# OPERATIONS MANUAL

*For the:* New York City Compost Project
*Hosted by:* Brooklyn Botanic Garden
*At the:* Red Hook Community Farm

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## INTRODUCTION

The New York City Compost Project, hosted by the Brooklyn Botanic Garden, operates the largest compost site in the United States that is run entirely by renewable resources: solar power, wind power, and human power. The biggest resource used is human power, coming from thousands of volunteers. That model fosters environmental stewardship in many ways:

1. diverting material from landfill;
2. processing the material in the most environmentally friendly way (all by hand and no fossil fuel machines);

3. inspiring volunteers because their work is essential and not displaced by fossil fuel machines;
4. creating a better context in which volunteers can learn about and invest in organics recovery (including the importance of sorting out contaminants);
5. inventing new and efficient techniques for successful urban composting without fossil fuel machines, especially for under-served communities that cannot afford such machines; and
6. helping community greening projects to beautify neighborhoods and grow healthful food locally.

The compost site is part of the Red Hook Community Farm, which occupies an entire city block of parkland surrounded by chain link fencing. The land dedicated to composting is about 20,000 square feet. The City's Department of Sanitation funds the Compost Project, which has locations/events city-wide, and different hosts in each borough.

The site diverts over 150 tons/year from the landfill, with the help of up to 2,000 volunteers year-round, hot or cold, rain or snow, nice weather or not. The incoming material is roughly half nitrogen-based and half carbon-based. The nitrogen-based material is mostly household kitchen food scraps dropped off at sites run by the Brooklyn Botanic Garden and Grow NYC. The adjacent Farm contributes a significant amount of weeds, spent crops, and produce that cannot be sold or donated.

The method for composting is windrows, aerated by hand or solar-powered blowers/pipes. The windrows replaced a bin system. Windrows were vastly more efficient, because the process of the build and the turn are unencumbered by a structure (i.e. the bin walls). And windrows are more friendly for large groups of volunteers, because there is more space in which a large team can maneuver, and each

individual can experience meaningful work. The more volunteers, the more compost.

In an urban setting, rats are a top concern. Surprisingly, the windrows serve better to control rats, when combined with improved protocols for materials management:

- using large rat-proof barrels for materials storage;
- moving stored materials periodically to prevent rat habitat formation;
- timely processing fresh nitrogen-based inputs;
- placing windrows in open space better to expose rats to insecurity;
- thickly sealing windrows with more mature compost so rats encounter heat if they penetrate far enough to reach food, and are repelled;
- turning windrows often to maintain high levels of heat while material is still of interest to rats, and to prevent habitat formation (especially in winter), and;
- *sweeping, sweeping, sweeping* to leave nothing of interest to rats on the ground.

The previous system of bins failed even though they were covered in hardware cloth – top, sides, and bottom – and placed away from fences on flat asphalt. The asphalt is a barrier to rats forming habitats below the bin (for warmth) or to burrowing upwards to access food. But New York City rats are professionals, and spent whatever time through the night to claw access. By contrast, a properly constructed/turned/maintained windrow, combined with all other protocols to frustrate rodents, has left the site without a single rat for over six years – even though the rodents are visible on nearby blocks.

Restrictions on inputs further help with rat and odor control – essential for an urban setting with neighbors across the street (there is a K-12 school on one side, and on the other side IKEA has a storefront running the entire block). The site does not accept meat, dairy or any post-consumer

waste. Meat and dairy have dense protein and post-consumer waste has oils, both of which are slow to break down. Those items would keep a windrow of interest to rats for a longer period, meaning the windrow would need a thick seal of developed compost for more turns than would needed if those items were not present – that's too labor intensive.

By honoring the needs of an urban site with neighbors – that is controlling rats and odors – the NYC Compost Project at the Red Hook Community Farm can then fulfill the goals of a community based compost program. Those goals include processing the community's organics locally for the benefit of greening the community. The finished product amends the soil for growing food at many urban farms on public land, food gardens in neighborhood public schools, flower beds and street tree care, and Brooklyn's community gardens.

By maintaining a nice site, the Compost Project can advance another goal of community composting: fostering environmental stewardship, which includes a commitment to recycling. An appealing site helps draw in the public for opportunities to develop and use the knowledge and skills to divert organic material from landfill, make compost, and rebuild soil for a greener city. That focus on public education, reducing waste, and rebuilding neighborhood soil is at the core of the NYC Compost Project's mission.

But an appealing site is not enough to motivate volunteers to become environmental stewards in compost, and expand their ranks. Their work at the site must be meaningful to motivate them. That has two components at the Red Hook Community Farm: volunteers' work really matters to the operation, and their work is part of a national model for environmental friendliness. Both things connect to the rule that the operation runs entirely on renewable resources. Ten kilowatts of solar power run two blowers for a few

actively aerated windrows, as well as two heat lamps to keep volunteers' gloves warm in the winter. A small wind turbine helps in the winter when there is less sun to power the solar array. But most of the power used at the site is human power, with pitchforks/shovels/wheelbarrows, for building/turning/sifting mounds. It's all done by hand, artisanal compost.

When an operation is done by hand, volunteers know that their contribution is essential, and is thus more meaningful to them. It could not be done without them. Further, they learn their contributions mean that the site not only diverts organics from landfill, keeps the organics local, and greens the neighborhood, but also that the process is the most environmentally friendly it could be: only renewable resources used. This enhances the message of stewardship, because the site models full sustainability.

Those motivational components help sustain weekly volunteer events, year-round and through bitter winter winds and sweltering summer heat, in addition to many annual events for groups like students or corporate employees. Without the volunteers, the site would not be the largest compost site in the United States that runs entirely on renewable resources, so we can honestly and glamorously conclude every work session with a "thank you for making the world a better place."

All that said, not all volunteers flourish, despite a daily creative struggle to find easier ways to do things by hand. As is true in many fields, a fair number of folks fail to connect lofty ideals for sustainability with the work required to achieve those ideals. And composting by hand is hard work. Some volunteers experience shock over the dissonance between what they talk about with friends on the exciting topic of sustainability and what sustainable practices require of the body/mind in the real world. This is especially stark at a site where there is an ethic of keeping in motion

even while talking. That ethic applies as well to walk-in surprise visitors (or groups who want a tour), for whom the deal is struck that they either work while they talk to a worker, or move/walk with the worker as the work gets done. Absent that ethic, very little would get done, as so very many folks want to come and just look and talk.

This challenging dynamic became a monster after Hurricane Sandy surged two feet of ocean water across the Farm, salting the soil beyond repair and otherwise piling up anything not bolted down – including a 200-pound wormbin that floated half a city block away. Cleanup required skid steers and large bucket loaders, parked on the Farm. On compost days, those gas-powered machines' presence tested volunteers to the extreme, because it was so clear the machines could do the composting in minutes rather than hours – although with less quality and more damage to the environment. Across different days the conversations unfolded along the same lines, with the need to re-state the whole point of the work: not only to divert local waste to local resources, but do it in the most environmentally friendly way, thus maximizing public participation best to foster environmental stewardship and greening the community. The struggle seemed similar to what must have been the struggle small farmers had decades ago in conversations about the disadvantages of over-sized farms – bigger and faster is not always better.

The compost work got a lot easier once the machines were gone. A common theme since then has been that sustainable practices are hard work. If they weren't, everyone would be already be committed to sustainable practices. So a meaningful commitment to sustainable practices will form only with the experience of those practices' real world challenges. Community-based composting is hard, much like all sustainable practices, but well worth doing.

Hard as it is, the goal is not to make it harder than it has to be. The site operators still look for efficiencies with a fervor similar to the fervor of those who look for ways to maximize efficiency by replacing humans with machines. For example, the site is configured so the processing can be like a pipeline, with material entering one end of the site and flowing to the other. In particular, operators prioritize what are called "walk-turns," when volunteers aerate a windrow by turning it just a few feet, as part of a longer journey of more turns toward the curing and sifting area. This allows for a quick turn because of little distance, in contrast to instances when the windrow must be loaded up in wheelbarrows and "roll-turned."

As another example, operators build new windrows when possible near carbon-based material and the more mature mounds that will be used to cover the new mound. In winter, hot mounds move close to where fresh builds will occur so the new mounds get kick-started with material from the hot mounds, and do not freeze.

Other operational efficiencies include micro-management and equipment choices. For example:

- set up any task to allow for the fewest steps to move material from one point to the next;
- in a windrow being sculpted, try to fix any dis-uniformity with material shoveled from the windrow's prior position rather than just pushing the new windrow around with the shovel (the material has to move anyway from the old windrow, so use that motion to do a fix, meeting two goals with one motion rather than two);
- build sifting tables to allow for sifting directly into wheelbarrows for immediate transport;
- move sifting leftovers when possible directly to the aeration pipes for constructing an air plenum, rather than mounding them up for later transfer;

- get rid of all pneumatic tires in favor of flat-frees to avoid needless wheelbarrow maintenance;
- favor tumblers as transitional devices for small amounts of incoming nitrogen-based material, but favor tumblers under which a wagon/wheelbarrow can collect contents to save the step of shoveling off the ground; and
- configure materials storage so that there is an easy visual code for determining what is older/newer (e.g., signs that move as the receptacles enter or leave the inventory).

One curve ball in an urban agricultural setting is that often there will be huge volumes of a single type of material coming off the farm into compost, like weeds when a section is cleared, or large collard stems when several beds are cleared. A rural farmer might push such material into a cold pile needing little or no tending, but in an urban setting the space for work is precious so all composting must be controlled for the maximum efficiency in getting compost to maturity and out of the way. But the excessive volume from clearing a bed would overwhelm the build of a windrow, because it is too much of one narrow type of material (lowering the quality of the compost recipe).

So a new invention launched: the "J row." The "J" stands for just weeds – even the spent crops are weeds once they are no longer wanted on the fields. The weeds are layered with wood chips into a long boxy mound and left to break down for many months, gradually transferred as appropriate for the recipe of any new windrow.

In the midst of the site's success, one feature stands out. It has to do with the volunteers who come back for more, and arrive with a kind of relish. For them, there is understanding that sustainable practices are hard work, and they embrace it. In community composting, there is a physical connection to the world of recycling that is difficult

to find with other resources like paper/metal/plastic/glass. With composting, participants can put their hands and bodies to work, see the steam rising from the hot windrows, touch the beautiful compost that once was raw food scraps, and glance out at the fresh produce growing for the neighborhood. For some, helping the environment has an added plus of getting a really good workout without being shut up in a gym, what we call "motion with meaning."

But for all, the relish in being present is in slowly rolling out the tools, folding into the task with the entire body, and methodically working the material for hours as part of something really important. In this way, what happens feels like what happens with the Slow Food movement. Slow Food is partly about accepting that most of the meaning with food comes from loving preparation that takes time and work, along with a product that is to be savored for what it adds to our lives. Community composters at the Red Hook Community Farm are part of Slow Compost.

## HOSES

GOAL (**Hoses**): The goal is to use, store, and maintain the hoses in a fashion that facilitates tasks, conserves water, and extends the equipment's lifespan as much as possible.

BACKGROUND (**Hoses**): The Farm's sole water source is one hydrant, and the compost site needs water mainly for moisturizing material, cleansing the receptacles for inputs (mostly barrels and toters), drinking, and cooling overheated humans. The challenges are to set up the hoses so the setup itself does not cause leaks, use the hoses to minimize wear and tear, and stow the hoses in an aesthetically appealing manner that does not waste the next users' time with entanglements.

