Jeremy O'Brien, PE, BCEE
Director of Applied Research,
SWANA

COMPARING WASTE MANAGEMENT OPTIONS

Metropolitan Washington COG Recycling
Committee Presentation
December 1, 2016

SWANA®
SOLID WASTE ASSOCIATION
of North America

SWANA

- Membership organization of over 8,500 public and private solid waste professionals
- Mission - “Advancing From Waste Management to Resource Management”
- Endorses “Highest and Best Use” for materials and products recovered from MSW.

SWANA Applied Research Foundation

- Founded in 2001
- 43 Local Government and Corporate Subscribers
- Conducts applied research on topics submitted by and voted on by Subscribers
- Four Research Groups – Collection, Recycling, WTE, and Disposal.

SWANA

FY2017 ARF Waste-To-Energy Group

CDM Smith	Paul Hauck, PE	Senior Environmental Engineer
HDR Engineering, Inc.	Joe Murdoch	Senior Vice President
City and County of Honolulu	Manuel Lanuevo, P.E.	Chief, Refuse Division
I-95 Landfill Owners Group	John Snarr	Metropolitan Washington COG
Lancaster County (PA) Solid Waste Management Authority	Robert Zorbaugh	Chief Operating Officer
Olmsted County, MN	John Helmers, PE	Director of Environmental Resources
Solid Waste Authority of Palm Beach County (FL)	Mark Hammond	Executive Director
York County Solid Waste Authority	Dave Vollero	Executive Director

Overview

- Comparing Recycling to Waste-To-Energy
- Noteworthy Findings of Recent Research
- Responses to Specific Questions

COMPARING RECYCLING TO WASTE-TO-ENERGY

SWANA®
SOLID WASTE ASSOCIATION
of North America

Is This A Fair Comparison?

- Many integrated SWM systems have both:
  - Source-Separated Recycling
  - WTE facilities
- Better comparison – types of integrated systems
  - Landfill-based systems
  - WTE-based systems
  - Composting/anaerobic digestion-based systems
- Materials and energy recovery are achieved by each type of system
- Criteria for system comparison
  - Costs
  - Disposal rates for each type of waste generator
  - Environmental impacts and benefits
  - Community sanitation and aesthetics
  - Customer service and convenience
  - System flexibility and reliability

Functions of Each Type of Facility

Materials Recovery Facility	WTE Facility
Recover materials from single-stream recycling collection programs for recycling into new products	Recover energy from waste not targeted for recycling or composting
	Convert HHW to harmless byproducts
	Recover non-source separated metals from waste
	Destroy pathogens in waste
	Stabilize waste to eliminate long-term landfill disposal risks
	Reduce volume of waste requiring disposal by 90%

SWANA®

Comparing Recycling to WTE by Waste Stream Component – A Better Comparison

Waste Component	Energy Recovery	Materials Recovery	Reason
HDPE Natural Containers		X	Material recycling revenues of over $500 per ton compared to energy revenues of less than $100 per ton.
Glass Containers		X	No heating value. Can cause maintenance problems in WTE facilities.
Metal containers	X	X	Metals not targeted for source separated can be recovered from WTE ash.
Flexible Packaging	X		Good for the environment but can't be recycled.
Plastic bags, films and wraps	X		Typically not collected in source-separation programs.

SWANA

NOTEWORTHY FINDINGS OF RECENT RESEARCH

SWANA®
SOLID WASTE ASSOCIATION
of North America

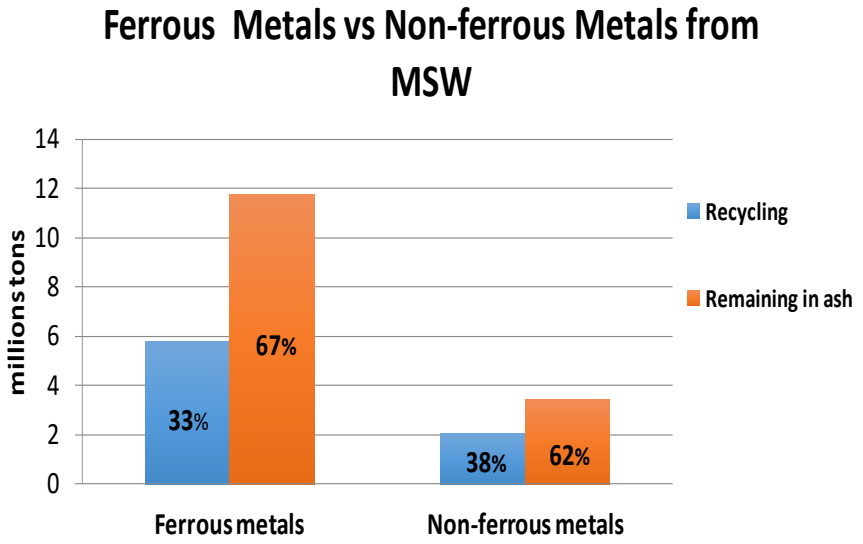
Recent ARF Reports

Year	Title
2016	Innovations in Waste-To-Energy Ash Management
2015	Food Waste Diversion Programs and Their Impacts on MSW Systems
2012	The Long-Term Environmental Risks of Subtitle D Landfills

