

## Cold Weather Composting

*Proven composting performance in temperatures down  
to -40°C*

Aaron Osczevski – Sustainable Generation®



# Introduction



Aaron brings 10+ years of landfill and composting operational experience, including leading Saskatchewan's first industrial composting facility. A former landfill operator turned subarctic composting manager, he has hands-on expertise in SSO processing, cold-climate operations, equipment, safety, and team leadership.

At Sustainable Generation®, he drives the expansion of high-performance composting systems across Canada, proving SG technology succeeds in even the harshest environments. Passionate about sustainability and practical organics recycling, Aaron advocates for scalable solutions in every province and territory.



# Agenda

- Fundamentals
- Cold Weather Operations
- Technology Solutions
- Questions



# Composting Basics

## Mix Recipe:



- Carbon (Bulking Agent)
- Nitrogen (Main Feedstock)
- 25:1 – 35:1 C:N Ratio
- Moisture Content of 55%-65%
- Porosity of  $\geq 25\%$
  
- Must pass PFRP (Process to Further Reduce Pathogens)
- Must be an aerobic process
- Can be multiple feedstocks but the science of compost does not change based on the weather.
- Ultimately Composting is a manufacturing process, not just a way to divert waste. The goal is to create a high-quality marketable product.



# Composting Basics

## Selecting Feedstocks:



- Feedstocks especially in Canada can change based on the seasons. Those Leafy trees in the summer have more available nitrogen in them than the leafless trees in the fall and winter.
- Consistent Nitrogen rich feedstocks such as digestate and biosolids are always a nice to have but not always the case. Typically, most composters in Canada compost foodwaste and yardwaste comingled as Source Separated Organics
- The most difficult thing to source in cold weather applications are typically clean carbon sources however there are clean sources of carbon available year-round.



Cold Climates challenge consistency--not feasibility



# Composting Basics

## Contamination:



- Unfortunately, inevitable at all facilities
  - Typical contamination at compost facilities are
    - Glass, Concrete/Rocks, metal, rigid and film plastic
    - Some composters can't handle compostable plastic.
- Contamination can ruin equipment very quickly, causing unwanted down time
- In cold weather/year-round facilities you will see an increase in contamination over the winter.
- There are lots of techniques to help with contamination but ultimately most are taken out mechanically or by hand.



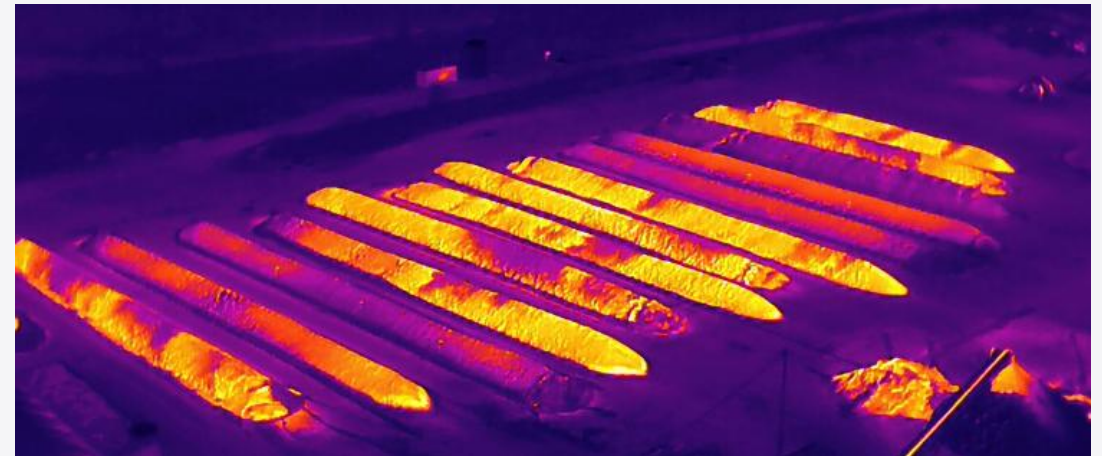
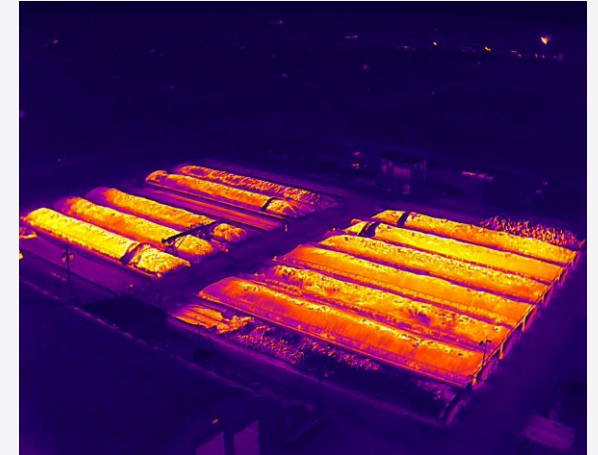
# Composting Basics: Process to Further Reduce Pathogens



