Objective: To Convert Raw Feedstocks
Into High Quality Soil Amendments
Using the Aerated Static Pile Method

Sonoma Valley Stables, Petaluma, CA
What is Composting?
This is **Not** Composting
This is Composting
This is Not Composting
This is Composting
This is **Not** Composting
This is Composting
"Composting" means the biological degradation and transformation of organic solid waste under controlled conditions designed to promote aerobic decomposition."
One Definition of Composting

WA Solid Waste Handling Standards: WAC 173-350-100

“Natural decay of organic solid waste under uncontrolled conditions is not composting.”
Front End Loader Turned Windrows
Tow Behind Windrow Turner
Oxygen Consumption with Time

- **Aerobic**
- **Anaerobic**

*Graph showing changes in pile oxygen percent with elapsed time in minutes.*
Aerated Static Pile (ASP) Composting

Horse Manure w/ Shavings
ASP Composting

- First Developed in the Early 1970’s – Beltsville Method
- Maintains Aerobic Conditions Throughout the Pile
- Controls Pile Temperatures by Adjusting Airflow
- Eliminates the Need to Turn the Compost Pile
- Saves Time and Reduces the Cost of Labor and Fuel
Advantages of ASP Composting?

With ASP composting, we:

- Construct the compost pile over a network of aeration pipes and
- Induce airflow into the pile using an electric blower / timer
- Do not turn the pile during the first 21 – 30 days (Active Phase)
- Adjust the airflow to manage pile temperatures and optimize the biology of the composting process; and
- Operate the blower using either grid power or solar power
The Anatomy of an Aerated Static Pile

Horse Manure w/ Shavings
Isometric View - Aerated Static Pile

Rule of Thumb
Max Pile Length 75 – 80-feet
Plan View

Length 75 – 80 Feet

Height ~12 Feet
Cross Section View of an ASP

Rule of Thumb:
Max Pile Length 75 – 80 feet
Section View of an ASP

Pipes on Grade
- Thin Wall – Pilot Test
- Thick Wall HDPE

Rule of Thumb:
Max Pile Length 75 – 80-feet
Section View of an ASP

Rule of Thumb:
Max Pile Length 75 – 80-feet

Below Grade Trenches
- Aeration
- Drainage
Section View of an ASP

Pipes on Grade

Aeration Plenum Layer
- Wood Chips
- Screen-Overs

Rule of Thumb:
Max Pile Length 75 – 80-feet
Section View of an ASP

Pipes on Grade

Aeration Plenum Layer

Initial Mix of Materials
- C:N Ratio
- Bulk Density
- Moisture Content

Rule of Thumb:
Max Pile Length 75 – 80-feet
Rule of Thumb:
Max Pile Length 75 – 80-feet

Pipes on Grade
Aeration Plenum Layer
Initial Mix of Materials
Biofilter Cover Layer
• Unscreened Compost
Biofilter Cover Layer

- Insulating Layer (PFRP)
- Biofiltration Layer
- Nutrient Retention
- Vector Barrier
- Moisture Retention
- Improve Aesthetics

Rule of Thumb:
Max Pile Length 75 – 80-feet
Partially Constructed ASP

ASP Hands-on Workshop
Constructing an ASP in 2 Minutes or Less
Section View of an Extended ASP

Unscreened Compost Cover

Screen Overs Plenum

Mix

Cell 1

Cell 2

Cell 3

Cell 4

W’

H’
Extended ASP Composting

Upper Valley Disposal Service, Rutherford, CA
The Importance of Aeration

**BY INDUCING AIRFLOW INTO THE COMPOST PILE WE ARE ABLE TO:**

- Maintain aerobic conditions without turning the pile
- Optimize the biology of the composting process
- Manage pile temperatures
- Reduce offensive odors and neighbor complaints
- Expedite the rate of composting
- Produce a high quality compost product in less time
Top-Down Aerated Bay System
Liberty Bell Farm, Snohomish

