# Composting in Small and Rural Communities

SWRC 2013 reForum

Saskatoon, SK

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# Composting's Role In Solid Waste Management

- Organic materials are one of the largest components of the solid waste stream.
- It is difficult to achieve any significant reduction in the amount of solid waste being landfilled without addressing organics.
- Additional benefits of recycling organics include:
  - Nutrient and organic matter recycling
  - Pathogen reduction
  - Plant disease suppression
  - Greenhouse gas emission reduction

# Solid Waste Stream Composition

| Waste Component | Town of Stettler | Stettler Rural | City of Red Deer[4] | Prairies[5] | City of Edmonton[6] |
|---|---|---|---|---|---|
| Paper | 38.9 | 31.2 | 40.6 | 41.1 | 44.5 |
| Glass | 2.2 | 5.1 | 3.8 | 5.6 | 1.3 |
| Metal | 4.5 | 7.4 | 5.4 | 6.5 | 6.5 |
| Plastic | 10.6 | 8.2 | 6.4 | 5.2 | 9.0 |
| Organic | 25.8 | 29.1 | 21.2 | 22.0 | 19.1 |
| Wood | 0.9 | 0.7 | -- | 4.3 | -- |
| Textile/Leather/Rubber | 1.7 | 4.0 | 12.2 | 4.3 | 4.3 |
| Ceramic/Ashes/Fines | 2.3 | 3.7 | -- | 2.4 | 1.4 |
| Yard Waste | 9.3 | 4.2 | 10.4 | 7.7 | 13.8 |
| Other | 4.1 | 6.6 | -- | 0.9 | -- |
| TOTAL | 100 % | 100 % | 100 % | 100 % | 100 % |

***30-35%***

*(excludng food soiled paper)*

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# Typical Compost Uses

- Home gardens
- Turf establishment and top dressing
- Agricultural fields
- Golf course fairways
- Soil blends
- Erosion prevention and control
- Landfill closure
- Gravel pit reclamation
- Surface water treatment

# Compost's Benefits

1. Improves the soil structure, porosity, and density, thus creating a better plant root environment.
2. Increases infiltration and permeability of heavy soils, thus reducing erosion and runoff.
3. Improves water holding capacity, thus reducing water loss and leaching in sandy soils.
4. Supplies a variety of macro and micronutrients.
5. May control or suppress certain soil-borne plant pathogens.
6. Supplies significant quantities of organic matter.
7. Improves cation exchange capacity (CEC) of soils and growing media, thus improving their ability to hold nutrients for plant use.
8. Supplies beneficial microorganisms to soils and growing media.
9. Improves and stabilizes soil pH.
10. Can bind and degrade specific pollutants.

# Most Common Composting Feedstocks

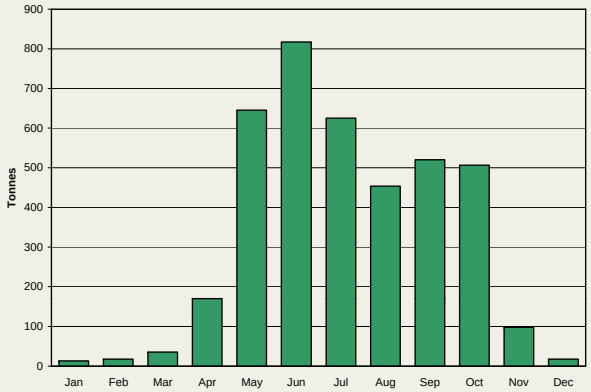
- Leaf and yard wastes (L&YW)
- Wood waste
- Food waste and soiled paper
- Biosolids

# Leaf and Yard Waste

- Yard wastes are produced by residents, businesses, and institutions and are the most common feedstock at composting facilities.
- Leaf and yard waste is generally a very clean and contaminant free feedstock.
- Contaminants that are found in yard waste include plastic bags, plastic plant pots and trays, pet wastes, dirt and sod, rocks, and fertilizer containers.

# L&YW Seasonal Variations

- The quantities of L&YW vary significantly over the course of the year.
- The nature of the material also changes throughout the growing season.
- L&YW quantities are also affected by rainfall and sunlight. This can cause year-by-year variations.
- This variations must be accounted for by composting facility designer and operators.





