Better Plants
U.S. DEPARTMENT OF ENERGY

How to Effectively Track and Measure Your Waste

Virtual In-Plant Training

Session 2

Tuesday – February 25, 2025

10 am – 12:30 pm EST

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

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 (April 1st) – Implementation of a Waste Diversion Program – Developing a Roadmap to Zero Waste**
- **Week 8 (April 8th) – Conclusions, Summaries, and Wrap up Presentations**

Plan of Action

Today, we will:

- Review key takeaways from session 1
- Discuss the homework
- Lecture on today's topic, "How to Effectively Track and Measure Your Waste"
- Conduct a Q&A session
- Test your knowledge with a Kahoot! quiz

Takeaways

Today, you will learn:

- Why waste tracking is important
- How to track waste
- How to conduct a waste characterization
  - How to interpret results
- What are best practices for material handling, signage, and waste containers

Presenters from Sustainable Solutions Corporation

Tad Radzinski, PE, SEP, LEED AP, SFP
President
Sustainable Solutions Corporation

Nick Mummau, LEED Green Associate
Senior Project Manager
Sustainable Solutions Corporation

Lora Urbaniak, LEED Green Associate
Operations Manager
Sustainable Solutions Corporation

Quick Review

Remembering Session 1

U.S. DEPARTMENT OF ENERGY

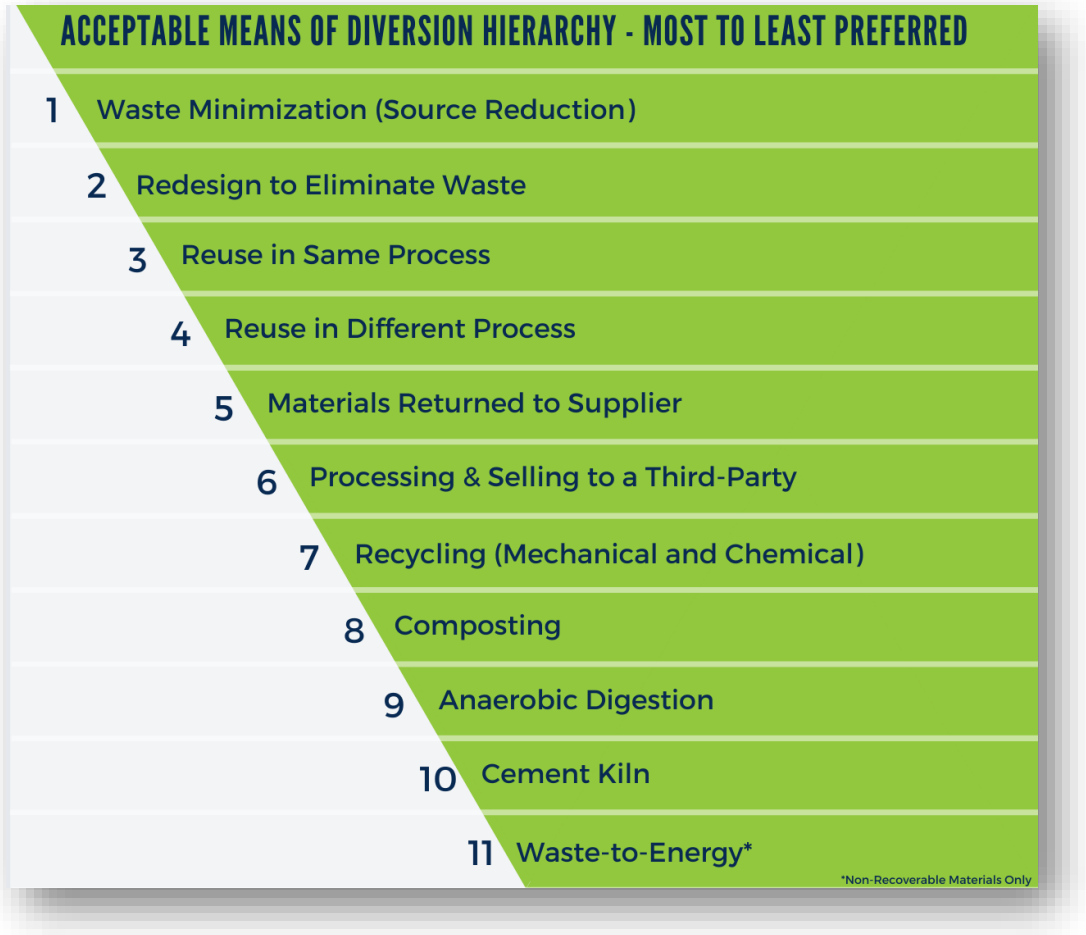
Session 1 Review

Poll: Which of the following is the most preferred method of waste diversion?

Please respond to the Zoom poll

Answer: Redesign to eliminate waste

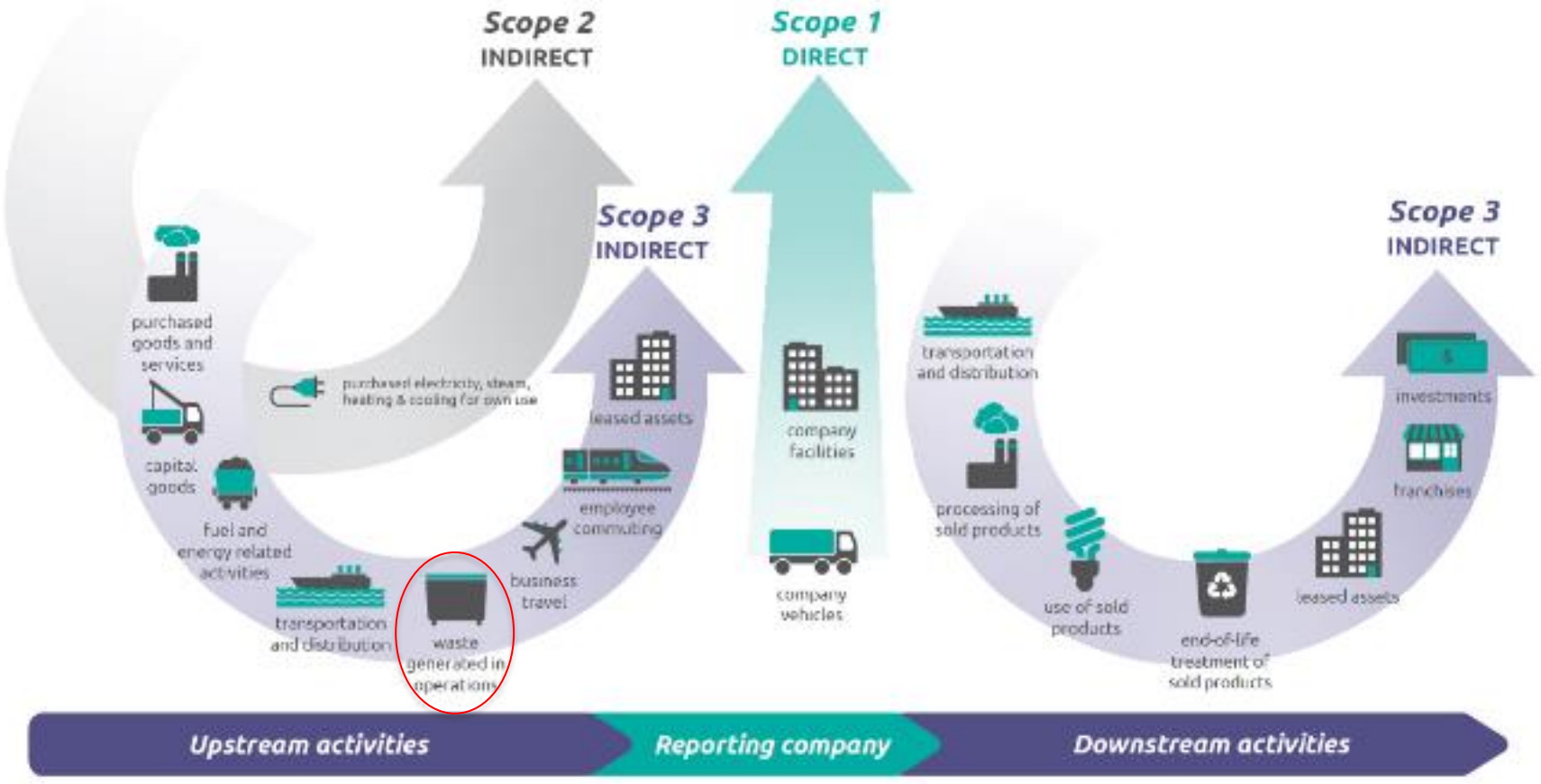
Review: Waste Diversion and Reduction 101



- Last session, you learned to:
  - Understand the difference between Scope 1, 2, and 3 emissions
  - Use the Waste Diversion Hierarchy to improve waste diversion and minimization
  - Interpret key regulations and policies

Review: Waste Diversion and Reduction 101

You should remember the three main types of emissions



Review: Waste Diversion and Reduction 101

You should remember the following common terms

- **Sustainability:** meeting the requirements of the present without compromising the needs of the future
- **Carbon Emissions**: a term which is commonly used in place of greenhouse gas emissions
- **Contaminated:** When multiple waste streams are commingled inappropriately
- **Greenhouse Gases:** gases which trap heat in the atmosphere including carbon dioxide, methane, and more
- **Triple Bottom Line:** a framework of sustainable development including considerations for people; planet; and profit which helps increase economic efficiency while valuing environmental stewardship and social equity
- **Waste Diversion:** preventing waste from being sent to landfill through various methods
- **Waste Minimization:** process of reducing the amount of waste generated

Homework Discussion

Homework Takeaways

Overview

- Review waste streams, available data, try to identify trends or issues needing corrective action, and observe waste in trash cans for divertible materials

Takeaways

- Many companies have very similar waste streams
  - Several listed food waste as an area of focus
- Data collection varies company to company
  - Several companies noted that there was no prior structure to collect waste data
- Some companies noted awareness of spikes in certain streams with corrective action being taken
- Several great initiatives in place for waste minimization and diversion
- Segregation of divertible materials could be better

Today's Topic:

How to Effectively Track and Measure Your Waste

U.S. DEPARTMENT OF ENERGY

Poll: Does your company currently track and review waste-related data?