In-vessel / ASP → 55°C for 3 days

Windrow → 55°C for 15 days + 5 turns

Achievable in all climates with proper system design



# Site Operations: Weather

## **Snow/Ice/Sleet:**

- Large amounts of snow can make it difficult to access your compost pile to add new materials or turn the pile.
- Ice forming on or in your compost pile can significantly slow decomposition. If the pile freezes solid, microbial activity stops completely until temperatures rise. Ice blocks air and water flow, which are critical to composting.
- Surprisingly, snow can act as an insulator for your compost pile. A blanket of snow helps trap heat inside the pile, preventing it from cooling down too quickly. Microbial activity can continue underneath the snow, albeit at a slower pace.

## **Rain:**

- can add excess moisture to your compost pile, which may lead to soggy conditions. This can create an anaerobic (oxygen-poor) environment, leading to odors and slowing decomposition.
- Like snow, rain can make it difficult to access your compost pile to add new materials or turn the pile.
- Rain does have a positive effect on Odour, being most VOCs are water soluble this will keep odour down and more local to site if dealing with any issue piles.

## **Wind:**

- Wind can be a nuisance, operationally with dust and debris around site. Wind is also a fast way to carry odour further than expected.



# Site Operations: Weather continued



## Turn or Not to Turn?

- While turning the pile is in very cold weather, will impact microbial activity, it still needs to be done. Turning it on warmer winter days can help mitigate heat loss, which may have less of an effect on the compost.
- Some systems such as Aerated static piles do not require the frequent turning of a windrow system. However, they do require a minimum of 1 turn.
  - These industrial systems can allow you to build larger piles and create more heat than your traditional windrowing system.
- Different equipment can also be used to turn depending on the size of your operation.
  - Windrow Turners, wheeled loaders, stackers, slow speed shredders.
  - My experience was using wheeled loaders and a covered aerated static pile.



# Site Operations Equipment

- **Loader, Skidsteer, tractor:**
  - These material handling pieces of equipment are a non-negotiable for all facilities. Typically the size of equipment is dependent on the throughput of the facility.
- **Trommel and Star Screens, Densiometric tables:**
  - All sites need to screen their finished compost; some do it annually via tender/rental but most of the larger sites have several screening pieces for different fractions.
- **Separators, bag breakers, labourers:**
  - Some sites use machines to separate plastics, and other would be contamination. But most still use labourers.
- **Winter Woes:**
  - Unfortunately all of these pieces of equipment deal with winter and some handle it better but no piece is able to avoid breakdowns and as a site operator/manager is it imperative to reduce the amount of unscheduled downtime.



# Site Operations Lessons Learned



## Operating Lessons Learned:

- Weather
  - It cannot be controlled; however, it must be worked around. Adjusting turning, planning for snow storage, having plans in place for all sorts of weather keeps a facility operating on all cylinders no matter what the weather is doing.
- Breakdowns
  - The most inevitable part of facility operations, the best is plan is to have replacement wear parts on the shelf; however, this isn't always feasible. It does prevent downtime from extending out of control.
- Staffing
  - Keep staff happy, purchasing higher quality safety gear such as gloves and winter gear is a great way to keep morale up and not lose production.



# Technology as an Aid Equipment



- From Exhaust Aftertreatment faults, to gelled fuel, plugged radiators and hydraulic woes. Operating equipment in extreme temperatures is not easy on equipment, operators, or budgets.
  - There are options to help deal with the colder weather, some of the things we used are listed below:
    - The best solution is to park your machines inside. This can lead to vector damage depending on where you are able to park.
    - Winter Fuel,
    - Diesel Pre-heat system such as Webasto, or Eberspaecher which heats your coolant and hydraulic oil, and cab.
    - Sourcing proper hydraulic oil for your machines.
    - Using a pre-cleaner for your engine air and radiators.