CHECKLIST (**Hoses**):

Purchase (**Hoses**): For connecting and disconnecting hoses efficiently, choose hoses with end connectors that can be turned and connected without turning the entire hose; otherwise you will waste significant time. Buy lead-free nozzles to avoid any leaching of lead.

Maintenance (**Hoses**):

- *Rigging* – The main threat to a hose is pressure on the connections, either from a bent position created by the hose connection's set up, or from humans pulling the hose all the way to the connection to get more length. The result is leaks, or full rupture, with unsustainable loss of water and loss of time/money on new hoses/fittings. Protecting the hoses from this pressure has several elements:
    - The configuration of hoses on the compost site allows any part of the site to be reached by a hose, so there is no need to pull a hose to its source because there is another hose with sufficient reach (the exception is in the winter, when several hoses are drained and stowed, at which time usage of hoses will diminish accordingly).
    - The site is a public space, with occasional unsupervised use of the hoses, so it is best to assume that individuals will, if not prevented, pull the hose all the way to the source. At each connection, rig the hose so:
        - The hose is relaxed at the connection, with no pressure on itself from how it sits; and
        - The hose is wrapped around something at the beginning of its length – like a cinder block – so if it is pulled all the way to its source then the connection is protected from that pull.

- *Washers*: At least once a year, replace the washers to prevent leaks and maintain pressure.
- *Winterizing*: By the beginning of December (first threat of extended frost), drain the majority of hoses so they will not burst from freezing, and stow them so they will not be hidden under the snow and accidentally nicked by our snow shovels (at present, we stow under the high tunnel on the plastic pallet). Maintain one hose running to the drain at the base of the wind turbine, and monitor temperatures to determine when that hose must be drained to avoid freezing overnight. The main line from the hydrant is elevated on the chain link fence so it will gravity-drain, although be mindful of letting it do so at the hydrant end and at the other end: the main junction to the remaining hose.

Usage (**Hoses**):

- When moving a hose, always hold the nozzle so it does not drag on the ground and get worn/broken.
- When putting the hose down during a task, don't drop the nozzle because it will wear/break.
- When placing the nozzle on the ground until next it is needed, position the hose away from the mound so it is not trampled or in the potential path of a shovel that may nick it.

Storage (**Hoses**):

- When the hose is to be put away, walk the hose to the storage area with the nozzle in hand so it will not wear/break from dragging.
- The goal of storage is to put the hose out of harm's way, do so in a neat and tidy way, with the result that the next user can grab the nozzle and walk to a task without any entanglements. There are two methods:
    - *Walk it out:* Where a wood chip perimeter allows, walk the hose to a portion of its length so there is at maximum only one bend and no overlap.

- *Figure eight it:* Where there is no wood chip perimeter, loop the hose in a figure eight, with each loop just inside the next.

Hydrant (**Hoses**):

- *Opening:*
  - Retrieve the hydrant wrench and hydrant adapter from the appropriate storage (this may change in winter).
  - Remove the hydrant flow cap with great care so the threads are not worn/stripped more than they already have been by inattentive users.
  - Install the hydrant adapter with similar care so the threads are not worn/stripped. NOTE: do not tighten beyond a snug fit, because that will degrade the washer and cause leaks.
  - Pull the hose through the fence at the key point, enough to have a large loop turn toward the hydrant, allowing the hose to be fully relaxed when connected and thus protect the connection from tension (but the hose should not rest in the street where a vehicle may run over it).
  - Rotate the top valve in the "open" direction three revolutions. That's when you should feel tension. At that point, gently but firmly push through another quarter of a turn to start the flow of water – no more turning or you will, over time, destroy the internal valve.
  - Monitor the hose for a moment – a slight seizure will indicate the water has started to flow.
  - Monitor the hydrant for another moment – if the opening revolutions with the hydrant wrench were insufficient, the hydrant valve at the top will start to vibrate, and another quarter revolution is in order.
  - NOTE: if you experience a drop in water pressure during a task, it may be the hydrant is vibrating and another quarter revolution is in order.

    - NOTE: if you seek to fill the water jug before hooking up the hose, it is necessary to turn the hydrant valve back to the firm snug closed setting before opening the flow again for the hose – that resets the valve. But it is important not to tighten beyond a snug setting.
- *Closing*
    - Retrieve the hydrant wrench and the cap.
    - With the hydrant wrench, rotate the top valve in the "closed" direction approximately three revolutions, but certainly not past a merely snug position.
    - With the hydrant wrench, and standing clear of the adapter in case it blows off, slowly loosen the hydrant adapter until you hear the release of pressure – <u>allow that release in full before you loosen any more.</u>
    - Once the pressure is fully released so the adapter will not blow off, hold the hose with one hand while loosening the coupling with the other. Hold the hose in a way that takes any pressure off it while you loosen, so the coupling is not over-taxed.
    - Once the hose is off, lower it gently (so you don't bash in the coupling) to the street to allow the gravity drain to occur most effectively.
    - Loosen the hydrant adapter the rest of the way, *taking care not to use too much pressure and degrade the threads on the hydrant.*
    - Replace the cap, taking care not to harm the threads.
    - Walk the hose back to the fence to stow it in a fashion that makes it easy to reach and pull out later, without entanglements.
    - Remember both the hydrant tool and the hydrant adapter, and take them back in to safe storage.

VOLUNTEER MANAGEMENT (**Hoses**)

When volunteers use the hoses, let them know not to drop the hose or place it in the path of shovelers.

## J ROWS

GOAL (**J Rows**): Manage a large volume of nitrogen-based material pulled at a given time from farms' fields, when that volume is too much to suit the recipe of balanced diverse materials needed for the weekly builds of compost mounds. Construct a mound that acts as a controlled storage unit for the material while it is being gradually incorporated into controlled compost mounds, in the meantime securing as much of the nutrients as possible while using the least amount of real estate otherwise needed by farmers.

BACKGROUND (**J rows**):
The excess material can be a bed of spent crops like broccoli or collard stalks, which have become weeds because they are plant material that is no longer where it is wanted. Or the material can be a bed of conventional weeds that never belonged in the first place.

The problem is that the material is a lot of the same thing. For the best quality compost, it's necessary to have a diverse set of materials. So if there are a lot of weeds, then there also has to be an appropriate balance of food scraps and other nitrogen-based material. That means the compost site coordinator cannot put a huge amount of the same thing into a windrow, because to follow the recipe we would have to balance the ingredients and make a windrow much larger than anyone could manage.

The solution is to store the extra material in a J-row, until we are ready for it. "J" is for "just weeds." It is a special controlled storage mound that is similar to a windrow but is flat at the top. The technique for building it is a little different, because we want to have the sides as flat as possible and the top as high as possible so the J row takes

up as little room as possible – otherwise the farmers will run out of space. The farmers process the weeds (see appendix re: processing) and layer them with wood chips into a J row, recreating the platform all the way to the top so it looks and acts just like a storage box. We do not need the ridge line like we do with a windrow, because we do not need the material to cook like a windrow – it's in controlled storage. And because the weeds are processed with NO food scraps or other nitrogen-based material, and interspersed with heavy layers of dry wood chips, it does not need to be turned like a windrow and there is no stink. Then the farms, or the compost site staff if the material is at the Red Hook Community Farm, gradually transfer just the right amount from the J row each time a controlled compost mound gets built.

J rows are one of many inventions at this site that address the unique needs of sustainable urban composting, which requires no fossil fuels for processing, extreme efficiency of manual techniques to compensate for the lack of machines, strict protocols to control rodents/odors out of respect for an urban setting, and a commitment to high standards for quality.

*J-Row Slows . . . creating semi-landfills that use up more space and attract rats*

Unfortunately, there are times when farms are under-staffed, overwhelmed, or weed management has failed, and the weeds cannot be cut down to an appropriate size before they are layered into a J-row. Then long or fat stringy weeds get layered onto the J-row. The long/fat stringy material makes the mound too labor-intensive to use in a compost windrow because it takes too long to pull it apart. That unfortunate mound is known as a "J-row Slow," because it is usually at least 6 months before it makes any sense to pull apart such a mound and transfer it to a compost windrow. This is undesirable for many reasons:

- Crowded Space: there is no room for these mounds on the compost site because material there has to constantly shift, so the J-rows instead eat up valuable space on the food sites.
- Acts Like Landfill: we lose more of the value of the material the longer it sits without blending or aeration, because there is more off-gassing like in a landfill.
- More Rodents: any material that sits a very long time, and can hold a burrow like a J-row, becomes attractive to rodents, including rats and possum.

So it's best to avoid J-row Slows, because they are less sustainable.

*J-Row NOs . . . more like landfills and extreme loss of nitrogen*

It's important to plan. Leave enough time in a work session to layer the weeds with wood chips and cap off the last layer of weeds. Otherwise the weeds are left exposed in a mound and start to vaporize some nitrogen that would otherwise be captured, and off-gassing more landfill gases than otherwise. Nitrogen is a top need for farming, so giving it away is unsustainable, as are landfill mounds. And to integrate the rotting weeds into a J-row at a later time is much more difficult, as they get wet, clump together, and smell.

STEPS **(J rows)**

- Plan a work session so the team is configured to get all nitrogen-based material in a J-row with a cap of wood chips. Lack of planning means that time runs out before the weeds are capped, losing nitrogen to the air and complicating the task for future workers (who may not know the depth of nitrogen-based material, and may confront wet, smelly, stringy, clumped masses).
- Create a 4-inch platform bed of wood chips for a new J-row. Or if building up on a pre-existing J-row then confirm that there is a sufficient layer of wood chips.

- Deposit weeds on the ground next to the platform, running the full length of the platform so less time is taken up by transferring the material to the mound because only one step is required.
- Using your hands or a pitchfork, spread the weeds across the top of the mound in approximately a 6-inch layer, making sure the material fills in to the very edge of the preceding layer so the sides of the J-row rise as perpendicular to the ground as possible – this is a space saver because more material fits into the space and less space is used [for a *J-row slow*, use long weeds all in the same direction to build out the structure of the layer] **NOTE**: it is important that the nitrogen layer ***not exceed 6 inches***, because the lack of carbon will:
    - increase the chance that the weeds rot and smell and off-gas more like a landfill; and
    - distort the recipe for the J-row and likewise distort the recipe for any future compost windrow (unpredictable balance of carbon/nitrogen), meaning that the compost site will be more difficult to manage (more turns, more smells, less predictability) and the finished product less consistent.

Think of it this way: the microbes that start to break down the material need carbon, nitrogen, and oxygen to do their work, and they are microscopic so they have microscopic dinner plates. Thus if thick layers of nitrogen exist between carbon layers then there will be mostly landfill activity with excess off-gassing and loss of nitrogen. Ideally, this material would go immediately into controlled composting, and be thoroughly blended and aerated, but that is not possible so it instead goes into controlled storage – second best.

**NOTE:** *Do not climb on top of the mound, or run wheelbarrows onto the top of the mound, because that compacts the material, drives out the oxygen, and further simulates landfill conditions. Further, material dumped out*

*of a wheelbarrow often is not spread to a six inch layer, leaving large balls of nitrogen as mini-landfills deprived of carbon or oxygen.*

- Before repeating the process (chips, weeds, chips, weeds….), pull out each layer with a pitchfork so the edges rise up as perpendicular to the ground as possible, saving on the space used by the J-row and thus leaving more space for farmers;
- Repeat process;

**NOTE**: ensure that carbon material is wood chips and NOT another J-row – they can look a lot alike and yet have vastly different nitrogen content.

