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Mastering The Art Of Compost Process Control



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Pacific Northwest Company is equipped to compost increasing volumes of food waste and other separated organics.

Greg Ehm

SINCE Pierce County, Washington began composting yard trimmings in 1992, more than one million tons have been diverted from the local landfill. The first facility, located in Purdy, served the county through much of the 1990s. But as the county's population expanded, the volume of yard trimmings exceeded the site's capacity. In March 1999, a second and more advanced composting facility opened in Puyallup. It was built in a developed area of Pierce County only 10 miles southeast of Tacoma. The site was selected to address the residential and commercial growth on the eastern edge of the county and to help reduce transportation costs.

Operated by Pierce County Recycling and Disposal LLC (dba Land Recovery, Inc. (LRI)), the facility is called The Compost Factory. "We added a lot of new technology to the Compost Factory that would allow us to continue operating as urban encroachment came up around the facility," says Don Taylor, site manager with LRI. "That forward thinking has enabled us to still compost successfully here today, because we wanted to take all types of odoriferous feedstocks and still compost in a suburban area."

While the major feedstock processed at the Compost Factory is yard trimmings, manure and food waste also are accepted. The food waste comes from commercial generators, such as restaurants, hospitals and institutions. However, the county is planning to develop a residential food waste collection program in the near future.

The Purdy facility, on the western edge of Pierce County, is processing yard trimmings only. The site has a roof and floor with aeration set in it, but no walls.

MATERIALS HANDLING

The Compost Factory building comprises 3.5 acres under roof with 2.5 acres of the building completely enclosed. Commercial haulers and residents deliver yard trimmings to the site. Materials are only allowed in bulk; no bagged feedstocks are accepted.

Each load is weighed and visually inspected for contaminants. Yard trimmings are offloaded in a covered receiving area at the Compost Factory and visually inspected again. A wheel loader pushes the material to an excavator, which mixes the commercial and residential yard trimmings to attain the correct carbon to nitrogen ratio. "Typically bulking agents need to be added in the spring when we receive a high concentration of yard clippings," says Taylor. "We use landclearing debris, such as ground-up stumps and logs, as a bulking agent."

Once the yard trimmings are prepped, they move into the composting hall building on a chain conveyor and pass over a Bulk Handling Systems' debris roll where fines are screened out. Overs travel on a 4-foot wide picking conveyor where a Compost Factory worker removes any remaining contaminants such as trash, plastic and yard tools before the material reaches the grinding stage.

Overs are processed in a 500 HP electric powered, Universal Refiner grinder using a range of screen sizes (2-inches to 8-10 inches) depending on the season. "Yard trimmings change a lot with the season," explains Carrie Gregory, Quality Control Manager at the Compost Factory. "We use smaller screens in the winter to grind the high carbon material small enough to break down and compost, and larger screens in the spring so that wet grass does not clog them. This also ensures there is enough porosity, and bulk density for the air to get through the wet clumpy grass."

Overs are remixed with the fines. As the mixed material flows down a conveyor, a 3-inch water bar sits on top of the conveyor allowing moisture to be added to the mixture before being placed in the composting stacks.

A wheel loader moves the material from the conveyor and builds a continuous pile across the front of the composting hall. The continuous pile spans the entire length of the 85,000 square foot floor with capacity to hold approximately 15,000 tons at any one time. The composting hall can process 170 tons of material daily with peaks up to 250 tons/day as needed. Pile height is about 10 feet; retention time on the floor is 14 to 25 days, varying by seasonal demand. About 60,000 tons/year of feedstocks are processed at the Compost Factory.

ADVANCED PROCESS CONTROL

The computer-driven aeration control and monitoring system for the composting process was designed and supplied by Engineered Compost Systems (ECS). (See "Plugging Into The Composting Process," December 2000 for a detailed description of the initial design and operation.) The building contains 17 individually controlled aeration zones for the primary, secondary and curing process areas. The aeration control provides positive, negative and reversing aeration depending on the process needs and the temperature profile of the piles. The in-slab aeration floor has close to 10,000 sparger-type aeration ports.

