# SUSTAINABLE *PACKAGING*

## Patch Requirements

(Cadettes, Seniors, Ambassadors)

Institute of PACKAGING PROFESSIONALS

spe FOUNDATION

# KNOW YOUR *PACKAGING*

## OUTCOME:

Participants will understand the history and benefits of packaging, different materials used in packaging, package formats, and levels of packaging.

## SUPPLIES:

- **Packaging protection activity:** An apple, knife, cutting board, Sharpie marker, Saran™ Premium Wrap, Glad® Cling Wrap, paper plate
- **Packaging scavenger hunt:** Five different types of packaging from your home or local store

## ACTIVITIES:

- Watch the *Moments in Packaging History* video.
- Watch the *Why do we need packaging?* video.
- **Packaging protection activity:** Complete packaging protection.
- **Packaging scavenger hunt activity:** Complete the packaging scavenger hunt.

## PROCEDURE:

- **Packaging protection activity:** Cut apples into four segments. Eat one segment and then completely wrap one segment in Saran™ Premium Wrap, one in Glad® Cling Wrap, and leave one unwrapped. Place all segments together on paper plate. Observe how long it takes for the apples to oxidize and turn brown. It may take longer than you think.
- **Packaging scavenger hunt:** Find five different types of packaging and fill out the worksheet below.

# KNOW YOUR *PACKAGING*

## Scavenger Hunt Worksheet

| | Name of Packaged Product | Format (Bottle, jar, box, can, bag, etc.) | Materials Used (glass, metal, paper, plastic, etc.) | Level of Packaging (Primary, secondary, tertiary) | Primary Purpose of the Packaging (Protect, inform, contain, etc.) |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |

# KNOW YOUR *PACKAGING*

## FOR THE TROOP LEADER:

First, we need to understand the purpose of packaging. The ideal package will incorporate as many of these benefits as possible.

- **Protection and Transportation** – Packaging provides protection from the environment and safety during transportation. Packaging can also preserve food to last longer.
- **Communication** – Packaging is regulated (Food Labeling Modernization Act of 2023) to ensure that manufacturers fully inform consumers about the contents of the package including product name, where the product was made and by whom, a list of ingredients, weight, nutritional information, and packaging information (i.e. recycled content, recycling…), use by date, etc. In addition, packaging communicates shelf-appeal, brand awareness, and product/company/consumer values.
- **Containment** – Packaging is used to contain the products in one place and to make it easier to transport and store.
- **Convenience** – Packaging will sometimes include features such as easy to open, reclose, dispense.
- **Security** – Packaging may provide protection from accidental use (like medications) or extra protection from theft.

Saran™ Premium Wrap and Glad® Cling Wrap are made from different combinations of polymer materials. Packaging film materials have different oxygen barrier properties that keep the oxygen from food, such as the apples. The apples in the activity will brown at different rates. A wrap with better oxygen barrier properties will keep the apple fresher for longer.

References: https://kenanfellows.org/kfp-cp-sites/cp17/cp17/packaging-lesson-2-what-purpose-packaging/index.html
https://www.feedough.com/packaging-definition-types-functions/

# KNOW YOUR *PACKAGING*

## FOR THE TROOP LEADER:

Packaging materials include paper, plastic, glass, metal, and biopolymers like cellulose and polylactic acid.

| Packaging Material Type | Pros | Cons |
|---|---|---|
| Glass | • Preserves food long time and inert to a variety of foods and chemicals<br>• Resistant to high heat<br>• Transparent<br>• Recyclable | • Heavy and Fragile<br>• Expensive to transport |
| Metals (aluminum and steel) | • Preserves food for long time<br>• Resistant to heat<br>• Strong<br>• High recycling rates | • May corrode<br>• Expensive<br>• Some foods can react with metal and need polymer coatings inside cans<br>• Expensive to transport |
| Paper | • Easy to print on<br>• Lightweight<br>• Low cost<br>• Biodegradable<br>• High recycling rates | • Easily flattened<br>• Not water resistant – may need polymer coatings<br>• High water usage to produce<br>• Uses trees - must plant more to be renewable |
| Plastics | • Lightweight<br>• Excellent barrier to water and gasses<br>• Can be molded into different shapes<br>• Can be colored or transparent<br>• May be recyclable | • Poor heat resistance<br>• Multi-layer harder to recycle<br>• Lower recycle rates for plastic (~9%) than paper (>60%), glass (~26%), and metal >44%) |
| Biopolymers (plant-based plastics) | • Renewable<br>• May be biodegradable | • Poor heat resistance<br>• May require industrial composting<br>• Generally considered non-recyclable |

References: www.researchgate.net/publication/349831699_Review_of_bioplastics_as_food_packaging_materials

