

COMPOSTING OF FATS, OIL, AND GREASE

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TOPICS TO BE COVERED

- Composting Basics
- Regulatory Requirements
- Knox County, TN Demonstration

COMPOST BASICS

Aerobic
Microbial
Process

COMPOST BASICS

Process Requirements:

- Oxygen
- Water
- Temperature
- Carbon
- Nitrogen
- Particle Size

COMPOST BASICS

Materials Composted:

- Biosolids
- Food Wastes
- Yard Wastes
- Manures
- Septage

COMPOST BASICS

Definitions:

- Co-composting
- Bulking Agent
- Amendment
- Materials Balance

COMPOST BASICS

Compost Systems:

- Windrow



COMPOSTING SYSTEMS

Windrow Basics:

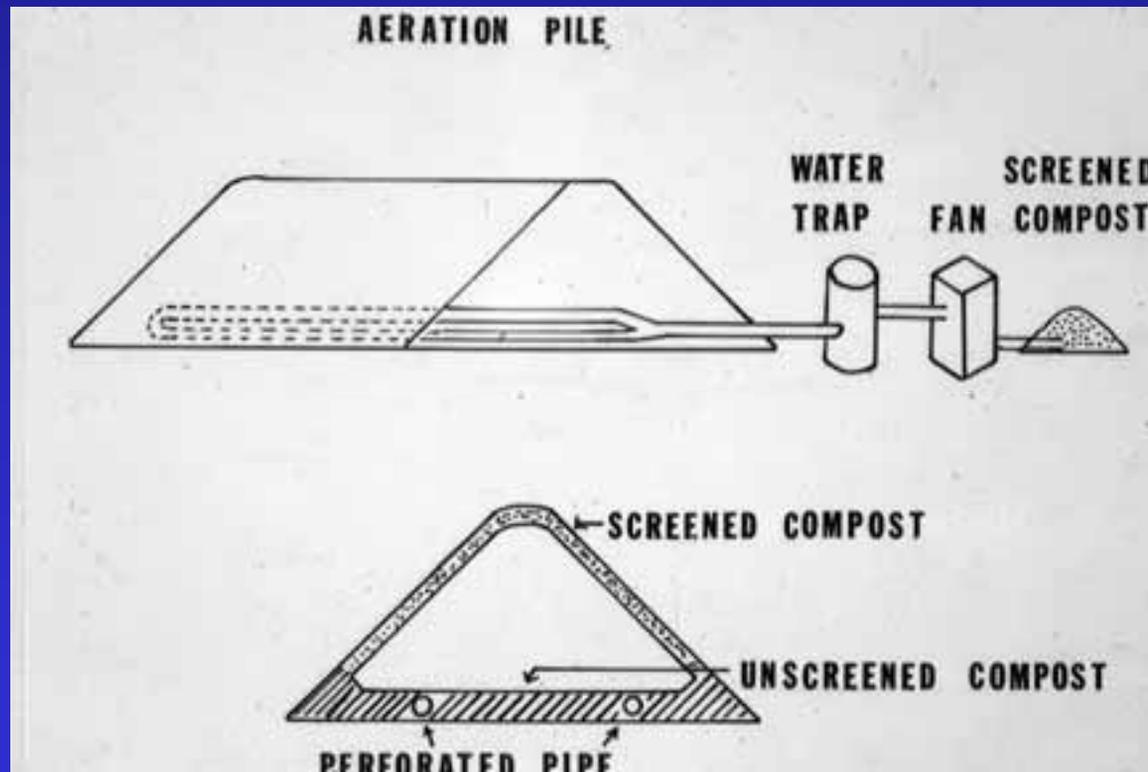
- Aerate by Turning
- Specialized Turners or Front-end Loader

COMPOST BASICS

Compost Systems:

- Aerated Static Pile

COMPOST BASICS



COMPOST BASICS

Compost Systems:

- Static Pile
- In-vessel or Mechanical

REGULATORY REQUIREMENTS

Federal:

- “503” Regulations Cover Biosolids
 - Vector Attraction Reduction (VAR)
 - Pathogen Reduction

REGULATORY REQUIREMENTS

Pathogens:

- Static Pile Composting - 3 Days $>55^{\circ}\text{C}$
- Windrow Composting - 15 Days $>55^{\circ}\text{C}$ with 5 Turnings
- All Products $<1,000$ MPN Fecal Coliform or <3 MPN *Salmonella* sp./4 grams Total Dry Solids

REGULATORY REQUIREMENTS

VAR Requirements:

