How Ocala's Biosolids Reuse Program Controls Costs, Meets Regulations, & Is Safe for the Environment

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As part of its aggressive biosolids reuse program, the city of Ocala uses environmentally sound, beneficial methods to reclaim solids removed from the wastewater treatment processes at its three water reclamation facilities (WRFs). Ocala uses a belt press to produce Class B biosolids from aerobically digested sludge at WRF #2, which are then land-applied as a low-grade fertilizer and soil amendment to various local cattle ranches.

Also, Ocala hauls anaerobically digested sludge from WRF #1 to WRF #3, where it is blended with undigested waste-activated sludge from WRF #3 and then fed to a belt press to produce between 17 and 19 percent dry solids product. The mixture is then sent through a 40-wet tons per day (WTPD) indirect dryer system for final processing, where it achieves an average 90 to 95 percent dry product. The end product is marketed as a slow-release fertilizer and soil amendment.

A new belt press installed at WRF #2 will help the city meet the same levels of solids processed at WRF #3 for drying purposes. A cake-handling facility is also being added at WRF #3 to allow the city to ship all biosolids now processed at WRF #2 to WRF #3 for final drying.

Ocala's newest wastewater treatment facility, the Michael S. Finn* WRF #3, was designed to meet the city's biosolids needs well into the future. The city incorporated drying technology into WRF #3 as part of its long-term biosolids plan that includes adding a 60-WTPD dryer later this year.

At this facility, Ocala is processing biosolids to a Class AA (or "EQ – environmental quality") product that meets U.S.EPA Title 40 of the Code of Federal Regulations, Part 503. The indirect heat-generating process delivers a dry, pasteurized product that can be used safely anywhere for almost any purpose, including food crops. A clean-air permit was not required for using an approved indirect drying process, which factored into Ocala's choice of dryers.

Ocala decided to produce Class AA product at WRF #3 for a number of reasons: The city has lost more than 1,000 acres of Class B land-application sites to new development since the year 2000. Also, the unreliability of long-term landfilling and associated tipping fees, as well as continuing increases in transportation costs for shipping biosolids over greater distances, made it financially more difficult for Ocala to continue land application of Class B biosolids. The city also took into consideration the likelihood of more restrictive biosolids regulations, the ability to reduce the overall amount of biosolids generated, and the marketability of the Class AA end product.

When comparing the cost of producing Class AA biosolids to the cost of hauling Class B biosolids to distant land-application sites or landfills with their ever-increasing tipping fees, Ocala determined it would ultimately break even by producing a dried Class AA product. The city plans to process Class AA biosolids exclusively by the end of 2007, producing the Class B product and using associated land-application sites only as needed or in emergency situations.

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Producing Class AA Biosolids

Biosolids from Ocala's three water reclamation facilities will ultimately be processed at WRF #3, which utilizes the Dragon Dryer® system from Siemens Water Technologies. Operators control the drying system by a PLC with inputs through a touch-screen color monitor.

The indirect rotating-chamber biosolids dryer, depicted in Figure 1, is designed to process 40 WTPD of biosolids on a continuous basis. The dryer uses heat drying to process dewatered cake so it complies with the federal and state government's Class A and AA biosolids requirements. The dried biosolids are discharged at 90 to 95 percent dry solids.

A belt filter press first dewaters the sludge to a 17 to 19 percent dry solids cake. The filtrate water is returned to the plant headworks, while the dewatered cakes drop directly into a 20-cubic-yard feed hopper.

The hopper contains an anti-bridging device that forces the solids down into an auger at the hopper's bottom. The variable-speed feed auger conveys the dewatered cake into the wet end housing of the dryer where a level sensor maintains the correct level of solids by controlling the auger.