Accompanying this manual is an appendix: APPENDIX A: COMPOST PROGRAM PROTOCOLS FOR NUTRIENT HARVESTING FROM FARM'S FIELDS [for task leaders]

## PITCHFORKING

GOAL (**Pitchforking**): Pitchforking mainly loosens material for shovels to (i) increase time efficiency for the turn and (ii) give the shovels a longer life. But it also breaks up any large clumps for better aeration, and blends any contrasting material in a mound like wet/dry, browns/greens, seal/not-seal or aerobic/anaerobic.

BACKGROUND (**Pitchforking**):
The Rule And The Reason – The rule is that shovels do not touch material until a pitchfork touches it first. That's because using a shovel to loosen material is time-inefficient, and will weaken the shovel's handle prematurely. The less pitchforking there is, the longer the turn takes and the shorter time the shovels last – that affects both labor and budget. Further, the pitchfork holder is best positioned to improve the blend in a new mound by redistributing material with a toss – such as a toss of mostly wood shavings onto what is mostly food scraps, or a toss of mostly developed

seal onto what is mostly food scraps – that affects ultimate quality.

The Two Methods – Pitchforking has two methods generally, and the choice depends on the team. With a small and/or experienced team that has the knowledge/skills to move in an effective rhythm with each other, it may make sense to have just one pitchforker working at the face of the mound, back and forth, seeking to dig out the base and cause an avalanche. The avalanche uses gravity to do much of the work that would otherwise be done by hand, significantly decreasing the amount of time devoted to the turn at the same time as maximizing the exposure to oxygen. This method is slightly modified for a "roll turn." In contrast, with a larger team on a walk turn, or when two shovelers can keep up with two pitchforkers for a very fast walk turn, the pitchfork holders strive to stay entirely out of the way of shovelers, working from opposite sides of the mound.

The Challenges – The biggest challenges with pitchforking are to avoid pitchforked toes and to avoid the kind of slow and inefficient pitchforking that moves material high up down on top of lower material that has not been loosened. Merely pulling material down off the mound means either that shovelers are using shovels to loosen the material underneath, or that the pitchforkers wind up pitchforking what they already moved in order to get to what they didn't pitchfork the first time around. With efficient pitchforking technique, the pitchfork seldom touches material more than once.

STEPS (**Pitchforking**):

Method One – One Pitchforker Works Across Face Of Mound (The Avalanche) (**Pitchforking**):

- Position at end of the mound to be turned, with a red bucket close by for inorganics.

- Stab and loosen at base of mound, moving from one side to the next, striving to keep a flat cliff face (maintaining the cliff face ensures that the mound is moved uniformly, blended by cross section, rather than moving more of the exterior first, or more of the interior first).
- Be mindful of the shovelers' movements, creating a rhythm with them that allows you to keep changing position to loosen more material for them at the same time they can, with an easy adjustment, shift away from you to a different target for sliding the shovels in. If there is no shared rhythm, then the shovelers either stop to wait for you, or feel like their flow is broken up. It helps to become an experienced shoveler before pitchforking, so you understand how shovelers can best adjust their targets.
- As the mound recedes backward to the higher part of its ridge line, seek to dig out the base in such a way that the higher material will eventually tumble down, or "avalanche," saving a lot of time. When you see an entire section of the higher material begin to quiver, exercise caution because that is a sign it is getting ready to topple. For especially dense material that won't seem to let go, you may have to find a fault line a few feet back at the top and use the pitchfork to help the avalanche happen. But don't do this prematurely, or you will lose the gravitational advantage and wind up digging out material under the avalanche. Effective avalanching vastly speeds up the turn.
    - <u>Adjustment To Method One (The Avalanche) For Unusually *Moist Material*</u>
      If the material is unusually moist, the avalanche can be so heavy that it compacts the material falling at the center, packing it so tight that it needs to be pitchforked again. In this instance, a more experienced pitchforker should demonstrate how to pull the avalanche down in a way that distributes the material with less compaction.

- Adjustment To Method One (The Avalanche) For *Roll Turns*
  Typically, a mound selected for a roll turn will move entirely by wheelbarrow during one session. That means a team can attack the mound from all angles, because there is little chance of an unfinished ugly mound. But to promote uniformity in the new mound, it is best to uniformly extract from the old mound. Thus the pitchforker adapts method one to loosen material around the entire perimeter of the mound. With a large team, this may mean keeping an eye on when a shoveler is moving away with a full wheelbarrow, and attacking that shoveler's particular section so it is loosened by the time the shoveler returns. In any event, the goal is to loosen uniformly along the entire perimeter (or, with a smaller team, from the two ends).

Method Two: Two Pitchforkers Plowing The Road (**Pitchforking**):

- With large teams or for very fast turns with staff, method two, called "plowing the road," is advisable. With large teams, the approach reduces problems, especially with pitchforkers who have no experience for understanding how to maintain the flow of shovelers, and for shovelers inclined to stop and watch when the pitchforker is nearby. With experienced workers, the approach is effective when two shovelers can keep up with two pitchforkers.
  - One pitchforker is on each side of the mound.
  - The goal is to loosen a section about one foot wide from the outside to the center, and all the way to the bottom so absolutely everything is loose, and then start over with a new section.
  - To begin, fork material that is high up in the section to be loosened. Toss the material toward the shovelers without hitting their feet, creating a little mound that runs a bit beyond the width of the

mound, which gives the shovelers a wide line to pick from for shoveling. Also, it avoids a hill developing at the center that gets compacted and is hard for shovelers to manage.

- Once the material that was high up is mostly down, start "plowing the road," which means pitchforking from the outermost point, at the bottom. Keep pitchforking until you get to the center, where the pitchforker on the other side meets you. With that section clear, start over by preparing/plowing a new section.

Elements Common To Both Methods (**Pitchforking**):

- Break up any large clumps. The pitchfork is better suited for that purpose, and the shovelers should stay focused as much as possible on forming the new mound, especially if there are multiple shovelers on each side who should not be standing and waiting while other shovelers are breaking up clumps.
- Blend any contrasting material as is consistent with keeping up with the shovelers. For example, toss less raw material on top of more raw material, or spread what is mostly browns across the other more blended material. This develops the mound more quickly toward maturity, with fewer turns, thus reducing labor inputs.
- Remove inorganics as you go, or you are just pushing off that job to future turners – an older mound with lots of inorganics is a sign that turners were focusing only on quantity and not on both quality and quantity.
- To clear debris on the pitchfork, push firmly but not forcefully with the flat of your foot, from the top of the fork's tines to the bottom.
- At the end of the turn, it's best to pitchfork from the mound's end over the top toward the shovelers, and otherwise push the material loose toward the shovelers.
- While the shovelers are managing the last bit of the turn, there is a window of time in which to clean the pitchforks

and put them away (or in an equipment transport wheelbarrow), so they are out of the way for raking/sweeping. This is also a good time to pick up a wide rake to push and consolidate remaining loose material for the shovelers.

TASK LEADER CONSIDERATIONS (**Pitchforking**)

- For a task leader choosing a role on the team, pitchforking gives you the most control over improving the quality of the mound (for example, with particle size, blending, and inorganics removal), at the same time it allows you to monitor other issues of quality (for example, with temperature/moisture/worms).

VOLUNTEER MANAGEMENT (**Pitchforking**)

- With a large volunteer team, keep in mind not only the space needed for a spin cycle (see WINDROW WALK TURN), but also for a "plow the road" pitchfork that creates a distinct mound from which the shovelers pull.
- When volunteers tire, it's important to monitor whether they lose sight of technique and begin to pull material down on top of other material that isn't loosened. That can add considerable time to the turn, and endanger the shovels. Where fatigue or other obstacles are too much, consider alternating the team, shifting from an all-hands "turn" session to a "prep" session where 4-6 people pitchfork side by side while everyone else chops and trims to the center (see WINDROW WALK TURN). You can manage that by calling out "Turn" and "Prep," or signal to others to do that by sounds, asking first who has great sounds that few other people can make.
- It is the pitchforker(s) who begins the transition to raking/sweeping, and it's best to manage that timely and closely so shovelers aren't wasting time on shoveling material that should be raked or otherwise standing around waiting on equipment.

## SEALING

GOAL (**Sealing**): With any freshly built or turned mound, the goal is to deter rodents/birds/insects by covering the mound with material that is no longer of interest to such pests.

BACKGROUND (**Sealing**): For a first-time build, or a mound turned onto a forced air pipe where it will sit for a long time, the material covering the mound must be one foot thick, from the bottom to the top, to be effective. That is called a "full seal." For turns of more developed mounds, it may be either a "half seal" of six inches is sufficient, or a "base seal" that merely covers the bottom section of the mound. The technique of sealing is the most difficult to teach volunteers.

STEPS **(Sealing)**:

- Sweep the area around the mound according to protocols; otherwise the seal is compromised (see "SWEEPING" for details).
- The next step is to create the "base shelf" of more mature compost. The depth of the shelf sets the unit of measure for the rest of the seal. If experienced individuals are available, they can create the base shelf by tipping fully wheelbarrows directly onto the bottom of the mound. That is the most efficient launch of the seal, because it saves a lot of time.
- Alternately, the seal team dumps the wheelbarrows out beside the mound and shovels it into place, or walks the material from a nearby mound that is sufficiently mature.
- If using wheelbarrowed material, drop it a few inches away from the mound so it does not intermingle with what needs to be sealed. [Later, this is additionally important because dropping the material too close to the mound can lead to needless widening of the mound as volunteer shovelers can fail to trim enough away from what has been dropped, which makes the task

take longer. O*r* they narrow the mound too much by trimming too deep, which reduces the depth of the seal and exposes the mound to pests.]

- For technique in tipping wheelbarrows, position the wheelbarrow parallel to the mound so it doesn't matter how far it spills forward, and thus tipping can occur more quickly.
- Using a shovel, create a band of the appropriate depth (one foot for full seal) all the way around the mound, creating the unit of measure for the rest of the task. For technique, most shovelers find it best for the shovel to approach the mound in parallel fashion, tipping sideways in one complete motion, because that is the fastest method and it works well at higher points when other methods of tipping get too difficult. For example, it gets difficult to tip the shovel perpendicular to the mound by raising the handle in the air.
- Once the base of the seal is perfected, shovel in the next layer/shelf, being careful to keep material on the shelf and not to cascade material down to the ground surface because that will needlessly widen the mound and lengthen the time for the task. Widening the mound also uses excess seal that could be used elsewhere.
- When the level of the seal nears the ridge line (the task leader will pinpoint the exact point depending on a variety of factors), begin the "ridge build," tossing the material along the ridge so it rises up while at the same time the material is filling in to the last layer. Building a high and sharp ridge line increases air currents and temperature, and it is easier to do that by finishing the mound with a ridge build rather than continuing with layers that produce a plateau.
- Conclude the seal by shaping the ridge with the flat side of a landscaping rake – this firms up the ridge against bird visits and rain/wind erosion.
- When the seal is complete, first tuck in the mound with the flat side of the rakes, because the rakes get the

bits too big for a broom. Then follow up with brooms for the tiny bits – see SWEEPING section;
- The task leader will indicate whether to blanket the mound.

