2012 COMPOSTING SYSTEMS EXCELLENCE AWARD
CHECKLIST AND RELEASE

2012 Applications must be submitted to SWANA no later than Friday, April 13, 2012

*** PLEASE NOTE THAT ENTRY REQUIREMENTS HAVE CHANGED ***

Application Checklist (Please make sure the following items are included in your submittal packet)

- Completed release statement (this page), to be scanned and included in digital submission
- Check (made payable to SWANA) or credit card payment for nomination fee (in U.S. dollars) via Excellence Award Nominations
- At least 2 pictures of your operation (may be included in nomination text)
- One copy of your award submittal uploaded using your purchased 2012 SWANA Excellence Awards Application Uploading Instructions
- If you would like to mail your submission, please contact Jesse Maxwell, Program Coordinator, at jmaxwell@swana.org or (240) 494-2237.

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SWANA 2012 COMPOSTING SYSTEMS EXCELLENCE AWARD APPLICATION

SPOTSYLVANIA COUNTY LIVINGSTON’S BLEND COMPOSTING FACILITY

EXECUTIVE SUMMARY (200 Word Limit)

In 2001, Spotsylvania County performed an evaluation of wastewater residuals management alternatives to determine the most cost-effective long term plan to serve the existing and future needs of the County. A research and market assessment verified that a significant market existed for a high quality compost product that could be used to generate revenues sufficient to offset distribution and marketing costs. The composting alternative was less expensive than other wastewater residuals management alternatives evaluated and its’ ability to generate a revenue stream significantly lowered the projected operating costs. In addition the project carried the added benefit of diverting all of the brush collected at the landfill and the County’s convenience center out of the landfill waste stream and into the compost operation for recycling. Based on the results of the wastewater residuals management study, the decision was made to develop a long-term plan including the renovation/construction of the current building into a composting facility capable of expanding in phases as needed with increases in treatment plant capacity. What followed was the construction of a state of the art, 15.5 million dollar, facility capable of managing all wood wastes and wastewater residuals produced by the County into the foreseeable future.

COMPOSTING SYSTEM DESIGN

In 2001, Spotsylvania County initiated a pilot composting program to divert material from the County’s landfill facility. The program combined the mulch, collected through convenience centers, and the undigested dewatered wastewater residuals from the Massaponax Waste Water Treatment Plant (WWTP) to create a marketable Class A product. The pilot program proved successful and in 2003, the program was expanded to handle up to 800 tons per month of wastewater residuals. The expanded operation processed approximately 8,800 tons of wastewater residuals in 2003 to an excess of 12,000 tons per year in 2008; leaving an additional 5,000 to 6,000 tons of wastewater residuals per year going to the landfill from FMC, a second WWTP.

By 2006, the composting program had proven so successful that the County elected to expand the program further with four main goals in mind.

1. To manage the ever increasing quantities of residuals cake generated from both County WWTP’s over the next 20 years.
2. To enhance and automate the compost process performance.
3. To accomplish this expansion with no offsite odor impacts.
4. Provide for 100% diversion of all wastewater residuals and wood waste out of the landfill waste stream.

Through growth projection analysis, it was determined that the expanded composting facility should initially be sized for 80 tons per day of dewatered solids on a 7 day basis or 29,250 tons per year, roughly three times the size of the original facility, with the capability to double in capacity to 160 tons per day in the future.

One of the fatal flaws of wastewater residuals composting facility expansions historically has been the lack of good odor control analysis and proper decision science in scaling up. All too often, demonstration sized facilities have worked well only to be fraught with odor problems upon expansion to larger full-scale operations that have been inadequately designed to manage the increased amount of odors produced. At the other end of the spectrum, total enclosure of compost facilities with 100% odor capture and treatment has been included in some facilities raising capital and operating costs to an extreme. In order to provide the right balance of technology for odor control and process performance while minimizing costs to the greatest extent possible, Spotsylvania County engaged CH2M HILL to assist in evaluating technical options available and to analyze the odor impact of expanding the facility. Information on technology options was presented, the advantages and disadvantages considered and tours of operating systems similar in design were visited to aid the County in the selection process.

An aerated static pile layout was designed in 2007 and construction was completed in 2009 with commissioning completed in early 2010. The expanded facility includes several innovative design features. Batch mixing is followed by composting utilizing below ground aeration piping and aeration risers with grates to deliver aeration to the compost piles. The solids receiving, mixing, composting screening and curing facilities have a roof cover instead of totally enclosed building. Figure 1 shows the aerial view of these facilities.

The aeration system is designed to be operated continuously using variable frequency drive (VFD) motors on fans so that airflow delivered can be adjusted to meet changing demands of the process at both partial and fully loaded conditions. Each of the 18 fans provides aeration to one compost pile containing approximately one operating days worth (112.5 wet tons) of wastewater residuals. Process offgas is managed through two bio filters to effectively control odors. Three wireless temperature probes are located in each pile to continuously monitor pile temperatures to meet regulatory requirements for meeting process to further reduce pathogens (PFRP) and vector attraction reduction (VAR) requirements per US EPA and VA DEQ regulations. The compost pile temperatures are monitored by a central computer that adjusts the VFD motor speed to deliver the amount of air required to keep pile temperatures at desired levels throughout the 21-day composting process. After active composting, the finished compost piles are moved by front end loader to a screening stage where the bulking agent is separated from the compost fines (3/8" minus). The screened woodchip overage is stockpiled and recycled back into the compost mixing process. The compost fines are then transported by front end loader to aerated curing. Similar to the composting step, the curing process occurs within a building in static piles that are 10 feet tall. Perforated aeration piping is placed on the
pad and screened compost is placed over the aeration piping connected to blowers for aeration using a cycling timer to maintain aerobic conditions in the curing process. The curing blowers operate in the positive aeration mode and the material is cured for an additional 30 days. After curing, the material is moved to a stockpile for storage until sold for use as a soil amendment.

