

Montgomery County, Maryland

A State-of-the-Art Biosolids Composting Facility

Editors Note: The Montgomery County, MD, Biosolids Composting Facility was closed on May 1, 1999. The pressure to commercially develop the strategically located County property where the project was sited combined with odor complaints from a community undergoing significant demographic changes appeared to be the cause of the closure.



The Blue Plains wastewater treatment plant is located on the banks of the Potomac River adjacent to Washington, D.C. It is one of the largest tertiary treatment systems in the world (Figure 1). Blue Plains serves Washington, D.C. and parts of Arlington and Fairfax counties in Virginia, and Montgomery and Prince Georges counties in Maryland. Under an Inter-Municipal Agreement (IMA) governing this waste treatment plant, each county and municipality using Blue Plains is required to handle its share of the sludge/biosolids produced. There are few industrial dischargers to the Blue Plains plant. The biosolids easily meet standards for heavy metals and are safe for agricultural and consumer applications (Table 1). To meet its responsibilities for processing its share of Blue Plains biosolids, Montgomery County, Maryland, just north of Washington, D.C., chose composting to produce a value-added product that would be saleable in multiple markets. County officials were responding to an environmentally conscious electorate in selecting an alternative for their county's biosolids that would do the most for organics recycling and beneficial reuse. The county settled on

composting as an “add-on” treatment for biosolids. Composting is primarily the acceleration of natural biodegradation, and may be accelerated by forced aeration. The elevated temperatures of the controlled aeration, which is produced by the microbial action, significantly reduces pathogens and breaks down the composting mass until a stabilized product is produced. The stabilization process takes between 30 and 60 days, depending on the end market use (Table 2). A comparison of trace metal concentrations at Blue Plains and MCRCF with EPA pollutant concentrations is shown in Table 3.

Blue Plains Biosolids Analysis (dried solids)		
	unit	level
aluminum	mg/kg	4,684.69
arsenic	mg/kg	2.22
boron	mg/kg	82.44
cadmium	mg/kg	10.24
chromium	mg/kg	29.25
copper	mg/kg	265.35
iron	mg/kg	34,117.44
lead	mg/kg	43.94
manganese	mg/kg	152.76
mercury	mg/kg	1.24
molybdenum	mg/kg	14.78
nickel	mg/kg	16.12
potassium	mg/kg	2,077.33
selenium	mg/kg	1.22
sodium	mg/kg	480.33
zinc	mg/kg	373.75
ammonia	mg/kg	1,183.11
organic nitrogen	mg/kg	46,182.11
total Kjeldahl nitrogen	mg/kg	47,345.22
nitrate	mg/kg	43.76
total phosphorus	mg/kg	14,076.00
pH		11.93
chlorides	mg/kg	21,731.56
sulfates	mg/kg	2,346.22
volatile solids	%	52.42
solids	%	23.09

Table 1. Blue Plains (DC) WWTP biosolids easily meet heavy metal standards.

Montgomery County Compost Analysis		
	measurement	level
total nitrogen	mg/kg	14,670.69
total nitrogen	%	1.61
TKN	mg/kg	15,895.05
ammonia	mg/kg	2,618.63
nitrite	mg/kg	10.13
nitrate	mg/kg	21.07
total phosphate	mg/kg	9,191.06
alkalinity	%	11.93
conductivity	KmS	1,648.69
arsenic	mg/kg	0.66
cadmium	mg/kg	0.69
chromium	mg/kg	47.91
copper	mg/kg	175.11
iron	mg/kg	27,876.21
lead	mg/kg	15.74
mercury	mg/kg	1.25
molybdenum	mg/kg	3.08
nickel	mg/kg	12.01
potassium	mg/kg	2,429.68
selenium	mg/kg	0.21
zinc	mg/kg	233.47
moisture	%	40.28
solids	%	59.57
pH		7.92
fecal coliform	MPN/gm	0.89
total coliform	MPN/gm	73.57

Table 2. MCRCF Compost Analysis.

Trace Metal	Blue Plains (dried solids) (ppm)	Montgomery County Compost (ppm)	EPA Pollutant Concentration Limits for Biosolids (ppm)
Arsenic	2.22	0.56	41
Cadmium	10.24	0.88	39
Chromium	29.25	47.91	1200
Copper	265.35	175.11	1500
Lead	43.94	15.74	300
Mercury	1.24	1.25	17
Nickel	16.12	12.01	420
Selenium	1.22	0.21	36
Zinc	373.76	233.47	2800

Table 3. Blue Plains and MCRCF metals concentration are much lower than EPA concentration limits for biosolids.