TASK LEADER CONSIDERATIONS **(Sealing)**:
- Determine in advance the source for the seal material, which involves reviewing the status and location of other mounds on the site and plans for future placement/turning of mounds. Factors may include:
  - clearing a forced air pipe for a future build,
  - clearing a space to which another mound must be turned, or
  - pulling seal material from a mound close enough to be walked rather than wheelbarrowed because of low labor inputs during the relevant time period.
- In light of labor inputs for the work session, consider how to configure the team so workers will not be idle. For example, it may be best for one or more workers to pull seal material into many wheelbarrows long before the seal starts. That way those shovelers who eventually do the seal will not be standing around waiting for material to arrive. This is less of an issue with a small team, because with 2 or 3 workers it is likely shovelers will alternate between sealing and pulling seal material so everyone stays busy.
- At the beginning of the seal, the task leader configures the team so the leader is close to the mound and works the mound from all angles and thus is vigilant in helping to perfect the base, because it is extremely inefficient to fix problems later in the game. For a first seal of a mound, the focus for the leader is on the section where leachate is most likely to emerge – get that right from the beginning. To ensure those doing the seal always have enough material, err on the side of assigning more workers to pulling seal material than doing the seal.

- At the beginning of the seal, it may be that to fix problems the task leader will have to take actions that are otherwise not allowed, like trimming a base that is too wide or cascading a base that is too narrow. These actions must be taken only with an experienced hand, because otherwise they lead to serious problems with construction of the mound. Thus the task leader explains to anyone who may be witnessing the corrections that the technique is not otherwise to be used and why.
- For those moving the wheelbarrows, it can be annoying to wait for sculptors to stand and think about where they want the load to go. The formula for where to dump material changes depending on how the team is functioning, but the goal is to allow those moving the wheelbarrows to make their own decisions. So at some point it is helpful, *if it's possible*, to let those bringing the material know that they can dump the load wherever the shelf looks low, or wherever a pre-existing pile looks low, or always at one end or the other.
- For most sculptors, it is best to convert to narrower shovels for the ridge build because it is more difficult to attain precision when the material is being tossed and the challenge of cascading, and needless widening, increases.
- Toward the end of the seal, it is best for the task leader or an assigned worker with experience to create the outer sweep circle while others are still finishing the seal, because that both defines the perimeter at the same time it demonstrates the level of thoroughness expected in clearing the surface (see SWEEPING).

VOLUNTEER MANAGEMENT **(Sealing)**:

- Before the seal starts, make a preliminary determination as to which workers will be in the role of continuing to pull seal material, and which workers will conduct the seal itself – it is best to have a separate

leader on the team pulling material who knows the technique for emptying wheelbarrows, because the task leader must focus on perfecting the base of the seal -- but if that is not possible then it is best to conduct a wheelbarrow training with the entire team before splitting up into different tasks. Wheelbarrows are expensive equipment and need to be treated well.

- Once it is clear who will conduct the seal itself, any veterans on that team can begin the task. Encourage those individuals to deposit material around the mound first so there is plenty for the team to work with once training is complete.
- The technique of sealing is the most difficult to teach volunteers, even those who have tried before, so it is important to assemble all volunteers new to the task and provide an explanation, beginning of course with the goal of deterring rodents/birds/insects and the history of how former alternate methods failed. For the purpose of the training, ensure in advance that the training area has material already deposited and further that all participants have shovels.
- Once the goal is conveyed and it is time to move into technique, move into a physical demonstration of the technique so it is easier for volunteers to follow (seeing is just as important as hearing words).
- Use different descriptions of shelf-building because it helps volunteers understand: it's like building a shelf, or steps, or laying in bricks, or like creating an igloo over the entire mound;
- Anticipate common problems and explain them in advance:
    - don't pull out shelf to fix it because you may pull food with it and ruin the seal,
    - don't pat down the material because it reduces air flow,
    - don't trim because we need a certain depth, and
    - do flip shovel fast to be efficient, rather than daintily spreading.

- Provide a heads up that the technique will change a bit as the seal progresses, but that more details will come later. It's always helpful to volunteers to have a map of what's to come, so they feel oriented and will be less confused.
- When the depth of the base looks fully developed all round, which is usually at least one foot in height, then the volunteers will feel confident enough that you can introduce the challenge of cascading, and link the challenge to the problem of the seal taking longer than it has to – at this stage, that will motivate them, because they'll be tired and won't want things to be harder then they have to be.
- When you announce the ridge build, include the "why" explanation about how the ridge won't be as crisp if the technique continues as is, and a crisp ridge promotes the chimney stack effect for good cooking, and then talk about the "how" of changing shovels and avoiding the cascade on the opposite side.
- Comment whenever you can about how good the mound looks, or how good the volunteers' technique is.

## SIFTING

GOAL (**sifting**)**:** With finished compost, the goal is to remove inorganics (like sticker labels), worms, and large wood chips.

BACKGROUND (**sifting**): Sifting is the last step in the composting process. That step happens no less than 120 days after the mound was built, to help ensure the material is finished. If the material were still decomposing when added to soil, that decomposition process could interfere with the plant growth. Likewise, if the material still includes large wood chips, those chips can soak up nitrogen from the soil and could interfere with plant growth – thus it is important to sift out the large wood chips (the exception would be for no-till soil, or when unsifted compost is used

for weed management, topics too large for this space). Lastly, the sifting phase is an opportunity to harvest worms to inoculate into the younger mounds and improve the product.

For sifting to be effective, the material must be fairly dry or it gums up the screen on the sifting tables. So prior to sifting, a mound dries out under the sifting tunnel for an appropriate period. There are two big challenges with sifting: potentially harming the screen with too much pressure, and low productivity when sifters are inefficient. Regarding what is removed, the inorganics go into trash (via red buckets), the worms go back into younger mounds to improve the compost (via small green buckets), and the wood chips (called "overs," short for leftovers) go back to the beginning of the compost process so they do not go to waste.

STEPS (**sifting**)**:**

- Identify which mound is to be sifted (often the site coordinator will place shovels/pitchforks on the chosen mound), and from which end (that's important because often sifters pull from a location that we needed vacated for the placement of a new mound).
- Assemble equipment into green wheelbarrows:
    - 4 (large) five-gallon red buckets *per* table (for inorganics that will go into landfill trash).
    - 2 (small) one-gallon green buckets *per* table (for harvesting worms), filled with about two inches of worm-friendly rainwater when seasonally available from rainwater harvest bins (otherwise hose water).
    - [during the season for sifting, short-handled shovels and tilling pitchforks are left in tunnel].
- Position table (**sifting**):
    - Position the loading end of the table near the mound to be sifted (the usual approach), or where it best suits users re: sun/rain/wind/hot/cold.
    - Position the table to allow room for workers to load table, stand and sift from each side, tip into a

wheelbarrow at the off-load end of the table, and be able to pull out and turn filled wheelbarrows that need to be emptied.

- Position wheelbarrows (**sifting**):
    - 10 cubic foot two-wheeled grays flush left and right under table, pulled to edge so they catch anything sifted at edges (must lift older tables to fit wheelbarrows underneath).
    - 6 cubic foot single-wheeled gray in center under table.
    - 10 cubic foot two-wheeled gray outside the *unloading* end of table, for the leftovers (or, the site coordinator may request gray barrels be used to collect browns for a build).
- Prepare/position buckets (**sifting**):
    - Get enough green buckets from stack in sifting tunnel to match number of red buckets, and use green buckets as pedestal on the floor for red buckets, placed assuming 3 people per each side of the table, so the buckets get shared between people.
    - Fill partly the small green worm buckets with material from the mound to be sifted, striking a balance so the worms will be able to avoid drowning but will also land on moist material when placed in the bucket.
    - Place green worm buckets on hooks at side of table, located between the first and second people on each side because those individuals should be harvesting any worms before they get too far down the table.
- Process (**sifting**):
    - No shovel touches material before a pitchfork has – loosen material with pitchfork.
    - Shovel unsifted compost from the mound onto the end of the sifting table closest to the mound. Tip: if material is moist it will gum up the screen, so select dry material from the edge to put on the screen first, moist material on top.

  - Move the material by hand, with circular motions, from the loading end to the other end, like an assembly line.
  - All of the sifters are looking to pull out worms into green buckets, and inorganics (stickers, rubber bands, pieces of plastic, etc.) into red buckets, but it is most efficient if sifters at the loading end focus mostly on harvesting worms while pushing the material down to colleagues, because then the worms experience less trauma and the colleagues are kept busy.
  - Move hands in a light circular or back-and-forth motion that causes material to go through the screen but does not exert so much pressure that it strains the screen and starts to pull it away from the sides. A gentle scrape is effective; a kneading motion is harmful because it pushes down too much.
  - The material cannot be piled deep because then it moves around at the top but not through the screen.
  - Wood chips and other large, chunky, organic materials stay on top of the screen and make their way down to the other end. Push these "overs" into the dustpan and lift them into the wheelbarrow outside the unloading edge of the sifting table (it's more efficient to push material onto the dustpan than to scoop up the material with the dustpan).
  - Unload full wheelbarrows (sifted material or overs) to locations identified by site supervisor, or park to side and use new wheelbarrows until the task wraps up.
- Wrap up (**sifting**):
  - Finish sifting material on screen.
  - Consolidate contents of red buckets into one and put them into green wheelbarrow unstacked (they get stuck if stacked inside of each other).
  - Pull off worm buckets, inoculate into mound designated by site supervisor (create small holes at midsection on the ends or the center of sides – all four locations when there are 4 buckets – tip in

buckets entirely, including all water, cover gently so location of hole no longer evident), and put empty worm buckets into green wheelbarrow.
- Pull out wheelbarrows with sifted material and do one last check for inorganics (random worms can stay in sifted material as they will continue to improve it and it's too labor intensive to harvest them all) – estimate total cubic feet sifted.
- Transport sifted material to location designated by site supervisor. If the designated location is a storage bay, load material so that the forefront of the stored material is six inches back from the concrete edge (a six inches that is level with the concrete) so heavy rainfall will not wash sifted material out of storage bay. Depending on how much is already in the bay, this may have to be achieved by trimming the material at the end with a shovel, shifting it to the top.
- Transport overs to location designated by site supervisor – if designated location is a forced air pipe, take extra caution in making sure the wheelbarrow does NOT hit or jar the pipe (this means that volunteers are not suited to the task, or must be accompanied).
- Leave tables/dustpans in place unless site supervisor indicates they should be moved (shovels/pitchforks also stay in place unless needed for winter work).
- Use sifting tunnel brooms to sweep floor clear, moving all material back into the mound being sifted.
- Return buckets to origin (little green buckets by fence to left of rainwater harvest bins; red buckets stacked against browns pen).

TASK LEADER CONSIDERATIONS (**sifting**):

- Sifting is a task that can end whenever you want it to, so it is a good task to plan as a potential follow-up for other tasks for which the timing is uncertain. But keep in mind

that at least an hour is best for the sifting task to be meaningful and not be over too soon after it starts (this may lead you to set up the table earlier so a team can get right to sifting and not use up time with setup).

- Sifting under the tunnel is also a good task as a backup during challenging weather, such as heavy rain or intense heat;
- In the winter, the tunnel may be cold and sifting may be more pleasant in the sun. In such a case, set up the tables in the sun and use green buckets to transfer the material to be sifted. Load a red wagon with filled buckets and move them to the table(s). In some instances, it works out well to designate one person to run buckets. And it is all the more important to talk about avoiding pressure on the screen, because the impulse is to dump the buckets directly onto the screen rather than from the air – it's best to demonstrate the correct method for all to see.
- Put a maximum of 6 people on a table, or it is crowded.
- Productivity is one of the big challenges, so you may have to demonstrate efficient practices at several points in the session, most importantly at the beginning to set the pace. One problem is that workers at the loading end get too caught up in completing the process before moving material down the assembly line to others. It may useful to mention that colleagues farther down do not have enough material to keep them busy. You or a designee may have to stay at the loading end to keep material loaded and flowing.
- Full wheelbarrows can be emptied out or parked out of the way to be emptied at the end of the session, replaced with empty wheelbarrows. If the team is on auto-pilot so you can lead other tasks, it's best to wait so you have the efficiency of emptying wheelbarrows all at the same time. Alternatively, you may need to train a task leader on the protocol so the team can shut down without you, which means an earlier emptying is a good idea.