![Livingston Composting Facilities](image)

**Figure 1 - Livingston Composting Facilities**

**REGULATORY COMPLIANCE**

The Spotsylvania County Livingston Composting Facility has been operating in compliance with US EPA and VA DEQ requirements per Permit VPA00065. The main compliance requirement is to ensure the wastewater residuals are processed appropriately to protect public health.

Wastewater residuals contain human pathogens such as bacteria, parasites, worms, and viruses. These pathogens, however, are killed when exposed to high temperatures over a given period of time. Studies have shown that if the temperature in the composting pile reaches 55°C (131°F) for a period of three (3) consecutive days or more, pathogens are destroyed. This temperature target is easily achievable during the composting process. The main regulatory requirement to achieve Class A product quality standards according to the USEPA and the VA DEQ is demonstrated achievement of the following temperature requirements:

- Pile temperatures must be maintained at a minimum of 55°C (131°F) for three (3) days to kill pathogenic organisms. This is referred to as the Process to Further Reduce Pathogens
(PFRP) requirement.
- Pile temperatures must average 45°C (113°F) or above, with no readings below 40°C (104°F), for 14 days to reduce vector attraction. This is referred to as the Vector Attraction Reduction (VAR) requirement.

The new composting facility has a very automated system to achieve these regulatory requirements. The original system relied heavily on staff to monitor temperatures, control fans, and document data for regulatory requirements. These manual procedures were both time consuming and subject to human error. Therefore, the new facility incorporated Supervisory Control and Data Acquisitions (SCADA) to control fan processes and document temperatures.

The SCADA system starts with the placement of three wireless temperature probes within each aerated static pile. These probes transmit data continuously back to the compost operation control computer in the main control building. The system automatically adjusts fan speeds to maintain pile temperatures in the desired range to achieve regulatory requirements. If the pile temperature decreases below a desired set point, the system will reduce fan speed until the temperatures climb to the desired level. Should pile temperatures increase beyond the desired value the system will speed up the fan to cool the pile. Data is continuously recorded for each compost pile constructed and trend charts showing permit compliance are stored electronically as well as printed at the completion of the compost process for storage in hard copy form as well for the VA DEQ requisite period of 5 years. In addition, the SCADA system creates automatic notifications of failures, changes in system settings, fan speed changes, and shutdowns.

The content of undesirable elements in compost, such as heavy metals is a direct result of the levels of these elements in the input sludge or wastewater residuals and, to a lesser extent, the bulking agents. Many of the contaminants, referred to as heavy metals, are actually needed by plants for normal growth. Therefore, measuring the concentration of these elements will provide valuable management data relevant to the fertilizer requirements of plants, and subsequent fertilizer application rates. Also, certain heavy metals can be phytotoxic to plants in high rates. The US Environmental Protection Agency (USEPA) has promulgated Part 503 wastewater residuals management standards; the State of Virginia has adopted these standards. These regulations have compost distribution and marketing standards for these pollutant compounds. The
content of these pollutants in the Livingston Blend compost are closely monitored on a quarterly schedule. The current USEPA ceiling concentrations for heavy metals in compost is shown in Table 1 below as well as typical analytical results for the Livingston Blend Compost.

