**CENTRE COUNTY SOLID WASTE AUTHORITY**
**ROCKVIEW COMPOSTING DEMONSTRATION PROJECT**

This phase I feasibility study for the Centre County Solid Waste Authority (CCSWA) for composting options of the food waste from the State Correctional Institution (SCI) at Rockview was prepared by Gannett Fleming Inc., under a SWANA Technical Assistance grant.

## Problem Scope

Mr. Harry Bower, SCI Rockview Recycling Coordinator, was contacted to provide food and non-food waste tonnage estimates for sizing/design of the proposed composting facility and associated equipment. Mr. Bower estimates that SCI Rockview generates 6,600 pounds per day (lbs/day) of pre- and post-consumer food waste and 2,830 (lbs/day) "municipal like waste". From conversation and a visual inspection of one waste load (8/19/98), it appears that a majority of the "municipal waste" is mixed office paper. Additional sizing capacity is included for SCI Rockview's other significant organic waste streams which include fruit/vegetable canning byproducts and lumber mill waste. Mr. Ted Onufrak, CCSWA Executive Director, also indicated a desire that any new facility have the capacity to handle regional yard waste. The CCSWA, asked that any new system have a 6,000 tons/year capacity to process all of these wastes with SCI Rockview's food waste making up over 20 percent of this total.

In this study three alternative technologies to the landfilling of these organic materials were examined:

1. aerobic composting, (further broken down by method)

    a. non-agitated container,
    b. agitated container,
    c. agitated bay,

2. wet waste fermentation, and

3. vermicomposting (worm composting).

**Process Descriptions**

To aerobically compost food waste, the addition/blending of a dry porous bulking agent is required, to provide the proper environment of oxygen, moisture, and food to the beneficial microbial population.

In non-agitated container composting systems, experimentally/analytically derived ratios of the given feedstocks are blended and loaded into sealed containers equipped with airflow and liquid controls. Inside the container is basically an aerated static pile with oxygen and humidity levels controlled using blowers and leachate recirculation (vessel is loaded - left for a prescribed time and then emptied). Agitated container systems are similar, except that inside the container the material is turned/broken-up once with a paddle wheel and it is constantly moving through the vessel (loads at one end - discharges at the other). In agitated trench systems, the blended material is placed inside long bays with aerated floor and turned daily. The turning moves the material down the bay so that when it emerges from the end it has completed the active composting phase. All of these systems require a final 30-90 day cure to stabilize the compost before it can be used/marketed.

Wet waste fermentation uses hydrolysis and anaerobic bacteria to process organic wastes into high value fertilizer (N-P-K), methane, heat and water. These large scale agro-industrial plants have been operating economically in Europe for over 10 years and can process all wet organic waste streams with no bulking/drying additives. Wet waste fermentation has large capital and labor costs, and is not economically viable until over 20,000 tons/year of material can be assured.

Vermicomposting with manure worms, converts pre-and post consumer organic wastes into a high value soil conditioner/fertilizer. Commercial vermicomposting has recently been successfully demonstrated in modular 2,500 ton/year systems. Ground-up wastes are loaded daily in a thin layer across the top of large aerated worm bins (thin enough so that the material remains aerobic and minimizes odors). The worms breakdown and consume the waste, actually digesting the bacteria on the surface of the particle and excreting the rest which will re-colonize with aerobic bacteria. This process is repeated until the bacteria/worms have depleted the waste of biologically digestible material, and only a stable nutrient rich vermicompost remains.

**Information Sources**

Data for the aerobic composting analysis were collected from a literature search and discussions with: Mr. Michael Bryan-Brown, Green Mountain Technologies – non-agitated containerized composting, Mr. Brad Matuska, NaturTech Composting Systems, Inc. – non-agitated containerized composting, Mr Ed, Boyd, Wright Environmental Management, agitated containerized composting, and Mr. Paul Gormsen, Wheelabrator Water Technologies – agitated bay composting. Data for the wet waste fermentation and vermicomposting system analyses were collected from Mr. Gael Kubil, SEI Inc., – wet waste fermentation, and Dr. Dan Holcomb, Oregon Soil Corporation – Vermicomposting.

**System Comparison**

In the following table the operational advantages and disadvantages to five landfill alternatives for SCI Rockview/CCSWA are outlined .

System 1A Non-agitated container organic composting.
System 1B Agitated container organic composting.
System 1C Agitated bay, organic composting.
System 2 Wet waste fermentation.

