City of Albany Biosolids Composting Demonstration Project

SG Mobile™ System using GORE® Cover

Summary from the full report: Albany Biosolids Compost Demonstration Project, prepared by Kennedy Jenks Consultants March 8, 2016

The City of Albany, OR, W.L. Gore & Associates and Sustainable Generation collaborated to conduct a Biosolids Compost Demonstration Study utilizing a Covered Aerated Static Pile (CASP) composting process. The City is interested in assessing technologies and processes for improving its current sludge treatment and handling program at its Albany-Millersburg Water Reclamation Facility.

The objectives of this Study included the following:

- Evaluate the optimal mix ratio by weight and by volume of sludge to the bulking material;
- Confirm the finished product will qualify as Class A Exceptional Quality biosolids compost;
- Assess the effectiveness of odor and emission control from the CASP process;
- Identify design, operational, and environmental considerations for the CASP process for the City;
- Confirm treatment time for system sizing, construction and design considerations

Project Team:

City of Albany
Sustainable Generation LLC
W. L Gore & Associates
Kennedy Jenks Consultants

Composting Batch Process Summary

On 5 November 2014, Batch 1 underwent Phase 1, active composting, for approximately four weeks. During this time, the heap reduced in size due to compaction and a reduction in solids quantity through decomposition. On 3 December 2014, the cover was removed and the heap was "flipped" by moving it to the side with a front end loader and then reassembling it back in the same location with the goal of ample mixing and incorporation of the toes of the heap. The heap was re-covered and underwent Phase II, maturation or curing composting, for two more weeks. On 15 December 2015, the pile transitioned from Phase II (curing phase) to Phase III (finishing phase). During finishing, the cover was removed and set aside. Phase III normally occurs for 14 days but in this case, it was 20 days to accommodate the Christmas holiday. Once Phase III was complete, the compost was set aside and stored unscreened for at least four weeks.

Batches 2 through 5 underwent similar processing from January 2015 through August 2015. Batches 1 and 2 were screened using rented equipment to ½-inch minus and the larger screened-out "overs" were used as part of the bulking material in Batches 4 and 5. The same sludge feedstock of WAS was used in each batch except for Batch 4, where solids directly from the Cannibal Interchange Reactors were used as this variable. The demonstration was extended through the summer to check for differences in composting due to varying environmental conditions. A detailed description of all five batches, with photos of the composting process, is provided in the full report Albany Biosolids Compost Demonstration Project, and prepared by Kennedy Jenks Consultants March 8, 2016. A summary of all five batches is presented in the Table 1 below.

Table 1: Comparison of Batch Composition and Process Duration

Parameters	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5
Duration (Days)	56	56	55	50	56
Sludge Type	WAS	WAS	WAS	IR	WAS
Carbon Type	Wood waste/ Hog Fuel	Wood waste/ Hog Fuel/ Green waste	Wood waste/ Hog Fuel	Wood waste/ Hog Fuel/ Overs	Overs/ Wood waste/Hog Fuel/ Overs
Sludge:Carbon Ratio (By Weight)	1:2	1:2	1:2	1:2	1:2
Total Weight (Wet Tons)	202	203	202	195	191

Abbreviations:

WAS = Waste Activated Sludge
IR = Interchange Reactor Sludge

Summary of Desired Compost Characteristics

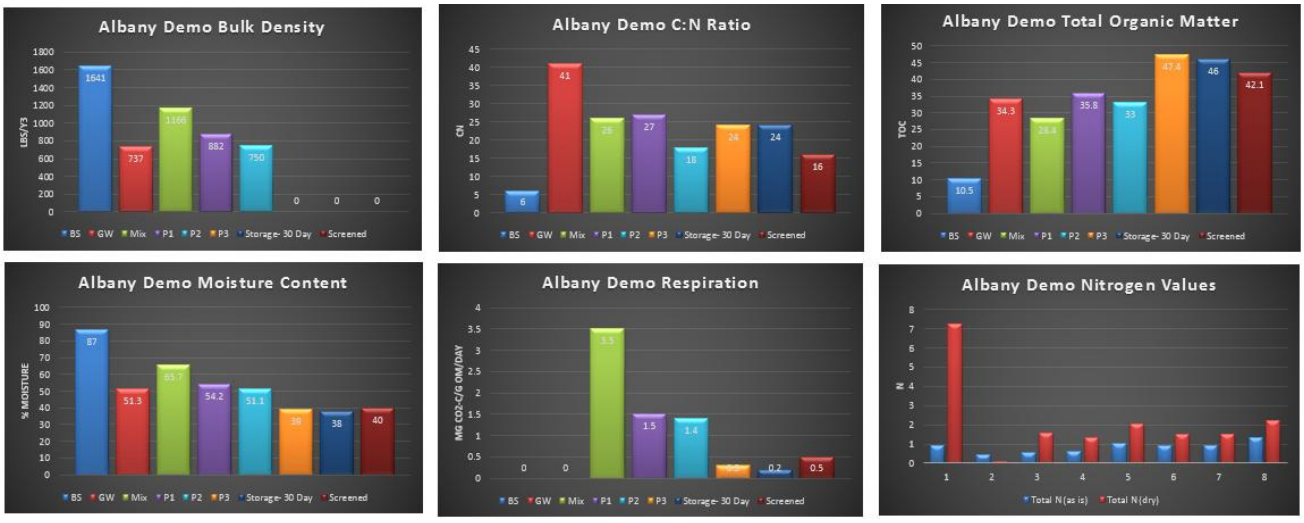
Sampling data comparing the initial mix (prior to Phase I) and final product (following Phase III) after screening for each batch are summarized in Table 2.

