Better Plants
U.S. DEPARTMENT OF ENERGY

Finding Outlets for Hard to Manage Waste Streams

Virtual INPLT Training

Session 4

Tuesday – March 11, 2025

10:00 am – 12:30 pm EDT

U.S. DEPARTMENT OF ENERGY

DOE's Waste Reduction Network:

- Open to all existing Better Plants partners
- Goals are flexible
- Six goal options based on partner feedback
- Quarterly webinars
- Bi-monthly newsletter
- Access to new waste-related tools, trainings and programmatic elements

Plan of Action

Today, we will:

- Review the previous training
- Discuss the homework
- Lecture on today's topic, "Finding Outlets for Hard to Manage Waste Streams"
- Test your knowledge with a Kahoot! quiz
- Conduct a Q&A session

Waste Virtual INPLT Agenda

- **Week 1 (February 18th) – Introduction: Waste Diversion and Reduction 101**
- **Week 2 (February 25th) – How to Effectively Track and Measure Your Waste**
- **Week 3 (March 4th) – Source Reduction and Waste Minimization Techniques**
- **Week 4 (March 11th) – Finding Outlets for Hard to Manage Waste Streams**
- **Week 5 (March 18th) – Construction Waste Management and Green Building Certifications**
- **Week 6 (March 25th) – Scope 3 Emission Considerations**
- **Week 7 (Aril 1st) – Implementation of a Waste Diversion Program – Developing a Roadmap to Zero Waste**
- **Week 8 (April 8th) – Conclusions, Summaries, and Wrap up Presentations**

Takeaways

Today, you will learn:

- What makes something a hard to manage waste stream
- What are some common hard to manage waste streams and outlets for them
- How to identify outlets for waste streams

Presenters from Sustainable Solutions Corporation

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President
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Operations Manager
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Session 3 Review: Which of the following was not a source reduction strategy discussed last week?

Please respond to the Zoom poll

Answer: Consistent waste collection.

Review: Source Reduction and Waste Minimization Techniques

Source Reduction Techniques

- Supplier takeback programs
- Product enhancement
- Process efficiency improvements
- Onsite recycling
- Material substitution
- Inventory control
- Industrial hygiene
- Preventative maintenance

Benefits to Waste Minimization

- Enhance material usage, reducing costs
- Reduces disposal and management costs
- Improved worker health and safety
- Reduces impacts of regulatory requirements
- Minimizes potential environmental liability
- Demonstrates environmental leadership to stakeholders

Homework Discussion

Homework Review: Did anyone identify any waste streams that are hard to manage or difficult to divert? If so, what were they and what makes them difficult?

Please type your response in the chat

Homework Takeaways

Overview

- Identify hard to manage waste streams onsite and describe what makes them hard to manage or divert. Determine what would need done onsite to make the waste easier to manage or divert.

Takeaways

- Hard-to-manage waste streams were usually those that people struggled to divert, referencing few to no outlet options
  - Others described issues with volume and segregation
- Waste streams described were often specific to company processes, rather than common waste streams
- Hard-to-manage waste streams also included several items made up of composite or bonded materials

Today's Topic:
Finding Outlets for Hard to Manage Waste Streams

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Overview of Hard to Manage Waste Streams

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Question: What considerations make a waste stream hard to manage at your company?

Please type your answer in the chat

What is a Hard to Manage Waste Stream?

- A hard to manage waste stream is different for every company and can be dictated by:
  - Waste stream
    - Volume or frequency of generation
    - Shape or state of waste
  - Ability to handle waste
    - Facility/site size or layout
    - Available personnel
  - Industry
    - Required processes
    - Products produced
  - Regional outlets
  - Regulatory requirements

Question: What are some hard to manage waste streams at your company?

Please type your answer in the chat

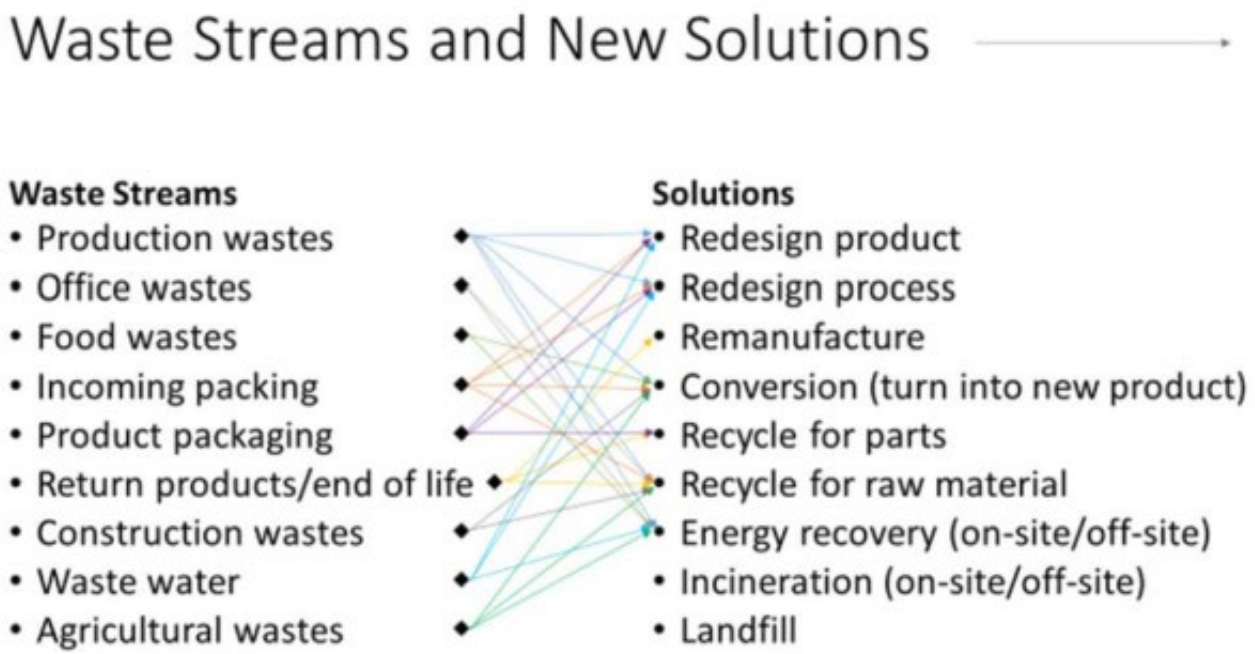
What is a Hard to Manage Waste Stream?