Table 1 Spotsylvania County Livingston Compost Analytical Results

<table>
<thead>
<tr>
<th>Parameter</th>
<th>EPA Ceiling Conc.</th>
<th>3-Jun</th>
<th>4-Aug</th>
<th>28-Oct</th>
<th>22-Dec</th>
<th>23-Feb</th>
<th>5-Apr</th>
<th>Average</th>
<th>% of Ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>METALS (Dry Weight)</td>
<td>Mg/Kg</td>
<td>Mg/Kg</td>
<td>Mg/Kg</td>
<td>Mg/Kg</td>
<td>Mg/Kg</td>
<td>Mg/Kg</td>
<td>Mg/Kg</td>
<td>Mg/Kg</td>
<td>Mg/Kg</td>
</tr>
<tr>
<td>Arsenic</td>
<td>41</td>
<td>16</td>
<td>15</td>
<td>13</td>
<td>12</td>
<td>16</td>
<td>18</td>
<td>15</td>
<td>37%</td>
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<tr>
<td>Cadmium</td>
<td>39</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>9%</td>
</tr>
<tr>
<td>Chromium</td>
<td>-</td>
<td>39</td>
<td>30</td>
<td>37</td>
<td>42</td>
<td>70</td>
<td>35</td>
<td>42</td>
<td>-</td>
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<tr>
<td>Copper</td>
<td>1500</td>
<td>276</td>
<td>189</td>
<td>260</td>
<td>281</td>
<td>345</td>
<td>177</td>
<td>255</td>
<td>17%</td>
</tr>
<tr>
<td>Lead</td>
<td>300</td>
<td>38</td>
<td>10</td>
<td>34</td>
<td>17</td>
<td>23</td>
<td>18</td>
<td>23</td>
<td>8%</td>
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<tr>
<td>Mercury</td>
<td>17</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6%</td>
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<tr>
<td>Molybdenum</td>
<td>-</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nickel</td>
<td>420</td>
<td>32</td>
<td>9</td>
<td>12</td>
<td>13</td>
<td>15</td>
<td>9</td>
<td>15</td>
<td>4%</td>
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<tr>
<td>Selenium</td>
<td>100</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Zinc</td>
<td>2,800</td>
<td>397</td>
<td>281</td>
<td>328</td>
<td>369</td>
<td>498</td>
<td>262</td>
<td>356</td>
<td>13%</td>
</tr>
<tr>
<td>PATHOGENS</td>
<td>MPN/g</td>
<td>MPN/g</td>
<td>MPN/g</td>
<td>MPN/g</td>
<td>MPN/g</td>
<td>MPN/g</td>
<td>MPN/g</td>
<td>MPN/g</td>
<td>MPN/g</td>
</tr>
<tr>
<td>Fecal Coliform</td>
<td>1000</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0%</td>
</tr>
<tr>
<td>Salmonella</td>
<td>3/4g</td>
<td>&lt;3/4g</td>
<td>&lt;3/4g</td>
<td>&lt;3/4g</td>
<td>&lt;3/4g</td>
<td>&lt;3/4g</td>
<td>&lt;3/4g</td>
<td>&lt;3/4g</td>
<td>&lt;3/4g</td>
</tr>
<tr>
<td>NUTRIENTS (Wet Weight)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Nitrogen (N) (%)</td>
<td>-</td>
<td>2.6</td>
<td>2.2</td>
<td>1.9</td>
<td>1.7</td>
<td>2.2</td>
<td>1.2</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Nitrate N (ppm)</td>
<td>-</td>
<td>61.0</td>
<td>11.0</td>
<td>55.0</td>
<td>0.8</td>
<td>79.0</td>
<td>23.0</td>
<td>38.3</td>
<td></td>
</tr>
<tr>
<td>Ammonia – N (ppm)</td>
<td>-</td>
<td>957</td>
<td>1339</td>
<td>1355</td>
<td>1007</td>
<td>1258</td>
<td>1406</td>
<td>1220.3</td>
<td></td>
</tr>
<tr>
<td>Total Phosphorus (P) (%)</td>
<td>-</td>
<td>1.4</td>
<td>1.1</td>
<td>0.8</td>
<td>1.1</td>
<td>1.7</td>
<td>0.7</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Phosphorus as P2O5 (%)</td>
<td>-</td>
<td>3.3</td>
<td>2.4</td>
<td>1.8</td>
<td>2.4</td>
<td>3.9</td>
<td>1.6</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>Total Potassium (K) (%)</td>
<td>-</td>
<td>0.43</td>
<td>0.43</td>
<td>0.34</td>
<td>0.36</td>
<td>0.44</td>
<td>0.28</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Potassium as K2O (%)</td>
<td>-</td>
<td>0.52</td>
<td>0.52</td>
<td>0.40</td>
<td>0.43</td>
<td>0.53</td>
<td>0.34</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>-</td>
<td>7.7</td>
<td>7.5</td>
<td>8.4</td>
<td>8.6</td>
<td>8.0</td>
<td>8.7</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Soluble salts (Conductivity)</td>
<td>-</td>
<td>2.8</td>
<td>2.7</td>
<td>2.9</td>
<td>2.2</td>
<td>3.0</td>
<td>2.3</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>CO2 Evolution mg/g OM/day</td>
<td>-</td>
<td>3.4</td>
<td>3.1</td>
<td>1.6</td>
<td>2.3</td>
<td>2.3</td>
<td>3.3</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Seedling Emergence (%)</td>
<td>-</td>
<td>100.0</td>
<td>82.0</td>
<td>10.0</td>
<td>70.0</td>
<td>160.0</td>
<td>90.0</td>
<td>75.3</td>
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<tr>
<td>Total solids (%)</td>
<td>-</td>
<td>66.2</td>
<td>72.8</td>
<td>65.2</td>
<td>57.0</td>
<td>65.7</td>
<td>51.4</td>
<td>63.1</td>
<td></td>
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<tr>
<td>Volatile Solids/Organic Matter (%)</td>
<td>-</td>
<td>68.2</td>
<td>67.10</td>
<td>69.0</td>
<td>68.1</td>
<td>67.80</td>
<td>68.20</td>
<td>68.1</td>
<td></td>
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<tr>
<td>C/N Ratio</td>
<td>-</td>
<td>10.3</td>
<td>12.2</td>
<td>11.0</td>
<td>11.0</td>
<td>10.0</td>
<td>16.0</td>
<td>11.8</td>
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</tr>
<tr>
<td>NUTRIENTS (Dry Weight)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Nitrogen (N) (%)</td>
<td>-</td>
<td>3.9</td>
<td>3.1</td>
<td>2.9</td>
<td>2.9</td>
<td>3.4</td>
<td>2.4</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>Nitrate N (ppm)</td>
<td>-</td>
<td>92.1</td>
<td>15.0</td>
<td>84.0</td>
<td>1.5</td>
<td>120.0</td>
<td>44.0</td>
<td>59.4</td>
<td></td>
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<tr>
<td>Ammonia – N (ppm)</td>
<td>-</td>
<td>1446</td>
<td>1840</td>
<td>2080</td>
<td>1765</td>
<td>1915</td>
<td>2735</td>
<td>1963.4</td>
<td></td>
</tr>
<tr>
<td>Total Phosphorus (P) (%)</td>
<td>-</td>
<td>2.2</td>
<td>1.4</td>
<td>1.2</td>
<td>1.9</td>
<td>2.6</td>
<td>1.4</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Phosphorus as P2O5 (%)</td>
<td>-</td>
<td>5.0</td>
<td>3.3</td>
<td>2.8</td>
<td>4.3</td>
<td>5.9</td>
<td>3.2</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td>Total Potassium (K) (%)</td>
<td>-</td>
<td>0.66</td>
<td>0.60</td>
<td>0.52</td>
<td>0.62</td>
<td>0.67</td>
<td>0.56</td>
<td>0.6</td>
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<tr>
<td>Potassium as K2O (%)</td>
<td>-</td>
<td>0.79</td>
<td>0.71</td>
<td>0.62</td>
<td>0.75</td>
<td>0.80</td>
<td>0.67</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Soluble salts (Conductivity)</td>
<td>-</td>
<td>4.2</td>
<td>3.8</td>
<td>4.4</td>
<td>3.9</td>
<td>4.5</td>
<td>4.5</td>
<td>4.2</td>
<td></td>
</tr>
</tbody>
</table>