# Wood Waste

- Green wood consists of brush, limbs, trunks and stumps.
- Significant quantities of green waste can be generated by wind and ice storms.
- White wood consists of dimensional lumber and other “processed” wood products.
- White wood is often further broken down into “clean” (i.e. unpainted, untreated) and “unclean” (i.e. treated or painted).

# Food Waste and Soiled Paper

- This feedstock generally has a high moisture content and a high density.
- Pre-consumer food waste tends to be less contaminated than post-consumer food waste.
- Soiled paper products (e.g., paper towels, napkins, soiled or waxed cardboard, soiled newspaper, and tissues) are often included in food waste diversion programs. These materials are readily degradable, and they absorb liquids released by food waste.

☑ ACCEPTABLE

*Food Waste:*

- *Baked goods*
- *Bones*
- *Cereal*
- *Coffee grounds and filters*
- *Dairy products*
- *Eggs/eggshells*
- *Flour and grains*
- *Fruit*
- *Grease and fat*
- *Meat and fish (raw and cooked)*
- *Nuts*
- *Pasta and rice*
- *Sauces*
- *Tea bags and loose tea*
- *Vegetables*

# Biosolids

- Biosolids, less commonly called sewage sludge, are the non-degradable and partially degraded solids that are separated from municipal wastewater.
- The characteristics of biosolids vary with the characteristics of the wastewater, the type of wastewater treatment system, and the treatment system's efficiency.
- Biosolids are typically dewatered prior to being composted.

# Collection Options

- Drop-off depots
- Community depots
- Residential curbside programs
- Commercial and Institutional collection programs

# Drop-off Depots

- Generally the least expensive option, but not appropriate for collecting food waste.
- Sites can be supervised or unsupervised. The latter often (but not always) have higher contamination levels.
- Various levels of sophistication from open piles to bunkers to bins.
- Weekly collection is recommended in May and June when there are large amounts of wet green grass.

# Residential Curbside Programs

- Curbside programs have significantly higher participation levels and diversion rates.
- Programs and be subscription-based or mandatory. (Note: Participation in subscription based programs can be hard to predict.)
- Automated, semi-automated or manual collection option
- Various scheduling options can be considered (e.g. leaf pickup, Spring/Fall, April thru October, year round).
- Weekly or biweekly service levels
- Key decision point is whether program will be carts or bag-based, and whether plastic bags will be allowed.


# Plastic Bags & Debagging Methods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# Composting Technologies

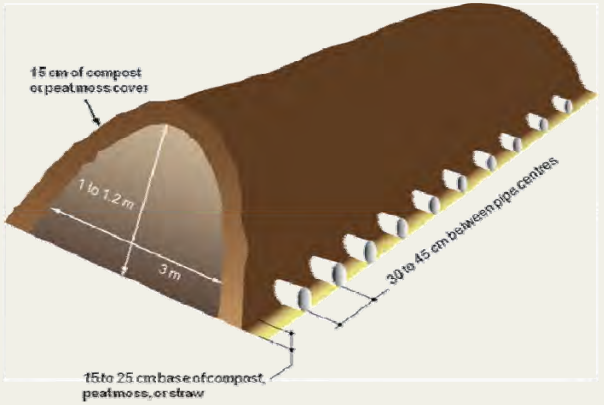
| Passively Aerated and Turned | Actively Aerated |
|---|---|
| • Passively Aerated Static Piles<br>• Passively Aerated Windrows<br>• Bunker<br>• Windrow<br>• Turned mass bed | • Aerated Static Piles (uncovered and covered)<br>• Tunnels<br>• Containerized (static and agitated)<br>• Channel<br>• Agitated bed<br>• Rotating drum |

# (Passively Aerated) Static Piles

- Generally appropriate only for leaves, brush and other feedstocks with high C:N ratio.
- Not appropriate for food waste, biosolids, or L&YW that contains large amounts of green grass.
- Piles are constructed in large windrows or cones.
- Piles are turned only a few times per year.
- Method relies on passive aeration (chimney effect).
- Characterized by long processing times.

