Section 8 – Aerated Bin Start-up Procedures

8.1 Introduction

If you are reading this Training Manual for the first time, the photos and schematic drawings included in Section 8.15 will serve as a good overview of how we like to operate our aerated compost bin systems.

If you are now at the stage where your O_2Compost System is fully constructed and you are ready to start composting, I encourage you to pay particular attention to Sections 8.2 through 8.14 and to go back and re-read Sections 1 – 6 in their entirety.

8.2 Test the Blower & Timer

Before you begin to fill your first compost bin, check to confirm that the blower and timer are operating properly.

- Plug the blower directly into the power outlet and turn the blower ON.
- Open one valve (pull it all the way out) and close the remaining valves.
- Check the outlet pipe in the plenum box (aeration floor) to confirm that air is flowing.
- Repeat for each of the bins.
- Connect the timer to the power outlet and plug the blower into the timer.
- Set the timer so that it turns On for ~1-minute and Off for ~2-minutes.
- Allow it to cycle On/Off a few times to confirm that it is operating properly.

8.3 Conduct the Wood Pellet Moisture Test (Provided)

Our goal is for the compost mix to have an initial mositure content of 60 – 65% as it goes into the compost bin. If the moisture content drops much below 50% during the composting process, composting (i.e., the biologic activity) will stop and no further degredation of the compost mix will occur. Refer to Appendix C – Laboratory & Field Tests To Determine Moisture Content.

With your equipment package, we have provided two Ziploc bags, each containing 1 cup of wood pellets. Conduct the following tests to demonstrate the “just right” moisture content and the “too dry” moisture content.

- **Just Right:** Add 1¼ cups of water to one of the bags of pellets, then close the bag and allow it to sit for 1 hour. After 1 hour, mix the contents thoroughly and then squeeze a handful of the wet sawdust very tightly. You should be able to get a drip or two to come out of the sawdust and the palm of your hand should be somewhat wet. The moisture content of this mix is ~65%

- **Too Dry:** Add ¾ cups of water to the second bag of pellets, then close the bag and allow it to sit for 1 hour. After 1 hour, mix the contents thoroughly and then squeeze a handful of the wet sawdust very tightly. The material will feel slightly moist and will stick together, but you will not be able to get it to drip and the palm of your hand will be dry or show a faint wet sheen. The moisture content of this mix is ~50%.

Maintaining a moisture content in the compost pile >50% is of critical importance.

The moisture content of the compost mix must be adjusted as it is going into the bin. This can be done in two ways:

- As you are collecting the waste (i.e., mucking out the horse stall), add water into the bucket or cart at that time. This will give the mix time to absorb the water as you move about the barn and then deliver the manure to the compost bin.
- Alternatively, you can add the waste to the bin and then sprinkle it with water on top. It helps to use a long-tined rake to mix the materials to a depth of about 4 – 6 inches.

Important Note: If you add dry material to the bin and do not add water as it goes in, you will not be able to spray the top of the pile and wet the mix thoroughly from top to bottom. If this occurs, you will need to transfer the dry material to another bin and wet it thoroughly as you do. This of course means extra work and should be avoided at all costs.

Maintaining a moisture content in the compost pile <70% is also of critical importance

If the moisture content of the mix is much above 70%, the void spaces in the compost mix will be partially filled with excess water and this will prevent proper aeration. This in turn may lead to anaerobic conditions, slower rate of composting, and the production of offensive odors.

This situation most often occurs with wet feedstocks; for example those that consist predominantly of manure (with little to no bedding), food waste, biosolids and other very wet substrates. This can be determined by conducting bulk density, free-air space and moisture content field tests as described in Appendices B, C & D of this Training Manual.

The solution to a mix that is excessively wet is to add dry bulking material in the form of wood chips, wood pellets or shavings. The objective of adding dry bulking material is to: 1) absorb excess water; and 2) establish structural porosity in the mix.

The compost pile will lose moisture during the first 30-days of composting

The moisture content of the pile will typically reduce by 10% to 15% during the first 30 days of composting. This is particularly true during the cold weather seasons because cold air is also very dry air with a very high moisture holding capacity.

8.4 Installing the Plenum Layer

Before you begin filling your first aerated bin, it is important to place a wood chip plenum layer on top of the pipes or aeration channels. The plenum material prevents the restriction of airflow (i.e., it gives the air a place to go) and it helps to spread the airflow evenly across the floor of the pile. (Refer to Section 3.10)

In those instances where the mix is too wet and drains water (>70% moisture content), the plenum layer also absorbs excess water to help prevent the formation of compost leachate.