The Livingston Blend Compost is also US Composting Council Seal of Testing Assurance (STA) Certified. The product not only meets regulatory limits for metals and pathogens, it also exceeds STA standards for high quality compost on a consistent basis.
PLANNING

In 2006, odor sampling was performed on the original composting facility at each stage in the process and by modifying aeration regimes to mimic a full scale negative aeration process design. The resulting data was used to perform odor dispersion modeling to compare the odor impact of the planned expansion to the original operation. Modeling was also performed for the ultimate build-out concept of 160 WTPD capacity. From the odor analysis performed, it was determined that by operating in a continuously negative aeration mode, greater than 95% of fugitive compost emissions can be captured for treatment. This analysis showed that with a covered only (not fully enclosed) facility, and treatment through biofiltration, the offsite odor impact of the expanded facility would be no more than from the existing facility. In fact, designing and building a covered only facility instead of a totally enclosed facility actually reduced the projected odor impact on adjacent property owners and saved approximately $3 million in capital costs. This proactive planning approach resulted in capital and O&M cost savings for the planned upgrade to the facility.

PERFORMANCE, ECONOMICS AND COST EFFECTIVENESS

Livingston Blend Composting: A Cost Effective Investment

The financial decision to make a $15.5 million dollar investment in wastewater residuals composting was not one to be taken lightly. The decision was made based on careful consideration of landfill diversion goals and the comparative cost of wastewater residuals processing by a third party contractor. Currently adjacent municipalities are paying around $85 dollars per ton to have a private contractor handle their wastewater residuals; extended to Spotsylvania County the management of wastewater residuals would easily exceed $1,324,300 per year. In addition, the cost associated with the wastewater residuals disposal would not be a fixed cost and would be subject to change by the third party. Finally the cost of the residuals management would only increase over time as each wastewater treatment plant was expanded to meet population demand; more flow would correspond to increased wastewater residual production.

In order to better control expenditures for current residual management and to provide for future residuals increases the County elected to move forward with the composting program. In the planning stage it was estimated that the processing of wastewater residuals through composting would run between $25 and $30 per ton. The actual net per ton cost of management in 2011 was $24.71 per ton meaning the operation is handling the material at a lower cost than originally projected.
Table 1 - Actual O&M Costs in 2011

<table>
<thead>
<tr>
<th>Operations Cost (Includes Personnel)</th>
<th>$559,947</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastewater residuals Tonnage Processed</td>
<td>15,580</td>
</tr>
<tr>
<td>Cost Per Ton Wastewater residuals Processed</td>
<td>$35.94/ton</td>
</tr>
<tr>
<td>Compost Revenues</td>
<td>$175,000</td>
</tr>
<tr>
<td>Cost Per Ton Wastewater residuals Processed After Product Sales</td>
<td>$24.71/ton</td>
</tr>
</tbody>
</table>

At the 2011 processing rate per ton the County’s wastewater residuals management program costs $384,981; compared to third party costs that is a savings of just under a $1,000,000 per year. This cost savings is being realized at the current wastewater residual processing rate; as residual production increase the processing cost should decrease realizing even more savings because of economies of scale. Currently the compost operation is loaded to slightly more than 50% capacity and could process an additional 14,000 tons of wastewater residuals per year. The substantial cost savings show that the composting of wastewater residuals and wood wastes is a cost effective waste management method.

However, these costs may not be necessarily be extended to other municipalities or commercial vendors. There are two major cost saving factors that are specific to Spotsylvania County. The first major cost savings was realized during the development stage as the project required no additional land acquisition. The compost operation was sited on the existing landfill parcel which already had existing infrastructure to support the operation. The second specific cost savings impacts the facility’s operational cost in acquiring bulking agent. Part of the strategic goals for the operation was to divert all of the County wood waste being accepted at the County Solid Waste Centers out of the waste stream. The wood waste material, which was already being processed and mulched by the Department, could be diverted to the compost operation at no charge. By having a free source of bulking agent the operation realizes a reduction in operational costs in the range $96,000 per year; based on the fact that single-grind mulch costs approximately $8 per yard.