- For storage in the bays, the inventory protocol is to fill from left to right, and then when the farthest right bay is full start again from the far left (the small bay all the way to the right is not used for storing sifted material, but for transitional storage of tarps or bagged compost). The bottom is always the ground level with the pavement because below that is mulch. The goal in loading a bay is to get the material up to the level of the side walls with about an 18 inch shelf at the top for the sand bags to be stable once the material gets tarped; at the base to the front of the material should begin six inches from the pavement so when it rains the compost is not washed away. Initially it is possible to load by dumping to the back of the bay, but at some point it is necessary to dump wheelbarrows on the pavement and shovel the material up, being careful not to shovel below the level of the pavement and hitting mulch.

VOLUNTEER MANAGEMENT (**sifting**):

- Sifting is a good task for anyone who for some reason is not suited to work on the more strenuous tasks. But we still treat sifting and all other tasks as important when we speak to volunteers, regardless of how hard the task is to do.
- With sifting, it is especially important to first explain the "why" – if we put unsifted compost in the fields, the larger wood chips will sponge up nitrogen, which is the most important nutrient for the crops to grow.
- On the "how," after explaining that a shovel never touches material before a pitchfork does, it is best to demonstrate with a shovel how to load the screen, and as part of that, talk about not tapping the shovel on the screen.
- Then cover these components:
    - harvesting any worms (why, hydration in bucket, inoculation later),
    - extracting inorganics (examples in first load, mention others),

    - sifting techniques (frantic piano, tornado, angry spider) and not pushing hard on screen,
    - not too much depth in material or sifting will be inefficient,
    - first workers in line are pushing material to better depth and harvesting worms as they go,
    - try to meet challenge of keeping assembly line going so other workers down the line have plenty of material to work on,
    - overs pushed into dustpan – scooping not as efficient.
- It is helpful to tell the person shoveling compost onto the table to keep an eye on the flow to know when to add more unsifted compost to the table and maintain a constant flow of material.
- Creating a gentle competition between tables can be a fun way to motivate volunteers. Explain that you will be counting cubic feet of material sifted at the end, and letting participants know how much each team sifted. Ask for team names. If there is only one table, the challenge can be posed as beating our current record.
- For the wrap up, beware the dynamic of a volunteer picking up one bucket or tool and walking back to the sheds, leaving other volunteers to do more work. So when you announce the wrap up, explain that you'll all stay together until the space is fully wrapped, and then explain the steps. The steps will vary depending on a variety of factors like how many tables are running and whether any volunteers already know the ropes. For example, you may want to close one table first so you can train volunteers on that table how to load into the storage bay, and have them stay at the bay while other tables close and bring more sifted compost to the bay. In any event, explain that the buckets are pulled away from the tables, red buckets consolidated, wheelbarrows pulled out and inspected (for inorganics and to estimate cubic feet if that hasn't already been done), wheelbarrows moved to the storage bays, worms inoculated, space swept, and

then tools put away (shovels/pitchforks against mound and brooms in the rafters), and THEN everyone heads back together. That theme of staying together should open and close your explanation so it can't be missed.

## SOLAR POWER SYSTEM

BATTERY MAINTENANCE
The level and uniformity of liquid in each cell must be sufficient to ensure efficiency as well as the longest lifespan for the battery. In addition, the terminals must be free of corrosion. Lastly, to further promote the battery's lifespan, the flow of current should be reversed by switching the cables on an annual basis – at present a hired professional does that annual task. For the other items, the maintenance schedule for the warm season is every 60 days (more evaporation), and in the cold season every 90 days.

Liquid Level (**solar power system**)
With a headlamp, it is a one-person job; otherwise an additional person is needed to hold a light.

- Supplies needed:
  - Gloves (in bin marked "safety")
  - Distilled water (best to have at least 4 gallons)
  - Funnel (in box marked "solar power items")
  - Light source (yellow solar powered light hanging by panels)
  - Safety glasses (in bin marked "safety")
  - Large piece of cardboard (just inside container door to the side)
- Steps (**solar power system**)
  - Put on gloves and safety glasses (on a rare occasion there is spashback)
  - Lift lid to white container housing all batteries
  - Open cap to a cell
  - Shine light in to evaluate liquid level
  - Goal is for liquid to rise roughly to midsection of slots on either side of channel below cap (this

will be clear on first inspection during training) – note that the cell space below the channel is open to the walls of the battery, so the liquid will rise slowly as it has to fill that entire space and not just the channel
- Place funnel into cell
- Add sufficient distilled water, checking levels to avoid over-filling
- Close cap
- Repeat for all cells
- For hard-to-reach cells in the back, lay down cardboard so you can climb up onto the battery bank, carefully (it's best to do these cells first, as they are the most challenging)
- Remove and discard gloves before touching anything
- Close lid to white container housing all batteries

Equalizing (**solar power system**)
The process of "equalizing" maintains uniformity in the cell liquid. Over time, stratification develops in the cell liquid with relation to acidity, and the areas with more intense acidity will degrade the lead plates unevenly and impair efficiency as well as decrease battery lifespan. Equalizing is most efficient when the cells are full of liquid, so it is best to equalize right after replenishing the liquid, or within a few days. If it's right after, you can leave the caps ajar as you finish the first task – ajar but not fully opened because particles could get in, just not snapped fully shut (the caps are vented anyway but the loose caps will give you more success from the equalizing process). To engage the process, it is necessary to cut the power to other sources, and otherwise use power for the process – thus it is wise to choose a time when you can be without power for a few hours and when you are not otherwise low on power stored (good to do this on a sunny day).

Steps: (**solar power system**)

- Ensure liquid levels are fully replenished
- To facilitate off-gassing of hydrogen/oxygen (non-toxic), ensure caps of battery cells are ajar (not fully open but just popped loose)
- Approach either one of the two charge controllers, which are the devices to the far right at the wall panel
- Having chosen one the charge controllers, hit the far left button to get the menu (note: far right button engages backlight for screen)
- Using either of the two middle buttons (which are scroll buttons going left and right on the menu), scroll to "EQ," which stands for equalization
- Once EQ is highlighted, hit button that corresponds to "GO" and a screen for "Battery Equalization" pops up
- Press "NEXT" and "1 HOUR" pops up
- Press "NEXT"
- Before you select from the new menu, you need to shut down three items:
    - Both inverters at the same time – the two black large levers to the left of the charge controllers on the adjacent equipment, marked "175" by each level
    - The breaker for "light/outlet/fan" – farther to the left in a line of breakers
- Return to the charge controller's menu and press "START" -- Note that a timer is triggered at the bottom right of the screen, which you will synchronize with your phone or watch
- At the conclusion of the hour, the charge controller stops the equalization automatically, but before you can restore power you must make sure the home screen shows that the power "OUT" is 60V or less (this will happen within a few minutes after the process terminates)
- Snap all the cell caps shut
- Turn the two inverters back on
- Turn the breaker for "light/fan/outlet" back on

## SWEEPING

GOAL (**sweeping**)**:** The biggest goal for sweeping is to control rats/birds/flies so we remain welcome in the community and in compliance with our regulator. A second goal is to demonstrate to our landlord and funder that we take good care of their land and money. A third goal is to create a pleasant and motivational work space for volunteers so we can better get the work done and foster their environmental stewardship.

BACKGROUND (**sweeping**): Given what we do, sweeping takes on extraordinary importance. Relying solely on renewable resources makes the Red Hook Community Farm a national model for environmentally friendliest compost sites. At the same time, total sustainability is time-consuming hard work, and we often must explain to visitors that if it wasn't hard work then everyone would observe sustainable practices and the environment would be safe from humans. That challenge of hard work separates those who merely talk about sustainability and those who actually achieve it. Nowhere is this separation more apparent than with the task of sweeping. Visitors who struggle with the challenging actions required to execute the idea of sustainability find it hardest to take those actions that they associate mostly with simple menial work like sweeping. And yet few tasks are more important to a sustainable site than sweeping.
If done well, sweeping is a top control for rats, and such control is required by the State regulator who decides whether we are allowed to compost, and the regulator's concern relates to any nuisance created for our neighbors. Separately, if our neighbors are unhappy because we foster rats, then we defeat our mission of fostering support for composting. Likewise, rats and other indicators of bad practices are problems for our landlord who allows use of the land (Parks), our funder who pays for salaries/equipment/supplies (Sanitation), and our volunteers

who give up their spare time to help us and potentially get excited about compost. Thus, sweeping is a task to be mastered with pride and commitment.

STEPS (**sweeping**)**:**

- Clear: Pull away obstacles to clear fully the area to be swept (buckets, wheelbarrows, tools, etc.). If there is time consider the next step for each item you are moving so you "only handle it once" (OHIO) and don't have to move it a second time – for example, tools into a green wheelbarrow for the next trip to the sheds, gray wheelbarrows moved to a staging area (either to eventually be put away in tunnel or for the next usage, like pulling seal).
- Expand: Whenever time allows, expand the area to be swept to include the next farthest perimeter – like the fence or the neighboring mound or the wood chip mound or the Air House or the outside line of the sheds – with this approach we succeed in periodically sweeping the entire site over time.
    - Exception: if we have a volunteer team close to dismissal time, focus solely instead on debris associated with building/turning the mound.
    - Exception: for a mound on its second turn or beyond, it will be incorrect to sweep into the mound debris other than what is associated with turning the mound, like leaves/twigs/etc. – in such a case, sweep that debris into a separate mound and barrel it for a future build.
- Rake: Some material is too large to allow the broom to be efficient, or too voluminous and will build up into piles that are too difficult to push with a broom. Thus, when necessary, precede the broom sweep with the 3 foot wide rakes, using the flat side. The brooms will follow the rakes and finish the job.
- Zig Zag: Starting at the outermost perimeter, begin broom sweep with the goal of a large line surrounding the mound, likely an oval of at least 30 feet by 40 feet and up

to 50 feet by 70 feet, and gradually closing in on the mound. If starting from a wall or fence or mound, it may be necessary to begin by pulling the broom toward you. As you develop the large oval, move the broom in a zig zag fashion to push material from two different directions and thus best loosening the material from the grooves/pockets of the surface – this minimizes anything of interest to rats and other rodents, birds and insects. Zig in one angled direction for a time, or even all the way round the mound, and then zag in the opposite angled direction.

- Lead with an edge: Especially with moist matter, the broom is most effective if the sweeper leads with the front edge of the bristles and then rolls the rest of the broom into the motion – this also helps address the problem of a broom leaving an imprint behind with every push.
- Finishing touch: When the circle is close to the mound, make the last push ride slightly up the mound so the edge is neatly formed and the fine dust acts as a further deterrent to insects. When working during a rainstorm, let the broom linger as it rests against the mound, so the water flows back and the debris stays put.
- Clean brooms: Little is worse than taking down a broom that spills dust/dirt on you because it wasn't cleaned, or that you find is so matted that it cannot sweep. So at the end of a session, gently scrape brooms on the chain link fence to clean before putting them away, choosing a space on the chain link fence where we would not mind debris dropping below.
- Back home: At present the 3 foot brooms live in the sheds, and the 2 foot brooms (orange or old) live in the sifting tunnel's rafters, above the wheelbarrows.

TASK LEADER CONSIDERATIONS (**sweeping**):

- Monitor the expansion of the sweeping area as part of the larger goal for full site maintenance, and keep in mind that volunteers may have put dirty tools down at the far perimeter so the sweep may have to extend that far.