Please respond to the Zoom poll

What is Waste Data Tracking?

- **Waste data tracking** is the process of continually logging and monitoring the amount and frequency of all onsite waste streams
- Waste tracking requires an understanding of all onsite waste streams and their end-of-life destination

Why is Waste Tracking Important?

- Waste tracking allows your company to:
  - Understand waste trends
  - Evaluate waste opportunities, which can lead to:
    - Higher diversion rates
    - Waste and material cost savings
    - Reduced production scrap rates
  - Set waste diversion goals
  - Prepare to calculate Scope 3 emissions related to waste

Getting Started

Waste Tracking Methodologies and Best Practices

U.S. DEPARTMENT OF ENERGY

Question: What are some key steps in waste tracking?

Please type your response in the chat

Waste Tracking Methodology

Waste tracking can be broken into the following steps:

1. Select a system
2. Delegate responsibility and accountability
3. Gather and input data
4. Validate data
5. Utilize data to act
6. Conduct an onsite assessment
7. Conduct a waste characterization (recommended)
8. Set realistic goals
9. Review on recurring basis

1. Select a System

U.S. DEPARTMENT OF ENERGY

1. Select a System

- A waste tracking system should provide a central place for tracking data and include (at a minimum):
  - Waste stream types (i.e., wood, metal, plastic)
  - Waste stream weights or volumes
    - Use the same units for all streams where possible
  - Costs and/or rebates by waste stream
  - Waste end of life scenario and outlet information
  - Raw material weights and costs
  - Packaging weights and costs

1. Select a System

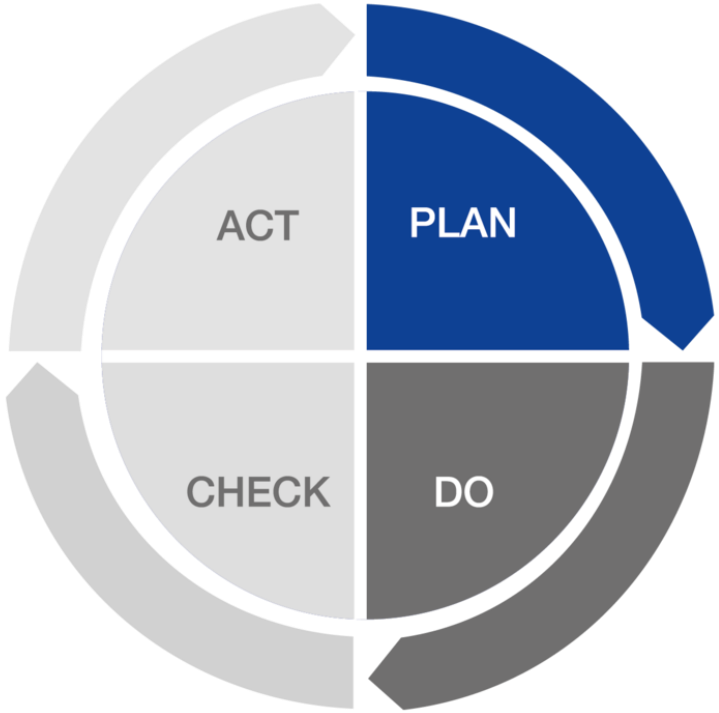
- System should have an established entry frequency
  - Monthly frequency is encouraged
- Tracking systems can be an internally or externally created
  - Excel spreadsheets or as complex as a cloud-based platform
- Complexity of tracking system will vary by company

1. ISO 50001

ISO 50001: Energy Management

This voluntary energy management standard helps organizations boost energy productivity and cut costs. Keys to success:

- Gain management support
- Establish energy team
- Identify major energy uses
- Set energy targets
- Track energy use
- Publicize successes



ISO 50001 structure is not just for energy!

1. ISO 50001

Manage Energy, Manage Risk, Control Costs

- Competitive organizations manage these various issues including staffing, inventory, shipping, and quality
- ISO 50001 brings an effective process to measure and manage energy use in order to:
  - Optimize energy consumption
  - Realize greater cost savings
  - Increase cost competitiveness
  - Improve health, safety, and comfort
  - Retain and grow staff

Corporate Benefits

ISO 50001 improves operational efficiency and cost reductions in all sectors, including manufacturing, commercial buildings, utilities, government facilities, military bases, and more.