Hot oil, heated in an external gas-fired

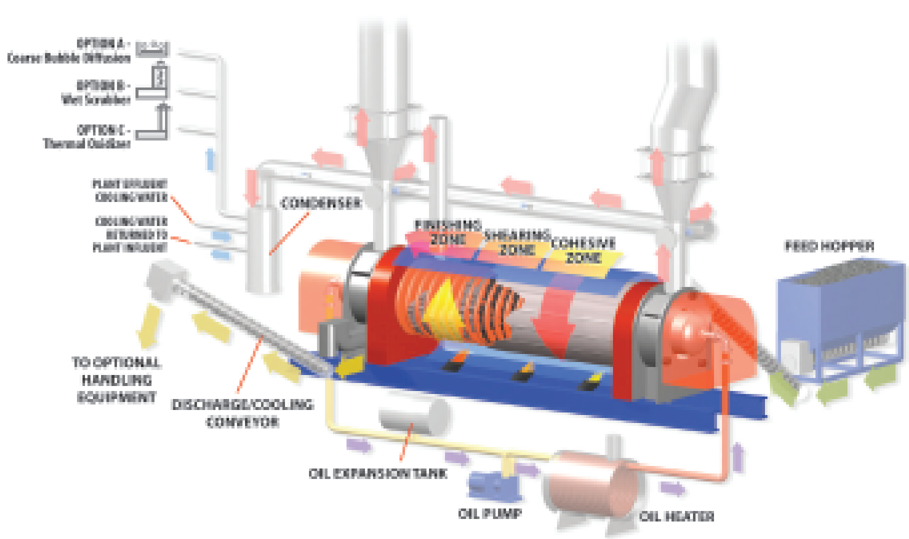

Figure 1

Photo 1

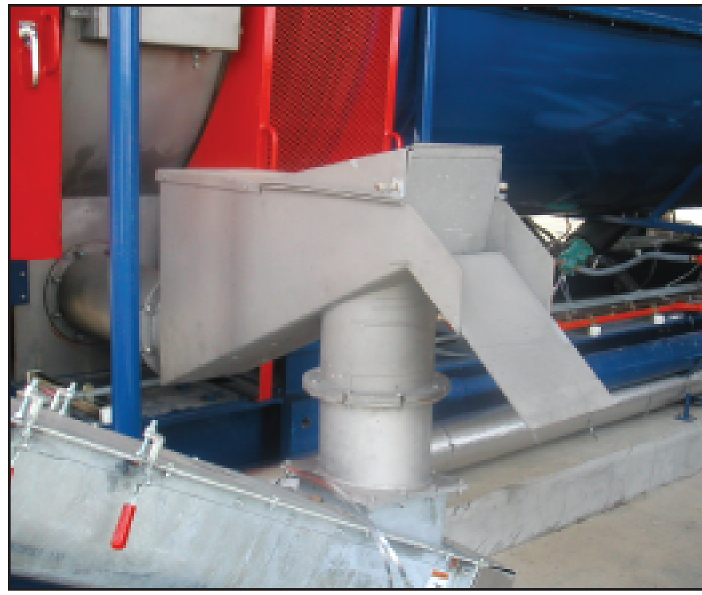

Photo 2

heating unit, is pumped through the auger at 360ºF to 400ºF. The oil circulates only through the auger flights. As the auger slowly rotates, it conveys the biosolids toward the dryer discharge end. The auger flights' very hot surface prevents material from sticking to the auger; instead, it quickly flakes off. The auger is inside the dehydration chamber, which is heated on the outside in three zones using high-efficiency gas burners.

Each gas burner is independently controlled. Typically, Zone 1 (where biosolids enter the dryer) is kept at a higher metal temperature than the other two zones. As the material dries further down the chamber in Zones 2 and 3, the input temperature drops, resulting in a typical product discharge temperature of 150ºF to 200ºF (see Table 1 for typical operating conditions). Biosolids retention time within the dryer averages 1.9 hours.

After the drying process, a dust control agent is added at the discharge airlock. The dust control agent binds the biosolids fines, eliminating most airborne particles. A screw conveyor blends in the dust control agent and conveys the dried biosolids to a truck that transports the mixture to various land-application sites in Florida, where it is used as an organic fertilizer for land application (see Photo 1).

Dryer Operating Data

Table 2 shows operational data for the belt press during a 24-hour run. The belt press produced a cake that averaged 17 to 19 percent dry solids at a rate of 99,360 gallons per day. Table 1 provides details of the typical dryer operating conditions of the drying system, which is started up each Monday and operates 24 hours a day until the holding basin is empty. Dryer shutdown typically occurs on Thursdays, resulting in a 3-1/2 calendar day operation per week.

The drying system's average daily processing is 40.53 WTPD. The dryer proved very efficient, using 1,485 BTUs of gas per pound of water evaporated. The average evaporation rate achieved by the drying system was 2,716 pounds of water removed per hour.

Characteristics of the dried biosolids are shown in Table 3. The significant figures are the 79 percent reduction in volume and the 84 percent reduction in weight. The dry product averages 92 percent solids, meeting the requirements for the state of Florida's Class AA standards with respect to metals, pathogen kill and vector-attraction reduction.