SWANA®

Innovations in WTE Ash Management (2016)

- Recovery of metals from WTE bottom ash can recycle as much or more metals than curbside recycling
- Reuse of WTE bottom ash for road construction can result in total waste diversion rates of over 90%



SWANA

Food Waste Diversion Programs and Their Impacts on MSW Systems (2015)

- 198 residential source-separation programs in 2013
- 75% of programs in 3 states
  - CA – 33%
  - WA – 29%
  - MN – 12%
- All use composting to process food waste.
- Most accept meat/fish waste.

SWANA

Single-Family Residential Programs

- Collected weekly with yard waste
- Cannot use plastic bags to contain food waste
- Accept meat/fish/bones
- Unpleasant to participate – odors, flies, mold
- High waste diversion impact
  - 5-10 lbs/HH/week
  - Similar to curbside recycling
- Low Cost impact – if collected with yard waste

SWANA

Impacts on Composting Facilities

- Compost mixture - 66% food waste and 34% bulking agent (weight basis: shredded branches)
- Co-composting yard waste/food waste not permitted in some states
- Food waste composting concerns
  - Odors
  - Pests
  - Pathogens
  - Water contamination
- Negative Impacts on compost quality
  - Plastic produce stickers
  - Food packaging materials

SWANA

Long-Term Environmental Risks of Subtitle D Landfills (2012)

- Long-term environmental risks due to landfilled biodegradable waste
- Perpetual maintenance of final cover system needed
- Custodial care needed beyond 30-year post closure care period
- Risks can be mitigated by stabilizing waste through WTE or composting/AD before landfilling.

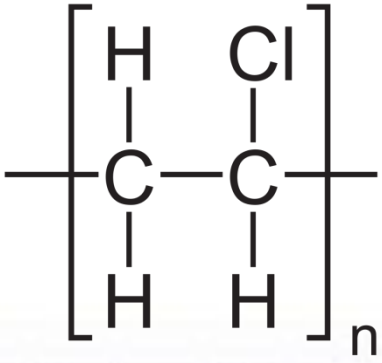
SWANA

RESPONSES TO SPECIFIC QUESTIONS

SWANA®
SOLID WASTE ASSOCIATION
of North America

Emissions From Burning Recyclable Plastics

- Plastics Nos. 1, 2, 4 5, 6
  - PET, HDPE, LDPE, PP, PS
  - Composed of hydrogen, carbon and oxygen
  - Combustion generates CO_2 and H_2O
- Polyvinyl Chloride (No. 3)
  - Contains chlorine
  - Combustion produces HCL and possibly dioxins
  - Both HCL and dioxin emissions are controlled to very low levels by air pollution control equipment
  - No correlation found between PVC in waste and dioxin emissions



SWANA

How Does The Energy Created by Burning Plastics Compare to the Energy Saved by Recycling Them?

Variable	Process Energy	
	Per Short Ton	Per Pound
	(Million Btus)	(Btus)
HDPE Made from Virgin Inputs	23.68	11,840
HDPE Made from Recycled Inputs	5.33	2,665
Energy Savings Due To Recycling	18.35	9,175
PET Made From Virgin Inputs	28.25	14,125
PET Made From Recycled Inputs	12.02	6,010
Energy Savings Due To Recycling	16.23	8,115
Lower Heating Value - Non-Recycled Plastics		14,000
Boiler Efficiency Factor		70%
Useful Heat Energy Produced from Burning NRP		9,800

SWANA

Processing of Glass in WTE Facilities

- Glass generally shatters into small pieces and then softens but does not melt on furnace grate
- Can lead to slagging on boiler tubes and be abrasive and cause minor erosion of combustion grates

	Degrees C
Melting Point of Glass	1,425 -1,600
WTE Furnace Grate Temperature	700-1,100

SWANA

Recovery of Ferrous Metals from Ash

- 98% of ferrous metals in waste transferred to bottom ash
- About 50% are oxidized during combustion process and/or are smaller than 2 mm in size
- About 50% of ferrous metals in WTE ash are recoverable with traditional equipment
- Typical ferrous metal recovery rate – 85-95%

SWANA

Burning Dead Leaves

- Leaves have roughly the same heating value as mixed MSW
- Burning leaves does not create problems in WTE facilities

Component	Higher Heating Value (Btus/lb)
MSW`	5,000
Yard Trimmings	6,000

SWANA

Burning of tree branches

- Average burn time on grate – 30-45 minutes
- Grate Temperature – 1,800 F
- Typical burnout - > 97%
- Cut branches six inches or less in diameter typically burn completely

SWANA

Burning of Trash Carts and Recovery of Metal Axles

- Short answer – Yes, the metal axles will be recovered by the magnet.

SWANA