Biosolids composting requires the addition of a bulking agent to provide air space and to make the mixture permeable. Typical bulking agents include wood chips, shredded bark, sawdust, shredded paper, shredded tires, and other materials. The bulking agent can also serve as a moisture absorbent and can supply carbon to bring the carbon/nitrogen ratio into a range that will prevent drawing nitrogen from plants when used as a soil conditioner. Biosolids composting also demands a controlled and properly distributed air flow to promote biological action, to serve as a coolant to keep biological action optimal, and to act as a carrier of the moisture being removed. Dewatered biosolids, which generally have the consistency of wet modeling clay, are mixed with the bulking agent, placed in piles, and force-aerated. The natural biological action creates a temperature rise, which is normally controlled at around 130 F (54 C). The off-gases of biosolids composting consist primarily of carbon dioxide and water vapor.

The Facility

During the early 1980s, Montgomery County officials worked with the nearby USDA Agricultural Research Service Laboratory in Beltsville, MD, to adapt the federal agency's advanced Beltsville Method of static aerated pile composting to the needs of

the county and its customers. The Montgomery County Regional Composting Facility (MCRCF) is designed to process up to a nominal rate of 400 wet tons/day, although it operated at half-capacity until odor issues were resolved. The plant was designed using the design criteria from USEPA/USDA's pilot work. The MCRCF covers five acres and has several enclosed metal buildings where the mixing, composting, and bagging operations are carried out. It includes drainage systems and a "pond" to catch runoff, eliminating chances of non-point source pollution from the plant (Figure 2). Montgomery County benefited from the Federal and State grants that were available for wastewater treatment facilities in the 1970s and early 1980s, receiving \$28 million in grants for construction and equipment -- almost half the \$58 million cost for the entire facility.

To create compost from Blue Plains biosolids, incoming biosolids and recycled wood chips are unloaded into receiving bins and moved by belt conveyors to an enclosed stationary mixing system (Figure 3). The compost mixture is transported to a composting building and stacked into an extended pile on a base of fresh wood chips and aerated under negative pressure for 21 days. Composting process air is collected and treated using a three-stage scrubbing technology patented by WSSC. After the composting phase, the piles are broken down by a front-end loader and taken to the screening building where the compost is separated from the wood chips. The wood chips are then returned to the mixing process, and the compost is cured by aerating under positive pressure for 30 days in a separate curing building. Following curing, the product is either sold in bulk or bagged and distributed to various users. The wood chips are screened out of the final product and reused in processing other incoming batches of biosolids. Figure 4 illustrates the MCRCF composting process.



Figure 2. The Montgomery County Composting Facility was selected by Maryland officials to maximize recycling and beneficial use.

Many composting methods use perforated plastic pipes under the compost piles to blow air into the piles, accelerating microbiological activity and the breakdown of wastes into compost. The Montgomery County/Beltsville method reversed the air flow, sucking air through the pile into the perforated pipes and expelling it into an air treatment system or scrubber.

Soon after the composting facility began operations, Montgomery County officials were confronted with numerous citizen complaints concerning odor. All biosolids processing plants produce odors. The question is whether the odors are strong enough and close enough to neighbors to be objectionable. The MCRCF is located in Silver Spring,

experimentation and operational experience with the first three-stage misting scrubber. The new scrubber design is based on the same chemistry as was the old scrubber but is built to handle a much greater air flow (Figure 5). The new scrubber was put into service on October 12, 1993, and has been in operation ever since. Performance data has shown improved efficiency in oxidation and removal of organic sulfides, improved removal efficiencies for non-sulfur-containing organic compounds, and improved performance at higher air flow rates. These improved performance characteristics will permit the processing of the larger airflows which will accompany the scale-up of the MCRCF to about 400 wet tons/day.

Marketing the Product

Making a high quality organic material from biosolids is a design and operation challenge that has been dealt with effectively by Montgomery County. Finding a market for the product was the initial stumbling block. To address marketing, Montgomery County created a unique organization -- Maryland Environmental Services (MES). Established in the early 1970's, MES is a not-for-profit organization spun off from the Maryland Department of Natural Resources (DNR) to manage wastewater treatment and drinking water plants. The idea was to separate enforcement - the DNR's job - from the operation of such facilities. When the MCRCF came on line, MES took over marketing the compost products.