# Passively Aerated Windrow System (PAWS)

- Generally appropriate for leaves, brush and other feedstocks with high C:N ratio.
- Not appropriate for food waste or biosolids.
- Piles are constructed overtop perforated piles that extend beyond the edges of the pile.
- Method relies on passive aeration (chimney effect). The pipes increase the inflow of air to the pile core.
- Difficult to construct.




# Bunker Composting Method

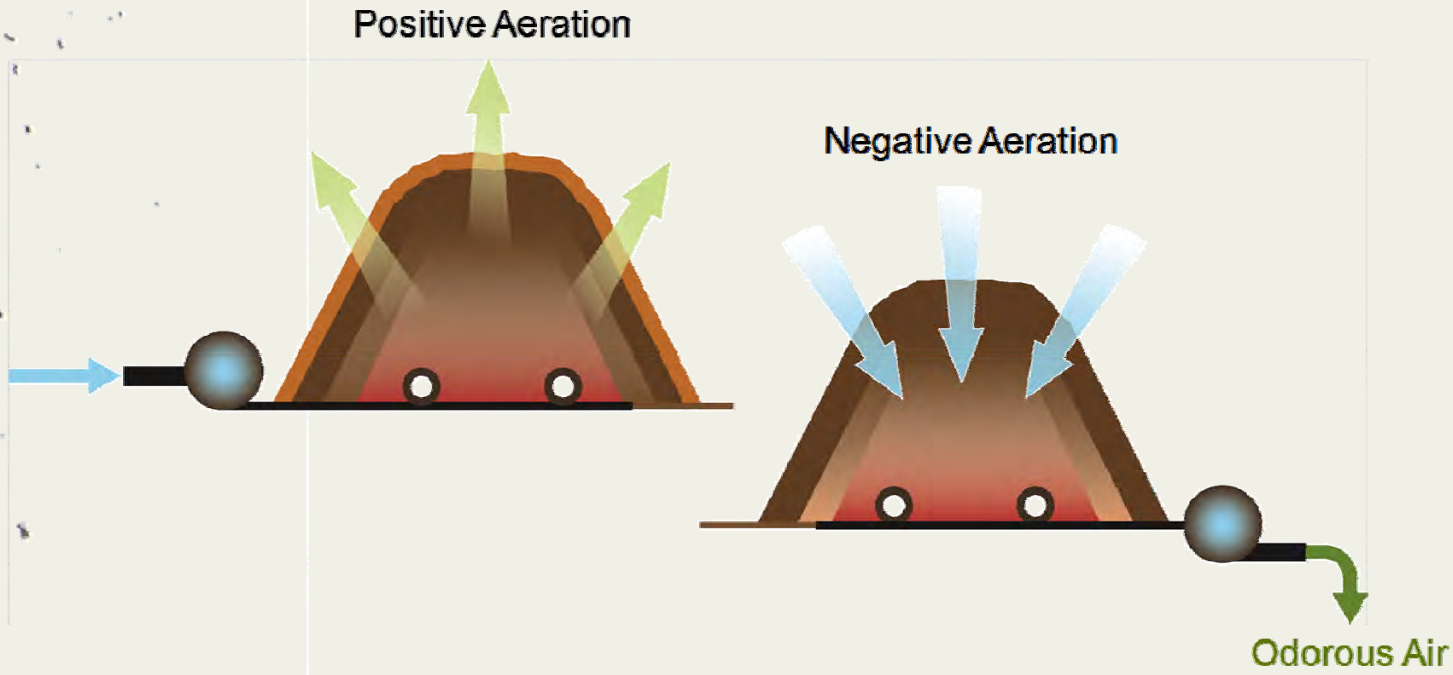
- Appropriate for L&YW and other materials with a high C:N ratio.
- Not appropriate for food waste, biosolids, or L&YW that contains large amounts of green grass.
- Piles are constructed within 3-sided enclosures.
- Materials are sequentially transferred from one bunker to the next.
- Method relies primarily on passive aeration.
- Suitable for smaller quantities of material.

# Windrow Method

- Suitable for L&YW and food waste.
- Not recommended for biosolids
- Windrows are typically 4 to 12 feet high and 10 to 25 feet wide.
- Aeration primary achieved through passive aeration.
- Mixing or “turning” (with front end loader or specialized equipment) used to re-establish free air space.