- Common hard to manage waste streams can include:
  - Sludges and swarf
  - Grease, glycol, oils, fuels
  - Filter cake
  - Hazardous waste
  - Metal grindings, trimmings, dust, and shavings
  - Plastic wrap, film, and bubble wrap
  - Foam packaging

Where can these wastes be diverted to?

Outlets for Waste Streams

Many waste streams have various outlets available as solutions for waste diversion



Better Buildings Taxonomy of Wastes

U.S. Solid Waste Infrastructure

U.S. Solid Waste Infrastructure

Infrastructure	Number
Curbside Recycling Programs	9,000+
Material Recovery Facilities (MRF)	586
Transfer Stations	3,350
Compost Sites	2,300
Mixed Waste Processing Facilities & Hybrid MRFs	70*
Anaerobic Digestion (Stand-alone)	25
Waste-to-Energy	76
Landfills	1,908

*Excludes facilities that solely produce refuse-derived fuel
Source: GBB, 2017 from various.

Solid Waste Management Options

- Solid waste collection
- Recycling
- Organics
- Waste conversion
- Landfilling

Question: Does your company bale or compact onsite? If so, what material(s)?

Please type your answer in the chat

Waste Streams and Possible Outlets

Waste stream

- Foam packaging

Why is it hard to manage?

- Not accepted in general recycling through local municipality
- Volume generated can be infrequent
- Form of foam can vary

Waste Streams and Possible Outlets

Waste stream

- Foam packaging

Possible outlets

- Specialty Recycling
- Waste-to-energy

Key Strategies

- Seek specific outlets and do not rely on municipalities

Waste Streams and Possible Outlets

Waste stream

- Pallet wrap
- Stretch film
- Bubble wrap
- Plastic coatings

Why is it hard to manage?

- Not accepted in general recycling through local municipality
- Volume generated can be infrequent
- Materials in film can vary
- Compacting can be difficult

Waste Streams and Possible Outlets

Waste stream

- Pallet wrap
- Stretch film
- Bubble wrap
- Plastic coatings

Possible outlets

- Raw material for products
  - Send to other companies
- Specialty Recycling
- Cement kiln
- Waste-to-energy

Key Strategies

- Baling will make it more desirable
- Seek specific outlets and do not rely on municipalities

Waste Streams and Possible Outlets

Waste stream

- Plastic strapping

Why is it hard to manage?

- Not many outlets
- Difficult to handle
- Not generated onsite – from suppliers

Waste Streams and Possible Outlets

Waste stream

- Plastic strapping

Possible outlets

- Recycling
- Waste-to-energy

Key Strategies

- Some plastic recyclers may let this material be baled with film
- To send this to an outlet directly (without baling) grinding/chopping the straps may be necessary

Waste Streams and Possible Outlets

Waste stream

- Sludges
- Swarf

Why is it hard to manage?

- Large volumes
- Minimal local outlets
- Requires onsite handling and storage
- Possibility of high moisture content

Waste Streams and Possible Outlets

Waste stream

- Sludges
- Swarf

Possible outlets

- Metal recovery
- Raw material for aggregate products
- Agricultural land application
- Cement kiln
- Waste-to-energy

Key Strategies

- Dry before shipping
  - Could use waste-heat recovery to do this
- Conduct laboratory testing of sludge

Waste Streams and Possible Outlets

Waste stream

- Filter cake

Why is it hard to manage?

- Limited outlets
- Irregular waste stream
- High moisture content

Waste Streams and Possible Outlets

Waste stream

- Filter cake

Possible outlets

- Recycling
  - Concrete and road aggregate
- Metal recovery
- Cement kiln
- Waste-to-energy

Waste Streams and Possible Outlets

Waste stream

- Grease
- Oil
- Fuels

Why is it hard to manage?

- Varying volumes generated
- Onsite handling
- Limited local outlets

Waste Streams and Possible Outlets

Waste stream

- Grease
- Oil
- Fuels

Possible Outlets

- Refine for reuse
- Recycling into blended fuels
- Cement kiln
- Waste-to-energy

Waste Streams and Possible Outlets

Waste stream

- Hazardous waste

Why is it hard to manage?

- Handling and diversion requirements
- Onsite handling
- Limited outlets for diversion
- Regulations and management requirements

Waste Streams and Possible Outlets

Waste stream

- Hazardous waste

Possible outlets

- Onsite recovery
- Recycling into blended fuels
- Waste-to-energy
- Water treatment

Key Strategies

- Separate non-hazardous and hazardous wastes, even if they are the same material
- Empty liquids into communal container, where feasible
  - Rinse containers, where feasible

Waste Streams and Possible Outlets

Waste stream

- Metal turnings, chips, dust, and shavings

Why is it hard to manage?

- May not be reusable/recyclable in current form
- Volume produced could be significant

Waste Streams and Possible Outlets

Waste stream

- Metal turnings, chips, dust, and shavings

Possible outlets

- Remelt
- Recycling

Note: Compressing grindings or dust into a briquette can make the material reusable and more desirable to a recycler

Waste Streams and Possible Outlets

Waste stream

- Fiberglass
- Fiberglass mat

Why is it hard to manage?