Completed Aeration System
Cross Section of an Aerated Bin
Cross Section of an Aerated Bin

Raw Mix
~ 30-days to fill
Moisture ~ 60 – 65%
Cross Section of an Aerated Bin

- Thermal Blanket
- Odor Control
- Fly Control
- Retains Moisture
Cross Section of an Aerated Bin

Typical Aeration Cycle: 2-min ON & 30-min OFF

No Turning!
Cross Section of an Aerated Bay

Highest Heat

131°F

Steam
Cleaning Out Wet Bedding
Removing Solid Manure
Moisture Conditioning the Mix
Dumping Cart into Compost System
Adding Final Cover Layer
Adding the Final Touch
Monitoring Compost Temperatures
Cross Section of a 3-Bay System - Stage 1

- Bin #1: Start Airflow (Active Phase)
- Bin #2: No Airflow (Filling)
- Bin #3: Empty
Cross Section of a 3-Bay System - Stage 2

- Bin #1: Curing Phase
  - 25 – 40% Volume Loss
  - ~ 100 - 110°F
  - 10% Airflow

- Bin #2: Active Phase
  - ~ 140 - 165°F
  - 90% Airflow

- Bin #3: Filling
  - No Airflow

Volume Loss: ~ 100 - 110°F

~ 140 - 165°F
Cross Section of a 3-Bay System - Stage 3

- Bin #1: Ready for Batch #4
- Bin #2: Curing Phase
- Bin #3: Active Phase

Airflow:
- Empty: No airflow
- 10% Airflow
- 90% Airflow
The Evolution of $\text{O}_2\text{C}ompost$ Systems Since 1998
Chicken Mortality Composting

Draper Valley Farms, Mt. Vernon, WA
Chicken Mortality Composting

Draper Valley Farms, Mt. Vernon, WA
Chicken Mortality Composting

Draper Valley Farms, Mt. Vernon, WA
Prototype Compost System

O₂ Compost “Research Laboratory”
On-Grade Aerated Compost Systems

Sonoma Valley Worm Farm, CA
On-Grade Aerated Compost Systems

Greenville, NC
On-Grade Aerated Compost Systems

Camden, NC
Top-Down Compost Systems

Horse Manure / Wood Pellet Bedding
Adding Raw Manure from Above
Removing Compost from Below
Top Down 3-Bin Compost Structure

Nickerson Farm – Sterling, MA
O2Compost Micro-Bin System

Plywood & 2 x 6 Tongue & Groove Bins
Top Down, Sliding Lid Compost System

Low Profile, Aesthetically Pleasing
Aerated Static Bin Composting

Edwards Equestrian Center, MT
Aerated Static Bin Composting

Mohican Farm, Cooperstown, NY

Quaker Smith Point, VT
Aerated Bay Composting

Silver Oaks Stable, Long Island, NY
Aerated Block Bay System

Thacher School – Ojai, CA
Free-Standing Aerated Static Pile

Detweiler Homestead Farm, PA
Aerated Static Pile Composting

Micro-Green Farm, NJ
Extended Aerated Static Pile

Two Particular Acres – Royersford, PA
Simple On-Grade Pipe System

Bailey Compost, WA
Large Aerated Bay Composting

Lenz Enterprises – Stanwood, WA
The Benefits of ASP Composting

WITH ASP COMPOSTING, WE:

➢ Reduce the footprint of the Active compost pad
➢ Increase site capacity as well as the throughput of a given facility
➢ Reduce the cost of processing (less equipment, labor and fuel)
➢ Resolve off-site odor impacts and neighbor complaints
➢ Process more challenging feedstocks
➢ Improve product quality and increase the selling price
Pop Quiz

The three layers within an Aerated Static Pile Include:

• The Plenum Layer – Why is this important?
  ○ To help distribute airflow uniformly across the base of the pile

• The Mix Layer – What are the Key Parameters
  ○ Nutrient Balance (Carbon to Nitrogen Ratio)
  ○ Bulk Density as an indirect measure of Porosity
  ○ Moisture Content

• The Biofilter Layer – What are the two key reasons
  ○ Insulate the mix layer > pile temperatures over 131°F for 3 days
  ○ Manage odors and off-site impacts to neighbors
Aerated Static Pile Composting

PART 3

COMPOSTING IS A BIOLOGIC PROCESS
The Secret to Composting is...