# Windrow Turning Methods

# Aeration Methods



# Aerated Static Pile Method

- Piles are built overtop a network of aeration pipes. Air is forced through the piles using high-pressure centrifugal fans.
- Piles are sometimes contained within 3-sided bunkers.
- Piles are not turned, or they may be torn apart and rebuilt once or twice during the active composting phase.
- Aeration fans are turned on/off by timers, or run continuously.
- Fan operation can be controlled by temperature or oxygen sensors.

# Covered Aerated Static Piles

- Covers provide litter control and shed precipitation.
- "Engineered" covers also provide a degree of odour control.
- Typically use individual aeration fans for each pile.
- Timer and/or temperature control.

# Static Container Systems

- Pre-mixed materials are loaded into the container. Containers moved with a roll-off truck.
- Positive aeration.
- End doors with seals for loading and unloading.
- Very modular, but more than 15 bins becomes unmanageable.
- Typically designed with a 7 to 14 day retention time.


# Agitated Container Systems

- Pre-mixed materials are loaded into one end.
- Moving floor, spinners or augers move the material along the length of the container.
- Positive aeration.
- Typically designed with a 7 to 21 day retention time.

# Other Composting Systems

- Tunnels
- Channels
- Agitated bays
- Drums

# Choosing "the Right Technology"

- **All composting systems rely on the same basic principles.**
- **Shorter residence times in the active composting system generally mean longer curing times.**
- **The quality of the finished compost is influenced more by collection and pre-processing methods than by composting technology.**
- **Composting process "performance" can vary based on the pre-processing steps/equipment used.**
- **Review technology's track record in similar installations.**
- **Visit reference facilities.**

- o capital costs
- o Land requirements
- o manpower requirements
- o Maintenance requirements
- o surge capacity
- o Scalability
- o power/fuel consumption
- o leachate controls
- o working environment for staff

# Support Equipment

- **Identify your supporting equipment requirements:**
  - Wheel loaders
  - Grinders
  - Mixers
  - Windrow turners
  - Screens
  - Stacking conveyors
  - Water Addition Systems
  - Bag Openers
- **Allow sufficient time for equipment procurement and delivery.**
- **Don't forget about spare parts.**
- **Make sure you have made arrangements for warranty and technical support.**

# Bonus Content:

# Program Development & Expansion Considerations

# Odour (mis)Management

- Several composting sites has been closed due to inability to manage odours.
- Every aspect of the composting facility is a potential odour source.
- Good odour management is one of the keys to success in this industry.
- Implementing best management practices can solve many odour problems and eliminate the need for redesign.

**Compost dump reeks havoc on nearby businesses**

City Hall deluged with calls about stinky west-end heap

CBC News Posted: Sep 25, 2012 7:07 AM MT | Last Updated: Sep 25, 2012 4:15 PM MT

**Fight brewing over compost site**

Last Updated: Tuesday, February 13, 2001 | 5:31 PM ET

CBC News

**Edmonton compost plant closed by province**

Alberta Environment orders west-end compost plant to deal with odour

CBC News Posted: Dec 16, 2011 2:47 PM MT | Last Updated: Dec 16, 2011 6:26 PM MT

**Residents ready for compost facility fight**

Last Updated: Wednesday, February 28, 2001 | 11:36 AM ET

CBC News

**Compost plant smells funny**

Last Updated: Tuesday, February 15, 2000 | 9:04 PM ET

CBC News

**Compost contract rekindles feud**

Couple wants Walker industries to buy home; odour is 'horrible'

**Composting site raises big stink**

*Neighbors protest proposed facility on Marine Drive*

BY JENNIFER ANDERSON

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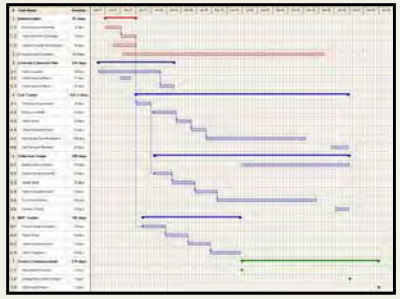
# Respect the Science!