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Temperature feedback is wirelessly transmitted to ECS's CompTroller via 64 RF TeleProbes™. Each temperature probe contains two sensors, one located at the bottom and one midpoint of the probe shaft. When temperature data show a significant difference between the top and bottom pile temperatures (preset by the operator), the control system automatically reverses the aeration direction.

To further enhance aeration, each of the 18 blower fans has variable-drive systems, allowing the computer to ramp aeration speeds up or down as needed. Once the new pile is built, two temperature probes are inserted into the material within each individual floor zone. The control system continuously monitors and records pile temperatures. "You end up with four readings for each aeration zone," says Gregory. "Those readings are matched against our desired temperature for each zone. The computer actually runs the entire process; we just monitor the computer system."

Once a month, the Compost Factory team pulls moisture samples throughout the entire facility. Samples are tested in LRI's in-house laboratory for moisture content. If needed, moisture can be added to the material from one of two 13,000 gallon underground storage tanks. "Liquid from the composting process is collected and stored in the underground tanks," says Taylor. "Because we use a lot of forced aeration it requires a significant amount of liquid to keep the compost at the appropriate moisture level. The liquid is applied to the material only during the first half of the composting process to reduce any potential contamination issues."

Piles are turned two to three times a week using a Vermeer elevating-face compost turner. "Our compost turner operator has extensive experience with our process and has fine-tuned his skills," says Gregory. "He's our main tool to verify moisture content of the materials. The operator uses a squeeze test to estimate moisture levels and we back that up with the in-house laboratory testing."

LRI has been using the elevating-face technology since 1992. "This turner allows us to compost more material in a confined space using the continuous stacking method versus traditional windrows," says Taylor. "We need every inch of our processing floor to be covered with material." In addition to saving space, the design facilitates movement of compost material through the building. Every time the stack is turned it moves finished material towards the screen. "We've been very pleased with this unit since we took delivery in April 2009," he adds. "It is capable of turning up to 2,500 cubic yards of material per hour."

With residential and commercial development within a mile of the Compost Factory, odor control is vital. The facility has an internal ventilation system and uses biofilters to scrub odors. "We have an acre of biofilters made of shredded woodchips," says Gregory. "Four ventilation fans draw air from inside the building and force it through the 4-foot thick biofilter. A sprinkler system is used to maintain the moisture level of the biofilter. Temperature is monitored with the automated system and we check airflow monthly using a hand-held pressure gauge." Other operational practices to minimize odors include not loading trucks early in the morning during the commuting hours and sweeping and keeping the area clean.

SCREENING AND MARKETS

The entire composting process, including curing, takes about 30 to 55 days, depending on the time of year. During winter, the process takes longer due to the higher level of carbon-based material in the feedstocks. Compost from the building is moved to a covered outdoor area, where it is cured and stabilized for approximately two weeks (depending on the time of year). Compost is not turned during the curing phase. Finished material is screened to 3/8- and 5/8-inch products using an Erin Starscreen.

The compost is sold as Pierce County Recycled Earth Products (PREP). LRI markets 80 percent to wholesalers; 20 percent is sold at retail. Since the facility has no storage, all compost must be sold the week it is produced, but so far demand has outstripped the supply. Overs are used at the local landfill as a temporary road base.

Recently, LRI purchased the Silver Springs Organics composting facility in an adjoining county (see "Creating An Affordable Road To Composting," October, 2007, for a profile of the facility). "The challenge is keeping the balance between your facilities and maximizing each one's potential," says Gregory. "We also want each facility to complement the other."

Silver Springs composts a wide range of feedstocks, including manure, yard trimmings and food waste. "The site processes the same materials as the Compost Factory, but in different ratios with a different operating system," says Gregory.

Greg Ehm is with Two Rivers Marketing in Des Moines, Iowa.

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