**Efficiency: Turning Less In to More**

What is efficiency when it comes to composting? The Livingston Blend Composting Team defines it as determining the optimum amount of effort to make a quality product; the operation seems to have found that niche. The compost facility processes over 15,000 tons of wastewater residuals and over 12,000 tons of mulch annually; that tonnage meets the goal of
diverting 100% of all of the County’s wastewater residuals and wood waste from the landfill waste stream. These materials are processed by one (1) manager and three (3) operators over the course of a 5 day work week with a minimum amount of overtime. The minimal amount of staff and the high processed tonnage is a credit to an efficient operations team and efficient design. But efficiency is only one part of an operation’s effectiveness; it must be successful with the customer as well. Through the operations strategic marketing and branding efforts (discussed later) the operation routinely is able to sell 100% of its product and in high season the material is often presold before the process is finished. Of the approximately 15,000 cubic yards of Class A compost produced residential sales account for about 15% with the remainder are bulk commercial sales.

Considering that the operation meets the strategic goal of 100% diversion of wood waste and wastewater solids out of the landfill waste stream and that 100% of the produced compost product is brought to market, the operation can be considered successful.

Success Without Customer Service Is Not Success
The Livingston Blend Compost Operation must be viewed in two separate ways: one as a form of efficient waste management and the other as a business. The major component of any business is customers and the only way to ensure that is through excellent customer service. The operation reflects the Department’s mission statement:

Mission – To maintain County-owned facilities and to provide safe water, wastewater services, solid waste management, and community beautification services while maintaining dedication to efficiency and regulatory compliance.

Specifically the operation prides itself on providing a high quality end product to the customer at a reasonable price. Part of making a high quality product is to not cut corners and to provide service to its customers. The facility is open to any visitor by appointment who is interested in how the product is made and all testing results are available to the public. The operation has found this to be critical in overcoming the stigma associated with the use of wastewater residual compost and in building a good customer base. A testament to the customer service being provided is the fact that over 80% of compost sold by volume is to repeat customers.

UTILIZATION OF EQUIPMENT/SYSTEMS AND TECHNOLOGIES

A new building was constructed covering the mixing, composting and screening operations. Composting and mixing area headspace air is discharged vertically through roof mounted fans. Within the building, the compost piles are negatively ventilated; drawing air into the compost piles rather the pushing air out through the piles. The negatively ventilated air stream is then pre-conditioned and directed to one of two biofilters that significantly reduce the odor intensity of the air stream and improve its odor character and hedonic tone to a more pleasant earthy, musty smell. Only curing compost material is processed in the original open sided building using positive aeration.
The main pieces of equipment at this facility are as follows. Three 5-8 CY front end loaders (40,000 - 60,000 lbs each), covered receiving and amendment storage; two 22 CY batch mixers with load cells; conveyors; aerated pavement; 22 VFD controlled fans, wireless temperature probes, SCADA system; portable screening; process exhaust capture and treatment with biofiltration.

One of the most important aspects of an aerated static pile composting facility is the consistency of the initial mixture of residuals cake and bulking agent. At Spotsylvania County, a batch mixing system was selected to provide the needed mixing. Two 3160 Reel-Auggie Kuhn-Knight stationary batch mixers with a discharge and stacking conveyor system were provided. The two mixers can process the requisite 112.5 tons of wastewater residuals each day in a 4 hour period. The mixers are automated and outfitted with weigh scales such that exact portions of residual cake and bulking agent can be blended on a consistent basis. Figure 3 shows the mixing system at Spotsylvania County. The final mixture is conveyed over a wall into a 3-sided concrete bunker where front end loaders move the mixture to the active aerated static pile process.

![Figure 3 - Automated Batch Mixing System](image)

An aerated static pile layout was developed utilizing below ground aeration piping and aeration risers with grates to deliver aeration to the compost piles. The facilities selected have a roof cover only instead of a totally enclosed building, with continuous negative aeration used to capture and treat the compost process odors using biofiltration. The aeration system is designed to operate continuously using variable frequency drive motors on multiple fans so that airflow delivered can be adjusted to meet changing demands of the process at both partial and fully loaded conditions. Continuous monitoring of pile temperatures through the use of wireless temperature probes and a programmable instrumentation and control system provide variable frequency drive adjustment to maintain desired pile temperatures throughout the 21-day composting process.
Each of the eighteen aeration stations (one for each operating day's production and three spares) provides maximum flexibility in process control. In addition, biofilter booster fans are provided to feed process gas to the biofilter. Each compost process fan has a capacity of 1500 CFM at 8 inches of water column requiring a 5 Hp drive motor. These fans provide 5,000 cubic feet per hour per dry ton of residuals being composted. The compost fans exhaust to a common collection header that is serviced by two biofilter booster fans on each side of the compost building. The biofilter booster fans have a capacity of 27,000 CFM at 11 inches of water column requiring a 75 Hp motor. The booster fans system is sized to provide up to 3 volumes of dilution air to one volume of compost process air for cooling the airstream prior to the biofilter. Compost fans and biofilter fans operate in a push-pull system. The balance of biofilter fan intake is provided with a modulating fresh air inlet damper that is controlled by a process controller designed to maintain the desired process airflow to the biofilter. In summertime conditions when the facility is fully loaded, two biofilter booster fans will be required. In the wintertime or when the facility is partially loaded, only one biofilter fan is required. The process air is humidified prior to feeding the biofilter to 100% relative humidity using ultra-fine misting system. Each side of the compost process has a biofilter with two zones to allow for ease of media replacement. High density polyethylene (HDPE) piping with an engineered hole pattern is located in the concrete aeration floor of the biofilter to deliver the odorous gas to a wood chip based biofilter media. Sizing and screening of the biofilter media and media testing was performed to deliver the desired biofilter media size. The design provides a loading rate of 5 CFM/SF of biofilter area, or a 60 second empty bed residence time at the design flow of 54,000 CFM on each side.