- Not a commonly recyclable or reusable material
- May be combined with other materials such as adhesives

Waste Streams and Possible Outlets

Waste stream

- Fiberglass
- Fiberglass mat

Possible outlets

- Reclamation for remanufacturing
- Recycling

Key Strategies

- Bale fiberglass mat
- Identify outlets that can grind fiberglass for reuse

Waste Streams and Possible Outlets

Waste stream

- Glass tubes

Why is it hard to manage?

- Chemical residues could make them hazardous
- Volume and handling
- May involve supplemental materials such as caps

Waste Streams and Possible Outlets

Waste stream

- Glass tubes

Possible outlets

- Specialty recycling

Key Strategies

- Wash tubes
- Separate clean from dirty tubes
- Separate tubes used with hazardous and non-hazardous chemicals
- Remove caps, stoppers, etc.

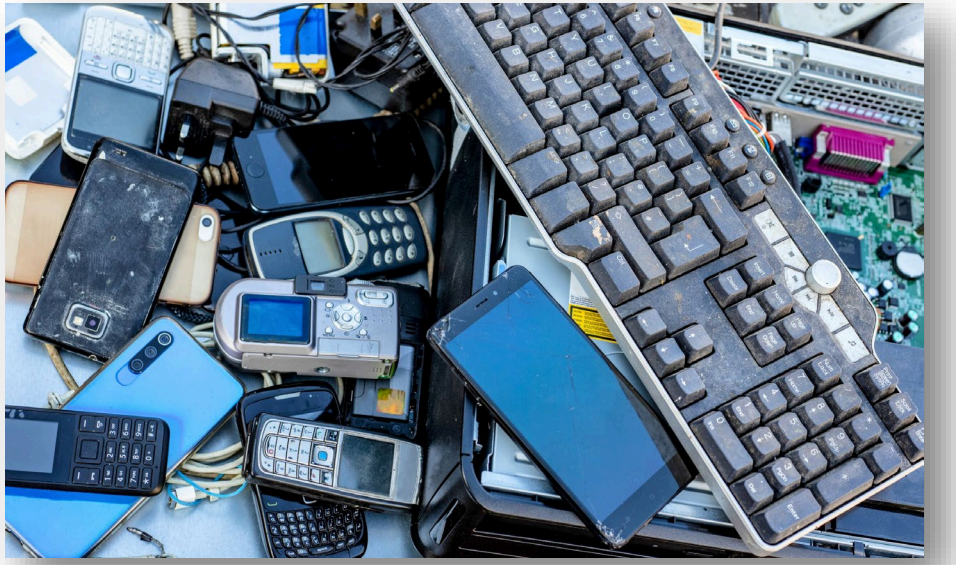
Waste Streams and Possible Outlets

Waste Stream

- E-waste

Why is it hard to manage?

- Infrequent generation may require more outlet coordination
- Some materials in electronics is considered hazardous waste
- Regulations and management requirements



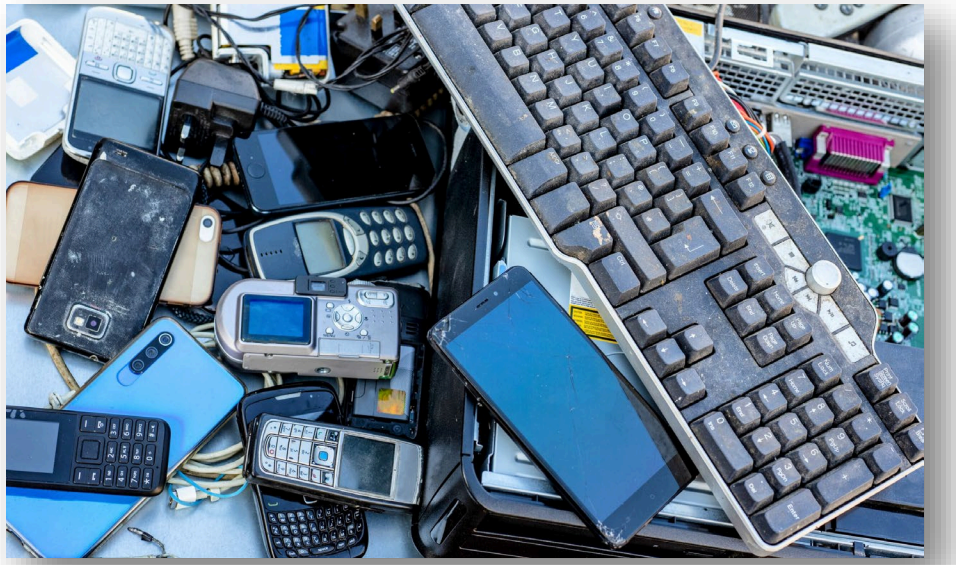
Waste Streams and Possible Outlets

Waste stream

- E-waste

Possible outlets

- Recycling
- Donation
- Company takeback programs



Key Notes

- Coordinate with IT department to develop a recycling and donation strategy

Waste Streams and Possible Outlets

Waste stream

- Expired products
- Recalled products

Why is it hard to manage?

- Infrequent generation of waste streams
- Combination of waste streams in one item
  - Packaging and product

Waste Streams and Possible Outlets

Waste stream

- Expired products
- Recalled products

Possible outlets

- Supplier return
- Recycling
- Waste-to-energy

Key Strategies

- Work with procurement on enhancing inventory control
- De-package and separate waste streams
  - Some companies can do this for you

Waste Streams and Possible Outlets

Waste stream

- Food in containers

Why is it hard to manage?