Risk Management

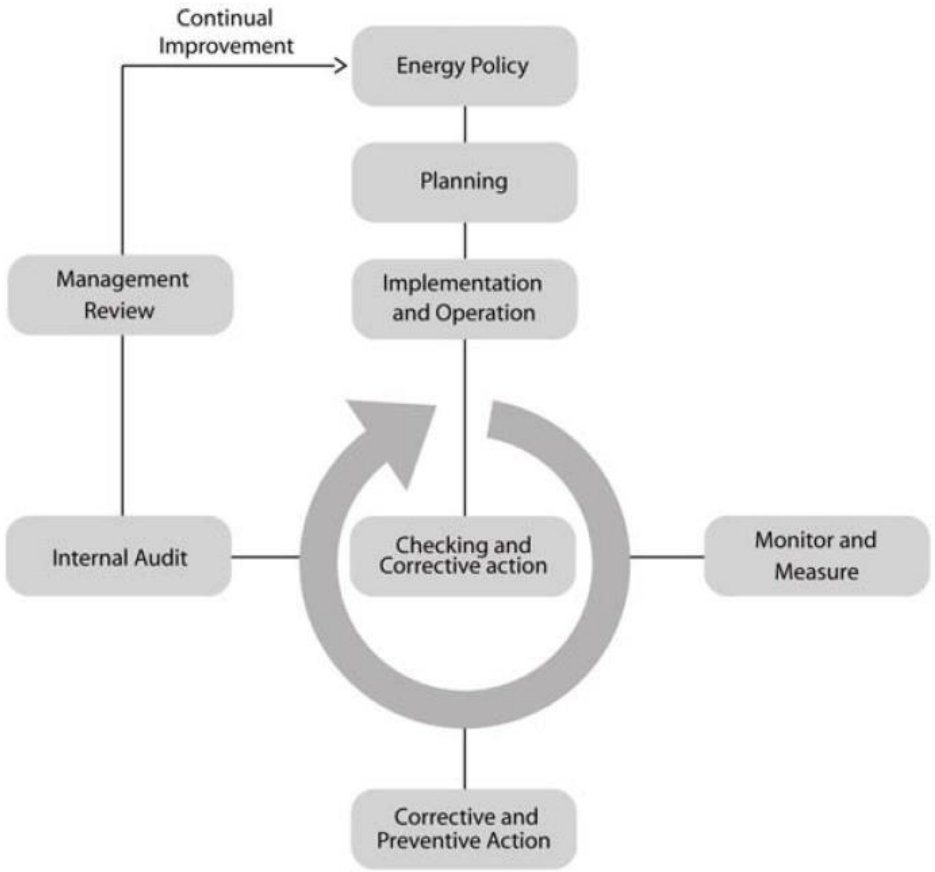
Profitability

Expanded Production

1. ISO 50001

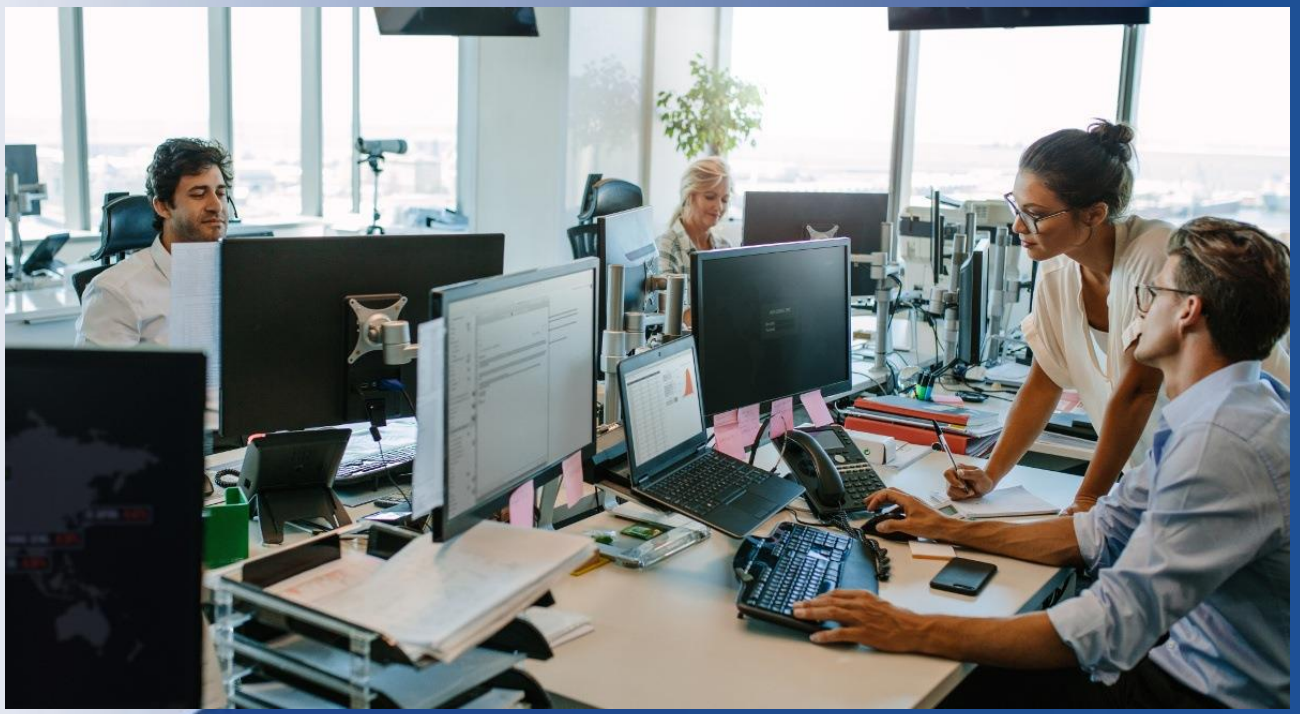
Key Concepts

- Generate policies and procedures
- Develop targets and objectives
- Use data to make informed decisions
- Review data once policies and procedures are in place
- Review effectiveness of policies and procedures
- Continually improve



Available Tools

- Better Buildings software tools are available to assist with tracking site data
  - Energy, water, waste, and emissions tracking
  - Generate reports and visuals
- EPA Model Recycling Program Toolkit
  - Provides resources to reference based on inputs such as goals and materials
- SSC has developed:
  - Tools for various client needs in the past including data collection, benchmarking, emissions calculations and tracking, and more equipped with output tables and reporting features
  - Operations playbooks establishing structures to identify and minimize waste across various company facilities

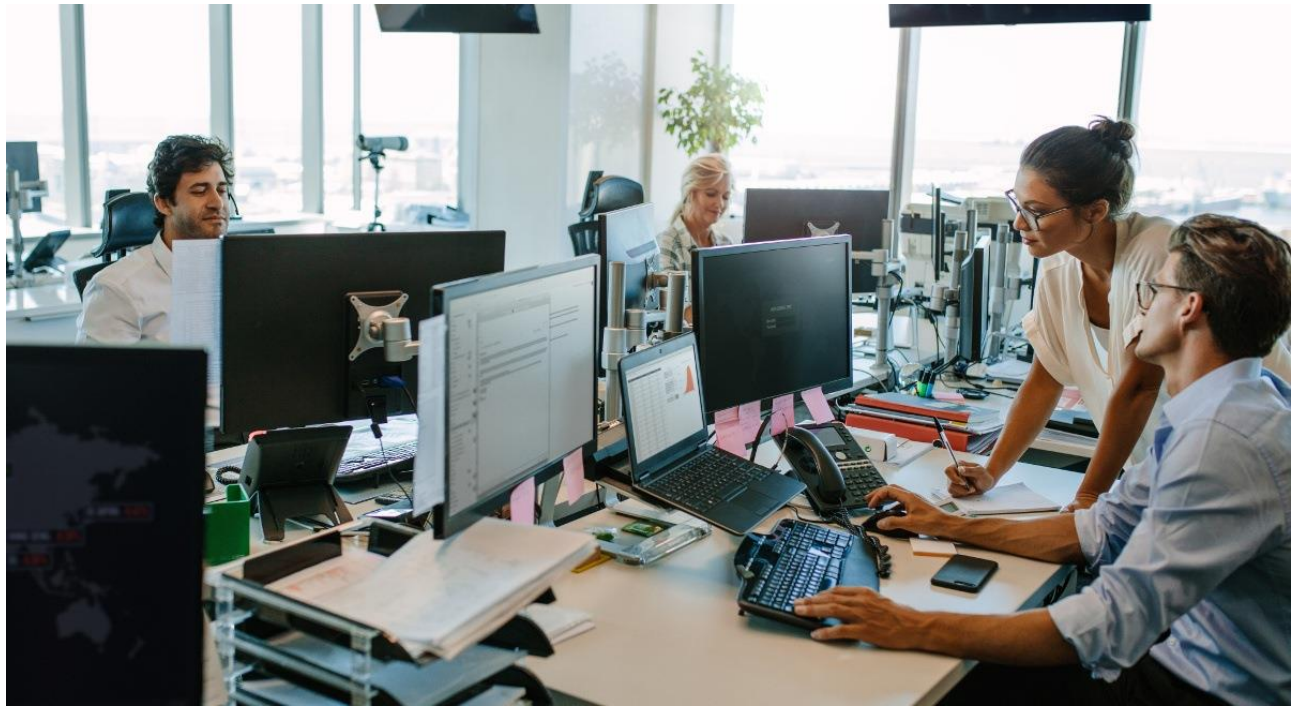


2. Delegate Responsibility and Accountability

U.S. DEPARTMENT OF ENERGY

2. Delegate Responsibility and Accountability

- Waste tracking cannot be accomplished without dedicated employees
  - Designate personnel to own the collection and entry of waste data
  - Determine who will review and present data on recurring basis
  - Assign personnel to hold both roles accountable



3. Gather and Input Data

U.S. DEPARTMENT OF ENERGY

3. Developing a Baseline

What is a baseline and why is it important?

- Provides a starting point to reference, allowing the ability to monitor progress over time
- Enables establishment of realistic targets and goals
- Better understand operations performance and costs
- Develop material flow and spend analysis

You can't manage what you don't measure

3. Gather and Input Data

- Obtain and record data on a regular frequency
- Obtain waste data from haulers
- Gather raw material and packaging data
- Ensure data is available to key site personnel
  - This will allow for data review and corrective action to be taken, if necessary
  - If hauler invoices are only obtained by a finance department, ensure they are still reviewed

3. Gather and Input Data

- Establish data requirements from the hauler in contract development
  - Put in place criteria that goes above and beyond a typical contract
  - Require regular data reporting
  - Determine data requirements such as:
    - Materials
    - Weights
    - Costs
    - Handling confirmation
      - Ensure that waste is disposed in agreed upon manner

3. Overview of Typical Waste Invoices

- Hauler fees include:
  - Miscellaneous company fees for processing
  - Transportation
    - Flat fee or weight based
  - Disposal or tipping
  - Fines for contaminated waste streams