# KNOW YOUR *PACKAGING*

## FOR THE TROOP LEADER:

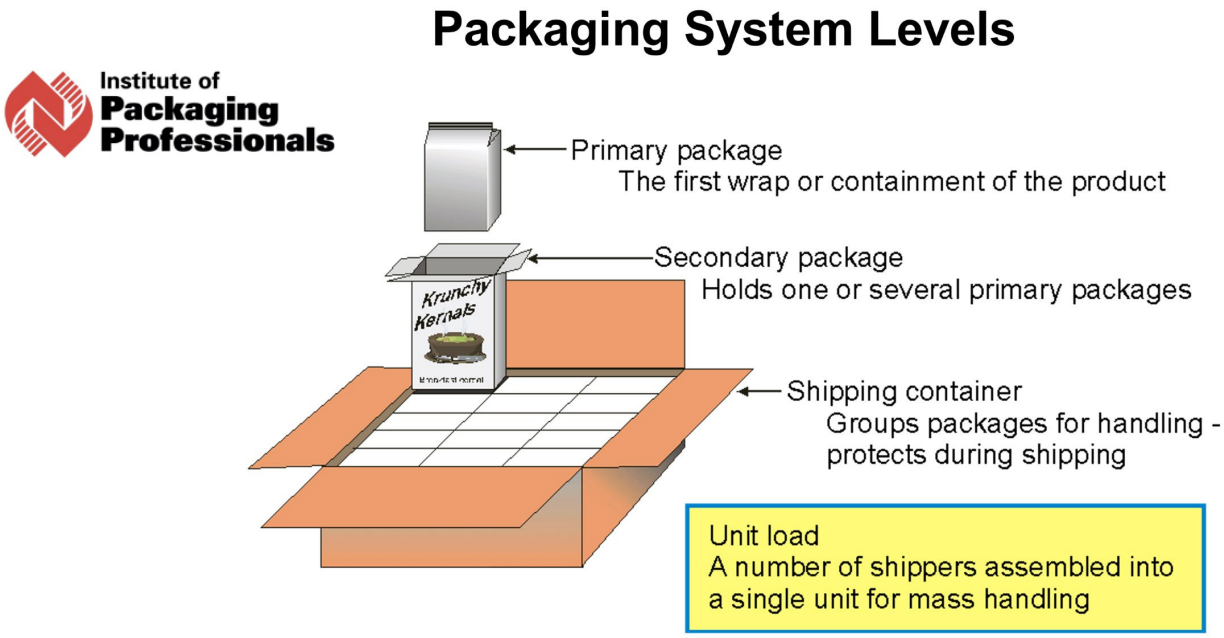
Packaging formats include bottles, jars, boxes, cartons, tubes, cans, flexible bags and films, trays, and tubs. The package format selection will depend on the needs of the product being packaged, how the product will be shipped, and how the end user or consumer will use or store the product.

Levels of packaging include:

**Primary Packaging:** packaging that touches the product itself.

**Secondary Packaging:** packaging that does not touch the product itself.

**Tertiary Packaging:** packaging that holds together a group of items (shipping container).



# PACKAGING *SUSTAINABILITY*

## OUTCOME:

Participants will understand the definition of sustainability and what makes a package sustainable.

## SUPPLIES:

**Bioplastic activity:** Milk, vinegar, food coloring, popsicle stick, heat resistance cup, slotted spoon, large container (or sink) that will fit the strainer, paper towels.

## ACTIVITIES:

- Watch the *What is Sustainability* video.
- Watch the *How to Make Your Packaging More Sustainable* video.
- **Activity:** Choose an item from the previous Packaging Scavenging Hunt exercise. Discuss with your troop whether you think this package is "sustainable" based on the videos and the sustainable packaging definition below.
- Watch *The First Plastics* video to 5:32 minutes.
- **Bioplastic activity:** Make casein (Milk Plastic). Color the casein with food coloring.

## PROCEDURE:

**Bioplastic activity:**

1. Add 1-3 drops of food coloring to a mug.
2. Add 1 cup of hot milk (not boiling) in a heat resistance cup.
3. Add 4 teaspoons of white vinegar to the cup.
4. Mix slowly with a spoon for a few seconds.