- Lack of local outlets
- Unavailable personnel to empty containers and segregate streams
  - Unavailable space or personnel to wash empty containers

Waste Streams and Possible Outlets

Waste stream

- Food in containers

Possible outlets

- Compost
- Feed for animals on farms
- Anaerobic digestor
- Recycling (containers)
- Waste-to-energy

Key Strategies

- Empty food from containers
- Clean containers
- Contact companies which will de-pack

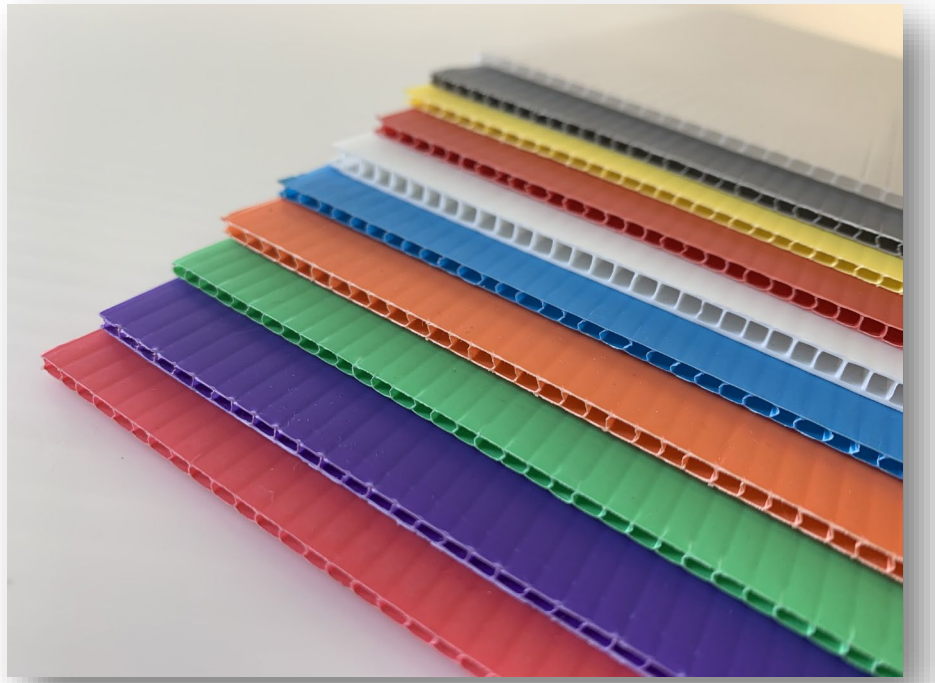
Waste Streams and Possible Outlets

Waste Stream

- Layered or composite plastics

Why is it hard to manage?

- Traditional plastic recycling tends to rely on single polymer types
- Recyclers must be able to identify each individual plastic type



Waste Streams and Possible Outlets

Waste stream

- Layered or composite plastics

Possible outlets

- Recycling
- Bulk used material sales
- Internal re-processing

Key Notes

- Contact local polymer recyclers to discuss options and capabilities

Participant Waste Streams and Possible Outlets

Waste Stream	Possible Outlets	Additional Information
Spent resin	• Advanced wastewater treatment • Return waste resin to supplier	• Separate resin from contaminants using filters, settlers, and biological treatments
Off-spec peanut butter in jars	• Specialized composting • Animal feed • Anaerobic digestion • Donations • Waste-to-energy	• Research local composters who specialize in contaminated compost • Donate to local pet shelters and setup recycling for emptied jars
Laminated or multi-layered plastic or packaging	• Plastic recycling • Grind and pelletizing machines	• Utilize plastic recyclers with elutriation systems to separate plastics by density • Install machinery to grind and pelletize plastics
Contaminated diatomaceous earth	• Concrete and cement filler • Asphalt filler	• Diatomaceous earth is a common additive in concrete and cement mixes • Diatomaceous earth can enhance the performance of asphalt
Spent solvent	• Hazardous waste • On site distillation • Contract distillation • Waste-to-energy	• Spent solvent can be hazardous so consult the EPA hazardous waste database before disposing

Waste Outlets and Acceptable Materials: **Anaerobic Digestor**

Acceptable

- Organic materials such as
  - Livestock waste
  - Crops
  - Food waste
  - Wastewater

Unacceptable

- Processed/produced materials

Poll: Which of the following is an unwanted waste stream by a cement kiln?

Please respond to the Zoom poll

Answer: Food

Waste Outlets and Acceptable Materials: **Cement Kiln**

Acceptable

- Sludges
- Oils and fuels
- Paper and cardboard
- Wood
- Plastics including films
- Absorbents and rags
- Rubber
- Wood

Unacceptable

- Hazardous waste
- Some plastics
- Metals
- Glass
- Building materials such as brick, concrete, etc.
- Food waste
- General trash