Job Description: Drum Shipment

** Payable in USD funds **

Last Service Date	Invoice No	Customer	Branch	Sales Order	Purchase Order	Terms

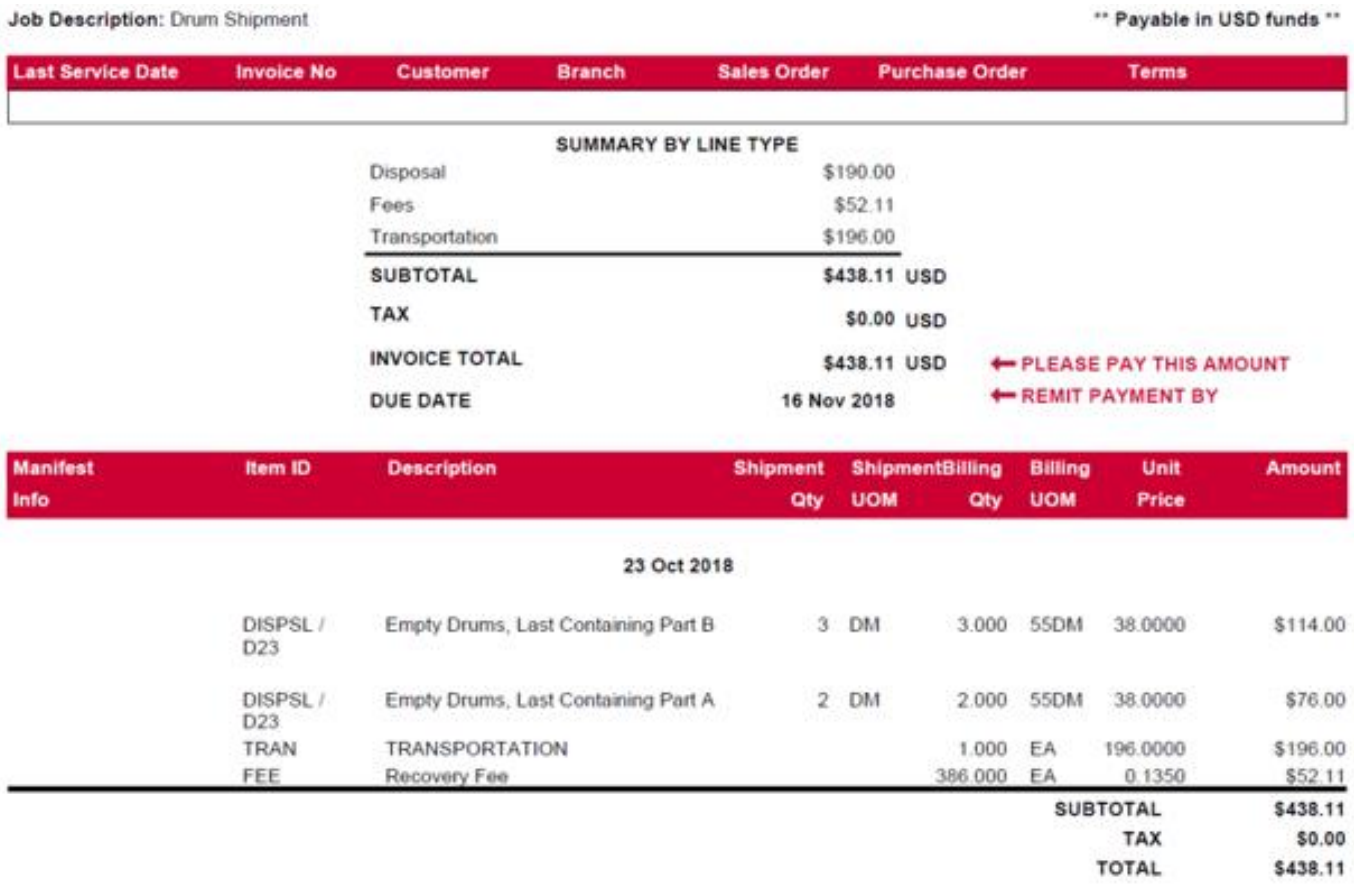
SUMMARY BY LINE TYPE

Disposal	$190.00		
Fees	$52.11		
Transportation	$196.00		
SUBTOTAL	**$438.11**	**USD**	
TAX	**$0.00**	**USD**	
INVOICE TOTAL	**$438.11**	**USD**	← PLEASE PAY THIS AMOUNT
DUE DATE	**16 Nov 2018**		← REMIT PAYMENT BY

Manifest Info	Item ID	Description	Shipment Qty	Shipment UOM	Billing Qty	Billing UOM	Unit Price	Amount
		23 Oct 2018						
	DISPSL / D23	Empty Drums, Last Containing Part B	3	DM	3.000	55DM	38.0000	$114.00
	DISPSL / D23	Empty Drums, Last Containing Part A	2	DM	2.000	55DM	38.0000	$76.00
	TRAN	TRANSPORTATION			1.000	EA	196.0000	$196.00
	FEE	Recovery Fee			386.000	EA	0.1350	$52.11
							SUBTOTAL	**$438.11**
							TAX	**$0.00**
							TOTAL	**$438.11**

3. Overview of Typical Waste Invoices

- Compiling hauler data:
  - Costs can be summed into one cost for company tracking, however, a detailed review of cost breakdown is recommended
    - This will allow costs related to fines, for example, to be noticed and addressed



Job Description: Drum Shipment

** Payable in USD funds **

Last Service Date	Invoice No	Customer	Branch	Sales Order	Purchase Order	Terms

SUMMARY BY LINE TYPE

Disposal	$190.00		
Fees	$52.11		
Transportation	$196.00		
SUBTOTAL	**$438.11**	**USD**	
TAX	**$0.00**	**USD**	
INVOICE TOTAL	**$438.11**	**USD**	← PLEASE PAY THIS AMOUNT
DUE DATE	**16 Nov 2018**		← REMIT PAYMENT BY

Manifest Info	Item ID	Description	Shipment Qty	Shipment UOM	Billing Qty	Billing UOM	Unit Price	Amount
		23 Oct 2018						
	DISPSL / D23	Empty Drums, Last Containing Part B	3	DM	3.000	55DM	38.0000	$114.00
	DISPSL / D23	Empty Drums, Last Containing Part A	2	DM	2.000	55DM	38.0000	$76.00
	TRAN	TRANSPORTATION			1.000	EA	196.0000	$196.00
	FEE	Recovery Fee			386.000	EA	0.1350	$52.11
						SUBTOTAL		**$438.11**
						TAX		**$0.00**
						TOTAL		**$438.11**

3. Gathering Data

What do you do when you do not have waste weights?

- Smaller dumpsters are often dumped into trucks, preventing weights from being available
- Track waste volume of container and frequency of pickup to allow for waste weight estimates to be calculated
  - Inspecting a dumpster prior to it being emptied will make tracking more accurate as you will be able to note the capacity of the container

3. Gathering Data

What do you do when you do not have waste weights?

- Utilizing the EPA's volume-to-weight conversion factors, estimates for waste weight can be calculated
  - All that is needed is an estimated volume
- Examples:

Waste Stream	Volume	Estimated Weight (lb.) from EPA	Annual Number of Volume	Total Estimated Weight (ton)
Commercial recyclables	Cubic yard	88	500	22
Non-ferrous metal	Cubic yard	225	50	5.6
Wood pallets	Cubic yard	169	25	2.1

Question: What are some key considerations that are part of your waste data collection?

Please type your response in the chat

3. Data Tracking Example

Waste Stream	Unit	Value	Cost ($)	Outlet (Current)
Production Scrap	Tons			Reuse
Sand	Tons			Reuse
Raw Material	Tons			Reuse
Raw Material	Tons			Recycle
Bag House Dust	Tons			Landfill
Pallets	Tons			Recycling
Pallets	Tons			Reuse
Metal	Tons			Recycling
Cardboard	Tons			Recycling
Wood	Tons			Recycling
Oils	Tons			Landfill
Oils	Tons			Waste-to-Energy
Paint	Tons			Landfill
Paint	Tons			Waste-to-Energy
Plastic Tote	Tons			Reuse
Drums	Tons			Recycling
Electronic Waste	Tons			Recycling
Plastic Film	Tons			Recycling
Plastic Film	Tons			Waste-to-Energy
Hazardous Waste	Tons			Landfill
Hazardous Waste	Tons			Waste-to-Energy
Plant Trash	Tons			Landfill
Plant Trash	Tons			Waste-to-Energy

Facility Location	Production	Wastewater	Hazardous Waste	Recycling	Composting	Waste-to-Energy	Landfill	Other Waste Disposal
	Tons	Gallons	Tons	Tons	Tons	Tons	Tons	Tons
Year 1 Totals								
January								
February								
March								
April								
May								
June								
July								
August								
September								
October								
November								
December								

- Compile hauler data in a central location
- It is recommended to track waste data monthly per waste stream and end-of-life scenario

3. Data Tracking System Example

End-of-life	Code
Landfill	LA
Recycling	RE
Offsite Reuse	FR
Onsite Reuse	NR
Waste-to-Energy	WE
Incineration	IN
Anaerobic Digestion	AD
Compost	CO
Other	OT

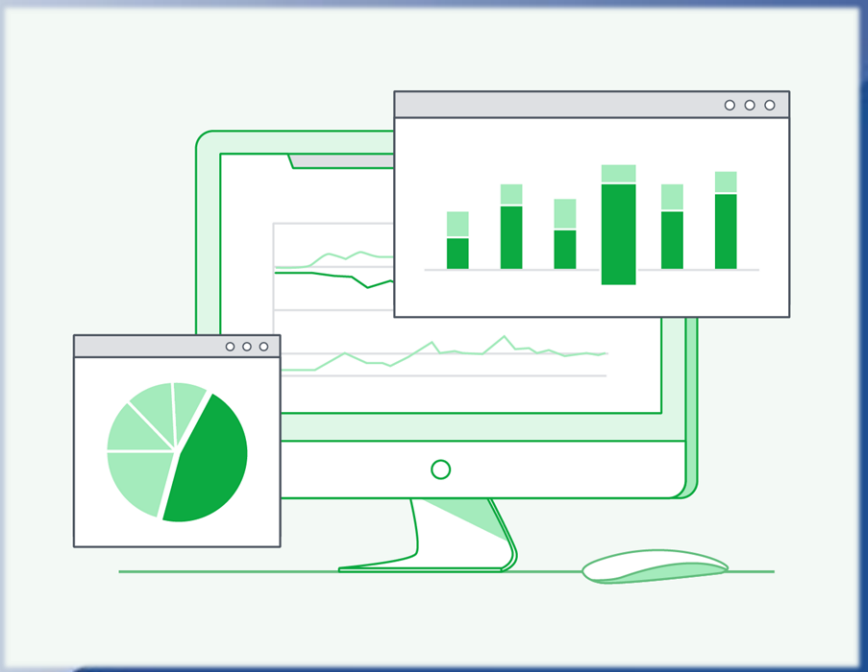
Waste Stream	Code #
Production Scrap	01
Sand	02
Raw Material	03
Bag House Dust	04
Pallets	05
Pallets	06
Metal	07
Cardboard	08
Wood	09
Oils	10
Paint	11
Plastic Tote	12
Drums	13
Electronic Waste	14
Plastic Film	15
Hazardous Waste	16
Plant Trash	17