Oxygen!
Oxygen Consumption with Time

- **Aerobic**
- **Anaerobic**

![Graph showing oxygen consumption over time](image)
The Composting Process

**Raw Materials**
- Raw Organic Matter
- Minerals
- Water
- Microorganisms

**Finished Compost**
- Stable Organic Matter
- Minerals
- Water
- Microbes

**2) Oxygen**

**Compost Pile**

- Water
- Heat
- CO₂
Aeration

Allows the Operator to:

- Maintain Aerobic Conditions
- Mitigate Impacts from Objectionable Odors
- Manage Pile Temperatures
- Reduce the Loss of Nutrients
- Facilitate the Rate of Composting & Curing
- Produce Superior Compost Products
Compost Mix – The Key to Success

4 Critical Parameters

1. Carbon to Nitrogen Ratio (C:N ~ 30:1)

2. Porosity: Volume of Void Space
   - Bulk Density: 550 – 950 pounds per cubic yard
   - Free Airspace: 35 to 60%

3. Moisture Content (60 – 65%)

4. pH
   - Bacterial decomposers prefer pH 6.0 to 7.5.
   - Fungal decomposers prefer pH 5.5 to 8.0.
   - Ideal range is 5.8 to 7.2
## Requirements for Aerobic Composting

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Reasonable Range</th>
<th>ASP Preferred Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>C:N Ratio</td>
<td>20:1 to 40:1</td>
<td>25:1 to 30:1</td>
</tr>
<tr>
<td>Moisture</td>
<td>40% to 65%</td>
<td>60% to 65%</td>
</tr>
<tr>
<td>Bulk Density</td>
<td>650 to 1,250 pcy</td>
<td>950 pcy (max)</td>
</tr>
<tr>
<td>Free Air Space</td>
<td>35% to 60%</td>
<td>35% to 50%</td>
</tr>
<tr>
<td>pH</td>
<td>5.5 to 8.5</td>
<td>6.5 to 8.0</td>
</tr>
<tr>
<td>Particle Size</td>
<td>1/16” to 3”</td>
<td>&gt;50% 1/8” to 2” (max)</td>
</tr>
<tr>
<td>O₂ Concentration</td>
<td>&gt;5%</td>
<td>&gt;10%</td>
</tr>
<tr>
<td>Temperature</td>
<td>131° to 170°F</td>
<td>131° to 150°F</td>
</tr>
</tbody>
</table>
The Compost Life-Cycle

- **A** = Mesophilic
- **B** = Thermophilic
- **C** = Curing
- **D** = Maturation

**Temperature °F**
- 180
- 160
- 140
- 120
- 100
- 80
- 60
- 40

**Active Composting Phase**
- 110°F
- 131°F

**Curing and Maturation Phase**
- 155°F

**Time**

PFRP (Peak Final Reaction Phase)
Actual Temperature Data Curve

The graph shows the temperature data curve from November 2002 to February 2003. The temperatures are labeled in Fahrenheit (F) and range from 100°F to 140°F. The data is divided into three stages:

- **Active Composting**: The highest temperatures are observed during this stage, indicating active composting processes.
- **Curing**: As the temperatures start to drop, the material is transitioning into the curing stage.
- **Maturation**: The graph shows a further decrease in temperature, indicating the maturation phase where the compost is stabilizing.

