplished through diversion. Diversion means sending something on a different course or path, so diversion methods send as much material as possible on a path that does not end at the landfill. Diversion methods to keep waste out of the landfill include:

- Compost / yard waste programs
- Recycling programs
- Demanufacturing programs
- Hazardous waste programs

Phase 2: Recycling

Why recycle?

One major way to extend the life of a landfill and conserve resources is through recycling. Recycling allows materials to continue to be used and have value instead of reaching their end destination in a landfill before their usefulness is exhausted. When manufacturers use recycled materials, they have to use fewer natural resources. Both of these scenarios illustrate the importance of a strong, sustainable recycling program.

Recycling guidelines are based on supply and demand. Metro Waste Authority's guidelines are based on the needs of material buyers and the size of the community we serve. A sustainable recycling program is one in which the community stays informed about – and follows – recycling guidelines, allowing recycling facilities to operate efficiently and meet the demand of buyers.

Recycling is not always profitable. Much like the stock market, the value of commodities, like aluminum, paper, cardboard, and plastics, changes often and widely. However, even when it is not profitable, recycling is the right thing to do.

Metro Waste Authority's Metro Recycling Facility

Metro Waste Authority opened a world-class, state-of-the-art recycling facility in Grimes, Iowa in November of 2021. This facility is over 100,000 square feet and utilizes advanced technology to help support our staff of recycling sorters. The facility processes thousands of tons of recycling each month.



This rendering shows the Metro Recycling Facility in Grimes, Iowa.

What does the recycling process look like?

1. Mixed material is tipped out of recycling hauler's trucks inside a giant room called the tipping floor.
2. Material is sent by conveyor belt to the sorting floor, a room filled with equipment and people.
3. Material is sorted into categories by people, equipment, and advanced technology.
4. Contamination, the term for materials not accepted in the recycling program, is removed.
5. Sorted material is compacted into large cubes called bales.
6. Bales are sold to buyers, who will engage in the next phase of processing.



Tipping floor.



Sorting floor.



Bale storage.

Recycling Education

The best way to have a sustainable recycling program is to have an informed and engaged community. Metro Recycling Facility includes an Education Center and recycling exhibit to help the community learn about recycling.



This photo shows the Education Center at the Metro Recycling Facility in Grimes, Iowa.

Phase 3: Compost and Yard Waste

What are compost and yard waste?

Compost is decayed organic material which can be used as a nutrient-rich additive to soil. Yard waste is the organic material that Metro Waste Authority put through the composting process, and includes “greens” and “browns” in a balance that allows for the decomposition process to happen most efficiently and create the most nutrient-rich material.

- Greens include wet, fresh materials like grass clippings, which are nitrogen rich.
- Browns include dry materials like twigs, branches, dead leaves, and hay, which are carbon rich.

What does the composting process entail at Metro Waste Authority’s Metro Park East landfill?

When leaves, sticks, and other yard waste are placed at the curb, a yard waste truck brings them to the compost pad at the Metro Park East landfill. This is also where much of the metro area’s storm debris comes.

The material is placed in rows called windrows. The rows of yard waste need moisture, oxygen, and heat in order to become compost.

The material will go through 3 phases:

- Phase 1 – the mesophilic phase
 - In this phase, the temperature will reach 68-104 degrees and soluble compounds will break down.
- Phase 2 – the thermophilic phase
 - In this phase, the temperature will reach 105-150 degrees and protein, fat, and cellulose will break down.
- Phase 3 – the maturation phase
 - In this phase, the temperature will drop to under 105 degrees, and the compost will settle and stabilize.

Because the material gets so hot and contains many dry, flammable materials, it is critical that the compost pad is carefully monitored and that the material is moistened and turned on a proper schedule.

While in the past it would take between 8-12 months for material at Metro Waste Authority's compost center to become the final product, Grow Gold Compost, new technologies have allowed this natural process to happen more swiftly and efficiently. With the addition of a windrow turner, which is a large piece of equipment that swiftly turns the rows, the composting process can now be completed in under 3 months.



This photo shows recently delivered yard waste.



This photo shows Metro Waste Authority’s windrow turner.

Why do we separate yard waste from the landfill?

One major reason Metro Waste Authority established a yard waste program is to save space in the landfill by diverting material that can be used to create something beneficial, aligning with our vision of “no wasted resources”. The valuable resource that is created through this program is then able to be used by our communities to enhance the health and vitality of our environment.

Phase 4: Demanufacturing

One impactful way to divert material from the landfill is through **demanufacturing**, or disassembling and recycling appliances instead of sending them to the landfill. Appliances and electronics contain parts that can be repurposed, reused, recycled, or are hazardous and should be kept out of the landfill.

Demanufacturing keeps large, bulky items made of and containing valuable materials from taking up space in the landfill and becoming waste before their material usefulness is exhausted.

Metro Waste Authority started a demanufacturing program in 2020, with a goal of keeping all appliances out of the landfill.



This photo shows a staff member demanufacturing an appliance.