Figure 4 - SCADA Screen Shot of Compost Pile Performance
SCADA system controls the aerated static pile portion of the process and the odor control portion of the process. Through the use of SCADA, each compost pile can be monitored with the data stored for regulatory tracking purposes.

After composting, the material is moved by front end loader to a rotary trommel screen where wood chips are recovered for recycling back to the mixing process. Screened compost is transported to the covered curing building (old compost building) and aerated with positive aeration for 30 days prior to utilization.

During the startup phase the facility systems were vetted and check before the facility entered full operation. One of the primary concerns was the actual operation efficiency of the odor control system. During startup the odor control efficiency was measured at 90% removal and above as shown in Table 3 below.

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**Table 3 - Biofilter Odor Removal Performance**

**WORKER HEALTH AND SAFETY**

A workers safety is absolutely paramount to conducting an efficient and successful operation regardless of what the operation is trying to accomplish. As with solid waste disposal and recycling, composting brings with it a whole set of safety concerns that must be addressed on a regular basis.

The Livingston’s Blend Compost Operator encounters various safety hazards throughout the day. From operating and working around heavy equipment to being exposed to the smallest of safety hazards; microbes within the raw wastewater residuals. Each of these hazards must be communicated to the operators in order to ensure a continued safe operation. Communication of those safety hazards are done both by annual and routine training. Each employee goes through annual training on general hazards, blood borne pathogens, and electrical arc hazards. These annual trainings are supplemented by “tailgate” safety meeting held monthly covering a variety of general safety topics from lock out/tag out to lifting techniques to heavy equipment safety.
However, teaching safety and living safety can be two different animals. It is for that very reason that the managers and supervisors of the facility express such a strong culture of safety in the field. By doing this they are ensuring that operations adhere to both safety training and safety regulations on a daily basis. Each day the facility supervisor meets with the operators to discuss the day’s activities and work schedules. At the meeting they discuss any potential safety hazards on the job site; ranging from expected visitors to equipment issues. This line of communication is critical to ensure that the work day is a safe day.

This all around commitment to safety has allowed the Livingston Blend Compost Operation to be lost time accident free for over 9 years.

PUBLIC ACCEPTANCE, APPEARANCE AND AESTHETICS

The entire concept of public acceptance, appearance, and aesthetics are integral part of product “branding.” If a product does not express quality through its operational appearance it will be perceived as having none. That is why the overall appearance of the facility and the general public perception/acceptance of the facility and its product are considered absolutely vital to the success of the Livingston Blend Composting Facility’s operation.

*Being a neighbor, not a burden*

One of the first steps toward fostering a good public perception and acceptance was the location of the facility. During the program development it was determined that many composting operations were not successful not because of poor product but because of odor issues. To address this, the facility was located adjacent to the Livingston Landfill in a rural portion of Spotsylvania County on a greater than 700 acre parcel to limit the potential impacts to adjacent property owners.

In addition, odors were modeled as part of the site design process to ensure the site location would be suitable. Finally the facility was outfitted with two bio-filters (mulch media scrubbers), the Best Available Control Technology, to eliminate any potential odors being produced by the site. There have been no odor complaints since this facility began operation in 2010.
Overall Facility Appearance: Crisp with clean lines

With the risk of becoming a poor neighbor mitigated with the site’s rural location and odor control technologies the facility needed to focus on the appearance of the work site and its equipment. Once again the aesthetics involved here can be directly linked back to the perception of quality in the finished product. Not only does the facility need to maintain a professional appearance for product deliveries but also for the facility in general as the facility does direct customer sales on a daily basis.

At the Livingston Composting Facility, upon entering the facility a customer will be greeted by a neat and orderly operation free of clutter. Management works to ensure that all employees, including supervisors, take part in the daily cleaning activities to help provide a sense of workplace pride at the facility. The overall facility boundary is gated and fenced to help provide site security. Within the facility all main access ways and haul routes are paved to aid in the cleanup of the any material spillage. These areas are cleaned on a weekly basis utilizing a quick connect broom mounted to one of the facilities wheel loaders.

Another noticeable aspect of the site is its clean lines. All operations are enclosed in well maintained structures from the mulch storage, to the control building, to the compost mixing
and product curing. These individual buildings are connected with underground conduits to carry all electrical, telephone, and SCADA lines throughout the site. The lack of overhead wiring and controlled nature of the operations really makes the site look crisp and clean. Note the lack of service lines in Figure 7.