The dates marked on the x-axis include 28th November, 6th December, 14th December, 24th December, 1st January, 9th January, 19th January, 29th January, and 8th February of 2002-2003.
Mid-Term Exam

- After turning a compost pile, or when the blower for an Aerated Static Pile turns off, how quickly does the oxygen deplete in the core of the pile?
- What percentage of O2 do we want to maintain in an aerobic system?
- Active Composting is primarily a __________ driven process whereas Curing is primarily a ________________ driven process.
True or False: Curing starts at an exact point in time

PFRP means a Process to ____________________.

What are the criteria for PFRP with ASP Composting?

Our objective in meeting PFRP conditions are to “destroy” __________. At these temperatures we also effectively eliminate __________ and __________.
What is the one correct answer to all composting questions?

It Depends!
Aerated Static Pile Composting

PART 4

COMPOSTING AS A MANUFACTURING PROCESS
## Mass Balance Analysis

<table>
<thead>
<tr>
<th>Tilz Soil &amp; Compost</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In-Bound Green Waste per Year</strong></td>
<td>7,000 tons / yr</td>
</tr>
<tr>
<td><strong>Process Mass Balance</strong></td>
<td></td>
</tr>
<tr>
<td>Monthly Tonnage</td>
<td>583 tons / mo.</td>
</tr>
<tr>
<td>Shredded Bulk Density</td>
<td>650 pounds / cubic yard</td>
</tr>
<tr>
<td>Monthly Volume</td>
<td>1,795 cy / avg. mo.</td>
</tr>
<tr>
<td>Volume Loss w/ Active Composting</td>
<td>25%</td>
</tr>
<tr>
<td>Volume After Active Composting</td>
<td>1,346 cy / avg. mo.</td>
</tr>
<tr>
<td>Volume Loss w/ Curing</td>
<td>10%</td>
</tr>
<tr>
<td>Volume After Curing</td>
<td>1,212 cy / avg. mo.</td>
</tr>
<tr>
<td>Screened Fines Proportion</td>
<td>60%</td>
</tr>
<tr>
<td>Screened Product Volume</td>
<td>727 cy / avg. mo.</td>
</tr>
<tr>
<td>Screen &quot;Overs&quot; Proportion</td>
<td>45%</td>
</tr>
<tr>
<td>Screened &quot;Overs&quot; Volume</td>
<td>545 cy / avg. mo.</td>
</tr>
<tr>
<td>Curing Time</td>
<td>1.5 months</td>
</tr>
<tr>
<td>Curing Storage Volume</td>
<td>2,019 cy</td>
</tr>
<tr>
<td>Screened Product Storage Time</td>
<td>3 months</td>
</tr>
<tr>
<td>Screened Product Storage Volume</td>
<td>2,181 cy</td>
</tr>
<tr>
<td>Screen Overs Storage Time</td>
<td>3 months</td>
</tr>
<tr>
<td>Screen Overs Storage Volume</td>
<td>1,636 cy</td>
</tr>
</tbody>
</table>
Continuous Flow
When the method of mixing and processing is successful at meeting the biological requirements for composting:

- The primary focus of composting then becomes materials handling.
- Composting is a manufacturing process, and
- The objective should be to produce a high quality product.
Adaptability

Your Method of Operating Will Evolve Over Time

Recommendations:

- Start small and grow in planned increments.
- Define your key objectives & set goals.
- Always strive to improve product quality.
Adaptability

Your Method of Operating Will Evolve Over Time

- Always work to reduce materials handling;
- Identify and manage constraints in your system;
- Respond to regulatory changes;
- Be a good neighbor; and
- Keep it Simple Stupid (KISS).
Summary – Keys to Success

- Manage the compost facility based on a continuous yet variable flow of materials (i.e., Flow Diagram);
- Handle raw feedstocks promptly;
- Pay particular attention to: 1) aeration; and 2) the amount of moisture in the system;
- Do not lose sight of the big picture; manage the site by practicing good housekeeping techniques; and
- Always strive to improve product quality!
PART 5

CONDUCTING AN ASP PILOT PROJECT
The Four Stages of Learning

- Unconscious Incompetence
- Conscious Competence
- Conscious Incompetence
- Unconscious Competence