To prevent short-circuiting of the airflow, it is very important that the plenum material not extend closer than 1 foot to the four side walls of the compost bin.

8.5 Filling an Aerated Bin

In addition to the six compost mix parameters described in Section 3.9, it is important that the initial mix be a homogeneous blend of materials, and not stratified. Layers, such as grass clippings, straw or paper products, will collapse during the composting process and impede uniform airflow through the mix.

The compost pile or aerated bin can be constructed as a single event or over a period of 3 to 4 weeks. In either case, it is important that the compost mix consist of relatively fresh materials. If the mix components are much over 6 weeks old, some of the energy of the feedstocks has been lost and pile temperatures will not be as high as with fresh materials.

8.6 Covering the Raw Mix of Materials

The compost cover is critical to the ASP method of composting and serves six important functions, as discussed in Section 3.10.

With a free-standing ASP System, I recommend that you cover the pile with at least 12 inches of previously composted material. It is very difficult to place a thinner layer using a front-end loader because the excess material flows down the side slope of the pile.

With an aerated bin, it is sufficient to place a 6-inch thick layer over the raw mix and spread it evenly with a rake or shovel.

You may ask yourself, “What do I use to cover my first pile? – I don’t have any compost yet.”

This is an excellent question. You can cover your first pile with old, decomposed material from an old manure stockpile or you can use stall bedding from one or more of your stalls. When this first pile has completed the Active Phase, you can scalp this uncomposted layer and add it to one of the other bins.

As a compromise, you can forego the cover layer with the first batch and then "scalp the upper 12 inches from the pile, place it on top of your second or third batch, and then place the next 12 inches of compost on top of that layer. In this way, all of the material will eventually reach temperatures sufficient to inactivate parasites, pathogens and weed seeds.

For all future batches, it will be important to reserve some of your compost for the cover layer.

8.7 Managing Flies and Odors as You Fill the Bin

The gestation period for most flies is 3 to 5 days. As you fill the compost bin each day, fly larvae will be covered up and hatchlings will not emerge from the pile to become a problem.

If flies and odors do become a problem during the hot season, they can be easily managed by placing an inch or so thickness of finished compost on top of the raw manure. This should be mixed in with the underlying raw manure before adding new waste on top.

8.8 Conduct a Smoke Test (Provided)

When the first bin is full and before you begin the aeration process, conduct a smoke test check to confirm that the blower and timer are operating properly. Two smoke emitters have been provided with your aeration equipment package. Follow the instructions that are provided in Appendix D: Smoke Test Instructions. The objective of this test is to visually check for air leaks and short circuiting of the aeration system.

8.9 The Initial Timer Setting

There are three levels of airflow with aerated static pile composting, the least of which meets the microbial demand necessary to optimize the biology of the compost system (refer to Section 3.13). For this reason, I always like to start with a minimum level of airflow to encourage the micro-organisms to multiply and diversify and produce heat. If the mix is cold and we apply too much airflow, we will very likely overwhelm the system and prevent the accumulation of heat.

Therefore, **I recommend starting with an ON time of 30-seconds and an OFF time of approximately 30-minutes as your initial setting**. This setting does not have to be precise, but the relative ON / OFF cycle time is important.

As the pile temperature increases, we will have the opportunity to increase the airflow to manage the composting process. Notice that I used the word "manage" and not the word "control". Making an adjustment to the On/Off cycle times will likely result in a change in pile temperatures, however this change will generally take 12 to 24 hours to occur.

Therefore, when making a change to the aeration setting it is important to: 1) make only one change at a time; and 2) wait for at least 24 hours to see how the pile temperatures respond. If we make multiple changes and we don't allow sufficient time for these changes to manifest themselves, we won't know which change has influenced the process or to what degree.

8.10 Initial Valve Setting

There are three ways to control the airflow into an aerated compost pile / bin. The first two are the duration and frequency of airflow as determined by the On/Off cycle times. The third way is with a valve to restrict the volume of air that is delivered to the pile during the On cycle.

All O_2Compost Bin Systems include slide gate valves (simple push-pull valves) to control the direction and volume of airflow to any one or combination of compost bins.

When first starting the airflow to a new compost bin, I suggest starting with the valve in the full-open position. We will observe the pile temperatures over the first week and provide suggestions for adjusting the valve setting if we feel that fine-tuning of the airflow is needed.