System 2 Vermicomposting.

Table 1. Operational Comparison.

| System | Advantages | Drawbacks |
|---|---|---|
| 1A | ▸ Control of odors, vectors, pests, and leachate.<br>▸ System capacity is adjusted by adding/subtracting extra containers.<br>▸ Low equipment needs & minimal operator involvement.<br>▸ Reduced housing requirements. Only need area for off loading, mixing equipment, and container loading. | ▸ Requires addition of dry high carbon/porosity bulking agents.<br>▸ Poor product quality and revenue is anticipated due to limited mixing.<br>▸ Closed system make operational adjustments extremely difficult.<br>▸ Area, facility and time for final cure of product.<br>▸ Operator must adjust mix to compensate for variability of food waste's physical characteristics. |
| 1B | ▸ Control of odors, vectors, pests, and leachate.<br>▸ System capacity is adjusted by adding/subtracting extra containers.<br>▸ Reduced housing requirements. Only need area for off loading, mixing equipment, and container loading.<br>▸ System used in most Canadian prisons.<br>▸ Better quality product | ▸ Requires addition of dry high carbon/porosity bulking agents.<br>▸ Closed system makes operational adjustments difficult.<br>▸ Area, facility and time for final cure of product.<br>▸ Operator must adjust mix to compensate for variability of food waste's physical characteristics.<br>▸ More extensive/complicated equipment (O&M). |
| 1C | ▸ Local experience/expertise with system.<br>▸ Inspection allows adjustment of operating conditions during processing.<br>▸ Frequent turning produces more uniform and higher quality product.<br>▸ Ability to track/follow daily loads to learn effects of varied feedstock and ensure regulatory conformance | ▸ More equipment and material handling.<br>▸ Larger volume of air/odor to treat (volume of entire building)<br>▸ Requires constant addition of dry high carbon/porosity bulking agents.<br>▸ More extensive housing requirements. |

Table 1. Operational Comparison.

| System | Advantages | Drawbacks |
|---|---|---|
| 2 | ‣ Absolutely hygienic treatment of organic wastes.<br>‣ No need for external energy.<br>‣ Highest value saleable commodities produced.<br>‣ Experience with food waste.<br>‣ No bulking agent needed. | ‣ Low volume of waste makes economics difficult/impossible.<br>‣ Untested in America (but vendor claims a guarantee is available).<br>‣ Extensive equipment & housing requirements.<br>‣ Intensive operation. |
| 3 | ‣ No or only limited bulking agent needed.<br>‣ Limited equipment & operator involvement.<br>‣ High value & easily marketed material produced (good public acceptance/perception).<br>‣ System capacity inexpensively/ quickly adjusted.<br>‣ Designed for food wastes. | ‣ Emerging technology with limited experience.<br>‣ Controlled housing environment required (building must be heated, no air conditioning)<br>‣ Severe system upset could destroy worms. Result in cost/time with new worms. |

**Cost Benefit Analysis**

Preliminary initial costs, revenue generation, and yearly operating expenses for these systems are summarized in Table 2.

Table 2. Capital, O&M, and Revenue Estimates.

| System | Total Initial Cost | O & M | Revenue | Operating Cost/Ton[1] |
|---|---|---|---|---|
| 1A | $1,900,000.00 | $425,000.00 | $65,000.00 | $60.00 |
| 1B | $2,300,000.00 | $438,000.00 | $130,000.00 | $51.33 |
| 1C | $2,400,000.00 | $450,000.00 | $130,000.00 | $53.33 |
| 2 | $4,144,000.00 | $670,000.00 | $750,000.00 | Potential Profit |
| 3 | $1,600,000.00 | $495,000.00 | $240,000 - $500,000 | $40 - Profit |

**Conclusions & Recommendations**

Based on the preliminary data gathered so far it appears that vermicomposting is the most economically attractive method for diverting the CCSWA organic wastes out of the landfill. With the general public acceptance of “worms are good”, it also appears that the market for vermicomposted material may in fact make this a revenue generating project. Additional refinements of the above gross estimates are needed as well as further discussions/research into the vermiculture vendor Oregon Soil Corporation.

This initial screening of alternative waste disposal technologies was made possible by the cooperation of SCI Rockview, CCSWA and the Solid Waste Association of North America (SWANA). Data collected here is limited in scope and not intended to serve as a system design, but it is an informed starting point for future project development/refinement that can be made under an Act 901 grant.