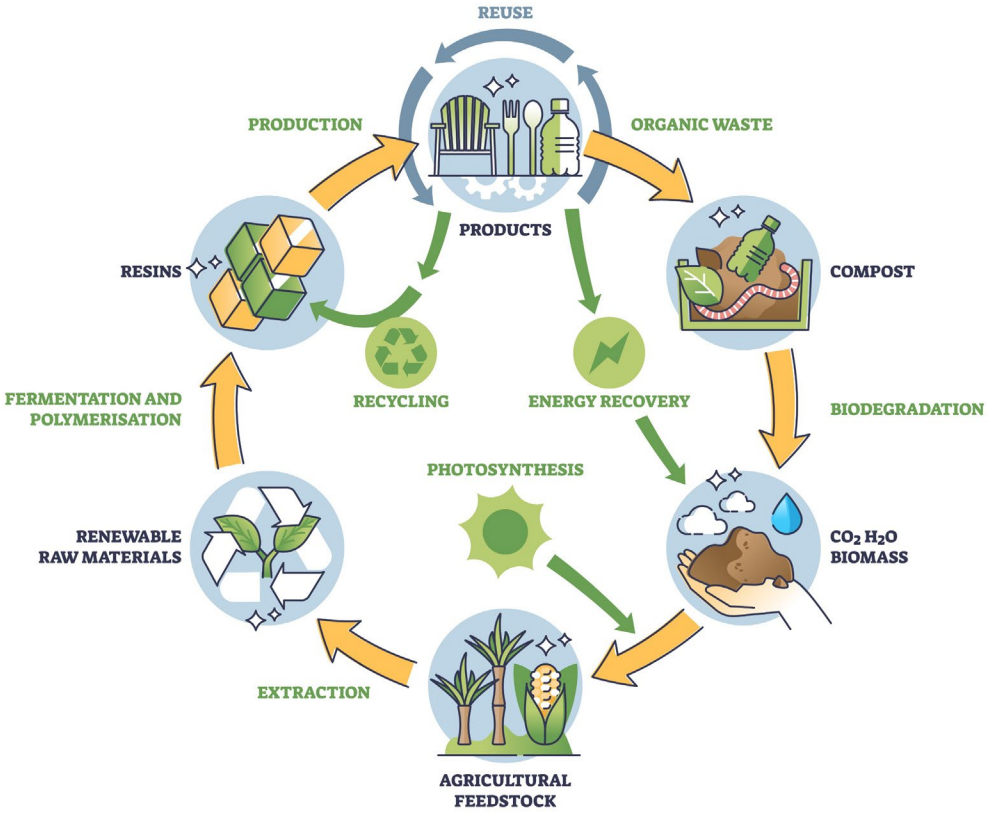
## PROCEDURE (cont.):

5. Stack layers of paper towels on a hard surface that will not be damaged if it gets damp.
6. Allow the milk and vinegar mixture to cool then use a slotted spoon to scoop out the curds.
7. Fold the edges of the paper towel stack over the curds and press down on them to absorb excess liquid. Use extra paper towels if needed to soak up the remaining moisture.
8. Knead all the curds together into a ball, as if it were dough. What you have in your hands is a casein plastic.
9. If you want to use the casein plastic to make something, shape or mold it by hand or use cookie cutters within an hour of making the plastic dough then leave it to dry on paper towels for at least 48 hours. Once it has dried, the casein plastic will be hard.

# PACKAGING *SUSTAINABILITY*

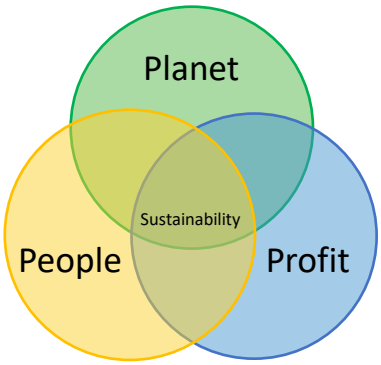
**Biopolymers** are polymers derived from a renewable resource. What is the difference between a renewable and a non-renewable resource? Most polymers are currently derived from fossil fuels that are non-renewable. These non-renewable resources are oil and gas, which are finite. Biopolymers are polymers that are derived from plants (plant sugar, or glucose) which are a renewable resource. Some examples include I'm Green™ Polyethylene from Braskem (made from sugar cane) and Polylactic Acid (PLA made from corn).

## THE LIFE CYCLE OF BIOPLASTICS



# PACKAGING *SUSTAINABILITY*

## FOR THE TROOP LEADER:



Triple Bottom Line

In 1987, the United Nations defined Sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". Some organizations follow the Triple Bottom Line framework with three parts: People (social), Planet (environment), Profit (financial) to help meet their sustainability goals. Sustainability is often described as the union of these three parts.

Sustainable packaging is defined as:

- Made from recycled content and renewable content for efficient use of resources.
- Made from materials that are safe and healthy for individuals, communities, and the environment throughout the package life cycle.
- Sourced, manufactured, transported, or recycled using renewable energy (ie. solar, wind)
- Designed to provide essential protection to products while minimizing the overall use of materials, reducing total energy consumption, and avoiding waste.
- Optimized for effective recovery of materials after use to enable recycling or reuse by the end user.

In the past, **a linear economy** was the traditional model of producing goods which takes new resources to make goods that are discarded at the end of the product life-cycle (take, make, dispose model).