8.11 Record Initial Pile Temperatures

As stated previously, our goal is for temperatures to exceed 131^{o}F throughout the compost pile for a minimum of 3 days. (Refer to Section 3.7). With high energy feedstocks (low C:N) this is typically an easy goal to reach. However, with low energy feedstocks (high C:N), attaining the desired temperatures can be very challenging.

It is equally important to observe the relative changes in temperature over time and to monitor the trends of these changes. To this end, it is important to take initial pile temperatures to establish a baseline.

If you have constructed your ASP System or filled your bin in one day, the pile temperatures will be near or slightly above ambient air temperatures. If, on the other hand, you constructed your pile or filled your bin over a period of several weeks, the core of the pile will likely be relatively hot. In either case, it will be important to observe the changes in pile temperature that results from the addition of airflow.

The procedures for taking and recording pile temperatures are discussed in Section 8.1, below.

8.12 Testing the System to Confirm Proper Airflow

You will notice during the first week of composting that the top of the compost mix will begin to drop. This is due in part to consolidation of the mix and a resulting decrease in porosity. This decrease in porosity causes an increase in back pressure against the blower and a decrease in airflow into the pile. It is therefore a good idea to check to confirm that we are still delivering air into the pile.

Safety First: The air inlet is a circle on the side of the blower (the opposite side from the motor). There should be either a plastic grate or wire mesh that prevents you from inserting your fingers into the impeller wheel. If this protection is missing, do not proceed with the following test. The impeller wheel turns at about 3,500 revolutions per minute and it will do considerable bodily damage if you are not careful. Please be careful.

Test 1: With the blower running and the valve to only one of the compost bins in the full-open position put your hand over the air inlet on the side of the blower. You should feel a definitive vacuum all around the inlet circle.

If you feel airflow "luffing" back out near the top of the inlet circle, then we have somehow developed an obstruction in the aeration system. If this is the case, please refer to Appendix E – Troubleshooting Guide and call O_2Compost for further instruction.

Test 2: In the morning when the air is cool and calm, turn the blower On and observe "steam" coming off the top of the pile.

Test 3: With the blower running, smell the top of the pile. The odors that are emitted should have a "friendly" organic odor, which confirms that the compost is aerobic. You can also dig down into the pile a depth of 12 – 18 inches and smell the odors coming from the core.

If these odors are strong, sour and generally offensive, we may have insufficient airflow into the pile. In this case, refer to Appendix E – Troubleshooting Guide and call O_2Compost for further instruction.

8.13 What You will Likely Experience the First Day or Two

Now that the timer is set and the valve is adjusted and you have confirmed that the blower does indeed cycle On and Off, you ask yourself, "Now What?"

During the first few aeration cycles you may notice a sour odor coming off the pile. This is anaerobic gases being displaced out of the core of the pile. This will soften and become more pleasant within the first hour or two of aerated composting.

During the first 12 to 24 hours, the pile temperatures can be expected to climb quickly, often 20 to 40^{o}F overnight. This is particularly true with a high energy / high porosity mix and less so with a low energy / low porosity mix.

The first morning, when the air is cool and still, you will also likely see steam coming off the top of the pile, especially when the blower turns On. This is an excellent indication that you are getting good airflow through the mix. The moisture from the steam will also condense on the surface of your cover layer and turn it a dark brown. Variations in the moisture / color will indicate where you have preferential airflow and shallow areas may need to be raked out a bit.

During the first week or two, you will also see some obvious settling of the top, perhaps as much as 6 to 12 inches. This results initially from consolidation of the underlying materials due to the weight above and later due to decomposition of the raw materials in the compost mix.

Also after a week or two, if you dig down into the mix a few inches, you will likely see a white fibrous material – Actinomycetes. This is a cross between bacteria and fungi and is ubiquitous in nature. It helps to degrade the more resilient forms of carbon in the mix and is typically present in oxygen rich sections of the compost pile.

Toward the end of the Active Phase, it is not at all unusual to see mushrooms growing out of the top of the pile. These too are degrading the more resilient forms of carbon in the mix and are a good thing. I have no idea what type of mushrooms they are so PLEASE DO NOT EAT THEM.

8.14 Arriving at the Point Where "You Don't Know What You Know"

During the first batch or two you will likely ask yourself "Am I doing this right?" and like many of us, you'll fret that you're making a mess of things. Remember, the most import thing is "Don't Panic".

When you dig into your first batch, it probably won't be perfect. You will likely see some dry spots or saturated spots or areas that obviously didn't compost. The key is to observe the pile as you are removing it from the bin and learn from what you see.