Waste Outlets and Acceptable Materials: **Waste-to-Energy**

Acceptable

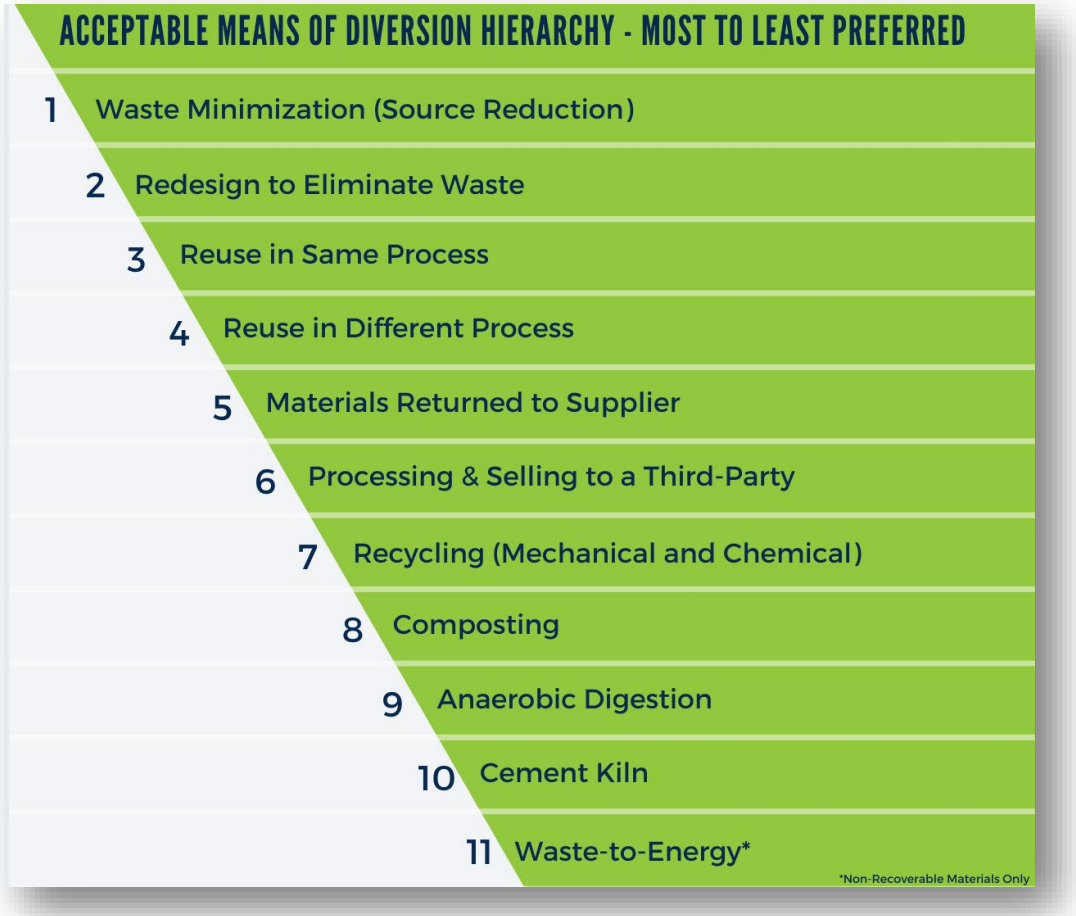
- Sludges
- Oils and fuels
- Some hazardous wastes
- Paper and cardboard
- Plastics
- Yard waste
- Wood
- General trash

Unacceptable

- Metal

Reminder – Follow the Hierarchy!

- Just because an outlet accepts a certain waste stream does not mean the waste should go to that outlet
- Utilize preferred diversion outlets first before moving down the list
  - Always consider source reduction first!



Recommendations for Identifying Outlets

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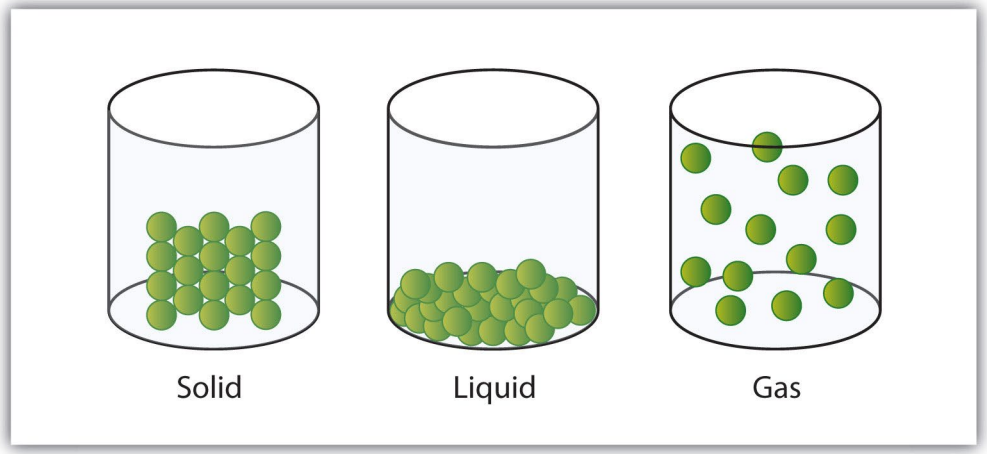
Understanding the Waste

- An outlet will need to know basic information before determining their ability to handle a waste stream
  - Frequency and volume of generation
  - Properties of the waste
  - State of waste (solid, liquid, grindings, chipped pieces, whole, etc.)
- Are there any uses for the waste?
  - Do other industries require similar materials?

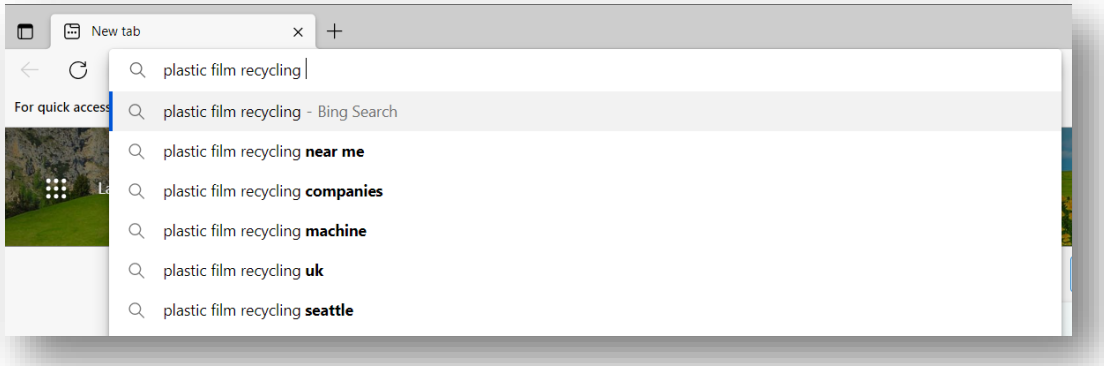


Outlet Communication

- Volume and frequency of volume are critical pieces of information
  - If volume is too high, a small operation may not be able to handle the waste
  - If waste stream is infrequent, it could be difficult to obtain an agreement
- If an outlet is only concerned with using aspects of your waste confirm what will happen to the rest of the waste
  - Ensure the rest of the waste is not sent to landfill
  - Example: metal recovery to retrieve metal from sludge – what happens to the rest of the sludge?
- If you are unsure if an outlet can take the material, offer to send a sample