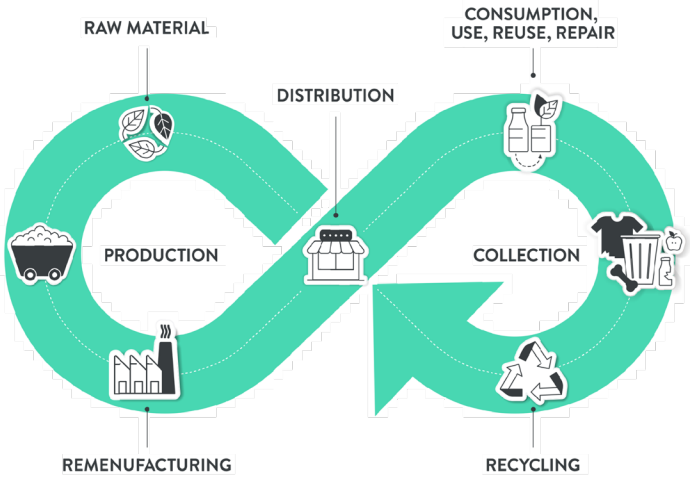
A **circular economy** is an economic model that envisions a closed system of continual resource use. The goal is to reduce waste, reuse or up-cycle what we have, and recycle those elements that cannot be reused. This redesign of the current operating system finds its roots in nature's cyclical model, where there is a continual cycle of renewal and reuse, and where the concept of waste, as an end product, doesn't exist. Everything becomes a valuable resource, as "food" for something else.

References: kidv.nl/media/rapportages/definition_for_sustainable_packaging.pdf?1.2.1
www.ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview

# PACKAGING *SUSTAINABILITY*

## LINEAR ECONOMY vs CIRCULAR ECONOMY


LINEAR ECONOMY




CIRCULAR ECONOMY

**"Single-use plastics"** are plastic products that are used only once before being thrown away, as part of the linear economy. The most common single-use plastics found in the environment are, in order of magnitude (number of items found of each type), cigarette butts, plastic drink bottles, plastic bottle caps, food wrappers, plastic grocery bags, plastic lids, straws and stirrers, other types of plastic bags, and foam take-away containers, according to Ocean Conservancy**.

**International Costal Cleanup Report 2017: Ocean Conservancy. https://oceanconservancy.org/wp-content/uploads/2017/06/International-Coastal-Cleanup_2017-Report.pdf

# REDUCE, REUSE, RECYCLE, RECOVER
# *AVOIDING WASTE*

## OUTCOME:

Participants will understand packaging waste hierarchy and the role of reusable or refillable packaging and compostable packaging.

## SUPPLIES:

- **Reuse activity:** plastic bottle, sticks, a pin, scissors, marker, string, and bird seed
- **Composting activity:** Two large plastic bottles (like 2-liter soda bottles), dirt, fruit peels and/or bread, leaves, compostable packing peanuts, polystyrene foam packing peanuts, paper towel, spray bottle with water, marker, scissors, a pin

## ACTIVITIES:

- Watch the *Waste Management Hierarchy* video.
- **Discussion:** What are the steps that you can take to implement waste hierarchy in your life? Where in your life can you reduce, reuse, and recycle more often?
- Watch the *Sustainable Packaging Innovations: Unlocking the Power of Reusable and Refillable Packaging* video.
- **Reuse activity:** Make a birdfeeder from plastic packaging.
- Watch the *What is Compostable Packaging?* video.
- **Composting activity:** Compare composting of organic packaging (fruit peels) vs. compostable packaging (cellulose packing peanuts or compostable film).
- **Other exercises:** *Experiment with Packing Peanuts* or *Earth Day Science Activities*.

## PROCEDURE:

**Reuse Activity:**

1. Watch the *Plastic Bottle Bird Feeder* video.
2. Mark the locations under the bottle for drainage holes and use pin to start hole.
3. Mark the locations where your sticks will go.
4. Mark the locations of the feeder holes, above the sticks. Don't remove too much material for the feeder holes or seeds will all run out.
5. Cut holes in the marked location with scissors and open up drain holes a little with tip of scissors. Keep them small enough for water to drain, but not seeds.
6. Place sticks through the holes, through one or both sides of the bottle.
7. Cut holes in the top of the bottle with utility knife and loop the string and tie knot to hang the feeder.
8. Decorate the bottle with ribbon or yarn however you like. Keep in mind, birds are often attracted to colors like their own, blue for Bluebirds, red for Cardinals, Yellow for goldfinches, Orange for Baltimore orioles, etc. Avoid using stick-on baubles, beads, or bling that could be confused for seeds.
9. Fill the bottle with bird seed using a piece of paper as a funnel. Check the type of birdseed you are using; certain types of birds prefer certain types of seed. Check it out at Cornell Lab: *Feeding Birds: A Quick Guide to Seed Types*.
10. If too much seed is falling to the ground, a metal pie tin could be hot-glued to the bottom of the bottle to catch the loose seed.

## PROCEDURE:

**Composting Activity:**

1. Watch the *How to Make a Mini Compost Bin!* Video from Maddie Moate
2. Remove the label and wash the bottles. Cut the top, tapered portion off and set aside. Poke drainage holes in the bottoms of the bottles.
3. Fill Bottles:
   - Add a brown waste layer first (paper, leaves, brown paper bag, etc.), moisten with water
   - Add a green waste layer (vegetable scraps, grass clippings, etc.)
   - Add another brown waste layer and moisten
   - Add a layer of compostable packing peanuts to one bottle and polystyrene foam packing peanuts to the other bottle
   - Add another green waste layer
   - Turn the cut-off bottle top upside-down and place it in the bottle to protect the compost (see picture below)
   - Label the bottles “Compostable Peanuts” and “Polystyrene Peanuts”
   - Moisten the layers and keep damp, as the layers decompose
4. Place bottles on a windowsill or outside in the sun, on a tray. Once or twice a week, take a picture or write down your observations and compare the compostable packing peanuts to the polystyrene packing peanuts. Are they decomposing in the same way?