- With multiple builds/turns on one day, and one task ending earlier than another, consider calling the first team "experts" on sweeping and maintain them in that role for the second team. Or maintain a special ops team that moves into the sweeping role as a work session comes to a close.
- In a downpour, when the sweep to the mound leads to roll back from the excess water, have workers push the broom in and hold it for a moment, so water rolls back but the compost stays in place.

VOLUNTEER MANAGEMENT (**sweeping**):

- To emphasize the importance of sweeping, tell the tale of the rat infestation years ago, with adult rats running over our feet while we worked and baby rats emerging from the mounds on the tines of our pitchforks – that's a problem for our regulator, funder, and cherished volunteers. No rat sighted since November 2011 (knock on wood). Add biting insects to explain why we even care about bitty bits. And also explain that we have a landlord, which most people understand.
- Depending on what else is happening at the site, like other tasks requiring brooms, either take brooms/rakes to the build/turn at the beginning or plan on getting them during a moment when you have the team on auto-pilot or can assign it to a team member – do not make the mistake of having the team finish a turn/seal without the tools ready to keep them moving.
- It is best for the task leader or an assigned worker with experience to create the outer sweep circle while others are still finishing the seal, because that both defines the perimeter at the same time it demonstrates the level of thoroughness expected in clearing the surface. This would require the task leader getting the team on auto-pilot, perhaps explaining the shift, so the leader can move to initiate the rake/sweep.
- Alternately, when some team members are not functioning well, it may be best to shift them to the

rake/sweep while others are on auto pilot for the turn. That cannot happen until the team has reached a point where they will not be messing up the space swept, so with a build that would be when the team is at the trim stage and with a turn that is when the team is about 15 minutes from completion – the sweepers are starting far enough out that their sweep should not be compromised by more tosses of the shovel.

- Ensure that tools/buckets/equipment are cleared, because tired volunteers will sweep around them and the surface will not get fully cleaned.

## VOLUNTEER MANAGEMENT (in general)

- Orient expectations in advance of the event so volunteers are best prepared, less likely to be disappointed, and more likely to reconsider if the project is inappropriate for them (tasks and tools and challenges, motivation re: environment and growing food, apparel, water, directions).
- Keeping volunteers hydrated is essential, but some do not like bottled water, and some do not like to drink from an Igloo, and often during winter there is no source of water, so the best approach is always to give volunteers advance notice that they should bring their own water, and then where possible (especially in the hot months) you supplement with bottled water and Igloo water. Tip: for the Igloo, freeze water overnight in a receptacle like a casserole dish or glass container, because that big block of ice will last longer than ice cubes, and consider adding non-sugary supplement for electrolytes.
- Providing gloves is essential, and they should be laundered at least once a week or they can get unpleasant to wear. Tip: get gloves with a reinforced crotch between the thumb and finger, because that is the first site of wear with heavy use of shovels and the reason many gloves get thrown – a couple extra dollars per glove buys an extra few years of wear.

- For the on-site orientation, it's best to wait until everyone likely to arrive indeed arrives, so you do not waste time repeating the orientation – but in the meantime volunteers should start work as long as you have told them that they will have an opportunity later to learn more about the big picture and have an opportunity to ask questions. Often the orientation will occur about an hour into the work session, and that works well for newcomers who need a break.
- For return volunteers who have had an orientation already, especially steadily returning volunteers, it is best to give them choices about what they would like to do when several tasks are available, and consider giving them opportunities to lead a task. Although keep in mind that some volunteers just like to be a cog in the wheel as part of their escape from their paid work.
- For the orientation, as well as explaining tasks, always start with goals and explaining why they are important, because then volunteers know that the hard work really matters, so for example:
    - It is not enough to say that the windrow's ridge needs to be a uniform height from end to end – you have to say that an uneven ridge will lead to one end cooking at a different rate.
    - It is not enough to say that trimming while turning a mound is necessary – you have to say it's important to move larger bits toward the center of the mound for exposure to more intense cooking.
    - It is not enough to say that patting the seal into place is not allowed – you have to say that patting it down will restrict air flow.
    - It is not enough to say that sifting is for "removing large wood chips" – you have to say it's important so the chips do not compete with plants for nitrogen.
- To best promote educational goals and foster environmental stewardship, look for opportunities to explain elements of the volunteers' experience. For example, identify different elements that pop up in a

mound being turned, discuss what inputs we do and don't accept and why, explain out loud the choices you are making as you move from one action/activity to another.

- Be wary of offering water/bathroom breaks for the entire team all at once – this can lead to significantly longer time taken off because the break becomes a social alternative to the social side of the task – it is best for water/bathroom breaks to be on an as needed individual basis, and of course individual water breaks in particular should be actively encouraged.
    - Exception: with an unusually unproductive team, there may be times when you can speed things up considerably by having staff work alone for 15 to 20 minutes.
- Be wary of a beverage/snacks table: it can lead to significant lost time because lingering at the table becomes an alternative to the social side of the task – it is best to limit offerings to water, on an as needed basis
    - Exception: for an especially challenging turn/build that exceeds 4 hours, it may be necessary to replenish volunteers with something like energy bars, and it is best not to bring the replenishment out until it is actually time for the scheduled break.
- When volunteers are present during a task, ensure that they remain the focus of your attention – so no side bar conversations or comments amongst staff reflecting preferences re: tasks/people ("Hate sifting," "heavy hitters," etc.), and no conversations in which volunteers cannot have at least the potential to participate.
- Whenever possible, it is best to wrap up tasks/teams close together so there can be a closing circle up of everyone, during which you recognize accomplishments (tons turned, cubic feet sifted, etc.), explain the significance of their work (material aerated so it will heat up again, material ready for application to our various farms, etc.), and thank them for the broader importance of their work so they understand how good they should feel about their contributions. At some point after the

group breaks up and there are ongoing conversations, and only after you have given any extra appropriate time to veteran volunteers, you may have to specify gently that staff has to move back to work.

## WINDROW BUILD

GOAL (**windrow build**)**:** Construct a new compost "windrow" mound in which food scraps are sliced adequately and contaminants are removed, there is an appropriate balance/blend between carbon-based and nitrogen-based material, and the windrow has a structure that maximizes favorable microbial activity and minimizes the risk of odors/rodents/birds and unwanted insects.

BACKGROUND (**windrow build**): Windrows are elongated mounds with the cross-sectional shape of a triangle. The shape promotes passive aeration. The build of the mound starts with a first layer of processed material. Thereafter each layer is blended at the side and tossed onto the first layer by shovel to decrease compaction. As the mound rises, it may start to ridge up on top, in which case a platform must be re-created with a rake at the top to allow for additional layers. Otherwise the larger material will mostly roll down and wind up predominantly at the bottom outside edge of the mound, leading to a less effective cook. When the material is nearly all processed, the mound is allowed to ridge up to promote a chimney stack effect of rising heat. That rising heat pulls air in from below and passively aerates the mound until it gets compacted. Sculpting throughout, and at the end, is essential to ensure the mound has a ridge that is centered, and a height/width that is uniform, so the cook is even from end to end. Then the mound is sealed with more developed compost to keep out pests.
The biggest challenges are slicing/blending efficiently, and managing tools/equipment so they do not become a time-waster because they have to be moved unnecessarily.

STEPS (**windrow build**)**:**

- Location and recipe: Per the site coordinator, identify location and inputs for the build (how many toters/tumblers/barrels of nitrogen-based material and corresponding carbon-based material).
- Prep: Assemble needed tools/equipment in a wheelbarrow – 4 red buckets (for inorganics), choppers, shovels, pitchforks, landscape rakes. Having all the tools assembled once reduces time wasted on walking back and forth as the need for tools arises.
- Setup: Mark the four corners of the build with the red buckets. Place the tool transport wheelbarrow in a strategic position so it may serve several roles that promote efficiency, as a place to lean or deposit tools so workers are not wasting more time than necessary:
    - looking for tools,
    - walking to get tools,
    - putting tools on other equipment like toters/barrels from which the tools have to be moved so the toters/barrels can be moved (only handle things once, or "OHIO"),
    - stepping on tools,
    - sweeping more later because of the debris that was distributed by tools that travelled willy nilly, up against walls and elsewhere.
- First Browns: For the first layer of carbon-based material, which will be processed inside the rectangle formed by the four red buckets, consider choosing the more challenging carbon material. That's because at the beginning the most space is available for blending and the material is lowest to the ground (e.g., wet matted hay that needs to be pulled apart across a wide area, or leaves on a windy day, etc.). Lay out the appropriate amount and then add a portion of bulk amendment (wood chips) and carbon available material (like wood shavings). Each layer thereafter should also have both bulk amendment and carbon availability.

- Retrieving Greens: Starting with this step, materials/equipment/tools/people will begin to flow more heavily in and out of the work area. So it's best not to crowd the area unnecessarily, because then time is wasted moving around things, or moving things out of the way. For example, it is best not to bring the greens to the work area all at once. That avoids crowding, but it also opens up another efficiency: whenever full bins/toters/barrels of greens are needed, empty ones can be removed to their next staging area on the way to get full ones. Thus when more full toters are needed, empty ones can be taken to the rinse station on the way to get full ones. Similarly, when it happens that both full and empty toters will be present, push the empties in one direction pointing toward the rinse station, and position the fulls on the opposite side – that way there is no time wasted on checking to see which ones are full/empty, or on correcting mistakes in thinking one was the other. Always look to save time and work, but without sacrificing quality.
- Tipping Greens: The goal here is to tip out greens on to the browns thoroughly. Invert the receptacle and tap it vigorously, not destructively, to get the most material out. Double check results. That will reduce rinsing time and waste of water.
- Culling/Slicing: Once the greens are tipped onto the browns, the relevant tool is the pitchfork to spread the greens so culling/slicing can occur. No other tool should be in action before the pitchfork, because that is a sign of wasted time. The spread has to be sufficient to visualize all material. Cull out inorganics to the red buckets. Cull out any whole fruits/vegetables for a slice, or items that require more reduction in particle size in order to compost well, like half a watermelon (too large), or half a coconut (too hard), or a corn cob without the corn, a long broccoli stem, or a pineapple top (they just don't break down quickly enough even though they've had surfaces exposed for

decomposition). The pitchforker quickly culls all items for a slice, and with our present inputs that should take no more than five (5) minutes, barring unusual items. Toss items needing a slice to the bare surface beside the material, so a chopper can slice once. Never slice an item while it is still on the browns, because that compacts material unnecessarily and may obscure what needs to be culled. Never slice more than once (except unusually large/hard/difficult items), because that wastes time. Slicing should take five (5) minutes, barring unusual inputs, and with more than one person on the task then the slicing can occur simultaneously with the culling, for a total of five (5) minutes.

- Blending: Once culling/slicing is done, the goal is to blend the browns/greens efficiently, to maximize the number of dinner plates for the microbes without overdoing the amount of time spent. Each task leader may have a different approach for blending, but one feature is always present – the blend gets to the point where you no longer see batches of browns or greens on their own, like a mat of wood chips or coffee chaff or weeds – any such mat signals zero microbial activity.
- Switch to side blends: Pitchfork the first layer flat to the four corners marked by the red buckets, and then future material will be blended at the side of the mound and shoveled up so the mound does not get compacted by tipping material directly onto it. With the switch to side blends, there is less space in which to work. The method is to create an elongated enclosure of browns, running the length of the mound with edges high enough and far enough apart for the greens to be tipped fully inside. This method does two things. It prevents material from rolling away, which saves time. It also creates a wraparound sponge for any liquids that might spill out. Constructing the browns enclosure alongside the full length of the mound saves time later because the material, once blended, can be more

quickly shoveled onto the mound – the toss requires at most one step, and no steps should be wasted.