Finding an Outlet

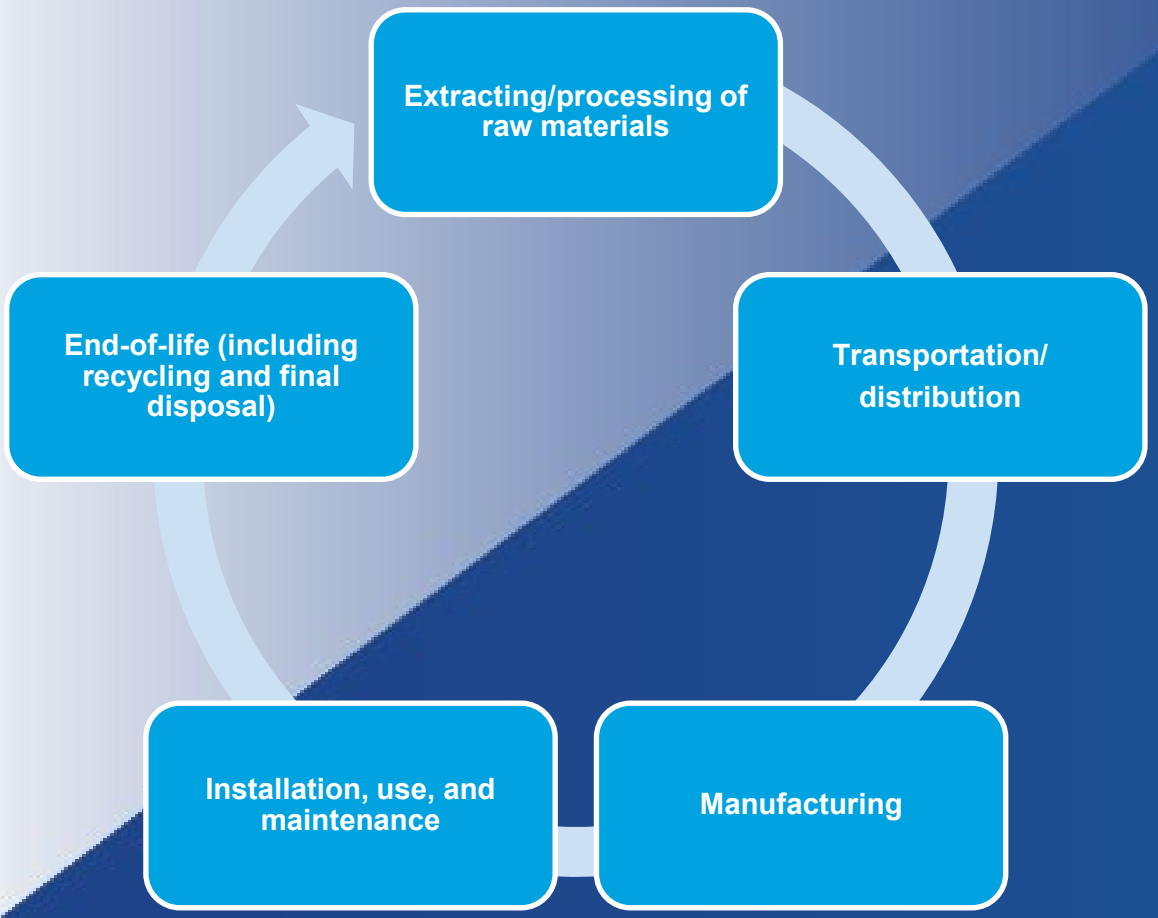
- Do not only rely solely on local municipalities!
- There are outlets available for many waste streams
  - Internet searches will yield fruitful results
    - Utilize outlet databases such as ENF as part of search efforts
  - Do not limit searches to just the city your site is in
    - Could you combine waste with another site, one that is closer to a waste outlet?
  - Sometimes suppliers will know of outlets that handle their products
- Now more than ever companies are working to utilize waste streams to create products, and they need waste!



Finding an Outlet

- It is always a best practice to have backup outlets on hand for hard to manage or critical waste streams
  - Facility outages, fluctuations in acceptable materials, and more can put a site in a tough situation to divert materials

Applying Life Cycle Thinking



Life Cycle Assessment (LCA)

- An analytical tool used to comprehensively **quantify** and interpret the **environmental impacts** of the entire life cycle of a product or system
- Methodology used to determine the embodied carbon, or **greenhouse gas (GHG) emissions** associated with the life cycle of a product
- Basis for the development of **Environmental Product Declarations**
- Requires specific and detailed information on raw materials, supplier locations, manufacturing/processing procedures, waste generation, transport, and end of life

How LCAs are Used

- To help manufacturers understand all impacts and can be used along with economic analysis to make products more sustainable
  - Evaluate product design or material changes
  - Transportation impact analysis
  - Analysis of chemicals including impacts of banned/restricted substances of concern
  - Evaluate benefits of closed loop (cradle-to-cradle) design
- As a tool that customers use to evaluate and select sustainable products and materials for integration into final products
- To satisfy green building standards and sustainable purchasing/supply chain requirements