# REDUCE, REUSE, RECYCLE, RECOVER *AVOIDING WASTE*

## FOR THE TROOP LEADER:

The waste hierarchy pyramid is a tool that evaluates waste process from the most environmentally favorable to the least favorable, in terms of resource and energy consumption.


- **Prevention -** avoid the use of virgin raw materials to produce packaging is where the waste hierarchy pyramid starts and is the most preferred method.
- **Reuse or reusable materials** is the second step on the waste hierarchy pyramid. A reusable material is defined as packaging that is used multiple times for the same application in functionally the same shape. An example would be a glass bottle used repeatedly for carrying liquids or inflatable cushioning that can be reused to ship goods a second time. Recovering value from a discarded resource without reprocessing or remanufacturing (e.g. clothes sold though resale shops represent a form of re-use, rather than recycling).

References: www.epa.nsw.gov.au/your-environment/recycling-and-reuse/warr-strategy/the-waste-hierarchy

# REDUCE, REUSE, RECYCLE, RECOVER
# *AVOIDING WASTE*


- **Recycling** is the re-processing of waste materials into products or packaging whether for the original or other purposes. We will dive into recycling in the next section.
- **Recovery** is the processing of waste to recover energy, sometimes called "waste to energy". This process incinerates non-recyclable waste to create electricity. Waste to energy is another way we can move away from fossil fuels and reduce our carbon emissions. Another method here is **composting**, which transforms compostable waste into nutritious food for plants.
- **Disposal** in the landfill is considered the last resort when all other methods are not feasible.

# LET'S *RECYCLE*

## OUTCOME:

Participants will understand how recycling works, the terms downcycling and upcycling, and how recycling happens locally.

## SUPPLIES:

- **Density separation of recycled polymers activity:** Container, strainer, water, PET soda or water bottle, milk jug

## ACTIVITIES:

- Watch the *How Recycling Works: Behind the Scenes at the MRF* video.
- Watch the *What it means to Recycle Often. Recycle Right.* video.
- Visit the EPA.gov website to learn *How do I Recycle Common Recyclables?*
- **Recycling exercise:** Compare two recycling centers in different parts of the US and find what is similar and what is different. Research your local recycling center and store-drop location. Discover what is recyclable in your community and how you can help your family recycle more.
- **Density separation activity:** Complete Density Separation of Recycled Polymers.
- **Optional activity:** Make recycled paper. Check out these great videos is you want to make recycled paper at home:
  - *DIY | How to make handmade paper from recycled materials - PAPER MAKING*
  - *DIY PAPERMAKING - How to make Handmade Paper WITHOUT BLENDER + MAKING my own MOULD and DECKLE!*
- Watch the *Plastic Bag & Film Recycling* video.
- **Project:** Collect Store-drop off plastic items as a troop or participate in the Trex Recycle Challenge.

# LET'S *RECYCLE*

NexTrex

## NexTrex Recycling Challenge

### How does the challenge work?

- Register on **NexTrex.com** to obtain access to the Trex Portal
- Determine a 12-month collection time period
- Collect a minimum of 1,000 lbs.
- Report recycling totals at **my.trex.com**
- Weigh, record and attached pictures
- Deliver the collected plastic film to a participating retailer see list) for recycling

*Stores prefer smaller and more frequent amounts in the provided bin. Please contact store ahead of time with larger amounts.*

### What does Trex provide?

- Up to three recycling bins
- Posters

### What can I win?

*Trex Bench*

### What can be recycled?

*All plastic must be clean, dry and free of food residue.*


Register on the website **NexTrex.com**

## PROCEDURE:

**Density separation of recycled polymers activity:**

1. Watch the *PET Bottle sink float* video.
2. Fill a medium sized container with water.
3. Using scissors, cut up a soda (or water bottle) and a clean half gallon milk jug into pieces about the size of a dime.
4. Add the mix of pieces to the water in your container.
5. Stir the water and polymer pieces. Note: some of the polymer pieces are floating to the top, but some are sinking to the bottom of the container.
5. Use the strainer to skim the floating polymer pieces from the top of the water and set them aside to dry. This polymer (*polyethylene* milk jug) has a density of approx. 0.95 g/cc which is less than the density of water at 1.0 g/cc, so it floats.
6. Clean the strainer and then pour the water and the polymer that sunk to the bottom of the container into the strainer. Set this polymer aside, separately from the floating polymer, and let it dry. This polymer (*polyethylene terephthalate* bottle) has a density of approx. 1.4 g/cc which is greater than the density of water at 1.0 g/cc, so it sinks.
7. When water bottles and caps are recycled and ground up, this is how the bottle material (*polyethylene terephthalate*), and the cap material (*high density polyethylene* or *polypropylene*) are separated.
8. Once separated, these materials can be used for different products. Search online to find products that are made from recycled water bottles or recycled caps.