It may happen in the first batch, or the second or the third but eventually you will have what I like to call, "An A-HA Moment". You will see uniformly dark compost that looks just like what you would expect it to look like and you'll say to yourself, "OK, Now I Get It. It Does Work".
If you are like me, you'll get excited and tell (bore) everyone you know about what you're able to do – convert raw manure into GOLD. But alas, the excitement will wear off after a while and you'll go about your business making compost week in and week out, year after year.

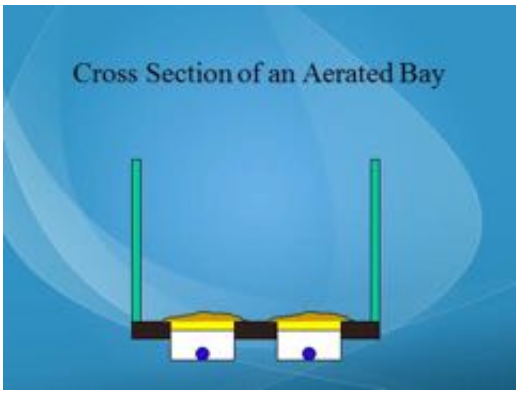
And you will have arrived at the point where "You Don't Know What You Know" about composting. And when your friends ask you, "How'd you figure all this out?" simply reply – "O_2Compost – give them a call".

8.15 Photo / Schematic Example

The following series of images depict the sequence of steps using both photographs and schematic drawings. The photographs are from Liberty Bell Horse Farm in Snohomish Washington. This system utilizes a top-down configuration, with a concrete block back wall and lumber dividing walls. Each of three bins has two aeration plenum boxes, with 2 by 6 lumber used for the aeration floor. The boards are spaced approximately 3/8 inch apart, and the top of the boards are recessed about ¼ inch below the surface of the concrete.