The LCA Process

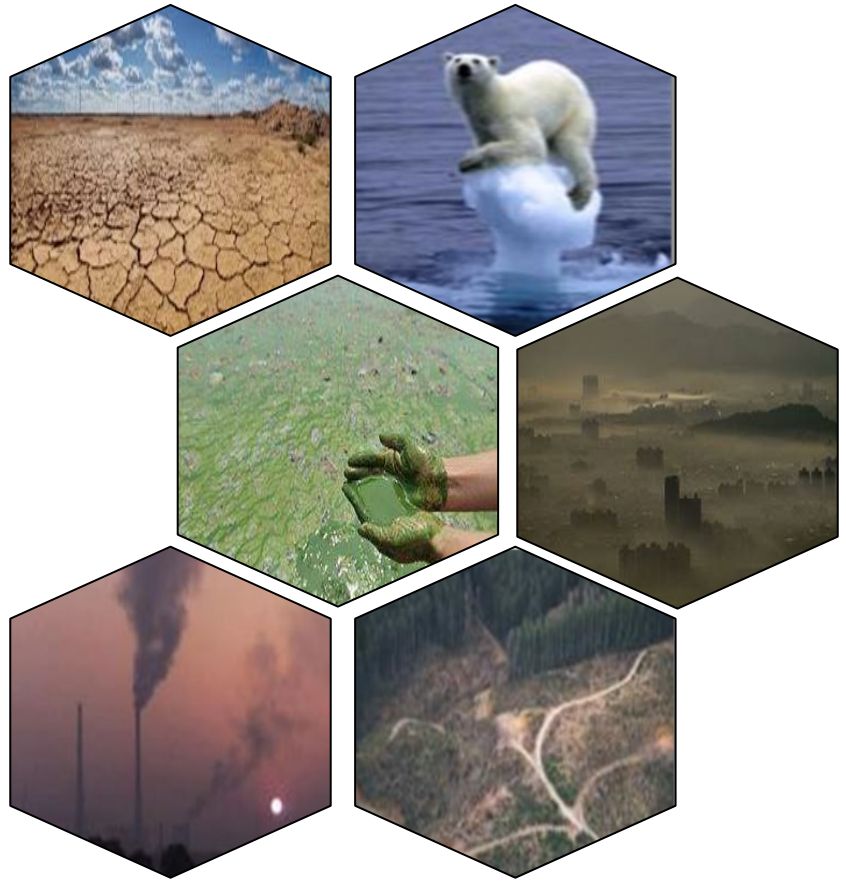
- LCA is an iterative process and requires an understanding of all inputs and outputs throughout the life cycle. It consists of the four phases:
  - **Goal and Scope Definition -** The product is described, the goal of the study and the system boundaries are defined, and the functional unit is defined.
  - **Life Cycle Inventory -** Data is collected and the manufacturing process is evaluated. Then, process and material flows diagrams are prepared and analyzed. This data is integrated into the LCA software for conducting the assessment
  - **Life Cycle Impact Assessment -** The significance of potential impacts are evaluated using the data collected in the LCA analysis
  - **Interpretation -** The results of the study are reviewed and interpreted

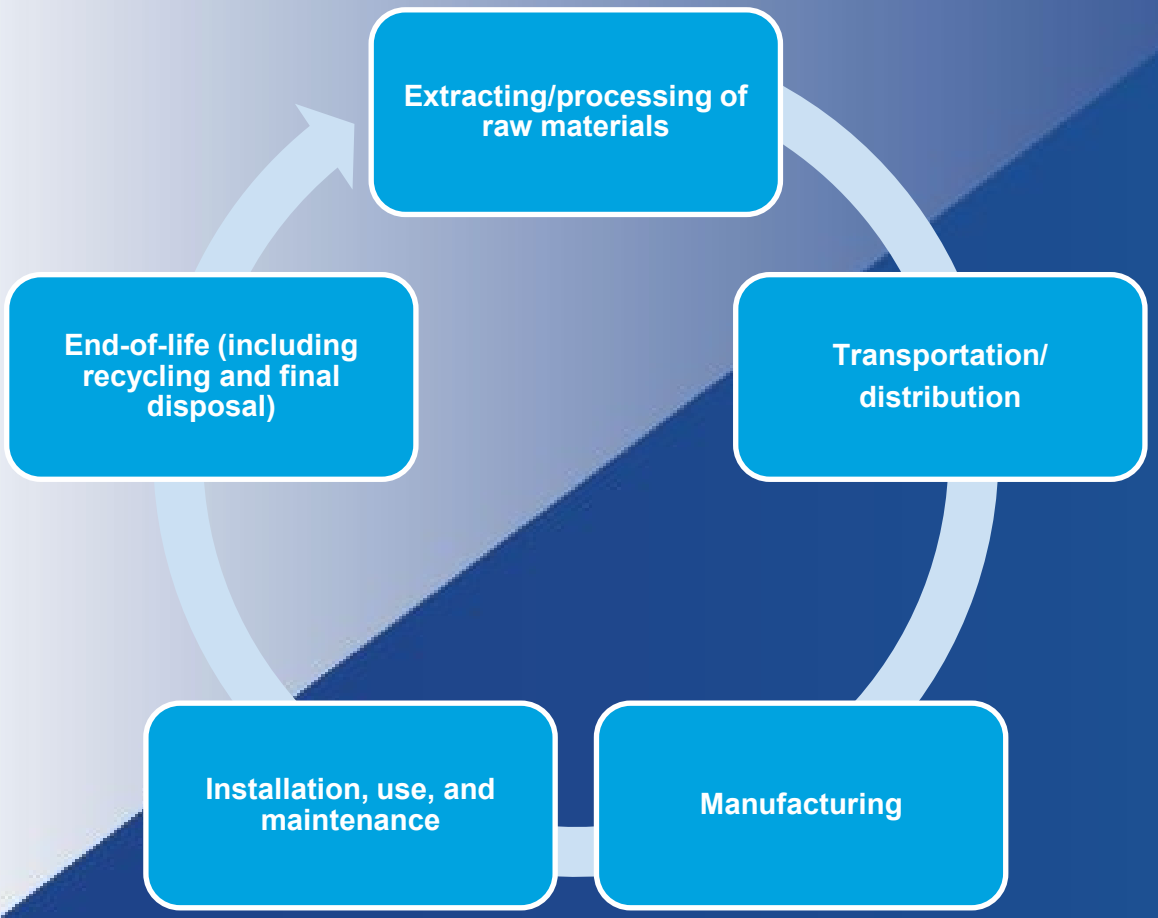
Environmental Impacts

An Environmental Impact is any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products, or services