# LET'S *RECYCLE*


## FOR THE TROOP LEADER:

There are four paths packaging can take after serving its useful purpose: recycling, composting, energy recovery/incineration, or landfill.

Recyclability means the likelihood that a material will be collected, recycled, and then made into a new, commercially viable product. Recycling is part of a complex ecosystem that depends on a variety of factors including geography, consumer behavior, collection processes, sorting processes, equipment, and profitability. Due to this complexity, recycling is generally local and which packaging can be recycled will be very different by community, city, state or country.

**Materials recovery facility (MRF –pronounced "murf")**, is a place where curbside recyclables are sorted and stored until large enough volumes are collected to be shipped to a buyer or processor. MRFs play an important role in reducing the waste stream, the demand for raw materials, and pollution associated with the manufacturing of new products.

**The MRF process** uses a series of conveyers that carry recyclable materials past workers and over sorting screens or other mechanisms that divide the materials. Facilities are designed to accept and separate various types of recyclable materials. Automated systems can sort a number of materials simultaneously, such as paper, cardboard, aluminum, plastic, and glass, using such tools as magnets and UV optical scanners. The mechanized process is augmented by workers who sort items by hand. The recyclables are sorted and then prepared for the market. Non-recyclable or contaminated materials are separated out, but they generally amount to less than 10 percent of the total stream of waste taken in by a clean facility.

# LET'S *RECYCLE*

**Curbside recycling collection** is a service provided to households that collects some combination of recyclables, depending on the recycler. Typically, those recyclables include paper, glass, metal, and rigid plastic. In most countries, curbside recycling systems don't want flexible packaging (e.g. bread bags), as it is not profitable to recycle and processing it messes up equipment.

**Single-stream or mixed recycling** is collecting all recyclables with a single bin. This type of collection makes recycling easier for the consumer and the curbside collection workers. The downside is that there is more cost to sort at the recycling center and mixing materials may introduce more contamination.

Certain flexible plastic packages can be recycled through **store drop-off** locations. Look for the description label on flexible plastics made of high-density polyethylene (HDPE) and low-density polyethylene (LDPE), including grocery and produce bags, bread bags, some plastic wraps, some plastic mailers, bubble wrap and more. Store drop-off recycled content is used by companies, like Trex, that diverts consumer waste out of landfills to create new products such as composite lumber, roads, and sometimes new plastic bags.

**Sink-float separation** is a common method of separating ground-up recycled plastics. Because the density of most polymers is either a little above or a little below the density of water, water is a good medium for the separation to take place. In the case where polymers are either all above or all below the density of water, we may have to either choose different liquids with a more appropriate density or choose some other method to separate those polymers.

# LET'S *RECYCLE*


Be sure to check your local recycling policy.

# SUSTAINABLE *LABELING*

## OUTCOME:

Participants will understand sustainable labeling and Resin Identification Codes (RIC) codes.

## SUPPLIES:

- **RIC code scavenger hunt activity:** Cell Phone Camera

## ACTIVITIES:

- Watch the *This New System Makes Recycling Faster and Easier* video.
- Visit Wikipedia's *Resin Identification Code* page to learn more about the RIC system and its history.
- **RIC code scavenger hunt activity:** Complete the RIC Code Scavenger Hunt.

## PROCEDURE:

**RIC code scavenger hunt activity:**

1. Find 10 examples of RIC labeling on recyclable products either at home or your local grocery store.
2. Use your phone to take photos of the various labeling methods.
3. Investigate the labeling? What does it mean?
4. Are any of the objects similar? How does the labeling vary?
5. Use what you have learned to help you, your family, and your troop recycle more effectively and create a personal sustainability plan.

# SUSTAINABLE *LABELING*

## FOR THE TROOP LEADER:

Sustainable labeling, called "ecolabels" by the EPA, are "marks placed on product packaging or in e-catalogs that can help consumers and institutional purchasers quickly and easily identify those products that meet specific environmental performance criteria and are therefore deemed "environmentally preferable". Ecolabels can be owned or managed by government agencies, nonprofit environmental advocacy organizations, or private sector entities."**

Typical sustainable labeling includes the following:

- End of life indicates whether products or packaging can be recycled or reused
- Identification codes of the material
- Biodegradable or compostable
- Recycled content
- Renewable content (e.g., made from sustainable forestry or biomass)
- "Free of" certain chemical or ingredient
- Renewable energy claims
- Lower carbon footprint package

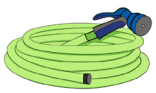
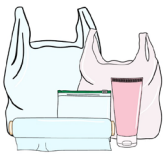
Most countries have their own recycling labels for their citizens. In the US and Canada, there is a standardized labeling system that communicates disposal instructions to the public. This system involves a coalition of brands and companies who want their packaging to be recycled through easily understood packaging labels that enable consumers to dispose of packaging properly.