Demanufacturing and Safety

People who work in demanufacturing are specially trained to handle the hazardous materials contained in some appliances and electronics. Demanufacturing is something that should only be done by people with specialized training and tools, as some materials can be hazardous or lethal if not handled properly.

Phase 5: Methane Recovery

What is methane?

One of the byproducts produced by landfills is methane gas. Methane is a greenhouse gas produced as organic material decomposes. This gas should not be released loose into the air and should instead be captured and processed. There are several ways to process the captured methane gas, including:

- Flaring
 - Flaring burns methane gas converts the methane to carbon dioxide, which is another greenhouse gas but one which is less harmful on a pound-by-pound basis. This option costs less initially than creating a landfill gas to energy system, but does not generate any useful product or revenue.
- Landfill Gas --> Energy System
 - Converting to natural gas allows landfill gas to be converted into a high-Btu renewable natural gas that can be used in place of other gases, like fossil natural gas or compressed natural gas.
 - Converting to electricity can utilize different technologies, like turbines and reciprocating engines, to generate electricity using methane gas.

How does Metro Waste Authority process methane?

Metro Waste Authority uses a gas to energy approach to processing landfill gas. Methane is collected and flows through pipes to one of two Methane Recovery Facilities on site, where it is converted to electricity and used to power over 10,000 homes and businesses.



This photo shows one of two Methane Recovery Facilities at Metro Park East landfill.

Phase 6: Hazardous Waste

Misconceptions about hazardous waste are common, and each of us encounters hazardous waste more times in a day than we may realize. Knowing how to identify hazardous waste is important for everyone's safety, but also to ensure that environmental safeguards are in place during the disposal process.

What is hazardous waste?

Hazardous waste can be identified by the following characteristics:

- Ignitability – this is a material that is flammable
- Corrosivity – this is a material that can break down solid material upon contact
- Reactivity – this is a material that is explosive
- Toxicity – this is a material that is poisonous

What are common examples of hazardous waste?

Common hazardous wastes include:

- Motor oil
- Oil-based paint
- Household cleaners
- Drain cleaner
- Pesticides
- Gas tanks
- Cooking oil
- Rechargeable batteries*
- Rechargeable devices*

**** One of the main causes of garbage truck and landfill fires is rechargeable batteries***

What should happen with hazardous waste?

Hazardous waste should be brought to a hazardous waste drop off location, like Metro Waste Authority's Hazardous Waste Drop-Off in Bondurant, or our by-appointment satellite drop off in Grimes.



This photo shows a staff member processing hazardous waste.

Why should hazardous waste be kept out of the general waste stream?

The characteristics of hazardous waste make them a danger to the health and safety of the environment, as well as the people involved with the waste stream, like garbage haulers or landfill staff. For example, let's consider a hazardous material that many people do not know is classified as hazardous: cooking oil. Imagine that cooking oil spills from its container in a garbage truck, soaking into the surrounding material. As cooking oil is highly flammable, if there is a spark or another material combusts, this cooking oil will allow the fire to grow and spread. To ensure everyone's safety, dropping hazardous waste at a hazardous waste facility is the right thing to do.

The Swap Shop

Many hazardous materials, like paints or cleaners, are brought to the Metro Hazardous Waste Drop-Off before they are fully used. In fact, some are barely used at all! Because of our vision of “no wasted resources”, these materials are offered to the public in our Swap Shop for free.



This photo shows the Swap Shop at the Metro Hazardous Waste Drop-Off in Bondurant.

Frequently Asked Questions

- **Why can't I recycle everything that has the triangular "chasing arrows" symbol?**
 - This symbol does not necessarily mean that a material is commonly recyclable, or recyclable at all given our current technology. It may mean that some part of the item is made from recycled material, or that in some areas it could be recyclable. On plastics, this symbol is merely part of the "resin identification number" symbol, alerting consumers and manufacturers to the type of plastic used to create the product. The presence of this symbol does not mean the material is recyclable or eco-friendly.
- **Why are local recycling guidelines different from place to place?**
 - This is largely due to supply and demand. Agencies that provide recycling services need to be able to find buyers for materials in order to accept them in a recycling program. Guidelines are also designed to help ensure that a recycling program does not get more of any material than they can find an outlet for, and that they get enough of each material to satisfy the needs of their buyers. If a recycling service provider cannot find buyers for a material, they will not put it on their acceptance list.
- **Why do recycling rules change?**
 - Rules change when demand changes. This could be the result of more or fewer buyers for a material, or because of changes in technology that create a need for updated guidelines.
- **Why can't everything be recycled?**
 - Advances in technology and creative problem-solving by engineers, scientists, manufacturers, environmentalists, and engaged citizens continuously expand what and how we can recycle materials. As that process continues, we will figure out ways to recycle more materials.
- **Why do some areas collect recycling less frequently than other areas?**
 - Communities need to determine how often, on average, residents are filling up their recycling carts. Because recycling carts typically fill up more slowly than garbage carts, it is not environmentally responsible to send vehicles to every home each week to collect recycling carts that are not full. Additionally, because recyclables should be largely clean and have no organic material, the contents of the cart will not rot and stink if left in the cart for more time.