- Don’t know what you don’t know
- Know what you know
- Know what you don’t know
- Don’t know what you know
Learning by Doing

Bridging the Gap Between Knowledge and Understanding
Small Volume Pilot Projects

- Quick and Inexpensive to Construct & Start-up
- Prototype Compost Mix
  - C:N Ratio
  - Bulk Density
  - Moisture Content
- Confirm Suitability Before Setting up a Larger Pile
- Get Stakeholder Buy-In

O2Compost Micro-Bin System
Large Volume Pilot Projects

- Provide Operator Training
- Resolve Logistical Constraints
- Test a Variety of Mixes
- Establish Standard Operating Procedures
- Reveal Permit Requirements
- Establish Regulatory Confidence.

O2Compost Aerated Bay System
Logistical Constraints

- Feedstock Sources
- Transportation
- Aeration System
- Equipment
- Operators
- Power/Water
- Permits

Salt Lake City Pilot Project
Stakeholder Buy-In

- Partners
- Investors
- Employees
- Regulators
- Neighbors
- Customers
- End-Users

Fish Waste Compost Demonstration Project
PART 6

INCREASING SITE CAPACITY BY REDUCING OPERATING FOOTPRINT

Aerated Static Pile Composting
Windrow Turners

Self Propelled Straddle Type
~16-feet wide by 7-feet high
Windrow Turners

PTO Powered - Tow Beside
~16-feet wide by 7-feet high
Example Turned Windrow Compost Facilities

Compost Facility in New York
Yard Waste & Leaves

Compost Facility in California
Yard Waste & Food Waste
Turned Windrow Compost Facility

Compost Facility in Texas Biosolids with Shredded Wood

15 Windrows ~ 7,500 cy
Problem: No Room to Expand
Turned Windrows

~ 2.4 acres
Site Dimensions and Turned Windrow Capacity

- Site Dimensions: 350-feet x 300-feet: ~2.4 Acres
- Windrows: 16-feet wide, 6-feet high, 300-feet long
- Windrow Volume: ~ 500 cubic yards / windrow
- 15 Windrows: Total Volume ~7,500 cubic yard
Turned Windrows

~ 2.4 acres

350-feet

300-feet
EASP Batch Flow-Through Composting

Bailey Compost, Snohomish, Washington
Section View of an Extended ASP

Unscreened Compost Cover

Mix

Cell 1

Cell 2

Cell 3

Cell 4

Screen Overs Plenum

W'

H'
Extended Aerated Static Piles
Site Dimensions and EASP Capacity

- Site Dimensions: 350-feet x 300-feet: ~2.4 Acres
- EASP: 80-feet wide, 135-feet long, 10-feet high
- EASP Volume: ~3,250 cubic yards / EASP
- 7 EASP’s: Total Volume ~22,750 cubic yards
- Increased Capacity: 22,750 cy / 7,500 cy = 3x
- Tow Beside Windrow Turners: 6x – 8x
Extended Aerated Static Piles
Extended ASP Composting
Continuous Flow “Wedge” Method

Envirofert Compost, Auckland, New Zealand
Blowers & Manifold System

Auckland, New Zealand
Advancing / Receding Faces

Auckland, New Zealand
Advancing / Receding Faces

Auckland, New Zealand
PART 7
RESOLVING ODOR IMPACTS & NEIGHBOR COMPLAINTS

Aerated Static Pile Composting
The Challenge

Offensive Odors are the single most common reason for compost facility closure.

Impacted neighbors become upset, organized and relentless in their goal to shut down offending compost facilities.

Despite this, they are not the enemy!
Turning Windrows

Core Gases Released from an anaerobic compost windrow in an effort to reestablish aerobic conditions within the pile.

Odors can be particularly strong and offensive when the feedstocks consist of high nitrogen manure, grass clippings and food waste.