- Build flat: The target of the shovel's toss matters. The mound rises best that rises flat, because that allows for a higher mound (using less real estate and fostering more air flow), and allows further for the larger items to be a part of each rising layer rather than roll down to the bottom outer edge and thus create a warp in the structure of the mound. To build flat, either toss the material in an even spray across alternating sections of the mound, or toss close to the edge of the mound to avoid it ridging up at the center.
- Trim: Do not waste time tidying up the work surface after each layer, because you will start a new mess with each layer. But do be meticulous about trimming the edge of the mound, where larger items invariably roll – those items should be trimmed to the top so they are distributed evenly throughout the mound.
- Recreate the platform and sculpt: If the top begins to ridge up so large items roll down, it is necessary to use a landscape rake to recreate the platform so larger items stay on top when shoveled there. At this juncture, first step back at least 20 feet on one end and then one side to evaluate whether the mound is positioned correctly per site supervisor's instructions. You will not see problems if you do not step back far enough. If the mound is crooked, use the rake to shape it back on course. If the mound is wider/higher at one end, or is rounding off at either/both ends, it will not cook uniformly, so use the rake to shape it to symmetry. At times you may have to supplement the sculpting by a rake with sculpting by trimming with a shovel at the base.
- Newark (NEver WAste youR walK): Whenever you walk away to do something (get inputs, drink of water, go to the bathroom, etc.), use the opportunity to take something with you to clear the work space (empty barrels/bins/toters, etc.). This keeps the work space

easier to navigate and saves time when the moment arrives for sweeping.

- Ridge it up: When the last layer is about to go up, recreate the platform first and do a deep trim at the base of all large items. Then use the last layer to ridge up the mound, supplemented by any trim needed to finish the ridge. Use landscape rake to sculpt the mound so ridge is centered and mound is an even height/width end to end.
- Sweep: (see SWEEPING)
- Seal: (see SEAL)

TASK LEADER CONSIDERATIONS (**windrow build**):

- When possible, locate the build near the material that will serve as seal, even close enough to walk the seal with 2-3 steps to the new mound.
- When a seal team is pulling seal for the new mound into wheelbarrows that will be parked, ensure that they do not encroach upon the sweeping perimeter for the new space, because you will have to waste time moving the wheelbarrows to start the sweep. Also, ensure the wheelbarrows do not block transport lanes for materials from one end of the site to the other, or you will again be wasting time later. Lastly, when possible park the wheelbarrows so they can be rolled from two different sides, saving time later when workers will not be in each other's way as much as they roll the material.
- Ensure barrels are not tipped over without support. Easing the barrels down to the ground gives them a long life; tipping them over into a free fall cracks the rim.
- Move equipment out of the way as soon as you can, so later steps flow more quickly. For example, when the last layer is going up on the mound, you can clean the pitchforks into the mound and either deposit them in a tool transport wheelbarrow or store them – otherwise you will have pitchforks to clean after the mound is

sealed, adding steps to the task because you have to clean them into something more time-consuming. Similarly, clear out the empty browns barrels so the prep for the sweep is quicker.
- Have workers close lids on empty toters to deter insects.
- On windy days, the carbon available material is challenging. Be ready to smother it with wood chips or greens. For stiff winds, when everything is blowing away, consider making a wall of wheelbarrows tipped on edge to catch flying material.
- Monitor need for sculpting, because the fixes are easier the earlier the need is identified.

VOLUNTEER MANAGEMENT (**windrow build**):
- The key to bringing a build in on time is to fill in the gaps where volunteer workers may feel less able to move as quickly as you can. Thus as a task leader, you will likely never shovel, because that job others can master that more easily, unless you need to demonstrate a faster pace. Instead you are best positioned first and foremost as the pitchforker, first culling, then calling the cull done so blending can commence ASAP, and then calling the blend done so the tossing can commence ASAP. When not pitchforking, you are positioning and tipping browns/greens, until you see that a worker seems to pick up on the technique and pace, at which point you can just inform the worker what browns/greens to use for the next layer. Otherwise, you are re-creating the platform.
- Articulate clearly in the orientation to the task that only one slice is necessary, and why, and then introduce the exceptions (too large/too hard/too difficult) as they arise during your culling. Otherwise workers can go into a trance over-chopping, and you get behind schedule.

- Similarly, at the conclusion of the first toss-up, articulate clearly that there's no reason to get too tidy, except with a trim, because you are moving quickly to mess up the workspace again with material for the next layer. Otherwise well-meaning workers will waste time over-cleaning each layer's material, and you get behind schedule.
- Many individual types of browns will not be sufficient as the full carbon-based portion for each layer: wood shavings, coffee chaff, hay, J row, fungal strip, trim from turns, etc. But they have to be integrated into the mound uniformly or there will be a warp in the structure. So ensure that any type of individual browns run from one end to the other for the creation of the browns enclosure, so the blend and toss-up is uniform. For example, if you have one barrel of wood chips and one barrel of J row, you cannot tip out the barrels at opposite ends of the browns enclosure. You have to have each drawn out to the full length.
- Attempt to get at least a portion of the team on auto-pilot as the last layer nears, so you and perhaps one or two others can get a head start on the sweep and define the broadest perimeter that time will allow, hopefully to the farthest edges so the sweep doubles as site maintenance. Of course be careful not to start too soon because you do not want to sweep so close that the final toss-up is rolling material down and outside your sweeping edge.
- Above all, monitor the scene to identify whether any volunteer workers are not moving – if so, something is wrong and they need your support in some fashion. Evaluate each phase of the work in advance to ensure volunteers will always have something to do. For example, if you are working on one side of the mound with one team and cannot break away for some reason, and the team on the other side finishes a layer, communicate the next step across the mound. As another example, do not start volunteers on sealing a

mound if they will run out of seal – have them pull seal instead. Volunteers do not have to move with the same urgency you do, but they do need to be consistently productive.

## WINDROW WALK TURN

GOAL (**windrow walk turn**)**:** Re-introduce oxygen and water to the mound for ideal conditions, further break down and blend material as well as cull out contaminants, and re-structure the mound so material needing a higher temperature gets to the core.

BACKGROUND (**windrow walk turn**): Depending on various factors including the season and the age of the mound, windrows will turn every seven days to three weeks – new windrows always turn frequently until they begin to cool. How well the windrow has developed will determine whether or not it needs some form of seal after it turns. A "walk turn" means that you turn by shoveling the material a few steps away, so when you are done the entire mound has moved about ten to twenty feet in one direction. This is the most labor-efficient turn; thus a site designed to act like a pipeline works very efficiently. But sometimes the mound must be moved farther, such as to a curing space. That requires a "roll turn" with wheelbarrows, and is well suited for a large volunteer team.
The biggest challenge is to balance quantity (how much gets moved in a period of time) with quality (meeting standards for proper moisturizing, contaminant removal, and mound structure).

STEPS (**windrow walk turn**)**:**

- Location and setup: Per site coordinator, identify target spot for turned material. Assemble two red buckets, pitchforks, and shovels into tool transfer wheelbarrow. Place buckets on either side of workspace, and locate wheelbarrow where it best suits to avoid the tools

migrating too far with attached food bits. For example, if the nearest target for leaning tools is a wall, place the wheelbarrow next to the wall so the tools go on the wheelbarrow and any dropped food bits are easier to sweep clear.

- Pitchfork (see PITCHFORKING)
- Turn: Shovel material to the target spot, forming a cone that will rise to the level identified by the site coordinator. Each time hit the top of the cone for a uniform rise. Cull out inorganic contaminants (rubber bands, plastic bits) as you shovel, except for the stickers that are too labor intensive to extract at this stage because they are often still stuck to produce – they will pop out easily during sifting.
- Moisturize: Once the cone is large enough it is possible to evaluate the need for water in the mound. Per site coordinator's direction regarding how much water is needed, implement plan for moisturizing. Initially, the hose can spray the entire cone; eventually, the hose should focus exclusively on newly added material and discontinue adding to material that has already been moisturized – otherwise the mound will be unevenly moist.
- Trim: As you shovel to the top of the cone, larger material will roll down to the base. Some of that material needs slicing/smushing, most often avocado pits. Periodically, walk from the workspace to the back of the cone, and slice/smush material as you go. Once at the back, return and as you go trim this same material at the edge back where you came from, toward that part of the cone that faces the mound from which it is being created. Toss the material along that face, beginning about two feet up. Your goal is to move all the larger material toward the core of the mound for higher temperatures and better development. Continue this trimming throughout the turn, but only as far back as the larger material is rolling down. Beyond that point you have already

trimmed sufficiently, and if you keep trimming what has already been trimmed then the mound will be narrower at the beginning and wider at the end, leading to a uneven cook.

- Extend and monitor ridge: Once the cone has reached the designated height, start shoveling to a point about six inches from the cone's top and in the direction of the old mound, so a ridgeline starts to grow toward the old mound.
- Sculpt: Periodically step back at least 20 feet on one end and then one side to evaluate whether the mound is positioned correctly per site supervisor's instructions. You will not see problems if you do not step back far enough. If the mound's ridge is crooked, use the rake to shape it back on course. If the mound is wider/higher at one end, it will not cook uniformly, so use the rake to shape it to symmetry. At times you may have to supplement the sculpting by a rake with sculpting by trimming with a shovel at the base. Conclude the turning with a final sculpt at the ridgeline, because that firms the ridge against birds, squirrels, and high wind.
- Sweep: (see SWEEPING)
- Seal if necessary: (see SEAL)

TASK LEADER CONSIDERATIONS (**windrow walk turn**):

- Direction: The direction of the turn depends on many factors. For example, you have to map out the direction that adjacent mounds will be turning, and where future builds will occur. Also, consider the proximity of seal if it will be needed, because if you can you want to take advantage of a "walk seal," meaning that the material for sealing the mound is only a few paces away and does not need to be rolled in a wheelbarrow. Another consideration is wind – turning into a high wind is challenging, because the material flies back in workers' faces.

- How far to turn: Pace out enough room for the turn so as you turn the gap between the new mound and the old mound does not close – this can happen because you are fluffing up the material as you turn, so the volume increases (twelve feet is usually comfortable). In addition, pace out extra room if you have a big team, because there has to be room for more human bodies (twenty feet is likely best). By contrast, a team of just two experienced turners (plus a pitchforker) may position themselves to turn while pivoting on one foot that never moves – this is the fastest of turns but requires the minimum gap (likely ten feet).
- How high to go: At some point you will call out that the height of the cone is good and extending the ridge can start. That's not an easy call. As a general rule, the higher the better, because greater height can mean more passive aeration. But adjustments are necessary. First, it's important to account for the height of workers, because it may be a tall turn is good for some but overly taxing for others, and productivity may drop. It may help to convert to narrower and longer shovels, because then there is less weight to lift and less of a reach. But, ultimately, it is getting the turn done well and on time that is more important than striving for the greater height. Second, there are seasonal adjustments – you may want more height in dead cold winter to foster higher temperatures and less height in sweltering hot summer to foster lower temperatures. Third, you may be short on real estate, and have no choice to go high to make a fit.
- Spin Cycle: A large team will split in two, half on one side of the turn and half on the other. The goal is to be as productive as possible without getting in each others' way, or clipping each other with shovels. The method is for each team to move in a circle, with one shoveler approaching the old mound, taking a shovel full of material, turning straight toward the new mound, depositing the material on top, and then swinging out

and away so the next shoveler can follow behind and likewise swing out so another team member can follow. This can also be a fast turn, but it may be necessary to orient faster shovelers to slowing a bit, and slower shovelers to stepping out if they need a break. Without those accomodations, the spin cycle can fall apart and each team member develops a solo lane, and that's when people start getting in each others' way and potentially injuring each other. Here again, the quantity moved by bigger shovelers is excellent, but quality demands taking into account the team as a whole.

