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**IN-VESSEL AEROBIC COMPOSTING
OF ORGANIC WASTE ON SITE AND RE-USE ON SITE
FOR ENVIRONMENTAL AND ECONOMIC ADVANTAGE**

A WHITE PAPER

By Morgan Levy, Administrator, SDSWCD

The requirement for beginning a program of in-vessel aerobic composting of organic waste products in South Florida is becoming more and more urgent as available landfill space becomes more scarce. The advantages of in-vessel composting of organic waste products over land filling must be considered now and projects must be initiated in order to have a better environmental alternative to land filling ready to augment the present waste disposal system.

In South Florida, our sole source of potable water, the Biscayne Aquifer, lies only 8 ft to 12 ft below us. Leachate from landfills, despite the plastic liners that are designed for a 50-year life, is already escaping into Biscayne Bay and to nearby the Northwest well field area. Methane gas that is produced in landfills produces 20 times more greenhouse gas than carbon dioxide. Methane gas that is flared creates carbon monoxide another damaging greenhouse gas.

Successful in-vessel composting begins with a good separation system at the source of the organic waste supply. This begins with separating food waste from plastic, metal, glass and Styrofoam. Many environmentally concerned operators will replace plastic dinner wear with compostable products. Others will be required to train their kitchen and dining room employees in the importance of careful separation. Good training and specifically designed and marked containers for organic waste products only has proven to result in good separation of organic waste.

Toyota Manufacturing Plant in Georgetown, Kentucky employs over 10,000 people. There are six employee cafeterias and extensive landscaping on the 1,400 acre campus. In-vessel composting of all food and yard waste at this plant has been going on since 2004. This plant is now a Zero Waste Plant. No permits were required since no waste from other locations are being processed and all finished compost is used on site as a soil amendment.

Montclair State University in New Jersey has been in-vessel composting the food waste at its \$78 million Conference Center since 2006. The in-vessel composter replaced four dumpsters that were originally required for food waste, reducing the disposal costs and the odors and rodent population that the dumpsters created.

These two examples are being repeated all over the country. The State of South Carolina Highway Department has just placed an order for in-vessel composters for road kill composting. Purdue has just ordered 25 in-vessel composters for composting chicken carcasses and chicken litter in Virginia. Broken Sound Club in Boca Raton, Florida recently installed an in-vessel composting system to compost food waste from four restaurants and yard waste from two golf courses. In the first ten months they composted close to 500,000 pounds of food waste and 1,200,000 pounds of yard waste, re-using all of the compost on the golf courses as a replacement for chemical fertilizers.

In-vessel composting equipment basically includes a drum (vessel) that can range from 3 ft diameter to 10 ft diameter and with capacities ranging from 3 c.y. to 96 c.y. Ancillary equipment can

include loading conveyors, air systems (blowers), temperature monitors, electric panels and downloading conveyors. The drum rotates only four revolutions per hour by electrical power only 2 hours on and 10 hours off using very little electrical energy. Heat is generated inside the drum by the combination of bacteria, carbon, nitrogen and moisture in the organic waste combined with oxygen (the aerobic process) as the mixture is turned very slowly.

Organic waste products that can be successfully in-vessel composted in only a few days include food waste, yard waste, soiled paper and cardboard waste, animal waste, wastewater residuals (sewage biosolids) and even animal carcasses. As these organic waste products are mixed in the right proportions (the recipe) and loaded into the vessel, no odors, leachate or vermin attraction is produced. In a four-day cycle, temperatures exceeding 131⁰ F for three consecutive days can be attained to comply with EPA Class AA compost standards. Animal carcasses require longer (up to 10 days in the vessel) to compost.

The resulting compost is then cured on a pile for 7 to 10 days until the temperature of the curing pile is less than 90⁰ F. Samples are taken of each finished batch and sent to a certified lab for analyses to show the NPK values and other essential micro and macro elements and to determine that there are no harmful pathogens or weed seeds in the compost. This compost is then classified as Class AA compost and it is approved by EPA, Florida Department of Environmental Protection (FDEP) and Miami-Dade Department of Environmental Resources Management (DERM) for use on row crops, groves, landscaping, golf courses, parks, etc. From beginning to end the entire in-vessel composting process produces a valuable soil amendment in only two weeks, ready to be re-used on site or sold to agricultural interests, landscapers, golf courses, parks, etc. as a valuable, nutrient-rich soil amendment.

The market for this valuable compost has been established for many years in the United States and foreign countries. Class AA compost is slow release, does not leach out in rains or irrigation, conserves water and offers approximately \$180.00 worth of nutrients for only \$65.00/ton. Compared to chemical fertilizers that are selling in excess of \$400.00/ton that do leach out after rains and irrigation, the Class AA compost is now preferred by many growers. The demand from local farmers for compost far exceeds the available supply.

