

Lessons Learned in Aerated Static Pile (ASP) Composting



**MICHAEL BRYAN-BROWN, GREEN MOUNTAIN TECHNOLOGIES,
BAINBRIDGE ISLAND, WA**

JEFF GAGE, COMPOST DESIGN SERVICES, OLYMPIA, WA

ASP Lessons Learned Overview



- Pile porosity, moisture and height must be consistent
- Pile covers can contain or treat odors but may restrict airflow rates, slowing the process
- Air distribution systems must match feedstock volatility and the potential rate of decomposition
- Temperature and/or oxygen feedback control systems need to accommodate process extremes
- ASP's are only one part of the compost process
- Turning and rewetting systems must follow for most energetic feedstock mixtures

Air flow Rates for Maximizing VS Reduction

- Determining the Degree of Aerobiosis of Composting Materials
 - 65° C with bulking agent
 - Oxygen discharge concentrations above 13% reduced anaerobic pockets
 - Oxygen consumption rates of over 4.5 to 8.4 mg O₂/g vs*hr were achieved which reduced VS at a significantly higher rate than those below 13%
 - ✦ Klauss, Papadimitriou in ORBIT Bioprocessing of Solid waste and sludge Vol 2 No.1, 2002
- Air flow rates should be for a 3 meter high pile 35-40 m³/hr/m² during the high oxygen demand period of composting over the first 3 to 5 days to provide adequate cooling to 65° C and oxygen levels above 13% for a green waste/food waste blend. This will maximize VS reduction and dry the pile.
- Within a large compost pile the moisture loss = energy loss = work done

Reducing Volatile Organic Compound Emissions



- Lifecycle VOC emissions from green waste composting in windrows were measured at less than one pound of VOCs per ton of compost feedstock
- Generation of VOC from Green Waste Windrows 70-80% in the first 2 weeks
- Doubled VOC emissions by adding Food Waste
- Using compost as a cover reduced emissions by 75% compared to uncovered pile
- San Diego State University - pseudo compost covers report
<http://www.ciwmb.ca.gov/publications/organics/44207009.pdf>

The Role of ASP's in a Compost Process



Desired Role

- Capture and treat initial odorants during the first 7 to 10 days
- Provide temperature control to meet initial sanitation requirements
- Significantly reduce volatile solids

Process Consequence

- Media dries as energy is released as water vapor
- Settling reduces pile porosity
- Surface precipitation can create veins of saturation
- Odors can form
- Compost process slows

ASP Systems



Aeration system

- Positive aeration →
- Negative aeration →
- Alternating positive and negative aeration →

Cover system

- Biofilter layer 15-30 cm
- Selective membrane
- Wood chips, overs
- Perforated membrane
- Fixed Biofilter
- Biofilter layer 15-30 cm
And
- Fixed Biofilter

ASP Systems



Air Distribution Systems

- Above ground perforated pipes
- Trenches with perforated covers
- Spargers from pipe manifolds
- Under-pile cavity forming



Silver Springs Organics, Tenino,
Washington

Alternating Direction ASP



Positive w/Biofilter layer

Perforated trench covers at 7" pressure



Lenz Enterprises, Stanwood,
Washington, USA

Negative with Biofilter

Pulled from pile at 10" suction





High Tech to Low Tech alternating directions

In-vessel or in an open pile, aerated static piles can be cheap or expensive, but must still be filled carefully to reduce short circuiting of air flow.

Consistent porosity

Consistent moisture

No driving on pile edges



West
Yellowstone
Compost
Facility



Cold Creek Compost, Ukiah, CA



Assisting Trench Cover Systems

Drill out larger holes in plates, or add more, but check air distribution engineering

Place coarse woody material over the trench covers

Or better yet, have the engineers design the system for higher pressures and more air flow.



Lenz
Enterprises,
Stanwood
WA



Port
Angeles
WWTP
WA



Assisting Above Ground Pipe Systems

Same issues as Negative
aeration

1/3 less horsepower
than negative aeration

Perimeter drainage
berm for reducing
leachate generation

Smaller individual
blowers per pile can
improve efficiency



Positive Aeration
North Mason Fiber,
Silverdale WA



Assisting Above Ground Pipe Systems

Keep pile pipe lengths
relative to diameter or
hole spacing engineered
for even flow