Based on the table above, plant trash sent to waste-to-energy would be: **WE.17**

- Waste coding is a good way to establish consistent tracking across a company
- Codes allow for quick analysis to determine areas of focus for improvement
- Code details will depend on the company
  - Level of granularity on waste streams will differ
  - May separate onsite and offsite treatment
  - Feasibility of data separation by hazardous and non-hazardous code

3. Process and Review Results

- Process the data into easy-to-understand tables and charts
  - Attempt to highlight any trends or anomalies
- Normalize waste metrics to energy and water data and determine a baseline year
  - Benchmark data to consistent metric
    - Example metrics for benchmarking could be production, operating hours, revenue, or building square footage
    - Benchmarking consistently makes data easily comparable year-to-year, site-to-site, or even company-to-company



4. Validate Data

U.S. DEPARTMENT OF ENERGY

4. Validate Data

- Waste data should undergo a validity check to:
  - Ensure correctness
    - Correctness can be based on historical data, knowledge of site activities, etc.
  - Recognize and flag anomalies
    - Compare data to previous month utilizing a percent change calculation
  - Catch hauler fines and enact corrective action to prevent them in the future
  - Determine necessary changes to site procedures for waste handling, collection, and sorting

5. Utilize Data to Act

U.S. DEPARTMENT OF ENERGY

5. Process and Review Results

- Develop a baseline to allow for trends to be tracked and implemented improvements to be confirmed as working
- Review data and discuss insights with your team (suggested quarterly)
  - What trends are noticeable?
  - Have any values spiked? If so, why?
  - Have operational changes impacted any trends?
  - What waste streams should be a priority for minimization or diversion opportunities?
    - This could be based on:
      - Volume of waste stream
      - Hauler costs
      - How manageable the waste is
      - Regulatory requirements
      - Cost of materials wasted

5. Review of Waste Data: Example

Review of Hauler Fees and Terms

- For certain waste collection containers, such as 30 yard open top dumpsters, haulers could charge a fee based on a pre-set minimum weight
  - Regardless of dumpster weight, a company could be charged for 2 tons per pickup, for example
- Review manifests from haulers to see how often your company is meeting the pre-set threshold
  - Consistently being under the threshold means that further action should be taken
    - Increased waste segregation or compacting waste could be possible solutions
  - Being under the minimum means that your company is **overpaying for waste hauling**

5. Review of Waste Data: Example

Communicating with Procurement:
What is bought vs. what becomes waste

- Review waste totals and compare to procurement purchasing and costs
  - Unused raw materials
  - Production scrap
  - Finished good waste
  - Company packaging

Example: *Vials were consistently expiring on the shelf of warehouses without procurement knowing. Procurement was purchasing consistent quantities on regular intervals*

5. Review of Waste Data: Example

Communicating Quality Data: What is the root cause of production waste?

- Quality often tracks the reasons for products failing inspection
- It is important that quality is communicating upstream to address the root cause of issues
  - Contamination
  - Issues with allowable limits
  - Failure to meet standards on color
  - Problems with product durability

Example: *In this situation, shingle scraps were under a general waste category, so there was little awareness to the true volume of waste*

5. Review of Waste Data: Example

How to evaluate?

- Review the current waste tracking methodology for each group
  - Does procurement know how much unused material is wasted?
  - What is the raw material storage expiration tracking process? Can materials be moved to other sites?
  - Does quality track root cause of issues?
  - Does quality focus only on costs or do they track weights?
- The goal is to estimate how much money is being lost
  - Strategies to obtain more granular data include:
    - Investigate waste streams/collection and estimate waste
    - Increase segregation to obtain specific weights
    - Conduct a waste characterization

5. Review of Waste Data: Example

- In any situations where waste is being evaluated ensure there is communication to the other key groups whose actions lead to waste generation
  - R&D
  - Procurement
  - Quality
  - Operations
  - EH&S
- Feedback could include details such as increases in certain waste streams, a lower diversion rate, fines, significant opportunities, key improvements, and more

5. Review of Waste Data: Example

Poll: There are three sites with the production and waste generation shown in the table below.

Site	Annual Production (tons)	Annual Waste Generated (tons)
A	100,000	8,500
B	250,000	16,000
C	75,000	5,250

Which site is operating least efficiently in terms of waste generation?

Please respond to the Zoom poll

Answer: Site A as site A's waste intensity is the largest at 0.085 tons of waste per ton of product produced. Site C is 0.070 and site B 0.064

5. Additional Waste Analysis Strategies

1% Savings Analysis

- Take 1% of the costs of utilities, wastes, packaging, and raw materials
- Allows for quick comparison on where the largest potential savings may be

Material Balance Exercise

- Show what goes in vs. what comes out
  - Raw materials purchased vs. waste generated

Environmental Cost Accounting

- Identify the “true” costs of using certain materials
  - Raw materials, waste handling onsite, waste hauling, required regulations, etc.

Emissions Assessment

- Compare wastes vs. the emissions they represent
  - To be discussed in session 6

5. 1% Savings Analysis Example

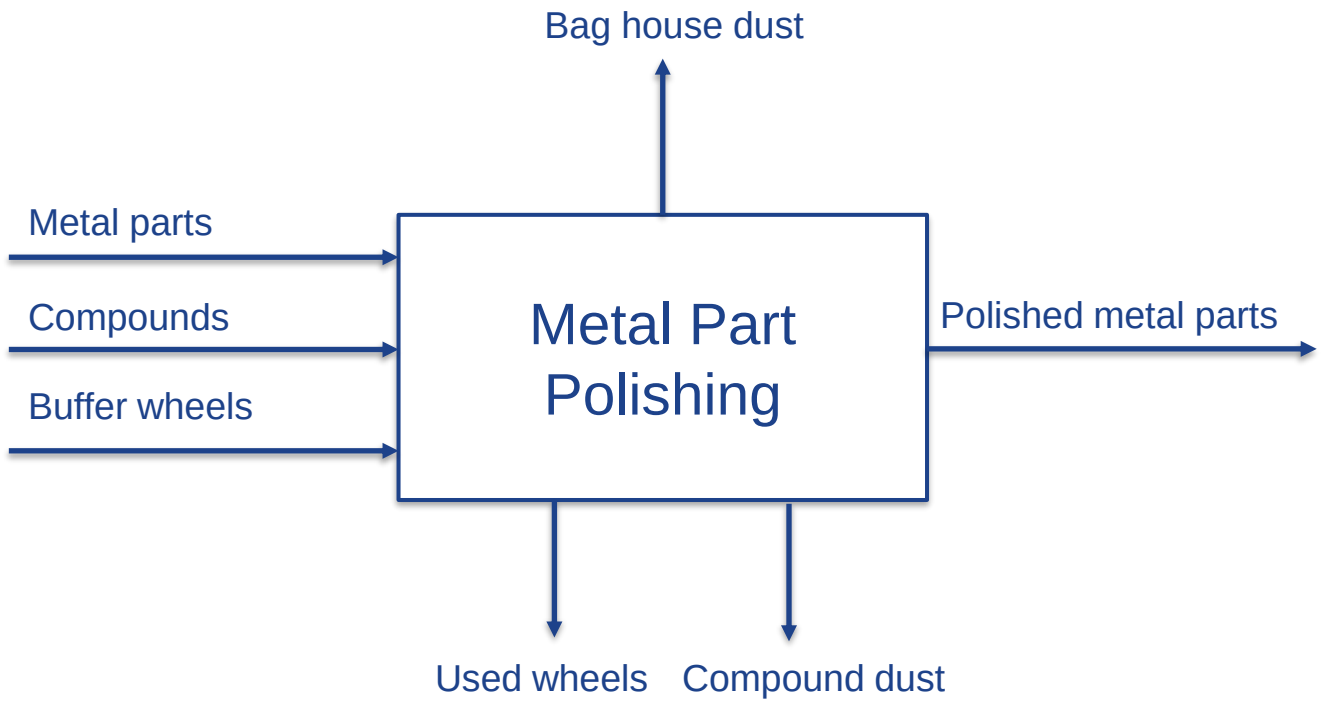
Category	Cost ($)	1% Savings ($)
Utilities		
Electricity	$1,100,000	$11,000
Natural Gas	$115,000	$1,150
Water	$150,000	$1,500
Propane	$600	$6
Waste		
Hazardous Waste	$1,000	$10
Organics	$52,000	$520
Wood	$2,500	$25
Trash	$200,000	$2,000
Special Waste	$6,000	$60
Scrap Metal	$14,250	$143