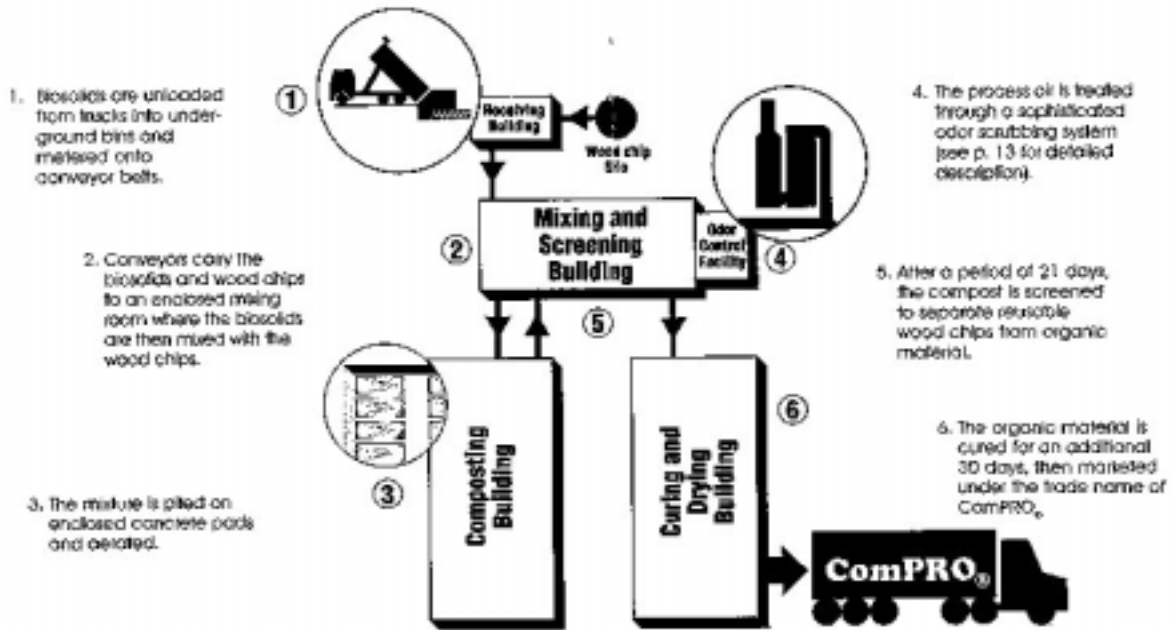
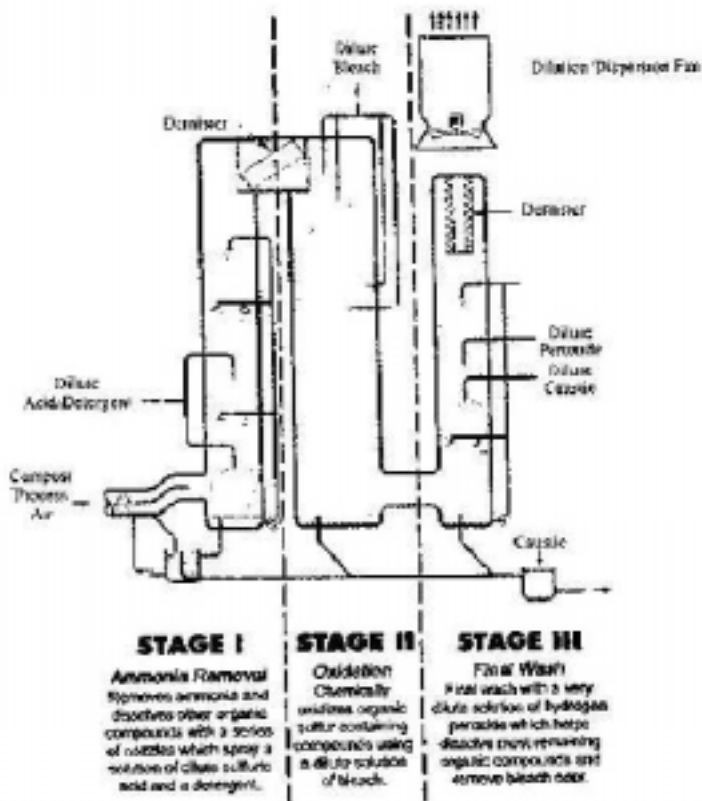


Figure 4. The MCRCF biosolids is sold under the brand name ComPro.

MES focused first on the bulk market -- landscape contractors, turf managers, top soil blenders. Since Blue Plains uses lime in the last stages of the process, the resulting compost product, marketed under the name "Compro," has relatively high alkalinity. This gives Compro an added plus since liming of lawns is common in the relatively acidic soils of the area. This also expands the active marketing period into the fall when lime typically is applied to lawns. Landscapers and turf managers realized that with Compro they are getting not only pH balancing, but also organic matter that helps soil quality and slow-release and organically bound nutrients that will help plants grow.

Although all the Compro product was initially bought by bulk marketers, MES also started to bag the product for sale to consumers through retail outlets like Home Depot and garden centers. The reason was economic -- bulk distributors payed only about \$10 per ton, whereas MES could command \$1.55 for a 40 lb (18 kg) bag of Compro that would be resold to home gardeners for \$2.88 to \$3.00 (or \$144 to \$150 per ton). MES began bagging in spring of 1995 and doubled its bag sales each year.

Figure 5. MCRCF uses a patented scrubber design to minimize odors.



Millions of people have appreciated the landscaping benefits of the Compro product without even realizing it. Compro is used on some of the most high-profile lawns and gardens in the country; including, the White House, Mount Vernon, the Governor's Mansion in Annapolis, Maryland and the celebrated Orioles Park at Camden Yards in Baltimore. When Tiger Woods and the rest of the 1997 U.S. Open Tour strode the fairways at Congressional Country Club in Potomac, MD, they were walking on grass fed with Compro.