- Global Warming Potential (Carbon Footprint)
- Acidification
- Eutrophication
- Ozone Layer Depletion
- Smog Formation (Photochemical Oxidation)
- Fossil Fuel Depletion
- Ecotoxicity
- Carcinogenics
- Non-carcinogenics
- Respiratory Effects

Greater uncertainty in results





Waste and LCA

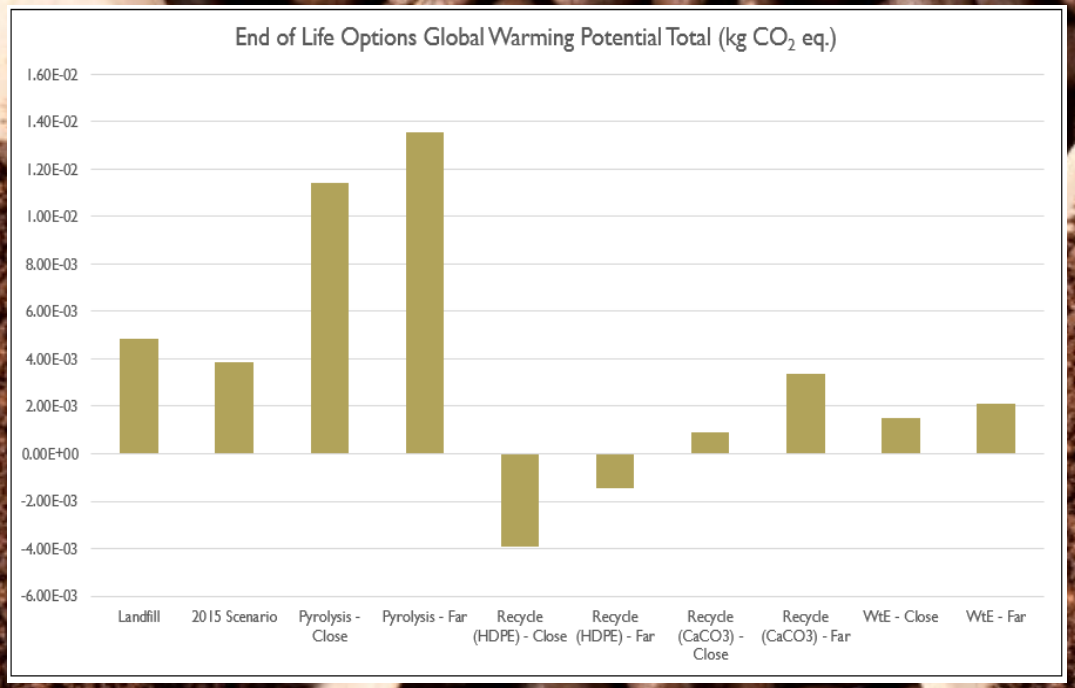
- What impacts waste's contribution to emissions?
  - Transportation distance
  - End-of-life scenario
  - Does it displace raw materials elsewhere?
- How can my company reduce impacts?
  - Can waste be reused in-house?
  - Is there a more appropriate outlet for waste?
  - Is there a closer outlet than the one currently used?

Poll: True or false - the closest waste outlet always results in the lowest impact on the environment.

Please respond to the Zoom poll

Answer: False

Case Study:



Coffee Company

Single serve coffee is convenient and popular in the workplace, but they create significant amounts of waste, particularly with single use plastic packaging. Marketing studies have shown that customers are requesting recycling of their coffee pod waste. SSC worked with a coffee company on their single-serve laminated plastic packaging material to measure the environmental impact of the packaging materials, as well as the end-of-life options using life cycle assessment methodologies.

Results:

A redesign of the primary plastic packaging materials removed a layer of the 3-layer laminated material, reducing the overall carbon footprint of the materials by over 30% and increasing the potential recyclability of the packaging. Reviewing waste handling solutions from a life cycle perspective revealed that recycling was the most beneficial for the carbon footprint of the materials if the recycling infrastructure is local. However, from a nationwide market, waste-to-energy provides a lower environmental impact. This resulted in SSC developing an end-of-life management strategy including communication and education for customers on the most sustainable management options for the coffee pods.

Closing Remarks

- Summary
  - A hard to manage waste stream is different for every site and company
  - Do not just rely on local municipalities to handle waste streams
  - Consider LCA thinking when considering waste outlets
- Homework!
- Next training
  - Construction waste management and green buildings certifications
  - March 18, 2025

Session 8 Participation

- We are looking for participants to present during week 8!
  - Hearing from participants provides a lot of value, as other attendees can see specific details related to real situations that may provide insights on how they can approach waste minimization and diversion
- Interested people will be provided with a base template to follow, giving guidance on what to discuss
  - Development of a few slides
  - Slides will be provided to Nick so that he can combine them all into one presentation
- Session 8 will **not be publicly available** on the ORNL Better Plants website

Homework Overview

- Homework will:
  - Engage participants in the topics to be discussed in the following session
  - Serve as a guide for waste diversion and minimization
- If a homework is completed, please send to presenter, Nick, at nick@sustainablesolutionscorporation.com
  - Please use the subject “Better Plants Session # Homework: Complete – Company Name”
  - Participants will be asked to share their learnings and experiences in session 8, and if you would like to participate in this, please reach out to Nick

Homework Review

Assignment

1. Recall if there were any construction, demolition, or renovation projects occurring onsite recently. What waste streams were generated?
2. Of the waste streams generated, which were diverted from landfill?
3. Of the waste streams generated, which were not diverted from landfill? Are any of these streams divertible?
4. Consider the materials diverted and not diverted from landfill. What measures could be taken in the future to assist in more materials being diverted from landfill?

Goal

- Provoke thoughts about wastes generated during construction, demolition, or renovation and where they end up.
- Lay the groundwork for considerations necessary for creating a C&D waste minimization and diversion plan.

Kahoot!

Quiz link:

Q&A