Sewer perforation pipe
does not work for air
flow distribution

Step down manifold
diameters to maintain
air velocity

Keep pipe velocity
below 15 m/s

Damper seals

Negative aeration
Washington State
University, Pullman



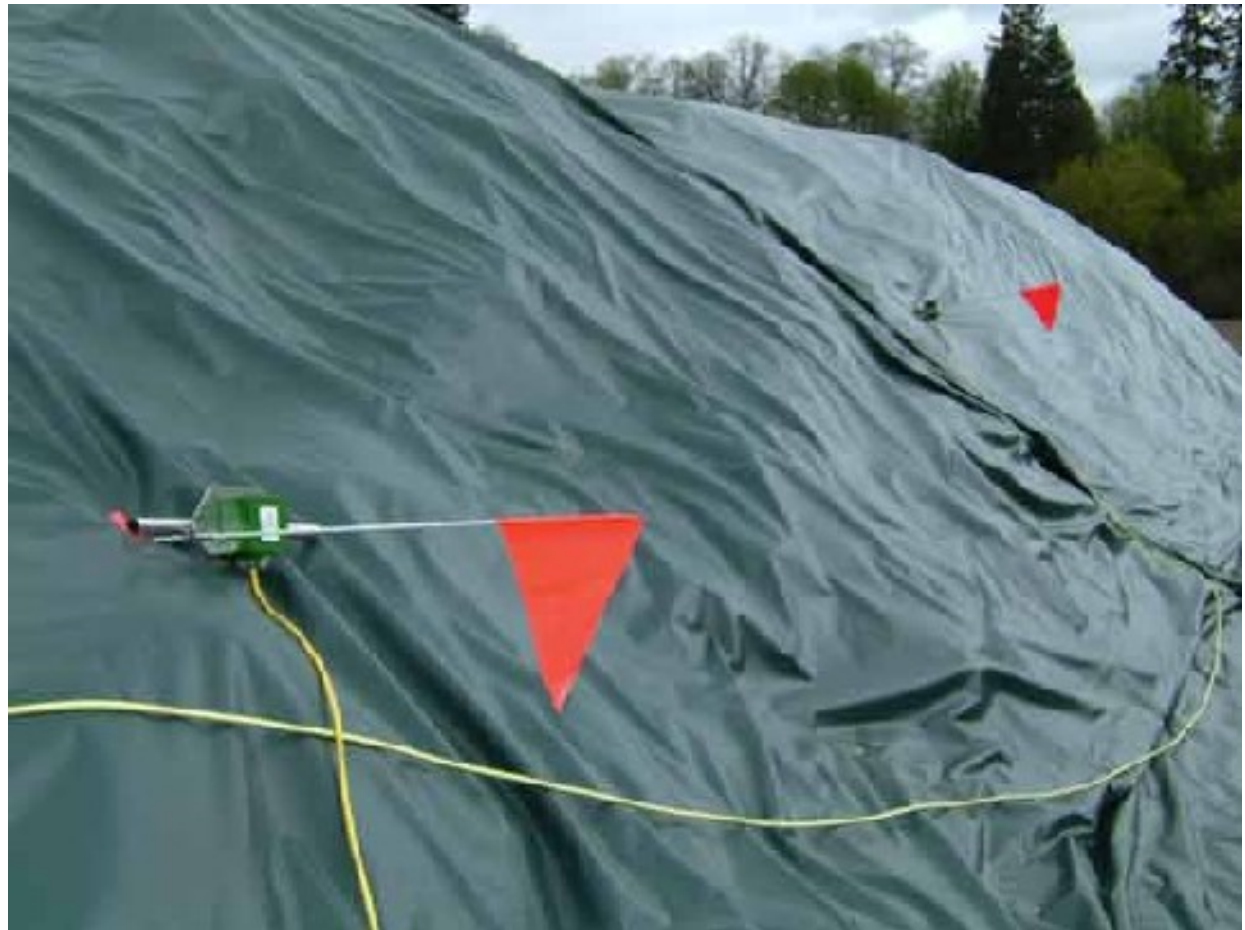


Probe locations

Where you measure oxygen or temperature is important to the control of air flow

Multiple sensors on a probe allow for understanding when to reverse airflow

Checking the representation of probe placement is important as well





Lowering pile height

Temperature control is easier the lower you get

A single direction air flow can reach temperature saturation ($>65^{\circ}\text{C}$) in 1.2 meters

Reversing air flow allows for a 2.5 meter pile to be effectively cooled





Covering piles

Covering piles reduced the temperature variability

Condensate forms in the top layer

Oxygen levels stayed high and drying still occurred





Turning and rewetting

It is essential to allow adequate moisture to be replaced to continue rapid decomposition

Rewetting during turning is the best way to provide uniform rewetting





Extended pile stabilization





Extended Pile Stabilization

Air flow continues through large particle redistribution. Even without forced air





Extended Pile Stabilization

Forced aeration provides significantly more drying and cooling



Finished Compost - Stable in 34 days