Photo: BioCycle Magazine
Extended Aerated Static Pile

No Pile Turning during the first 30-days of Active Composting

Blowers Operated by On/Off Cycle Timers

Easy to Maintain Aerobic Conditions Throughout the Pile

Photo: Ned Foley Two
Particular Acres Compost, Royersford, PA
Oxygen Consumption with Time

- Aerobic
- Anaerobic
Most Odors are By-Products of Anaerobic Respiration

- Rotten Eggs - dimethyl sulfide, hydrogen sulfide.
- Rancid Fats, Oils & Grease - butyric acid.
- Dead Animals - putrescine, cadaverine
- Fishy – trimethyl amine
- Pine - terpene.

➢ Ammonia – not $O_2$

conditions > function (pH)
Figure 1. Composting odor wheel

Source: “Sensory Assessment and Characterization of Odor Nuisance Emissions during the Composting of Wastewater Biosolids,” Water Environment Research, Volume 81, Number 7
How Do Anaerobic Compounds Form?

Under conditions that restrict the entry of oxygen into feedstocks or compost piles.

- High moisture content
- Inadequate porosity (high bulk density)
- Rapidly degrading substrates
- Excessive pile size
How do you remediate anaerobic metabolism?

ADD OXYGEN
AND MAKE SURE THE MIX WILL SUPPORT AEROBIC MICROBES!
Section View of an ASP

- Unscreened Compost Cover (1-foot)
- Insulating Layer (PFRP)
- Biofiltration Layer
- Nutrient Retention
- Vector Barrier
- Moisture Retention
- Improve Aesthetics

Rule of Thumb:
Max Pile Length 75 – 80-feet
VOC Emission Reduction Study

Tulare, CA 2012
Odor Evaluation

Gathered Representative Samples from the Surface of Compost Piles

Evaluated Odor Character and Strength by Off-Site Odor Panel

Evaluated Constituent Gases

Measured VOC and GHG Emissions.

C.E. Schmidt Environmental Consultants
The Benefits of ASP Composting with a Biofilter Cover Layer

### Table ES-1: Results in emissions testing in pounds of pollutant per ton of feedstock over the 22-day active composting period

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatile Organic Compounds – VOC’s</td>
<td>98.8 %</td>
</tr>
<tr>
<td>Ammonia – NH₃</td>
<td>83.2 %</td>
</tr>
<tr>
<td>Carbon Dioxide - CO₂</td>
<td>71.9 %</td>
</tr>
<tr>
<td>Methane - CH₄</td>
<td>13.0 %</td>
</tr>
<tr>
<td>Nitrous Oxide - N₂O</td>
<td>88.8%</td>
</tr>
</tbody>
</table>
Steps to Minimize Offensive Odors

1. Receive and Process Odorous Wastes Promptly
2. Provide Adequate Carbon-Rich Bulking Material
3. Establish a Bulk Density of 650 – 950 pcy
4. Place on an Aeration System ASAP
5. Cover with a Biofilter Layer (unscreened compost)
6. Maintain Aerobic Conditions for the first 30-days
People “Smell with Their Eyes”

- Good Housekeeping
- Clean-up Receiving Areas
- Temporary Covers on top of Raw Feedstocks Overnight
- Clean Ditches and Puddles
- Aerate Stormwater & Leachate Ponds
- Correlate Meteorological Conditions and On-Site Activities with Complaints

Lenz Enterprises - Stanwood, WA
Aerated Static Pile Composting

PART 8

REDUCING OPERATING COSTS
Extended Aerated Static Piles
Turned Windrows

~ 2.4 acres
Site Dimensions and EASP Capacity

- Site Dimensions: 350-feet x 300-feet: ~2.4 Acres
- Windrow Volume: ~ 7,500 cubic yards
- 7 EASP’s: Total Volume ~22,750 cubic yards
- Increased Capacity: 22,750 cy / 7,500 cy = 3x
- Tow Beside Windrow Turners: 6x – 8x
- Increased Cycle Time: 1 ½ - 2x cubic yards / year
Composting Flow Chart