**https://www.epa.gov/greenerproducts/introduction-ecolabels-and-standards-greener-products

# SUSTAINABLE *LABELING*

**Resin Identification Coding System**, often abbreviated RIC, is a set of symbols appearing on plastic products that identify the primary plastic resin out of which the product is made. It is important to note that while many have used the RIC as a signifier of recyclability, the presence or absence of a code on a plastic product does not indicate whether it is recyclable or not. The codes were originally introduced in the US in 1988 by the Society of the Plastics Industry to make it easier for employees in recycling facilities to sort and separate rigid items according to their resin type.

## RESIN IDENTIFICATION CODES (RIC) FOR PLASTIC

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| **PETE or PET** | **HDPE or PE-HD** | **PVC or V** | **LDPE or PE-LD** | **PP** | **PS** | **O or N/A** |
| Polyethylene Terephthalate | High-Density Polyethylene | Polyvinyl Chloride | Low-Density Polyethylene | Polypropylene | Polystyrene or Styrofoam | Other |
|  |  |  |  |  |  |  |
| soda bottles, water bottles, polyester film, containers for food, jars, fibers for clothing | detergent containers, plastic bottles, piping for water and sewer, snowboards, boats | window frames, plumbing products, electrical cable insulation, clothing, medical tubing | shopping bags, plastic bags, clear food containers, disposable packaging | plaboratory equipment, automotive parts, medical devices, food containers | CD and DVD cases, packing peanuts, single-use disposable cutlery, trays | baby feeding bottles, car parts, water cooler bottles, sippy cups |

# SUSTAINABLE *PACKAGE DESIGN*

## OUTCOME:

Participants will understand the sustainable package design principles then apply the knowledge to develop a more sustainable package.

## SUPPLIES:

- **Packaging design activity:** Find and use supplies available to you to build each of your unique design versions.

## ACTIVITY:

- Watch the Tips for Recyclable Package Design video.
- Watch the Designing Eco-Friendly Packaging video.
- **Packaging design activity:** Design two packages for a raw egg.

## PROCEDURE:

**Packaging design activity**

1. Design a package with the best "new" materials you think will protect you egg from a drop of 6 ft. Did your egg survive? What could you do differently with your design? Would more material, or different materials, make the design better?
2. Design a package using sustainable (reused) materials that will protect your egg from a drop of 6 ft. Did your egg survive? Was it easier or harder to use only sustainable (reused) materials? Was it easy or hard to find the reused materials that you feel you needed for a good design?

Discuss with your troop the challenges companies might face sourcing reused or recycled materials to replace new materials in designs. How could this be improved?

# SUSTAINABLE *PACKAGE DESIGN*

## FOR THE TROOP LEADER:

Sustainable package design needs a holistic product design approach. Designs must optimize overall environmental performance, ensuring that packaging is made from responsibly sourced materials while, at the same time, meeting the market needs in terms of performance and cost.

One way to make packaging more sustainable is by optimizing design, use, and performance. The prevention of product or food waste has an enormous environmental benefit. Keeping wasted products or food out of landfills reduces greenhouse gases and conserves all the resources, time, and cost that go in to creating products or foods.

**Sustainable Packaging Design Principles:**

1. Reduce the unique number of material types used. Use only what is necessary.
2. Use alternative materials such as recycled content or renewable materials.
3. Design for reuse or recovery using the waste hierarchy pyramid.
4. Limit the use of colors or print that can limit recovery.
5. Ensure labels and glues can be easily removed or are similar material to the packaging.
6. Optimize product-to-package ratio so that the package is as small as possible while still protecting the product.
7. Provide consumers with information on sustainability. Be accurate and clear with how customers should dispose of their packaging, and what (such as tape or labels) needs to be removed before disposal.
8. Design for efficient transportation to end user. Maximize bulk density in boxes or trucks.

References: www.sustainablebrands.com/read/packaging/avoiding-greenwashing0-principles-of-truly-sustainable-packaging-design

documents.packagingcovenant.org.au/public-documents/Sustainable%20Packaging%20Guidelines%20(SPGs)

# BEYOND THE *PATCH*


## GLOASSARY:

**Biodegradable** is a material that can break down in the natural environment within a year.

**Biomass** is plant materials that are used as a renewable energy source, like wood, or agricultural waste.

**Bioplastics** are plastic materials made from biomass rather than petroleum, which is what makes traditional plastic.

**Biodegradability and compostability** both refer to a package's end-of-life. All compostable packaging is biodegradable, but not all biodegradable packaging is compostable.

**Biodegradation** is a natural chemical process in which materials are being transformed into natural substances such as water, carbon and biomass with the help of microorganisms that depends on environmental conditions as well as on the material or application itself.

**Compost** is material that biodegrades in a commercially managed or home composting system.

**Curbside recycling collection** is a service provided to people for the collection of recyclables, typically, paper, glass, metal, and rigid plastic.