Cold Weather doesn't stop equipment—poor preparation does

# Technology as an Aid

## Composting Technology



Open Windrow Composting—Lowest Cost, highest weather exposure

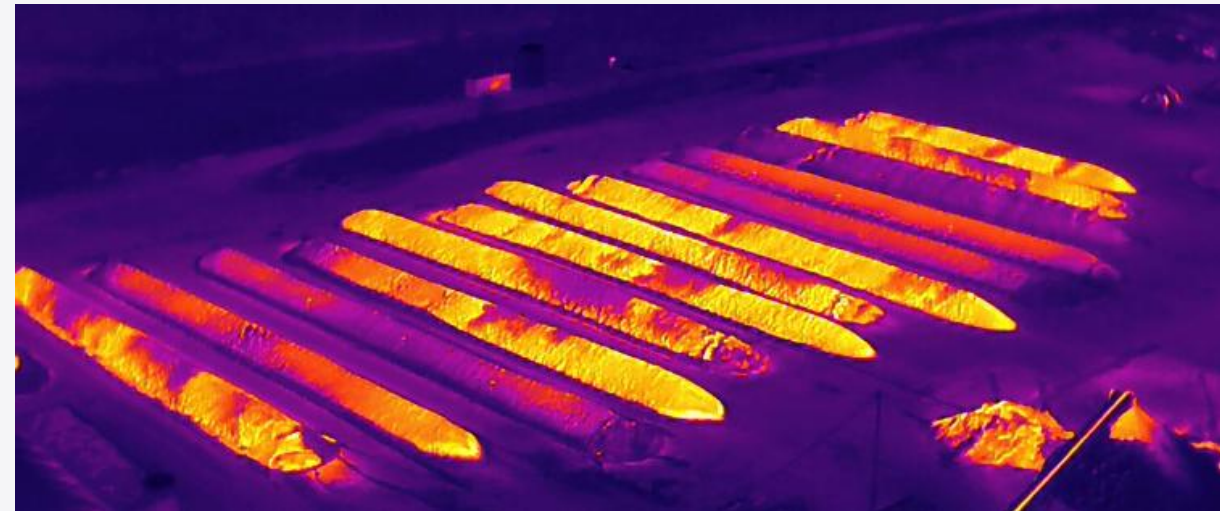
### Pros:

- Moderate capital cost
- Easily Scalable
- Proven system
- Flexible feedstocks
- Easy to visually inspect



### Cons:

- Odor exposure
- Weather dependent
- Turning requires fuel & labor
- Emission control limited
- Inconsistent heating across pile
- Larger land footprint
- Longest processing time (6-18 months)
- Structured recipe still critical



# Technology as an Aid

## Composting Technology



### Aerated Static Pile

#### Pros:

- Reduced turning
- Mechanical aeration
- Improved oxygen distribution
- Moderate capital investment
- Faster Process Time (2-6 Months)
- Smaller Footprint

#### Cons:

- Weather exposure
- Heat loss
- Moisture variability
- Odor risk if airflow poorly managed
- Uneven temperature zones
- Structured recipe still critical



*Step-change improvement over windrow in cold climates*

# Technology as an Aid

## Covered Aerated Static Pile

### Pros:

- Positive aeration control
- No turning during active phase
- Heat retention
- Moisture management
- Odor containment
- Emission reduction
- Shorter active phase (~4–6 weeks)
- Easily Scalable
- Predictable, reproducible batches

### Cons:

- Higher initial capital cost
- Requires blower and airflow design
- Operator training required
- Structured recipe still critical

*Optimized for year-round, all-climate performance*



# Technology as an Aid In-Vessel



## Pros:

- High process control
- Smaller footprint
- Better odor containment
- Faster active phase (~4-6 Weeks)
- Enclosed system

## Cons:

- High capital cost
- Complex mechanical systems
- High maintenance
- Energy intensive
- Limited scalability flexibility

*Maximum control, maximum cost*



# Conclusion:



## Year-Round Composting is Achievable!!

- Composting works **365 days a year—even in extreme cold**
- Weather affects **operations, not the biology**
- Success depends on **planning, process control, and experience**
- Technology enables **consistent, predictable performance**
- **Composting is a scalable, year-round solution in any climate**



# Questions?

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