1. 3-Bin, Top Down System

2. Two Plenum Boxes

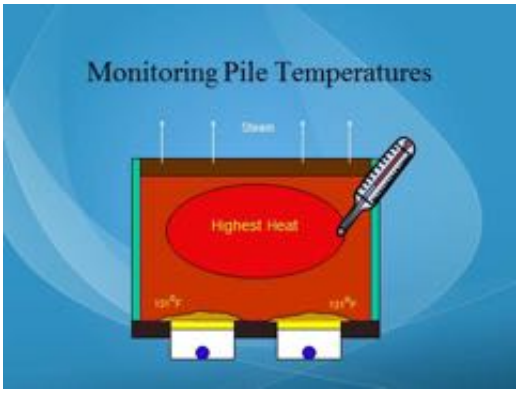


3. Empty Bin with Shavings as a filter

4. Fill Bin over a period of 3 to 4 Weeks

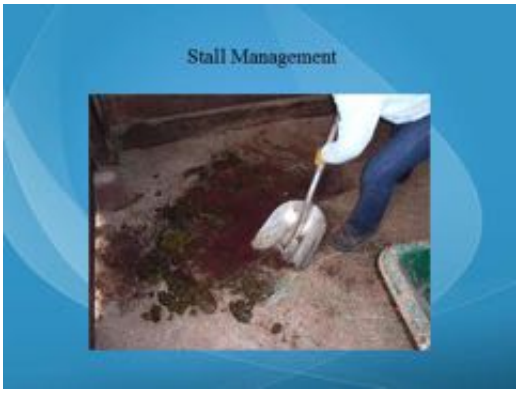
5. Place Cover Over Raw Mix

6. Set Timer and Start Airflow



7. Check and Record Pile Temps

8. Acitve Composting / Settlement



9. Scoop Out Saturated Areas

10. Sift Out Solid Manure

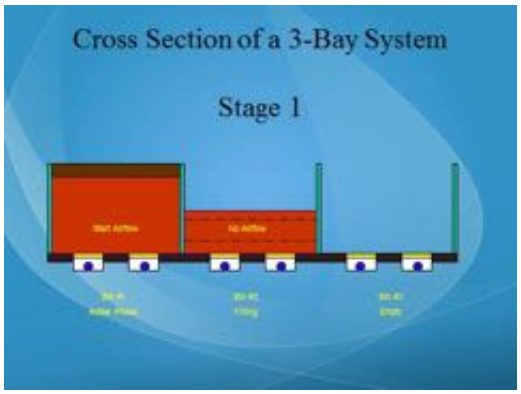
11. Moisture Condition Mix

12. Deliver Manure to the Bin

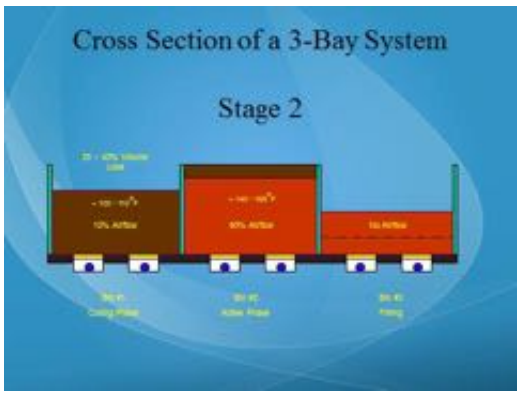
13. Place Compost Cover

14. Spread Compost Cover Evenly

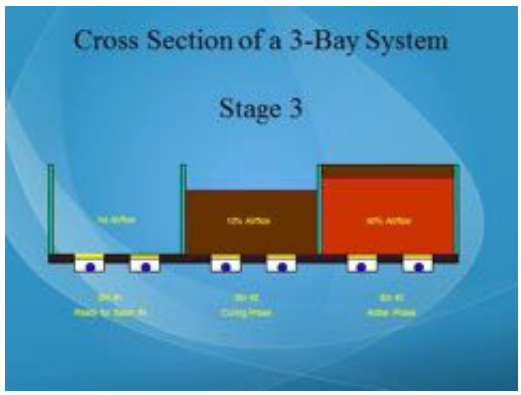
15. Goal: Pile Temps > 131^{o}F



16. First Bin Full, Filling Second



17. Second Bin Full, Filling Third



18. First Bin Now Ready to Fill Again

Appendix A - Safety and Hygiene

Feedstock Handling

While working with raw compost feedstocks, it is important to remember the following:

- Avoid hand to mouth transmission of contaminants and disease causing organisms;
    - Do not eat or drink while working with raw feedstock materials
    - Do no smoke in the vicinity of combustible feedstock materials
    - Do not rub your eyes or pick your nose
- Wear gloves, especially when handling raw manures and food waste
- Wash hands thoroughly (at least twice) after completing field work
- Wash your face, forearms, fingernails and back of hands – thoroughly
- Clean off boots before reentering public office areas

Personal Protective Equipment

- Rubber gloves and work gloves
- Boots
- Overalls
- Hearing protection
- Safety glasses
- Radio communication

Heavy Equipment

- Heavy equipment is dangerous and can lead to accidental injury or death
- Maintain eye contact with the equipment operator
- Use hand signals to communicate your intentions

Confined Spaces

- **Never enter confined spaces without proper training.**
- **Never enter confined spaces alone. Always have a partner on the outside.**
- **Never enter confined spaces without proper air sampling equipment.**

Appendix B – Field Tests

To Determine Compost Mix Bulk Density and Free Air Space

The procedures for measuring pile bulk density simulate the compaction of materials that you would expect under normal composting operations. Dropping the bucket 10 times from a given height helps to keep the measuring process consistent.

Volume of a Bucket

To determine the volume of a plastic bucket for the bulk density and free air space tests, complete the following four steps:

1. Weigh the empty bucket and record its weight (lb).
2. Fill the bucket to the top with water, weigh and record the weight (lb).
3. Subtract the weight of the bucket to determine the weight of water.
4. Divide the weight of water by 8.35 lbs / gallon to determine the volume of the bucket.

Bulk Density

To determine the bulk density (unit weight) of an individual feedstock or a compost mix, complete the following seven steps:

1. Weigh an empty 5-gallon bucket and record the weight; then
2. Fill the bucket 1/3 full with your mix of materials;
3. Raise the bucket approximately 6-inches above firm surface and let it drop 10 times. This will compact the material to reflect actual field conditions;
4. Next, place additional mix in the bucket to fill it 2/3 full then repeat Step 3;
5. Then, fill the bucket to the top with material and repeat Step 3;
6. Finally, fill the bucket to the top (water level) and weigh it to determine the weight of the bucket plus the compacted mix of materials;
7. Subtract the weight of empty bucket from the total weight and record the weight of the compacted materials;
8. The target range for the weight of the compacted material is 16 to 24 pounds

Note 1: A cubic yard is a common unit of measure when dealing with compost. One cubic yard equals a volume that measures 3-feet x 3-feet x 3-feet = 27 cubic feet.