**Downcycling** is when a material or product is transformed into something of lesser value.

The **environment** is the world that surrounds all living organisms including people, soil, water, plants, animals, buildings, etc.

**Facility** is a building or structure that is used for a particular activity.

**Incinerator** is a furnace or apparatus designed to reduce the volume of waste by burning it.


## GLOASSARY:

**Inert** means the packaging does not react with most chemicals/foods.

**Landfill** is a specially engineered land site for disposing of solid waste in the ground.

**Life cycle assessment** is the evaluation of the complete cycle and environmental impact of a product from raw material extraction to end of life.

**Market** can have multiple meanings. It is either the entire value chain of the production and sale of goods (e.g., the used car market) or just the location where products are staged and sold (e.g., a grocery store).

**Materials Recovery Facility (MRF)** is a place where curbside recyclables are sorted and stored until large enough volumes are collected to be shipped to a buyer or processor.

**Multi-stream recycling** is multiple bins to collect different recyclable materials (i.e.. Glass, plastic, paper, and metal).

**Non-renewable resource**s are natural resources that cannot be replenished, to replace the depleted portion, after consumption or usage. Examples include oil, natural gas, and coal, collectively called fossil fuels.

**Packaging** is the act of enclosing or protecting products using containers to aid its distribution, identification, storage, promotion, and usage. Three levels of packaging includes *primary packaging* that is in direct contact with the product; *secondary packaging* that is not in direct contact with the product and is used to store, distribute, protect, and communicate; and *tertiary packaging* that is used to help handling and transport of packaged products.

# BEYOND THE *PATCH*


## GLOASSARY:

**Renewable content** covers a range of materials that are not traditionally oil based and come from a natural resource that can be renewed. Many products are converted from plant-based materials into packaging such as paper, board, and fiber packaging and are considered renewable content if from managed certified forestry or recycled pulp.

**Renewable resource** is a resource which can be used and repeatedly replaced naturally. Examples: forests of trees, solar and wind energy, oxygen.

**Resin Identification Coding System**, often abbreviated RIC, is a set of symbols appearing on plastic products that identify the primary plastic resin out of which the product is made. The codes were originally introduced in the US in 1988 by the Society of the Plastics Industry to make it easier for employees in recycling facilities to sort and separate rigid items according to their resin type. Today the numbers are being used more broadly, on both rigid and flexible items, to inform both recyclers and consumers.

**Recycled content** refers to material that is recovered from the waste stream and reprocessed to make new packaging.

**Recycling** refers to the series of activities by which waste materials are collected, sorted, processed, and converted into raw materials and returned to the economic mainstream by being used in the production of new products.

**Reuse or reusable materials** is to extend the life of an item by using it more than once, repairing or modifying it, or by creating new uses for it.

**Single-stream recycling or mixed recycling** is collecting all recyclables with a single bin.

# BEYOND THE *PATCH*


## GLOASSARY:

**Store drop-off recycling** refers to flexible plastics made of high-density polyethylene (HDPE) and low-density polyethylene (LDPE), including grocery and produce bags, bread bags, some plastic wraps, some plastic mailers, bubble wrap and more. These certain flexible plastic packages can be recycled through store locations like retail stores. Look for the How2Recycle Store Drop-Off label.

**Upcycling** is when we convert discarded materials into something of equal or greater value.

**Waste** is defined as any item which is discarded after its primary use, deemed worthless, defective, or of no use.

**Waste-to-energy** is the process of burning waste to produce energy/electricity.

# BEYOND THE *PATCH*


## CHOOSE ONE OPTION:

- Find 3 careers in plastics that interest you. Choose one and click to complete this career card. You can start with the websites below or do an internet search using the keywords below.
- Find out more about the Packaging programs at two universities listed below.
  - California Polytechnic State University
  - Clemson University
  - Michigan State University
  - Rochester Institute of Technology
  - San Jose State University
  - University of Wisconsin-Stout
  - University of Florida
  - Virginia Tech

## KEYWORD SEARCH FOR CAREERS:

- Applications Engineer, Food Scientist, Chemical Engineering, Chemist
- Electrical Engineer, Industrial Engineer, Injection Molding, Material Engineer, Material Scientist, Mechanical Engineering
- Packaging Engineer, Polymer Engineer, Polymer Scientist, Process Engineer
- Plastics Engineer, Supply Chain Manager, Transportation Management
- Sustainability Manager
- Graphic Designer

## Schools with programs in Polymer Science and Plastics Engineering:

- University of Southern Mississippi: USM-polymer science
- University of Akron
- Pennsylvania State University: PSU-Materials Science and Engineering
- Ferris State University
- University of Massachusetts–Lowell
- Shawnee State University: Shawnee State Plastics Engineering Tech
- University of Wisconsin-Stout
- Western Washington University

## Career Websites:

- Women in Plastics on Careers, Challenges, and the Future
- Indeed - 12 Plastics Industry Jobs (With Duties and Salaries)

## Careers in Packaging:

- Video: *5 Reasons You Should Pursue a Career in Packaging*