Category	Cost ($)	1% Savings ($)
Packaging		
Corrugated Boxes	$5,500,000	$55,000
Case Labels	$140,000	$1,400
Labels for Retail	$145,000	$1,450
Printing Ink	$1,500	$15
Wood Pallets	$140,000	$1,400
Plastic Wrap	$85,000	$850
Supersacks	$40,000	$400
Bags	$3,500	$35
Raw Materials		
Material 1	$22,500,000	$225,000
Material 2	$3,000,000	$30,000
Material 3	$1,250,000	$12,500
Material 4	$900,000	$9,000
Material 5	$750,000	$7,500
Material 6	$250,000	$2,500
Material 7	$85,000	$850
Material 8	$15,000	$150

- Based on 1% savings, corrugated boxes and material 1 would be focus areas for this company

5. Material Balance Example

- Simple formula:
  - Materials in = materials out + materials accumulated



5. Environmental Cost Accounting

- The “true” cost of something is a cost which includes considerations outside of the cost to purchase materials or dispose or waste

Example True Cost Accounting for Hazardous Waste

Category	Additional Information	Cost ($)	Term
Physical Costs			
Raw material cost	Materials 1, 2, and 3	100,000	Quarterly
Hauler fees	Outlet 1 and 2	15,000	Monthly
True Costs			
Employee(s) time to handle waste • Transport onsite • Compile into central containers • Disposal of empty containers	Two employees	200	Daily
Employee(s) time to monitor raw material use	One employee	150	Daily
Employee(s) time monitor waste	One employee	150	Daily
Employee(s) time coordinate with outlet(s)	One employee	500	Monthly
Employee(s) time fill out paperwork • Data collection • Compliance documents • Quality checks	Multiple personnel involved	25,000	Annual
Fines and ongoing liabilities	Multiple personnel involved	1,000	Variant
Spill prevention/handling materials	Drum spill prevention kits and replacement materials	2,500	Monthly
Employee(s) to handle spills	Multiple personnel involved	500	Per spill
Additional materials or equipment to safely handle waste	Forklift fuel, drums for centralized storage, signage, etc.	500	Monthly
Estimated cost of hazardous waste		**35,000**	**Monthly**

6. Conduct an Onsite Assessment

Pushing past the “that’s the way it’s always been done” mantra

U.S. DEPARTMENT OF ENERGY

6. Conduct an Onsite Assessment: Question

Poll: True or false - when conducting an onsite assessment for waste, you only need to focus on waste collection areas and waste bins.

Please respond to the Zoom poll

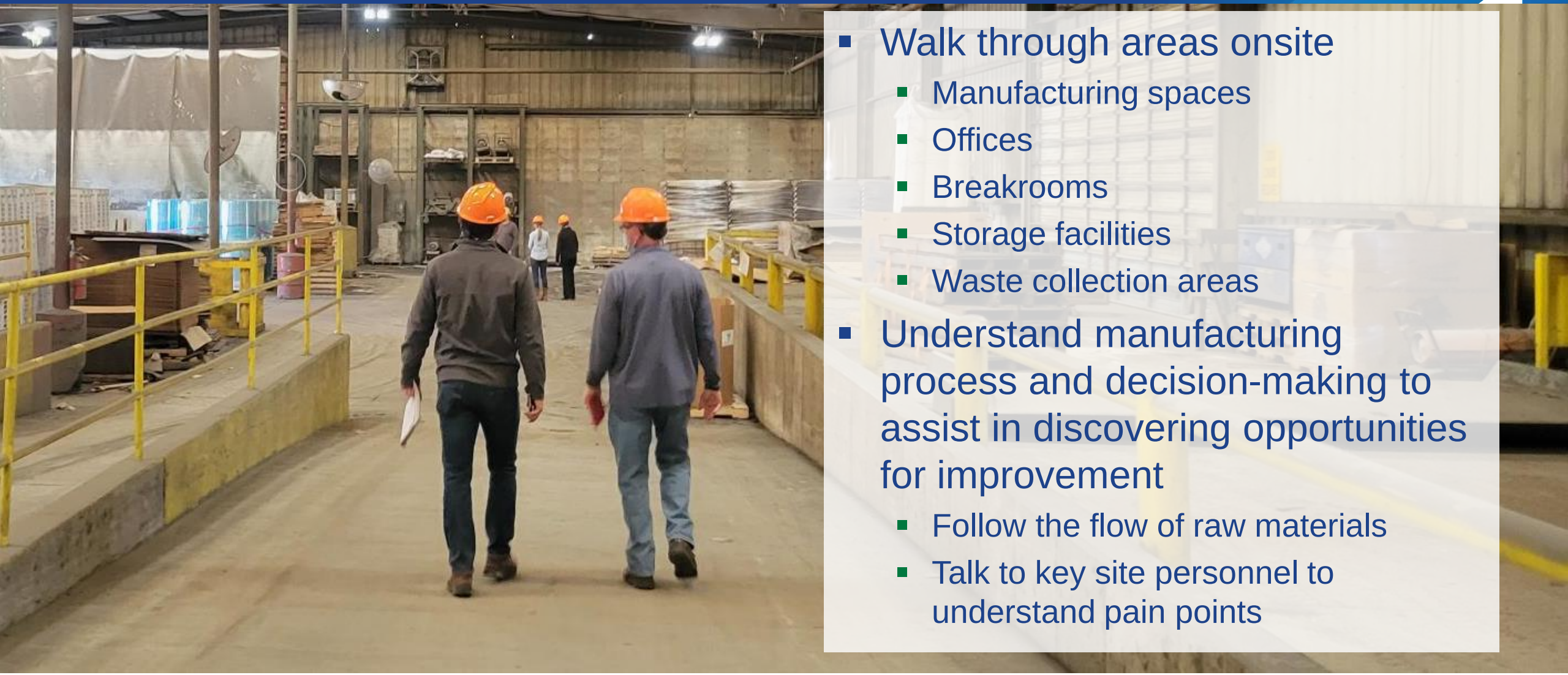
Answer: False, you must also evaluate the production process

6. Onsite Assessment

Pre-assessment preparation

- Understand waste generated onsite
- Collect and review waste-related data
- Obtain basic understanding of process flow of either materials throughout the site or individual processes
- Understand how materials become final products
- Learn about current waste initiatives and pain points
  - Are there any current losses?
  - Were there any initiatives that faltered and why?

6. Onsite Assessment



- Walk through areas onsite
  - Manufacturing spaces
  - Offices
  - Breakrooms
  - Storage facilities
  - Waste collection areas
- Understand manufacturing process and decision-making to assist in discovering opportunities for improvement
  - Follow the flow of raw materials
  - Talk to key site personnel to understand pain points

6. Onsite Assessment

- Do not limit concerns or questions to just where is the waste and what do we do with it?
- Work to understand how waste is generated and why
  - Press for reasons why operations occur in the manner they do
  - Identify possible changes

6. Onsite Assessment

- Focus on root causes of issues
  - May have nothing to do with technology or engineering
    - Could be related to material handling, safety, available space, etc.
- Consider implementation issues related to:
  - Manufacturing processes
  - Business processes
    - Impact how, what, and why materials are used
  - Available space and personnel
  - Willingness of union
  - Cost of opportunity
- Goal is to identify opportunities with the highest potential for implementation
  - Quality vs. quantity

7. Conduct a Waste Characterization

U.S. DEPARTMENT OF ENERGY

Question: Have any of your companies conducted a waste characterization at a facility?