- 14 Days Aerobic
- $>40^{\circ}\text{C}$
- Average 45°C

REGULATORY REQUIREMENTS

Organic
Food

REGULATORY REQUIREMENTS

- Air Quality
- Odor
- Organics

KNOX COUNTY DEMONSTRATION

Participants:

- Knox County Solid Waste Board (KC)
- Knoxville Utility Board (KUB)
- First Utility District

KNOX COUNTY DEMONSTRATION

Materials:

- Lime-stabilized Biosolids
- Raw Sludge
- Ground Yard Waste
- Ground Pallet Wastes
- Grease Trap Wastes

KNOX COUNTY DEMONSTRATION



KNOX COUNTY DEMONSTRATION



KNOX COUNTY DEMONSTRATION

Mix Characteristics:

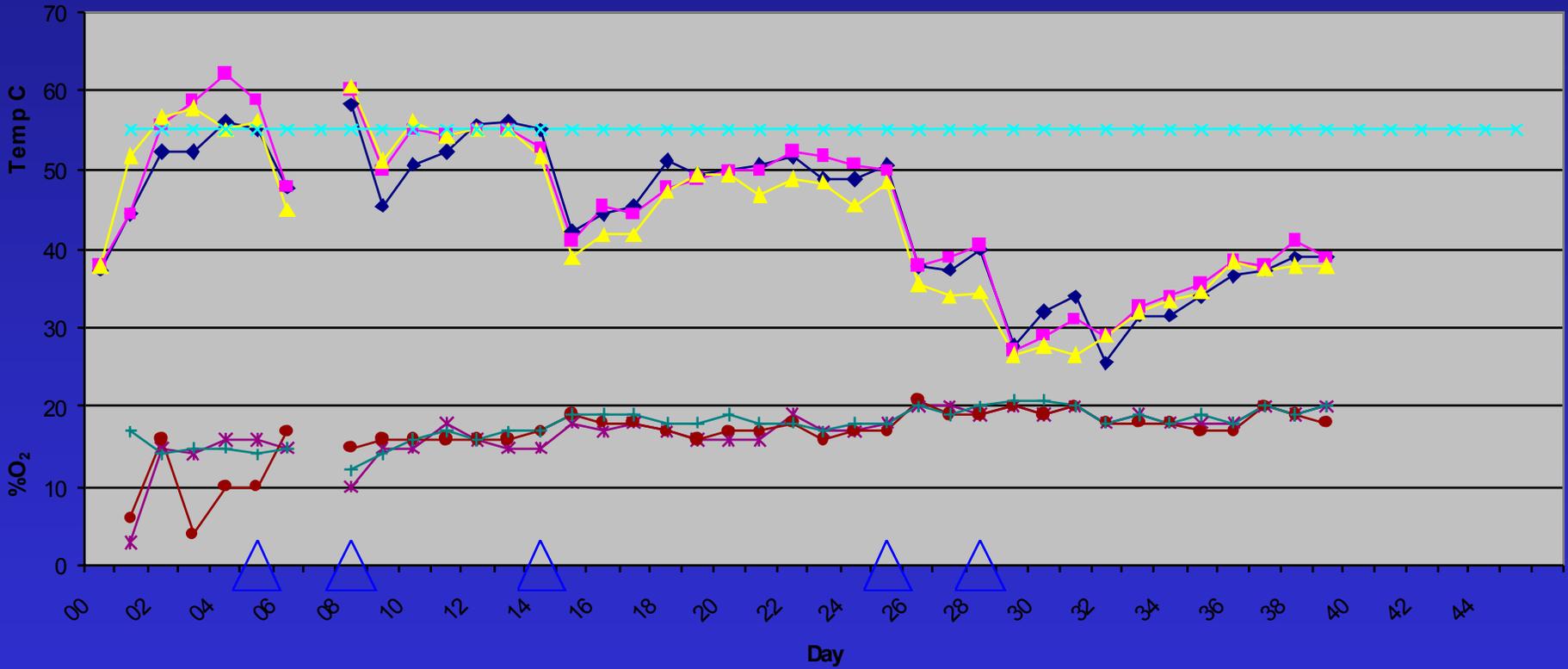
- FOG Absorbed to Wood
- No Odor After Mixed
- 3 Days to 55°C
- 8 Days at 55°C
- Met VAR
- 57% Volatile Solids

KNOX COUNTY DEMONSTRATION

Mix Characteristics:

- 37% Solids
- pH = 8.7
- Bulk Density = 1,230 lbs/yd³
- FOG = 7,570 lbs
- Green Wastes = 10,770 lbs