- Analyze Markets
  - "Begin with the End in Mind"[2]
- Process Review
  - Observe
  - Survey
  - Adjust
  - Continue
- Develop Mix Recipes
- Acquire Feedstocks
- Import Amendments
- Combine Bulking Agents
- Prepare Initial Mix
  - Sort, Grind, Chip & Blend
- Active Compost
  - Low Tech
  - High Tech
- Curing
  - Time
- Screening
- Compost Product
  - Quality Assessment
- Temporary Storage
- Deliver Product to Market
- Product Refinement
  - Blending and Bagging
- Screen "Overs"

Flow Chart: Adapted with permission from the "On-Farm Composting Handbook," NATCE 04 June, 1992
## Process Comparison

<table>
<thead>
<tr>
<th>Turned Windrows</th>
<th>Aerated Static Piles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windrow Construction</td>
<td>Pile Construction</td>
</tr>
<tr>
<td>Windrow Turning 8-16x</td>
<td>No Pile Turning</td>
</tr>
<tr>
<td>Time on Pad: 6 – 8 wks</td>
<td>Time on Pad: 4 – 6 wks</td>
</tr>
<tr>
<td>Pile Deconstruction</td>
<td>Pile Deconstruction</td>
</tr>
<tr>
<td>Move to Curing</td>
<td>Move to Curing</td>
</tr>
</tbody>
</table>
## Process Comparison

<table>
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<td>Pile Deconstruction</td>
</tr>
<tr>
<td>Move to Curing</td>
<td>Move to Curing</td>
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</tbody>
</table>
Windrow Turners

Self Propelled Straddle Type Windrow Turner
16-feet wide by 7-feet high
<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turned Windrows – 22,750 Cubic Yards</td>
<td>$600,000 - $850,000</td>
</tr>
<tr>
<td>Investment</td>
<td>$600,000 - $850,000</td>
</tr>
<tr>
<td>Life Expectancy</td>
<td>4 – 6 years</td>
</tr>
<tr>
<td>Labor</td>
<td>80 hrs/mo.</td>
</tr>
<tr>
<td>Fuel Cost</td>
<td>$YY / mo.</td>
</tr>
<tr>
<td>Routine Maintenance</td>
<td>$ZZ / mo.</td>
</tr>
<tr>
<td>Major Repairs</td>
<td>$10,000 - $20,000/yr</td>
</tr>
<tr>
<td>Insurance</td>
<td>Strongly Recommended</td>
</tr>
</tbody>
</table>
## Aerated Static Piles – 22,750 Cubic Yards

<table>
<thead>
<tr>
<th>Item</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment</td>
<td>$25,000 - $50,000</td>
</tr>
<tr>
<td>Life Expectancy</td>
<td>20 years (plus)</td>
</tr>
<tr>
<td>Labor / Site Inspections</td>
<td>2 hrs/wk or 8 hrs/mo.</td>
</tr>
<tr>
<td>Power Installation Cost</td>
<td>$15,000 - $30,000</td>
</tr>
<tr>
<td>Power Operating Cost</td>
<td>$100 - $250 / month</td>
</tr>
<tr>
<td>Maintenance &amp; Repairs</td>
<td>Incidental</td>
</tr>
<tr>
<td>Insurance</td>
<td>None Recommended</td>
</tr>
</tbody>
</table>
How Much Will My Compost System Cost to Build?