The initial mix is targeted to meet the following:
• A beginning carbon to nitrogen ratio (C:N) of approximately 25-30:1,
• A moisture content of approximately 55-65%, and
• Adequate structure material (bulking agent) to optimize the mixed material porosity, approximately 3 inch minus shredded wood waste, hog fuel or wood chips.

The final compost product is targeted to meet the following:
• An ending carbon to nitrogen ratio (C:N) of approximately 20-15:1,
• A moisture content of below 50%, and
• Carbon Dioxide (CO_2) respiration below 1.0.

As the demonstration project moved from Batch 1 to Batch 5, the early batches were used to gain an understanding of the following:
• Train the operations team to run the technology,
• Understand the feedstock components and identify the optimal mix ratio of dewatered sludge to bulking materials,
• Understand how the mix ratio influences the system control settings, and
• Monitor and record, time and temperature requirements for meeting Class A biosolids requirements.

Results from Batch 5:



As the demonstration project moved to later batches, it was apparent the City gained confidence in running the demonstration equipment independently from the SG team. Batch 5 was clearly the best batch in terms of demonstrating a proper mix ratio, control settings, temperature profile and the lab reports indicate an ideal initial mix and the screened compost produced a high quality and fully stabilized finished Class A biosolids compost.

Table 2: Summary of Compost Characteristics in Batches 1 Through 5

Parameters	Batch 1		Batch 2		Batch 3		Batch 4		Batch 5	
	Time of Sampling									
Time of Sampling	Initial Mix	Screened	Initial Mix	Screened	Initial Mix	Screened	Initial Mix	Screened	Initial Mix	Screened
Bulk Density (g/cm^3)	0.58	*	0.66	*	0.52	*	0.54	*	0.69	*
Moisture Content (%)	57	58	63	58	66	43	60	33	66	40
pH	6.4	5.8	6.4	6.5	6.2	6.5	7.0	6.0	7.4	6.1
Organic Matter (%)	28.3	30.7	31.2	30.7	27.7	47.9	32.3	43	28.4	42.1
C:N Ratio	24	25	30	25	29	19	36	17	26	16
Respiration ($mgCO_2$/ g/day)	**	0.6	7.1	0.6	**	0.8	4.9	1.0	3.5	0.5
Total N (dry) (%)	1.4	1.6	1.4	1.56	2.2	1.6	1.1	1.9	1.6	2.2
Total P (%)	*	0.51	*	0.45	*	0.69	*	0.50	*	0.58
Total K (%)	*	0.51	*	0.48	*	0.55	*	0.45	*	0.47

Abbreviations:

* = Not sampled because data was not of value
** = Inadvertently not tested

Summary of Results

The data in Table 3 shows the compliance of all five batches with the 40 CFR Part 503 regulations for Class A biosolids compost

Table 3: Summary of Compliance with 40 CFR Part 503 Regulations

	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5
EPA 503 PFRP Requirements Met[a]	YES	YES	YES	YES	YES
EPA 503 VAR Requirements Met[b]	YES	YES	YES	YES	YES
EPA 503 Pathogens[c][d]	PASS	PASS	PASS	PASS	PASS
EPA 503 Pollutants	PASS	PASS	PASS	PASS	PASS

Notes:

(a) Requires the sludge is maintained at 131°F or higher for 3 days
(b) Requires biosolids to be kept under aerobic conditions at temperatures over 104°F for at least 14 days with an average temperature greater than 113°F
(c) Passed for Salmonella *Spp.*
(d) Also passed Class B biosolids limits and thus could be used directly for land application