Solid waste reduction is now a goal of local, state and federal governments. Many large solid waste producers can actually re-use all of the compost they would produce. Universities, schools, resorts, theme parks, country clubs, correctional facilities, dairy farms, poultry farms, hog farms, horse stables and horse race tracks can in-vessel compost their organic waste on site and re-use the finished compost on site. This reduces the volume of solid waste that must be disposed of, saving huge disposal costs, taking hundreds of truck trips off of the roads, saving fuel and reducing the carbon footprint.

Recent successful tests of in-vessel composting of Class B biosolids from the Miami-Dade Water and Sewer Black Point Municipal Wastewater Treatment Plant have proved how in-vessel composting can be advantageously utilized in producing Class AA biosolids more quickly while reducing the odor. Local grove owners are now applying Class AA biosolids three times a year, replacing commercial chemical fertilizers that are prohibitive in cost. This new demand is now greater than the supply of Class AA sludge that is presently being produced in drying beds and then aerated compost piles, taking three to four weeks to produce.

Environmental Advantages of In-Vessel Composting

1. Reduces volume of organic waste going to landfills.
2. Reduces odor and vermin attraction
3. Compost is slow-release and will not leach out.
4. Compost conserves water.
5. Reduces greenhouse emissions. (production of landfill methane also produces carbon monoxide which is more harmful than methane)
6. Compost has valuable nutritional value and has a ready market.

7. Produces Class AA compost in all weather conditions in only 4 to 10 days.
8. Provides additional recycling credits.
9. Eliminates hundreds of truck trips that can reduce the carbon footprint of the area, while reducing costly fuel expense and wear and tare on local roads.

Economic Advantages of In-Vessel Composting

1. Re-use of organic waste on site saves fertilizer costs for operator
2. Sale of excess compost to local farmers.
3. Reduction of waste disposal fees.

Florida, with its major resorts and entertainment destinations, has historically high occupancy rates with an average of 37,800,000 guests annually. The Florida Hotel/Motel Association estimates that there are 4,500 hotels/motels in the State, representing 400,000 rooms, employing 850,000 people. These numbers represent a major contribution to Florida's waste stream. It is important to begin the process of in-vessel composting of organic waste on site and re-use on site for a few local hotels to serve as models for other local hotels to follow as future landfill space diminishes.

This can also be accomplished for hotels that do not have acceptable space for an on site in-vessel composter with the cooperation of the present waste disposal companies. A special daily route could be established to pick up only organic waste products including food waste, yard waste and soiled paper waste. This organic waste would then be delivered to composting sites where in-vessel composters would be located to process this organic waste. The sale of the finished compost, plus the charge to the hotels for the collection and disposal of the organic waste would create a profitable business plan for the waste disposal companies. Compost sites can be located strategically around the county, even at some transfer stations, to reduce the transportation costs.

A good in-vessel composting operation on site would include:

1. Separating the organic waste by the waste producer into specific, identifiable containers.
2. The contents of these containers are then added to a mixer/grinder in the correct recipe: carbon/nitrogen 3:1 and moisture.
3. Once in the mixer/grinder for about ten minutes, the material is automatically transferred into the composter via a u-trough screw conveyor.
4. The vessel is then loaded to its capacity, either all at one time or one-fourth of the capacity each day for four days. The timer on the vessel turns it on to rotate for two hours and turns it off to rest for ten hours. Temperatures are taken twice a day and recorded to determine if the contents have maintained at least 131⁰ F for three consecutive days. On the fifth day, one-fourth of the contents is downloaded onto conveyor into a front-end loader or a truck to be removed to a curing area. An alternate download procedure would be directly into a concrete bin where it can be scooped up by front-end loader and placed on curing pile.
5. Daily temperatures are taken of the curing pile and recorded until the temperature is below 90⁰ F.
6. Samples are then taken and sent to a certified lab for analysis.
7. When the lab analysis is received and shows no harmful pathogens or weed seeds, the compost is ready to be used as determined.
8. Sound engineering practices addressed to cover site plan, weather contingencies, fire control, with bonding to cover possible closure of the site.

This in-vessel composting on site and re-use on site has been shown to be both environmentally and economically sound. In 2010, an EPA Grant to the South Dade Soil and Water Conservation District proved this with The Breakers Resort in Palm Beach, Florida, The Metrozoo in Miami-Dade County and the Homestead Air Reserve Base as participants. The Return On Investment (ROI) for Toyota

Manufacturing Corporation in Kentucky was only 6 months. Other similar results have been obtained for in-vessel composting operations all over the United States with ROI's ranging from 6 months to 3 years depending on the volume of material to be composted and the original cost for disposal.

The 3,000 Soil and Water Conservation Districts in the United States, one in almost every county, are encouraged to promote in-vessel composting of organic waste products on site and re-use on site and also to establish contact with the South Dade Soil and Water Conservation District who will be happy to cooperate with the latest and best technology.

In-vessel composting on site and re-use on site will protect and enhance our environment for the benefit of future generations.

The South Dade Soil And Water Conservation District is a World-Wide Consultant on In-Vessel Composting Equipment, Installations and Operations.

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OUR GOAL IS TO HELP OTHERS BECOME ZERO-WASTE ORGANIZATIONS