- Switch sides: Turns can be physically challenging for the body, so it is best to call out a change of sides periodically so one set of muscles is not over-taxed.
- Moisture Management: Evaporation rates are low in winter, meaning less need for water, and high in summer, meaning more need for water.
- Trim Trouble: Watch closely for a mound growing thin at the back, fat at front. That's a sign of over trimming the mound, namely starting at the back every time rather than trimming only what is newly fallen, closer to the front. Catching this too late is the single biggest sculpting challenge.
- Time Trouble: If you are running up against a time deadline for a turn, and you can reconfigure teams, consider an early start on the seal (if a seal is necessary). This entails sweeping in the back third of the mound and commencing the seal process while the turn continues at the front. To preserve the opportunity for doing this, it is all the more important to be monitoring the mound for any sculpting fixes early and often. Otherwise, backtracking to fix a mound will create a whole new round of trimming, which wastes time in itself, but may also eliminate the opportunity to do an early seal because a sweep would be premature.

- Last call on trim: As the turn finishes, often the last trim is a bit raw while the rest of the mound is fine, not requiring a seal. Barrel the raw material for the next build, underpinning and capping the material with wood chips.

VOLUNTEER MANAGEMENT (**windrow walk turn**):

- The biggest challenge is sometimes presented by the hardest workers. Hard workers often put their heads down and move a lot of material. But as much as quantity counts, the quality of the turn matters as well. The work session should not end with empty red buckets. And anything that needs a slice/smush should not get a pass. To anticipate these issues, it helps for the task leader to include them in the orientation to the task ("We will get a little tired, but…) and then find an opportunity for a reminder ("Our buckets are looking empty….[or] "Whoa, there's a lot of whole avocado pits that need smushing").
- Explain the trim when you start doing it, because there may be confusion about why you are hitting the mound lower when you expect others to hit the top, and you don't want others to take a cue from you and start hitting lower. Similarly, when you need to sculpt the mound to fix it, explain any feature of what you are doing that may seem to conflict with what you've told others to do.
- Another challenge is with moisturizing. Without attention from the task leader, the mound can suffer. The moisture has to be even throughout the mound, and not in excess (the goal is 50% water in the mound). What that means for any moisture management plan varies wildly. For example, the mound can need minimal moisture, so the hose is on for brief interludes – *this means the task leader has to time the interludes.* That can be done by watch/phone, or it can be done as a counterbalance to another periodic task, like trimming – one full trim, then

moisturize, one full trim, then moisturize, etc.. As another example, the mound may need heavy moisture, so the hose is on constantly and the challenge is to find a nozzle setting that does not outpace the mound's ability to absorb the moisture. Keep an eye out to ensure any moisturizing addresses new material being added, and not the entire mound, as a failure there means the back of the mound is too wet and more wet than the front. Lastly, orient well at the beginning of the moisturizing that it's important to not impede the shovelers, who have enough of a challenge already in transferring material – they don't need the jarring interruption in their rhythm from a moisturizer who steps in front of them.

- Volunteers are gold, so let them know from the outset what the process is throughout, especially that there may be a seal. Even though they will work however much time is allotted, it can nonetheless be deflating to think a task like a turn is done when in fact the second phase of a seal, if there is one, can take just as long.

## WINTERIZING

- Gloves: Stow the black Atlas re-grips, which are vented and do not allow knit gloves underneath, and pull out from Tex storage bins the blue gloves, which are waterproof and under which knit gloves can slide for greater warmth.
- Hoses: Drain and disconnect all hoses except the one closest to the gravity drain (this will run to the drain behind the air house for the winter season). Disconnect is necessary because otherwise partners may fiddle with the valves and inadvertently fill the hoses that then freeze and burst. Stow in the tunnel any hoses that cannot be left out of the way of tools removing snow or ice – for example, the hoses are safe that run close to the base of the south fence from the gravity drain to the curing pad. Monitor temperatures

to determine when daily draining of the one working hose is necessary (see HOSES section for detail).

- Rainwater Harvest Bins: By the first week of December, drain the bins almost entirely and divert the run-off from the gutter away from the lead bin's intake and into the downspout – related materials are in Tex storage bins marked for hoses and harvest bins.
- Wormbin: In case the winter is severe enough to substantially decrease the worm population in the active mounds, fill the wormbin under the rainwater harvest shed with partly composted material, with worms added toward the bottom, and insulate for the winter with the two silver debris bags – if there are sustained bitter cold temperatures, and sufficient solar power backup for other essential systems, plug in the warming cable (40 degrees) that wraps the wormbin to ensure worms do not freeze (only as necessary because the power draw is large).

## WOOD SHAVINGS

GOAL (**Wood shavings**): Essential for our compost recipe and other purposes when they are dry, wood shavings arrive in bags and get transferred to Brute barrels that are waterproof, impervious to rodent damage that allows rain in, and stowed without need for underlying pallets or other versions of storage more hospitable to rodent habitats.

BACKGROUND (**Wood shavings**): Wood shavings provide a highly carbon available ingredient that kick starts the microbes in a fresh mound, serve as the best brown for the occasional extra absorbency needed in community tumblers, and further serve as the best brown for smothering the rare bit of anaerobic material that arrives at the site. To retain their desired qualities, as well as not clump during a fresh build, wood shavings must be dry. Storage in lidded barrels guarantees dryness and reduces potential rodent habitats. We use USDA-compliant yellow brute barrels. For inventory

control, the barrels line up in storage in groups marked by signs as "Old" and "Empties" and "New," with the front line of the New group always leading forward, left to right, followed by the Old group bringing up the rear, and Empties in between. The wood shavings arrive in plastic bags from sources we can trust not to include contaminants or excess allellopathic potential, and the big challenge is to transfer the material from the bags into the barrels without breathing in or getting covered by dusty clouds.

STEPS **(Wood shavings)**:

- Make sure there is an open area in front of the browns pen to transfer the wood shavings. Consider whether to move the truck if it is nearby because it may divert the wind in the wrong direction.
- Pull empty yellow brute barrels from the browns pen where the red sign points "Empties".
- Determine which way the wind is blowing and position your back toward wherever the wind is blowing from.
- When possible try to untie the garbage bags so they can be reused. A screwdriver helps loosen tight knots without ripping the bag. If bags are tied too tightly or are too battered to save then rip them open in a way that creates an opening big enough to pour out the wood shavings yet small enough to control the flow.
- With the goal of not creating a dust cloud, slowly turn the bag upside down into the barrel with the open portion of the bag entirely in the barrel. This is just to get the bag into position. Then grab the bottom corners of the bags and loosen. This process should be slow to avoid a dusty cloud that poofs up. Really, slow.
- Fill each barrel to the very top. The lids will prevent spillage for any subsequent transfer of the barrel (unlike the gray barrels, which are not lidded and thus must not be filled too much).
- Keep pulling empty barrels until all the wood shaving bags are emptied, saving one barrel at the end to sweep any spillage into.

- Before putting away the newly filled barrels and blocking any signs, move the signs to correspond to the new position of the barrels (for example, you will add to the front of the "New", so that sign should move forward).
- Also, weigh or estimate the weight of one full barrel's contents and multiply by the number of filled barrels.
- Store full barrels at the lead edge of the "New" barrels, stacking to the height and depth of what is already there, saving the last barrel for sweeping up any spillage.
- Sweep all remaining wood shavings on the ground into the last barrel.
- If there is time, sweep out debris from the area of the pen that has been cleared, as well as between barrels and down the aisle, placing that material in a gray barrel for the next build, stowing the gray barrel under the rainwater shed.
- Cover the filled barrels with mesh wire screens to ensure they do not tip over in high winds.
- Shake out all the dust from the bags to be reused and stow them in the truck. Discard the bags in bad condition.
- Report weight to site supervisor.

TASK LEADER CONSIDERATIONS **(Wood shavings)**:

- Avoid transfer into barrels if there are strong winds or if it is raining. In such instances, stow the bags in one of the jumbo white leaf bags (cable tie the handles), then invert the bag upside down on a pallet (or lumber, to keep out of rain on the ground) with a second leaf bag drawn over the top of the first to ensure dryness with those two layers.
- It's best to for you to control stowing the full barrels to protect inventory protocols (placement of barrels and numbers needed to calculate full weight of inputs).

VOLUNTEER MANAGEMENT **(Wood shavings)**:

- Explain to volunteers they are transferring wood shavings from plastic bags to avoid rodent damage that allows

entry of water, and to allow for easy measurement for a windrow recipe.

- This task should be done slowly. Volunteers should all be prepped on where the wind is coming from and told to stand with their back to that direction. Invariably the hard-working volunteers will try to speed up the process and get thoroughly dusted, so mention that it always happens, and in this one instance slow really is better.
- Position individuals or teams on one barrel sufficiently away from other individuals or teams to avoid contact with any of the other team's mistakes on dust clouds.

## **APPENDIX A: PROTOCOLS FOR HARVESTING NUTRIENTS FROM CROP MATERIAL/WEEDS ON THE FARM'S FIELDS** [for task leaders]

The farms' fields generate a lot of organic material that is compostable, like dead stalks and weeds. A big green weed is a big chunk of nitrogen stolen from our growing soil. Weeds and other field material contain free and valuable nutrients to recycle into compost and then put back into our soil.

The challenge is to extract the material in a sustainable manner. To do that, we have to think all the way through to the point at which the material is composted. Thinking that far ahead, the best approach is to cut up the material at the point of extraction. Otherwise the material gets mounded on the field, or jumbled in a wheelbarrow, and the work of pulling it all apart later makes the whole process take three times longer. True, it feels good to clear a field quickly. But it is not sustainable to triple the amount of labor hours that other farmers must dedicate to a task.

- The Right Particle size. As a rule of thumb, you should break down material so it is no longer than a hand, so it will compost well and not slow down our system.

- The Right Tools. The type of plant you will process determines the type of tool you need:
    - your hands for tender plants,
    - clippers for tougher plants, and always use a holster rather than put them on the ground (make an "o" with the thumb and index finger holding the material so the clippers do not nip you),
    - loppers for large plants,
    - digging tools for roots – your hands for the shallow roots, a trowel claw for deeper, and an appropriate shovel for deepest

- The Right Method.
    - process into farms' wheelbarrows, as indicated by team leader
    - get the entire plant, roots and all
        - with weeds, failing to bring up the roots can cause an even larger root system to grow, and/or more weeds
        - you will best prepare the planting bed for the next crop if it is cleared of extraneous material that gets in the way
        - green material left behind does not recycle as much value for our soil as it does when composted in a controlled system
    - leave the soil behind
        - shake out the soil on the roots, because if it goes into compost *we're lowering the soil level of the farm beds*, and adding unnecessary labor to carry to/load into compost, to turn, to sift, and then to carry back to the fields
        - shake low to the ground with firm taps against the farm's wheelbarrow or the ground, because shaking high can get soil on the leaves of crops and harm them – or it will get soil on colleagues and annoy them

- The Right Finish.
    - fill the farm's wheelbarrows loosely or you will add extra time to pull it all apart to blend with carbon-based material
    - allow enough time during the work session to put the material into a compost system
    - choose the right compost system per protocols.