Please type your answers in the chat

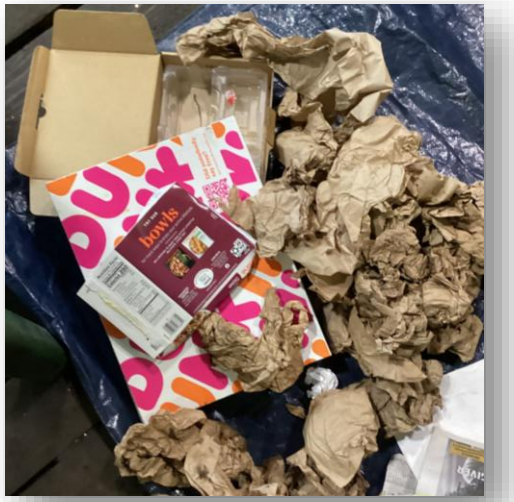
7. Waste Characterization - Goals

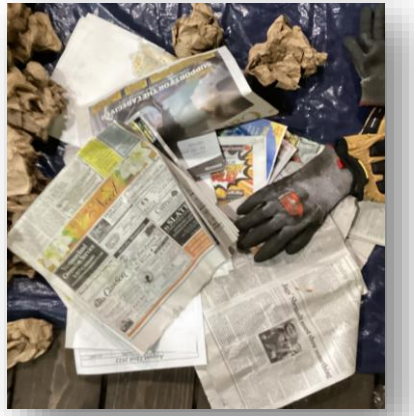
- To expand the knowledge of waste onsite
  - Take the understanding of what is currently being recycled/diverted and learn what can be recycled/diverted further
- Increase awareness to assist with identifying areas for improvement
  - Increased segregation
  - Process improvements
    - Production, waste management, etc.
  - Outlet identification
- Provide more granular data to use in decision making and communication internally and externally

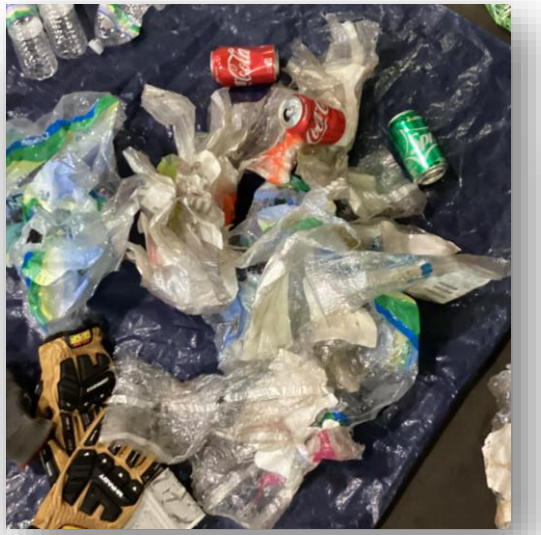
7. Waste Characterization - Procedure

- Conduct a waste characterization as part of or after an onsite assessment
- Determine areas or waste streams to evaluate
  - Example: Trash from operator stations in production building
- Obtain waste from a location
  - Generally, 5-10 bags/containers of waste is enough to obtain an understanding of a typical waste breakdown for one area of interest
  - Separate bags/containers trash from recycling and characterize the waste separately
  - Know the timeframe for waste generated onsite to allow for scaling data
- Empty out waste and sort it into separate streams
  - Plastic bottles, aluminum cans, cardboard, paper, PPE, trash, etc.
  - Can group streams if they would normally be hauled away together, such as in single-stream recycling
- Record the weight of the groups of waste

7. Waste Characterization - Procedure







7. Waste Characterization - Findings

Quantify

- Weighing the sorted waste will supply a general understanding of typical waste breakdown in the area evaluated
- Divide the weight of each group by the total weight of the waste evaluated
- If desired, group streams into general categories such as recycling, trash, compost, or waste-to-energy

Example

Waste Stream	Weight (lb)
Trash	52
Cardboard	18
PPE	10
Plastic Bottles	7
Liquid in Container	6
Aluminum Cans	2
Plastic Film	2
Paper	2
Wood	1

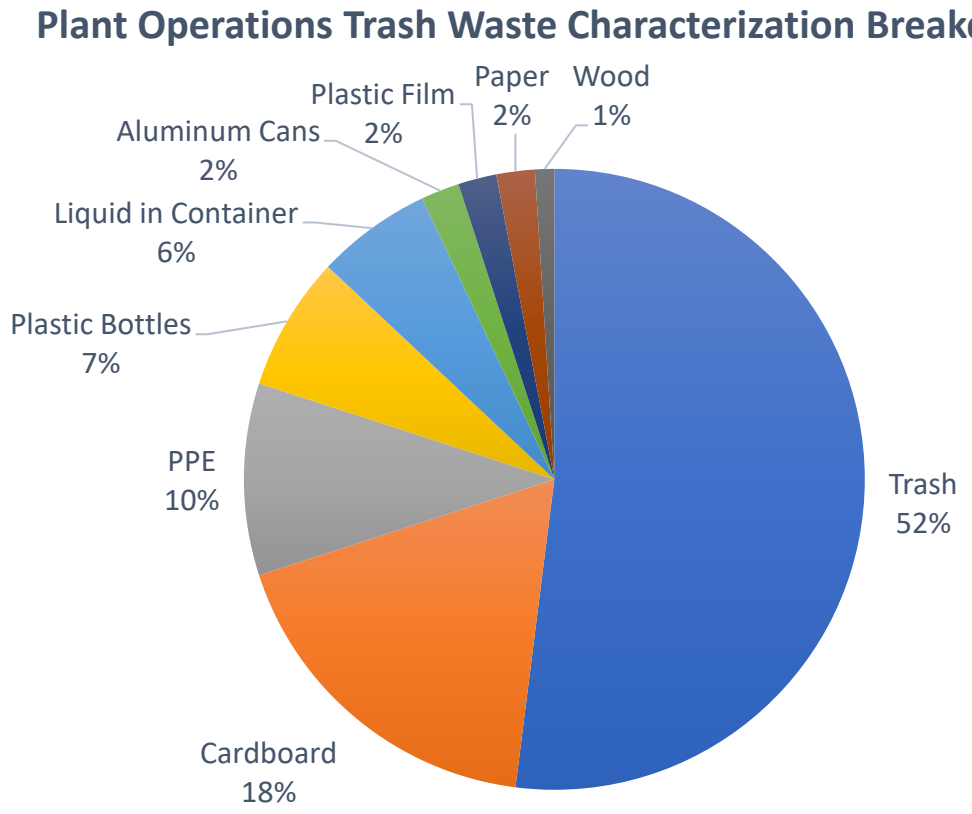
Waste Stream	Weight (lb)
Trash	58
Recycling	42

7. Waste Characterization - Findings

Interpret

- Evaluate the percentage of recyclable material in the waste evaluated
  - This will represent the amount of waste which can be diverted in the area evaluated
- Compare waste breakdown from characterization vs. annual data to obtain a feasible diversion rate
- Utilize waste characterization data to inform material management organizations (MMOs) on anticipated volume of waste

Example



7. Waste Characterization - Procedure

If waste (or certain streams) cannot be sorted, consider doing a visual assessment with additional considerations

- How much waste is currently present and how long did it take to generate it?
- What process generates the waste?
- How much waste is generated within a shift?
- What minimization opportunities exist for this waste stream?
- What would the implementation of changes include?

Waste Stream	Amount Present	Process Which Generates Waste	Amount Generated in a Shift	Minimization Opportunity	Implementation Requirements
Bio-hazardous waste	60 55-gallon drums	Product testing	15	Review segregation in testing areas to ensure bio-hazardous waste is not commingled with non-hazardous	Communication with lab manager and training of employees

8. Set Realistic Goals

U.S. DEPARTMENT OF ENERGY

Poll: Does your company have waste-related goals (internally or publicly)?

Please respond to the Zoom poll

8. Set Realistic Goals

- Based on the onsite assessment and waste characterization opportunities, estimate potential savings
- Select opportunities to pursue and set goals based on their projected savings
- Make sure goals are S.M.A.R.T.

9. Review on Recurring Basis

U.S. DEPARTMENT OF ENERGY

9. Review on Recurring Basis

- Continue to schedule waste data review calls to discuss progress towards goals, opportunities, and pain points
- Schedule follow up assessments to understand how changes are going and identify new opportunities