There are Three Cost Components:

• O2Compost Training Program
• Construction Materials
• Construction Equipment and Labor
## Average System Costs

<table>
<thead>
<tr>
<th>O2Compost System</th>
<th>Style</th>
<th>O2C Training</th>
<th>Materials</th>
<th>Constructio n</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro-Bin</td>
<td>Portable</td>
<td>$675</td>
<td>$325</td>
<td>0</td>
<td>$1,000</td>
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<tr>
<td>Macro-Bin</td>
<td>Fixed</td>
<td>$1,675</td>
<td>$500</td>
<td>$250</td>
<td>$2,425</td>
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<tr>
<td>Cornerstone ASP</td>
<td>Portable</td>
<td>$2,475</td>
<td>$250</td>
<td>0</td>
<td>$2,725</td>
</tr>
<tr>
<td>Cornerstone 3-Bay</td>
<td>On-Grade</td>
<td>$2,475</td>
<td>$2,525</td>
<td>0</td>
<td>$5,000</td>
</tr>
<tr>
<td>Cornerstone 3-Bay</td>
<td>Top-Down</td>
<td>$2,475</td>
<td>$2,500</td>
<td>0</td>
<td>$4,950</td>
</tr>
<tr>
<td>Sterling 3-Bay</td>
<td>On-Grade</td>
<td>$3,975</td>
<td>$3,525</td>
<td>$2,500</td>
<td>$10,000</td>
</tr>
<tr>
<td>Sterling 3-Bay</td>
<td>Top-Down</td>
<td>$3,975</td>
<td>$3,525</td>
<td>$4,000</td>
<td>$11,500</td>
</tr>
<tr>
<td>Paragon</td>
<td>On-Grade</td>
<td>$3,000</td>
<td>$5,250</td>
<td>$2,500</td>
<td>$10,750</td>
</tr>
</tbody>
</table>
How Much Will My Compost System Cost to Operate?

There are Four Cost Components:

• Time to Prepare the Mix and Fill the Bin
• Time to Monitor the Composting Process
• Time and Equipment to Remove the Compost
• Electrical Power
What About Getting a Grant to Help Pay for My Compost System?

- Paper Work, Paper Work, Paper Work
- This Process Can Take 12 to 18 months
- More Stringent Construction Standards
- Cost Share of $1 : $1 After Construction
- Often it’s “Hurry-up and Wait”
- Open Invitation to Visitors
Return on Your Investment

Reduce Expenses
- Hard Costs
- Soft Costs
- Environmental Costs
- Intangible Costs

Create Benefits
- Product Sales & Profits
- Improve Horses’ Health
- Improved Aesthetics
- Sustainable Agriculture
Hard Costs

Eliminate Disposal Expense
Soft Costs

• Owner’s Time and Effort
• Inefficient Use of Labor
• Excessive Bedding
• Fuel Costs
• Equipment Maintenance & Repairs
• Veterinarian Bills
Improving Horses’ Health

Lush Pasture Grass - Parasites and Weeds?
When to Call Your Vet?

• Soft Costs
  o owners’ time,
  o fuel and equipment,
  o horses’ health,

Ascarid Impaction of SI
Environmental Costs
Protecting Aquatic Life

The Chesapeake Bay watershed is 64,000 square miles.

It has 11,600 miles of tidal shoreline, including tidal wetlands and islands.

The watershed encompasses parts of six states.

Approximately 17 million people live in the watershed.

About 10 million people live along its shores or near them.
Protecting Aquatic Life

Ammonia in Small Concentrations is Toxic to Salmonoids
Protecting Aquatic Life

High BOD and Nutrients in Runoff
Intangible Costs

- Human Health
- Neighbor Complaints
- Regulatory Compliance
- Poor Aesthetics & Lost Business
- Deferred Maintenance
- Frustration and Sleepless Nights
Protecting Human Health

Nitrates in the Ground Water
Benefits of Using Compost

- Convert Nutrients to plant available forms
- Increase soil organic content
- Decrease soil compaction
- Improve pasture grass, reduce weeds
- Increase infiltration and moisture retention in soil
- Decrease soil erosion
Soil Horizons

Topsoil is a Complex Living Organism

Organic Soil
Mineral Soil
Parent Material
Soil is a Complex Living Organism
Q&A

Oklahoma

Massachusetts

Washington

New Jersey

Maryland

O2C compost
Compost Systems & Training
Aerated Static Pile Composting
Applications and Opportunities

THANK YOU

PETER MOON - O2COMPOST