The office building and customer receiving area is also kept very professional and clean. This is done not only for the afore mentioned perception of quality but also by necessity. The office building is the brain center of the compost facility and houses all the facility’s SCADA equipment allowing the operation to be controlled to an optimal level.

**Equipment Cleanliness**

In addition, to the buildings on the site the operation also requires a small fleet of heavy equipment to complete the operation. The operation’s inventory currently consists of a three wheel loaders, a delivery dump truck, and two trommel screens which are all kept in excellent condition. This equipment is routinely cleaned to prevent buildup of compost and mulch on the units. This is done not only for aesthetic reasons but also safety issues. If materials are allowed to build up on equipment it can result in potential loss of equipment due to fire.

*Figure 8 – Screening equipment used to create a uniform end product.*
Reaching Out: Making a great product, a known product

While “branding” has a lot to do with a facility’s appearance and overall acceptance it also has to do with making a product desirable. A facility can produce a phenomenal product but if no one knows about it; no one will buy it. When the previous compost operation first began in 2001, it relied heavily on word of mouth between customers to spread the word of the product benefits. This method of product self-marketing was incredibly successful as the use of the product was quickly realized from residential/commercial lawn revitalization to use as a soil stabilization product. However, as productions increased the operation could no longer only rely on these initial repeat customers to purchase all of the produced material. In order to be more proactive in product marketing, the County started a branding campaign which started with the trade marking of the “Livingston’s Blend” product name. This trade marking effort is intended to keep inferior products from being sold under the same product name. Once the name was trademarked the facility developed a product logo under which the product would be marketed.

With a name and logo in hand the facility embarked upon the next objective of getting the word out. The operations did things such as product brochures, facility tours, providing information at local environmental events, and direct marketing to landscaping/contractor communities. However, additional efforts of community outreach were needed. In order to get the word out about the product to a wider audience the facility moved to work with various community organizations on special projects. Two of the most recent special projects have been with the Fredericksburg Area Food Bank and the Cal Ripken, Sr Foundation.

Fredericksburg Area Food Bank: This organization works in and with seven different community gardens within four different localities to help provide fresh food to local food pantries. Five of the gardens supply fresh produce to local food pantries; two are located in lower-income apartment communities where the gardens are divided into family plots, which families sign up to use and are responsible for throughout the growing season. In addition the food bank offers workshops and hands-on learning opportunities at the Fredericksburg Area Food Bank Community Garden to all who are interested. For two years now the Fredericksburg Area Food Bank has utilized Livingston Blend Compost at no charge, to revitalize the garden soil each year. The impact of utilizing the compost material was quickly seen within the first year of use and has brought the organization back as regular user of Livingston Blend Compost. Lindsey Williams, the Fresh Food Manager for the Food Bank had this to say about the product’s use:
“Thank you so much for the Livingston’s blend compost that we have received for the gardens. The gardens where we have added the compost are all thriving! It is very exciting to see.”

Above graphic from the Fredericksburg Area Food Bank website: (http://fredfood.org/programs/communitygarden.aspx)

Cal Ripken, Sr. Foundation: This foundation helps youth build character and teach critical life lessons to disadvantaged young people. To meet a growing need in the Fredericksburg, Virginia area the Foundation is building Sunshine Ballpark in partnership with the City of Fredericksburg. The park will be a multiuse facility centering on baseball and softball themed programs. To date the Livingston Blend Compost facility has donated over 120 cubic yards of compost material to help make this park a reality. Above rendering graphic from the Cal Ripken Sr, Foundation website (http://ripkenfoundation.org/virginia.php).

**PRIOR AWARDS**

**Virginia Recycling Association’s Outstanding County or Municipal Program Recycling Award**

In 2005, the Livingston Blend Composting Operation received the Virginia Recycling Association’s Outstanding County or Municipal Program Recycling Award for the successful diversion of yard waste and wastewater residuals from the landfill to produce a high value compost product that is sold to the public.

**The Livingston Blend Compost Facility An Exemplary Environmental Enterprise**

Spotsylvania County’s Livingston’s Blend Compost facility received the second highest honor in the Virginia Department of Environmental Quality: Virginia Environmental Excellence Program (VEEP). The facility received recognition in 2011 as an Exemplary Environmental Enterprise (E³) and was the first compost facility in
the State to receive this honor. In order to obtain the E³ designation the facility had to meet the following criteria:

1. Have a written policy statement outlining the facilities commitment to improving environmental quality, stressing compliance with environmental requirements, pollution prevention, training, communication and continuous improvement.
2. Perform an evaluation of the actual or potential environmental impacts and aspects from current or future activities at the facility, including a comprehensive list of impacts and aspects, an explanation of the process used by the facility to determine its significant impacts and aspects, a summary of the most recent impact and aspect review process, and the facility's schedule for reviewing and reevaluating its impacts.
3. Create objectives and targets for addressing significant environmental impacts, including the facility's goals (or objectives) for addressing its significant impacts and aspects and the projects or tasks that are planned to address each of the significant impacts and aspects (with an implementation schedule).
4. Develop and implement a pollution prevention program, and have actually acted on the program.
5. Develop and implement a mechanism for tracking changes in environmental compliance requirements, including a system for learning about legal requirements and changes in regulations.
6. Develop and implement written documentation of how the facility defines documents and maintains roles, responsibilities and authorities for its environmental management system, including assignments for projects, tasks or reporting responsibilities and upper management involvement or review.
7. Develop and implement procedures for reporting and record keeping to document the status of Environmental Management System (EMS) operations and activities, including a system for attractive tracking of the EMS.
8. Develop and implement procedures for ensuring that all employees have the necessary training, including a systematic approach ensuring all employees have role in the EMS.
9. Develop and implement emergency response procedures for responding to, reporting, mitigating and reviewing incidents, including emergency management program coordinated with local emergency response efforts.
10. Monitoring, investigative and corrective actions for noncompliance with environmental management system.
11. Perform voluntary self-assessments (external or internal auditing system), which may include regular self-assessments, corrective action plans or third party audits.
12. Develop and implement procedures to communicate with and inform external and internal audiences.
13. Provide annual reports which include at least two VEEP measures.