Image Source

Onsite Waste Collection Strategies

U.S. DEPARTMENT OF ENERGY

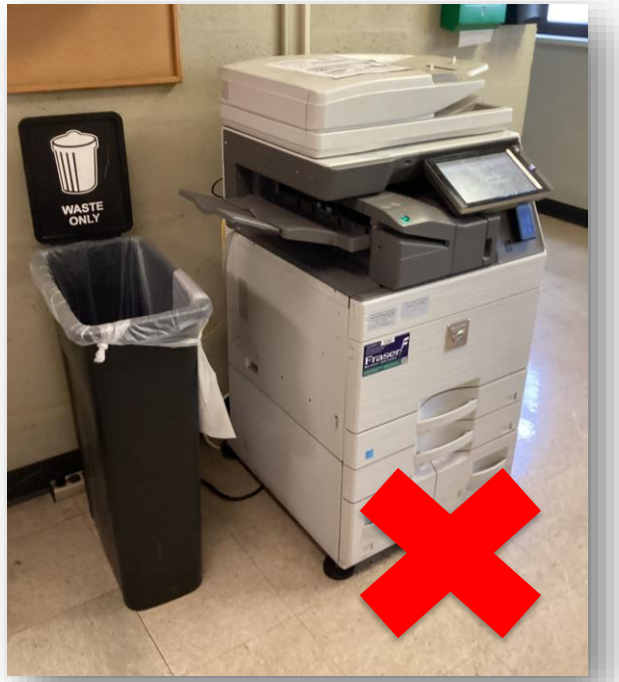
Waste Collection

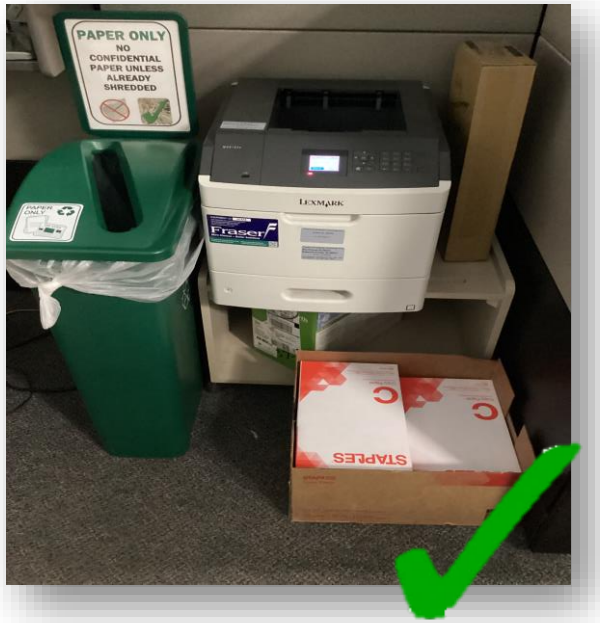
Evaluate bin consistency

- Availability and location
  - Centralized and/or near generating areas
- Labels
- Color
- Size
- Lid vs. no lid
  - It is recommended that lids have slots for specific waste streams
- Trash bag vs. no trash bag
  - Recycling containers should not have trash bags
    - Some outlets will send recycling to landfill if it is in a trash bag
    - If necessary, implement a de-bagging procedure

Waste Collection in Office Spaces

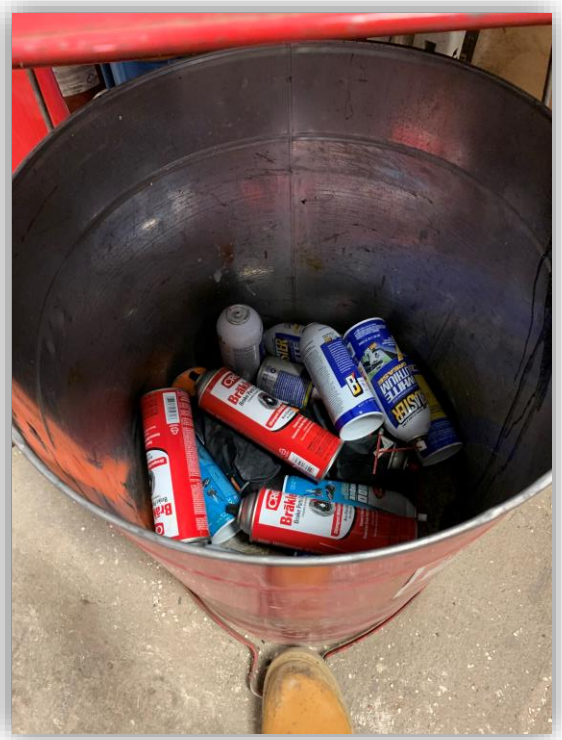
- Strategies for production spaces apply to offices as well
- Ensure bins are consistent
- Segregate waste streams





Waste Segregation

- Combining waste streams negatively impacts diversion rates while reducing the accuracy of waste tracking
  - Inconsistencies in bin location, size, labeling, color, etc. can increase the chance of contamination
- Determine which waste streams should be segregated by:
  - Reviewing waste data
  - Communicating with current or new haulers
  - Reviewing diversion possibilities through on or offsite treatment
    - The aerosol cans depicted to the right are in a hazardous waste bin, but if punctured, they could be recycled
- Segregation best practices:
  - Do not mix hazardous and non-hazardous wastes
  - Have clear and safe procedures for segregating waste streams



Waste Collection in Manufacturing Spaces

- Centralize waste collection
  - Have bins for each waste stream collected onsite (or the streams relevant to the building)
  - Ensure all bins are labeled with acceptable materials
  - Can have more than one collection area
    - Ensure that they are consistent
  - Avoid single waste bins at individual workstations

Compacting Waste

Benefits

- Assist with being under hauler minimums for pickup
- Reduce hauler traffic onsite
- Increase price from recyclers for baled materials
  - Cardboard and plastics

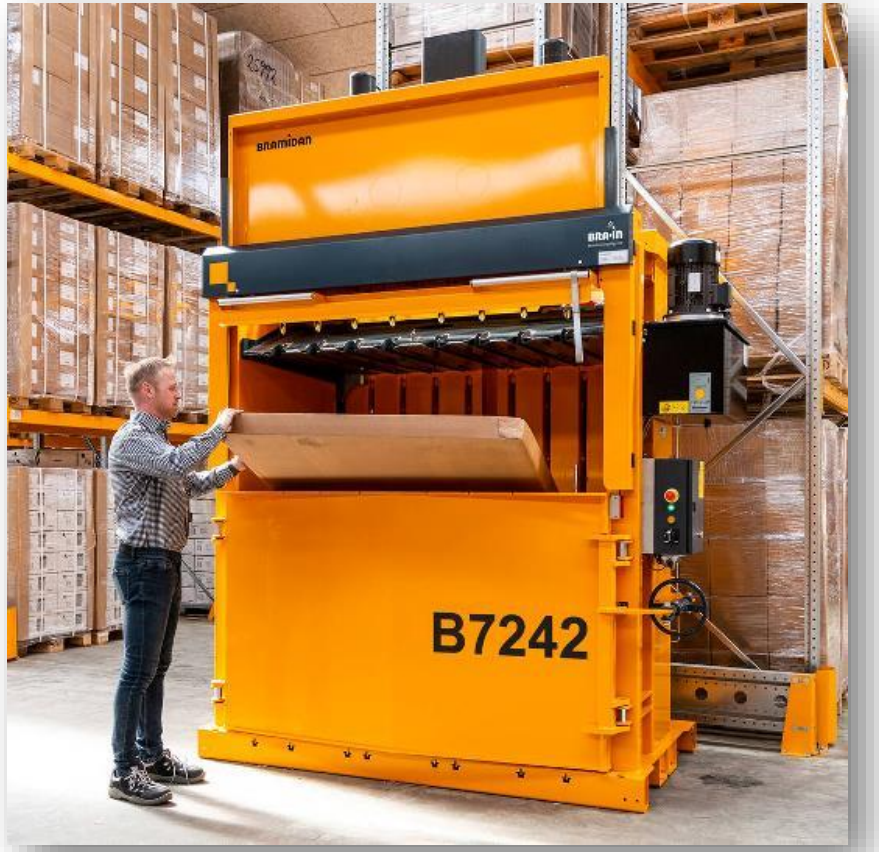
Negatives

- Can take up more space that regular dumpsters
- More expensive to purchase
  - Can be leased through agreements with waste hauler
- Generally located centrally onsite meaning there must be waste hauling onsite

Baling Waste

Baling Cardboard

- Balers can cost $5,000 - $20,000
- Return on investment for a baler dedicated is volume dependent, but can be short
- Baled cardboard is worth more than non-baled
  - Cardboard: $50 - $90 per bale
    - Prices fluctuate



Employee Training and Expectations

- A waste diversion program can only achieve so much without employee cooperation
- Trainings should include proper waste handling procedures along with expressing company goals and expectations
- Educate employees on waste diversion and minimization and why it is important
- Set expectations based on role within the company
- Consider having waste handling as part of job descriptions and performance reviews, where applicable

Employee Trainings – Industry Example

- Sprint, a participant in the DOE's Waste Reduction Pilot, established a company goal to divert over 50% of operational waste from landfill by 2025
- Through tracking data from 400 properties, they established the company diversion rate at over 40% in 2019
- Their approach to improve this rate included a comprehensive employee engagement program which included educational materials, internal videos, activities, newsletters, and more

Sprint Improves Waste Diversion

Contractor Training and Expectations

- Companies are responsible for any waste generated on site which includes contractor waste
- Contractors should be held to the same expectations as employees for handling and segregating waste
  - Establish who a contractor should connect with within a building if they are unsure where waste should go
  - Consider having contractors
    - Disclose waste streams they expect to generate prior to arriving onsite
    - Develop waste management plans

Closing Remarks

- Summary
  - Establish standard procedure for data collection and review
  - Segregating waste streams results in increased data granularity
  - Assess waste onsite utilizing onsite assessment and waste characterization procedure
    - Evaluate onsite waste collection
- Homework!
- Next training:
  - Source reduction and waste minimization techniques
  - March 4, 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 Overview – Session 2

Assignment

1. Identify a process which generates a waste stream(s). Describe the process and how the waste is generated.
2. Is the waste stream(s) identified in Question 1 reused, or is it sent offsite? If sent offsite, what is the disposition? If a waste stream is not used by another company, could it be?
3. For the process described in Question 1, brainstorm some possible solutions to reducing or eliminating the generated waste stream(s).
4. What would the implementation process for a strategy identified in Question 3 be? What kind of support is required? How much funding, research and development, or time would there need to be?

Goal

- Conduct an exercise which will get someone in the source reduction mindset
- You cannot begin to implement source reduction techniques until you understand what waste is being generated and how

Q&A