Pile #4 KUBG & GWG



KNOX COUNTY DEMONSTRATION

Compost Characteristics:

- Fecal Coliform <1
- pH = 8.3
- 53% Volatile Solids
- Ammonia <56 mg/kg
- 40% Solids
- Cadmium = 0.2 mg/kg
- Chromium = 6.1 mg/kg

KNOX COUNTY DEMONSTRATION

Compost Characteristics:

- Copper = 12.5 mg/kg
- Nickel = 4.2 mg/kg
- Lead = 13.3 mg/kg
- Zinc = 113.2 mg/kg
- Selenium = BDL
- Mercury = 0.2 mg/kg
- Kjeldahl Nitrogen = 4,163 mg/l

KNOX COUNTY DEMONSTRATION

Observations:

- Co-composted Well
- No Trace After 7 Days
- No Odor
- Chips Could Hold More FOG
- No Mass Buildup

KNOX COUNTY DEMONSTRATION

Economic Analysis:

Key Assumptions in Designing a Liquid Grease Trap Waste Compost Site

<i>Item</i>	<i>Units</i>	<i>Recommended Value</i>
Liquid Storage	days	2
Daily Volume of Liquid	gallons	10,000
Method of Mixing	method	Mix Box
Method of Composting	method	Windrow
Days of Composting	days	14
# of Cycles Bulking Agent Used	#	7
Solids Content of Liquid	%	3.5
Volatile Solids of Liquid	%	70
Bulking Agent Storage	days	14
Operational Days per Week	days/week	6
Hours of Operation/Day	hours/day	10
Odor Control	method	None

KNOX COUNTY DEMONSTRATION

Economic Analysis: Site Sizing Calculations

<i>Activity</i>	<i>yd³/Day</i>	<i># of Days</i>	<i>yd³</i>	<i>Area Required (ft²)</i>
Liquid Storage ^a	50.0	2	100	314
Bulking Agent Storage ^b	185.4	14	2,600	7,921
Mix Area ^c				600
Compost Area ^d	222.5	14	3,115	48,544
Total				57,379

^aAssumes a 20-foot diameter silo.

^bAssumes a 12-foot pile height = 5,850 ft², or 77 x 77; therefore, accounting for slope need, 89 x 89 = 7,921.

^cAssumes a 20-foot x 30-foot area.

^dAssumes 14 piles areas: 12 active and 2 extra. Assumes a Scarab 16 = 2.29 yd³/ft windrow capacity, 14 windrows, 100-foot windrows, 4.5 feet between windrows, 32-foot turn distance, and 16-foot-wide windrows.

KNOX COUNTY DEMONSTRATION

Economic Analysis:

Capital Costs – Moving Equipment

<i>Item</i>	<i>Unit Cost</i>	<i>Units</i>	<i>Quantity</i>	<i>Estimated Cost</i>
Front-end Loaders	185,000.00	6 yd ³	1	185,000
Mix Box	115,000.00	18 yd ³	1	115,000
Scarab 16	227,000.00	ea	1	227,000
Total Moving Equipment ^a				\$527,000
Engineering (5%)				26,350
Total				\$553,350
Annual Amortization ^b				\$95,537
Annual Amortized Cost ^c			\$/gallon	\$0.0031

^aAssumes direct City purchase; no overhead and profit.

^bAmortized over seven years at five percent interest.

^cBased on 10,000 gallons/day x 6 days/week x 52 weeks/year = 3,120,000 gallons/year.

KNOX COUNTY DEMONSTRATION

Economic Analysis:

O&M Costs

<i>Item</i>	<i>Unit Cost</i>	<i>Units</i>	<i>Daily Quantity</i>	<i>Annual Quantity</i>	<i>Annual Estimated Cost</i>
Labor	14.00	\$/hour	12	31,201	436,814
Laboratory	3,000.00	\$/year			3,000
Front-end Loader O&M	29.59	\$/hour	8	2,496	73,857
Scarab O&M ^a	59.82	\$/hour	1	156	9,332
Batch Mixer O&M	15.00	\$/hour	4	1,248	18,720
Bulking Agent ^b	6.20	yd ³		6,886	42,693
Administrative		lump			15,000
O&M Costs					599,416
O&M Costs/gallon ^c					0.192

^aAssumes three turns per week.

^bAssumes ground brush is obtained at average retail price for the Knoxville area.

^cAssumes 10,000 gallons/day x 312 days.

KNOX COUNTY DEMONSTRATION

Conclusions:

- Can Compost
- Do Not Need to Dewater
- Can Co-compost
- Can Meet Regulations
- Can Be Cost Competitive