- Composting is a controlled "rotting" process.
- Maintain appropriate pile heights.
- Ensure there is sufficient free air space in the pile.
- Maintain proper moisture contents.
- Use appropriate recipes and mix as evenly as possible.
- Production targets and revenue goals should take a back seat to running a good process.

# (Re)Permitting Processes

- Understand whether your existing provincial permit(s) needs to be revised or renewed.
- Don't overlook municipal development/bylaw requirements.
- Confirm general and site specific development and design requirements.
- Be sure to understand public consultation/notification obligations
- Include permitting milestones and review periods in your overall project schedule.
- Engage in informal discussions with your regulators (provincial and municipal) early on.

Saskatchewan Environment



# Winter Operations

- Winter temperatures can slow down or halt the biological process.
- Many programs allow composting piles to hibernate during the winter.
- Mix recipes, composting pile sizing, and turning schedules may have to be adapted if you plan to operate in the winter.
- Steam released from composting piles can reduce visibility and lead to safety issues.
- Think ahead about snow removal and snow stockpiles.

# Surface Water & Leachate

- Water <u>will not</u> run uphill.
- Ponding water is a source of odour and provides a habitat for mosquitos.
- Fix ruts and depressions. Re-establish site grading periodically.
- Keep ditches and swales clear of debris that will impede flow.
- Detention ponds must be monitored and emptied!
- Treat or dispose of surplus leachate.
- Run-off from active areas should never drain into or through curing or storage areas.

# Working Areas & Surfaces

- All weather roads and working pads are not optional - “If you can’t access it, you can’t manage it.”
- Design working areas and roadways for the size and weight of vehicles anticipated.
- Lay out equipment and operating areas for efficient movement and material handling.
- Include sufficient area for storing products (hint: compost doesn’t get sold in the winter).

# Site Security and Access Control

- Protect yourself from vandalism, arson, and unwanted visitors.
- Control when and where feedstocks are unloaded.
- Control where the public goes within your facility.

# Bird and Critter Controls

- Birds, bears, rodents & coyotes will be attracted to food waste.
- Critters will also be attracted to the heat from the composting piles.
- Critters can drag fresh food waste off your site creating a nuisance for your neighbours.
- The same critter controls used at landfills can be used at composting sites.

# Safety & Fire Prevention

- Spontaneous combustion and fires are a real possibility at composting facilities and proper planning and prevention steps must be taken.
- Vehicles and mobile equipment.
- Grinders and shredders.
- Rotating equipment (i.e. belts, conveyors, fans).
- Noise.
- Airbourne particulates and mold.
- Pathogens.
- Off-gases from a process gone bad (e.g. $NH_3$, $H_2S$, CO, $CO_2$).

# Operator Training

**Investing in your front line personnel will improve your chances of success.**

- Composting science and principles.
- Odour assessment and complaint response.
- Compost benefits and uses.
- Fire prevention and control.
- Health and safety.
- Feedstock acceptance and screening.
- Emergency response.
- Proper equipment O&M.

# Facility Siting

- **The initial and future space required (for receiving, processing, curing and storage) is a key criteria in the site selection process.**
- **Technology choices and level of management will influence buffer zone requirements which directly affects land requirements and siting.**
- **Other considerations include:**
  - Flood plains
  - Proximity to feedstock sources
  - Trucking routes and access
  - Availability/cost of utility installations
  - Zoning bylaws
  - Adjacent land uses and proximity to “sensitive receptors”
  - Proximity to airports
- **Consider proximity to neighbors, weather patterns, site lines from neighboring properties, existing grades and roadways.**

# Project Budgeting

- **Use "full cost accounting" practices**
  - Engineering costs
  - Capital purchases
  - Construction costs
  - Replacement reserves
  - Salaries and benefits
  - Staff incentive and retention programs
  - Environmental compliance
  - Utility costs
  - Maintenance costs based on program type (predictive, preventive, breakdown)
  - Marketing costs

# Equipment Maintenance

- Check air filters and blow down equipment regularly.
- Check grease points frequency.
- Schedule rolling stock maintenance around operating schedules. If necessary, bring in rental equipment.
- Repair holes in air ducting and blower housings.
- Monitor aeration fan vibration.
- Identify critical parts that have long delivery times - keep spares onsite.
- Fix broken doors immediately.

# Questions?

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