Note 2: There are approximately 200 gallons in one cubic yard. Therefore, there are roughly forty 5-gallon buckets in one cubic yard.

Given the results of Step 8, above, the target range for bulk density is between 650 and 950 pounds per cubic yard, where:

- 16 pounds x 40 ~ 650 pounds per cubic yard (pcy)
- 24 pounds x 40 ~ 950 pcy

Free Air Space

Use the same full bucket from the bulk density test to complete the free air space test. This test uses water to approximate the amount of voids (free air space) in a bucket full of compost materials as an indirect measure of porosity. Complete the following five steps:

1. Place the bucket of material on level ground;
2. Fill the bucket with water completely without overflowing;
3. Weigh the filled bucket. Use caution – the bucket will be heavy;
4. Record the weight and calculate the volume of water in the bucket.
5. Calculate the percentage of voids.

The target range for free air space for compost piles is 35% to 60%

Example

Part 1 – Determine the Bulk Density of a Sample of Raw Feedstocks.

1. Your bucket holds 42 pounds of water and therefore it has a volume of about 5 gallons.

2. You complete the eight steps to determine the bulk density of your mix, and the net weight of materials is 22-pounds.

3. The bulk density of this material is (22-lbs x 40) = 880 lb / CY. This material is within the desired range.

Part 2 – Determine the Free Air Space of this mix.

4. You complete the five steps to determine the free air space of your mix, and the weight of your mix plus water 38 pounds.

5. You calculate the weight of the water by subtracting the weight of the mix: 38 pounds minus 22 pounds = 16 pounds of water.

6. You divide the weight of the water in the bucket by 8.35 pounds per gallon to determine that you have added 16 pounds of water = 1.92 gallons. But we don't like decimal points in composting and therefore we round up to get 2 gallons.

7. You divide the volume of water by the total volume of your bucket to determine the Free Air Space: (2 gallons / 5 gallons) x 100 = 40% FAS.

8. This is an acceptable FAS, albeit somewhat toward the low end of the range.

9. In this example, additional bulking agent (comprised of coarse woody material) could be added to increase the free air space to enhance the porosity for aeration.

10. Adding dry bulking material is also commonly done to adjust the moisture content of wet feedstocks, such as food waste or wet (sloppy) animal manure.

Appendix C – Laboratory & Field Tests

To Determine Moisture Content

Laboratory Test

1. Weigh an oven proof container to determine its tare weight
2. Place a small sample in the container and weigh it
3. Subtract the tare weight to determine the wet weight of the sample
4. Dry the sample in an oven at 220°F for 24 hours
5. Weigh the dried sample and subtract the tare weight
6. Determine the moisture content of the sample using the following equation:

Moisture Content (%) = (Wet Weight – Dry Weight / Wet Weight) x 100

Procedures for the Hand-Squeeze Test

1. Reach into a pile (bucket) and grab a handful of compost mix
2. Squeeze the material very tightly; check for drips of water
3. Release your grip and allow the material to stay in your hand, smear some between finger and thumb;
4. Inspect material and your hand;
5. Use "Rules of Thumb" for Estimating Moisture (see Table B-1, below).

Table B-1: "Rules of Thumb" for Estimating Compost Moisture Content

Observations	% Moisture (Estimate)
Material feels very dry and dusty	42% or less
Material feels mostly dry with a hint of moisture	42% – 47%
Material feels tacky and sticks together	47% - 52%
Material feels moist, but no water comes out when squeezed	52% - 58%
Material leaves a wet sheen on hand	58% - 63%
One or two drops of water come out, bead of water between fingers	63% - 68%
Many drops of water come out during squeezing	68% - 73%
Stream of water from material when squeezed or pudding texture	73% or more

As an example of the desired moisture content, place 1 cup of wood pellets in a Ziploc bag (provided with your equipment package) and add 1 ¼ cups of water to the pellets. Close the bag and allow it to sit for 30-minutes or longer. Mix the contents of the bag and perform the squeeze test as described above. The moisture content of the wood pellets will be ~65%.

Adjusting the Moisture Content

In some cases your initial mix will be too wet. In order to dry the mix you will need to either:

- spread the material out and allow the excess water evaporate; or
- add dry bulking material to the mix.

If the initial mix is too dry, we need to add water as we mix the materials together to make sure we get uniform distribution throughout the mix.

Adding water to a compost pile by simply spraying the top of the pile does not work well. The outer layer of material (perhaps to a depth of 6 – 12 inches) will get wet, but the core of the pile will remain dry. Additionally, if the feedstocks become very dry, they will likely be hydrophobic (i.e., water off of a duck's back) and will require a shearing action like that provided when running material through a manure spreader.