14. Have a perfect record of compliance with environmental regulations. Facilities applying to any level of VEEP must have a record of sustained compliance. As defined by Section 10.1-1187.1 of the Code of Virginia, record of sustained compliance means that "the person or facility (i) has no judgment or conviction entered against it, or against any key personnel of the person or facility or any person with an ownership interest in the facility for a criminal violation of the environmental protection laws of the United States, the Commonwealth, or any state in the previous five years; (ii) has been neither the cause of, nor liable for, more than two significant environmental violations in the previous three years; (iii) has no unresolved notices of violations or potential violations of environmental requirements with the Department or one of the Boards; (iv) is in compliance with the terms of any order or decree, executive compliance agreement, or related enforcement measure issued by the Department, one of the Boards, or the U.S. Environmental Protection Agency; and (v) has not demonstrated in any other way an unwillingness or inability to comply with environmental protection requirements.

The facility has achieved all the requirements for the E3 certification and is now in process of applying for the VEEP Extraordinary Environmental Enterprise E⁴ certification, Virginia's highest VEEP honor.

E³ Recognition Ceremony, September 13, 2011: Spotsylvania County Board of Supervisors
Names Left to Right: Hap Connors (Chancellor), Gary Jackson (Salem), Ed Petrovitch (Director, Utilities/Public Works), Emmitt Marshall (Berkeley), Tom Faha (Director DEQ NRO), Benjamin Pitts (Battlefield), Mark van Devender (EMS Coordinator), Thomas Waddy (Livingston), Jerry Logan (Courtland), Gary Skinner (Lee Hill)
How Is It Made?

Livingston Blend is produced from wastewater residuals and mulch through a controlled biological process. During composting the product is subjected to high internal temperatures which remove any potential pathogens and undesirables seeds. The product is monitored and tested regularly to be in compliance with US EPA standards for metals and pathogens. Testing results are available for review by contacting the Compost Facility at 540-507-7402.

The stringent testing and quality control performed at the Livingston’s Blend Compost Facility has earned it the industry coveted United States Composting Council’s Seal of Testing Assurance.

Limited Warranty/Disclaimer

Spotsylvania County guarantees that all Livingston’s Blend Compost has been treated by a process to further reduce pathogens as defined by the United States Environmental Protection Agency (EPA). In accordance with the Virginia Department of Health, the Virginia Department of Environmental Quality and the EPA the metal concentration in this product are below regulatory limits for exceptional quality biosolids. This no warranty of merchantability or fitness of Livingston’s Blend Compost. Spotsylvania County is not in anyway responsible for crops, gardens, or other vegetative growth damaged, injured, or destroyed from its application. Livingston’s Blend Compost is hygienically and environmentally safe if it is used properly. The product should be stored in protected areas away from play areas or children. The user agrees to abide by the instructions for usage provided by Spotsylvania County.

Group Tours Available On Request

Livingston’s Blend Compost Facility
6241 Massey Road
Spotsylvania, VA 22553
Phone: 540-507-7402

Exemplary Environmental Enterprise

Diverting Over 25,000 Tons From The Landfill Each Year!

Quality Through Care
Since 2001
Establishing A New Lawn
- Apply 1" Compost over lawn area and roto-till to a depth of 4" to 6" into existing soil.

Top Dress An Existing Lawn
- Thatch and aerate lawn.
- Apply ½" Compost and rake evenly.
- Re-seed as desired.

Repairing Bare Spots
- Apply 1" Compost over lawn area and roto-till to a depth of 4" to 6" into existing soil.
- Re-seed as desired.

Vegetable and Flower Gardens
- Apply 1" Compost over garden area and roto-till to a depth of 4" to 6" into existing soil.

Enrich Your Potting Soil
- Mix 1 part Compost, 1 part perlite, 1 part peat moss, 2 parts potting soil.

Plantings Tree and Shrubs
- Mix 1/3 Compost by volume with 2/3 of existing soil when planting.

Contractor Use: Re-Establishing Vegetation
- Apply 1" Compost over lawn area and roto-till to a depth of 4" to 6" into existing soil.
- Seed as desired.
- Greatly reduces time required to reestablish vegetation.

Chicken Coop Deep Litter Method
- Add 6" to 12" of Compost below your existing Chicken Coop to help eliminate unpleasant odors.

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Current Pricing
Under 100 Cubic Yards: $16/cy
100 Cubic Yards and Over: $12/cy
We Deliver
$75 Within 30 Miles