Table 1 - Dragon Dryer Operational Data
(Snapshot of a typical 24-hour operation period)

Average Retention Time, hours	2.2
Auger Oil Temperature, °F	420
Dehydration Tube, Zone 1 Temp.	450°F
Dehydration Tube, Zone 2 Temp.	420°F
Dehydration Tube, Zone 3 Temp.	200°F
Discharge Temperature of the biosolids from Dryer	159°F
Water Evaporation Rate, lbs/hr	3,129
Wet Cake per day (US Tons)	44.51
Dry Solids per day (US Tons)	6.96

Table 2 - Belt Press Solids Data
(Snapshot of a typical 24-hour operation period)

Dry Solids Percentage to Belt Filter Press	1.77
Belt Press Feed Rate, GPM	69
Dry Solids Percentage from Belt Press	15.63

Table 3 - Dried Biosolids Characteristics

Density (US Pounds per cubic foot)	45
Dry Solids Percentage	92.3
Color	Black
Appearance	Granular
Volume Reduction percentage	79
Weight Reduction percentage	84

Controlling Odors

WRF #3 controls odors by completely separating the steam that results as water evaporates off the drying biosolids from the combustion gases. The combustion exhaust from both the dehydration chamber burners and the hot oil burner are routed up through the roof and discharged.

The dryer is sealed at the feed end by the biosolids that are extruded into the dryer. A special airlock (Photo 2) at the discharge end prevents air from entering at that point. Rotary seals are provided at the ends to keep the dryer airtight.

The steam that results from the evaporating water is pulled out of the dryer under a slight vacuum by a blower and into a venturi/condenser. The venturi section is used to remove any particulate that may have been carried out with the steam. Spray nozzles use plant effluent to cool the steam prior to and within the condenser. Figure 2 shows a schematic of the dryer off-gas cooling and recycling system. The temperature is reduced from 350ºF exiting the dehydration tube to under 90ºF at the discharge of the condenser, ensuring that all the steam is converted back into water.

During the drying process, some volatile compounds are driven off with the steam. Essentially all of these are re-condensed back into the liquid phase and re-entrained in the water. About 170 gallons per minute of cooling water and condensed steam is returned to

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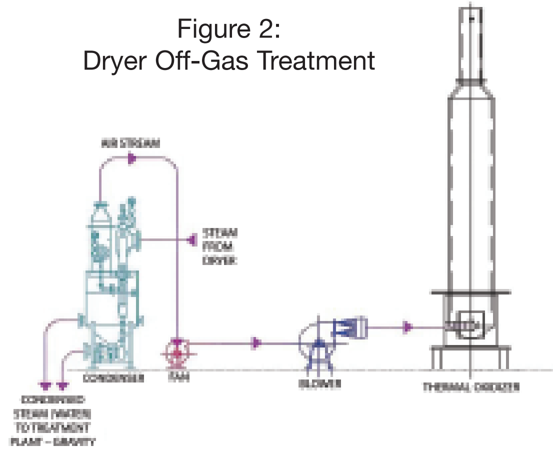
the treatment plant headworks. The approximately 230 cubic feet per minute of gas that remains contains a slightly burnt smell. This odor seems to be associated with a very small amount of smoke still in the scrubber discharge.

A thermal oxidizer controls odors for the entire drying process. Off-gases from the dryer are piped to the thermal oxidizer, where they are burned (Figure 2) to remove the smoke and remaining smell.

Figure 2:
Dryer Off-Gas Treatment



As is true of other biosolids fertilizer products, some residual odors occur when Ocala's AA product is first rewetted; however, these quickly dissipate within a day or two.

The End Product

Ocala sells the Class AA end product in bulk for $5 per dry ton to an Orlando-based broker, Nutri-Source Inc. The broker maintains two 46,000-pound capacity dump trailers on site to collect the dried product from the dryer. Nutri-Source then sells the end product to area orange grove owners and others in the agriculture industry. The Class AA biosolids product is considered a low-grade, slow-release organic fertilizer and excellent soil amendment.

Ocala has also sold numerous 20-pound bags of the material to raise money for local charities and to help increase product awareness. In the future, the city hopes to also interest nurseries, landscapers, homeowners, and other potential users in the product. Orchid growers expressed interest in the product at Ocala's most recent charitable fund-raising event.

Conclusion

Across the country, Class B biosolids are becoming a less viable "end" to the wastewater treatment process. Communities are finding they have more biosolids to dispose of in less space and at greater cost. In addition, they have to meet increasingly stringent local, state and federal disposal regulations.

As part of its extensive biosolids reuse program, Ocala produces Class AA biosolids and markets them to a local broker. In the future, the city hopes to also interest smaller commercial users such as nurseries, landscapers, homeowners and others in the beneficial use of biosolids.

Ocala uses an indirect rotating-chamber biosolids dryer to continuously process 40 WTPD of dewatered biosolids. The dried biosolids emerge from the dryer at 90 to 95 percent dry solids. Odors from the dryer are minimal and are maintained by a thermal oxidizer. Ocala is planning to bring a second 60-WTPD unit online in late 2007.

**Michael S. Finn served as a city councilman for 22 years and was a vocal advocate of the city's Facilities Improvement Plans, Retrofit & Replacement Programs, and Water & Sewer Master Plans.*