It is surprising how much water is required to change the moisture percentage of the initial mix. The following equation will serve you well in terms of judging how much water will be required:

$$W = Q \times (G - M) / (100 - G)$$

Where:

W = required water mass
Q = Mass of material / feedstock
G = Moisture goal in %
M = Moisture content of material / feedstock in %

Example:

You have 1,200 pounds of yard waste with a moisture content of 40% and your moisture goal is 65%. How much additional water is required?

$$W = 1{,}200 \text{ pounds} \times (65 - 40) / (100 - 65)$$

$$W = 857 \text{ pounds}$$

Water weighs approximately 8.5 pounds per gallon and therefore:

$$W = 857 \text{ pounds} / 8.5 \text{ pounds per gallon} = 100 \text{ gallons}$$

For a given water source (e.g., garden hose), you can determine the volume of water delivered by measuring the time it takes to fill a 5-gallon bucket. Let's assume that you conduct this test and discover that your garden hose fills a 5-gallon bucket in 1 minute.

$$W = 100 \text{ gallons} / 5 \text{ gallons per minute} = 20 \text{ minutes}$$

Appendix D: Smoke Test Instructions

Aerated Static Pile Composting

The method of composting that we use with all of our compost systems is referred to as Aerated Static Pile (ASP) Composting. This simply means that we induce airflow through the mix of materials using an electric blower - we do not turn the pile during the active phase (first 30 days) of composting.

With aerated composting we maintain aerobic conditions throughout the compost pile and are able to control pile temperatures. This, in turn, expedites the composting process and yields a high-quality compost product that is effectively free of pathogens, parasites, and weed seeds. By composting in this manner, we are able to control offensive odors and flies, improve the aesthetics of the waste handling area, quickly produce a superior product and reduce your labor.

Aeration of the compost bin or pile is possible when the airflow is pressurized and confined to the base of the pile. Air leaks (i.e., short circuiting) reduce the effectiveness of the aeration system and therefore compromises the composting process. The enclosed Smoke Generators (produced by Superior Signal Company) will enable you to visually check for air leaks in your new compost system.

This following test can be accomplished by one person; however it is a much easier process with two or more people.

Test Procedure

1. Be sure that the bin is filled to capacity when running this test to provide sufficient back pressure to reveal all significant leaks;
2. Set the timer so that the blower runs continuously;
3. Open the valve to the bin being tested, to the full open position. Close all other valves;
4. Place a smoke generator on a pie tin (or alternate non-flammable surface), light the fuse and hold it next to the air inlet on the side of the blower (duration about 30-seconds).
5. The smoke will be pulled into the blower and distributed through the aeration system.
6. If there are leaks in the system, concentrated smoke will pour out of these openings;
7. If there are no significant leaks, the smoke will emerge in a diffused manner between cracks in boards and then through the compost pile itself. This is what we hope to see.
8. If the system does have significant leaks, these can be closed with caulk or lean concrete.
9. If you have questions, please contact O2Compost to discuss ways to seal the leaks.
10. Two smoke emitters have been provided. Contact us if more are needed for further testing.

Take Necessary Precautions

If you are conducting the test in a populated area, be sure to notify everyone that you will be creating a considerable amount of smoke and to not be concerned. If you are in a highly populated area (e.g., public horse venue, university, prison, etc.) be sure to notify the authorities (including the local fire department) that you will be conducting the test at a specific time. Provide the MSDS Sheet that is included with the smoke emitters to these same authorities before conducting the test.

Safety Note

The smoke is not harmful or malodorous. What odor you will detect is faintly similar to burning paper. Over exposure could be caused if the smoke generator is ignited in a confined area and a person remains in that area for 10-minutes or longer.

Over exposure could result in throat irritation and mucus membrane congestion requiring medical treatment. Should this occur, remove the individual to fresh air and if breathing is difficult, get medical attention immediately. The smoke is non-hazardous and safe when used outdoors as directed.

Link: The Material Safety Data Sheet (MSDS) https://www2.itap.purdue.edu/msds/docs/7967.pdf

Appendix E - Trouble-Shooting Guide

Introduction

From time to time, operational problems may occur with an O_2Compost System. Use this Section as a quick guide to identifying the cause or source of the problem and to identify a way of solving the problems. Common problems involve:

- Offensive Odors
- Low Pile Temperature
- Equipment Failure
- Site Grading Problems
- Vectors
- Other Problems

Some of the more commonly encountered problems at composting facilities are listed together with a guide to potential sources and suggested corrective action. If problem is not easily resolved, contact O_2Compost for diagnosis and recommendations.

■ Offensive Odors

Problem	Solution
Manure remaining on pad	Avoid letting the manure remain on the pad for long periods of time. Mix the bulking agent into the manure as soon as possible.
Blowers are not operating, power is disconnected, fuses are blown.	Replace blowers or correct problem source. Add fencing and vandalism, etc. security devices as needed.
Aeration pipe leaks	Check connectors, gaskets, and replace as necessary. Tape or glue pipe joints.
Air valve leaks	Check gaskets, adhesive, and replace as necessary.
Pile temperatures are too high	Increase aeration rate.
Odors occurring when piles are broken down due to excess moisture or uneven mixing	Check / adjust bulking agent ratio. Mix more evenly. Move piles when there is a low potential for impacting receptors. Provide continuous aeration in the pile for several hours or days before moving.

Problem	Solution
Atmospheric conditions	Avoid tearing down piles during stagnant atmospheric conditions or temperature inversions. Inversions frequently occur in early morning following a cold, clear night.
Leachate puddling on pad	Wash down the pad or spread sawdust or dry compost over puddles to absorb the leachate. Spread lime. Clean up the absorbent and place on an aerated compost pile.
Inadequate cover on pile – compost mix is exposed	Add more finished compost to cover piles; to a minimum depth of one (1) foot.

■ Low Pile Temperature

Problem	Solution
Improper aeration	Check blowers, pipe connections, power, etc. and set timers accordingly. Check for water in the pipelines, flooding of the aeration plenums / trenches. Conduct smoke test to visually check for airflow short-circuiting
Improper mix, solids content chips too low	Tear down pile, add more wood or compost to the mix, and rebuild.
Inadequate cover thickness on pile	Add more compost to cover the pile to a minimum depth of 1-foot.

■ Equipment Failure

In the event of failure of the various pieces of equipment, the operator has the following options:

Problem	Solution
Front-end loader breakdown	Use another front end loader on-site or rent a replacement. Contact City authorized mechanic for repairs.
Aeration blower failure	Use a spare curing or composting blower (check the nameplate to verify the correct type blower is being used).

Problem	Solution
Controller failure	Use backup timers. Contact controller manufacturer. Information on the timers is contained in its handbook. Call O_2Compost for replacement timer
Aeration piping breakage	Replace with fresh, undamaged section of pipe. If supply appears to be running low, notify supervisor and order fresh supply from vendor.
Temperature probe failure	Use replacement temperature probe.

■ Prolonged Power Failure

In case of a prolonged power failure, composting and curing operations will be suspended. After power is restored, composting and curing pile aeration will recommence. If the composting piles have not met pathogen reduction requirements, they will need to be composted to meet the requirements, undergoing composting for 21 days from resumption of power. There is a high potential for odor generation during and after a power outage. If possible, delay pile breakdown until after 2 to 3 days of aeration following the resumption of power.

■ Site/Grading Problems

Problem	Cause	Solution
Surface ponding	Depressions or ruts	Fill depressions and/or regrade.
	Inadequate slope design	Grade site to recommended slope.
Impacts to surface water	Leachate discharge	Collect and treat leachate before it leaves the site by passing over-ground or through the soil.

■ Vectors

Problem	Cause	Solution
Flies	Available Breeding Habitat	Place a cover finished compost over raw materials to a depth of 6 to 12-inches.
Rats & Birds	Presence of garbage (food, etc.)	Remove garbage or use rat bait (Garbage and food wastes are not accepted at the facility).
Mosquitoes	Presence of stagnant water	Eliminate ponding

■ Other Problems

Problem	Cause	Solution
Fires/spontaneous combustion*. *Unlikely with an O_2Compost System	Long-term unmanaged piles that go from wet to dry condition. Excessive temperature Inadequate moisture.	Make piles smaller. Break piles apart; add water and remix. Avoid excessive watering as this may lead to anaerobic conditions.
	Stray sparks, cigarettes, etc.	Keep potential fire sources away from windrows. If fires do start, break windrows apart and extinguish completely.
Wet initial mix	Heavy precipitation	Postpone mixing until rain stops or mix only under a cover.
Mixing during rain; Excessive moisture		Cover existing piles with plastic tarps, with cutouts in the top to allow the piles to breath.