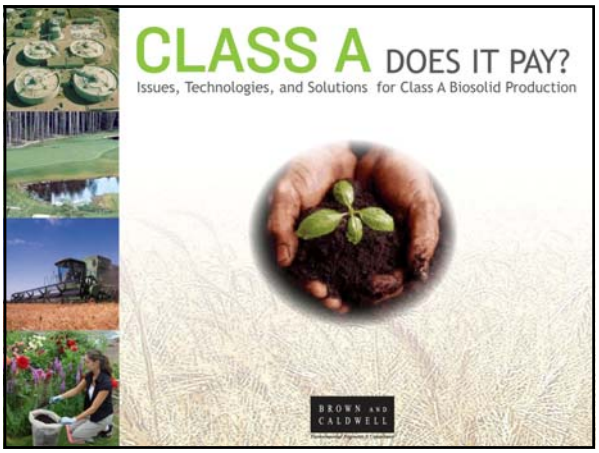


What are biosolids?

- "Biosolids are the nutrient-rich organic material resulting from the treatment of domestic wastewater"
- Biosolids differ from "sludge" in that they are treated to standards required for recycling

How marketable is a Class A product?

- "Soil-like" appearance makes product more marketable; examples include compost, topsoil blends, and thermally dried biosolids
- Simply meeting regulatory standards for Class A may be insufficient to maximize market potential

Example Programs

Location	Product
Newberg	Compost
Myrtle Creek	Dried Product
Newport	Lime Pasteurized
Eugene	Air-dried
Milwaukee, WI	Milorganite
Tacoma	TAGRO
Pierce County	SoundGRO

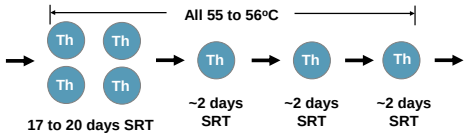
Review of Class A Market Options

- Class A digested biosolids
- Class A via storage and air-drying
- Alkaline processing
- Thermal drying
- Compost

Class A digested biosolids

- Thermophilic or temperature-phased
- ATAD
- Slurry or dewatered product
- Base market similar to Class B
- Upgradeable product with further processing

Vancouver BC Class A Thermophilic Digestion



DC WASA TPAD Concept Design

Biosolids slurry application

Slurry application

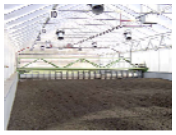
Dewatered product application

Field stockpiles can be problematic

Class A via storage and air-drying




Solar/Greenhouse Air Drying Systems for Future Consideration



Wendewolf® - Degremont's Heliantis System

Huber's Kult® Solar Dryer

Alkaline processing

- RDP lime pasteurization
- FKC lime pasteurization
- N-Viro

RDP


Lime pasteurized product

- Variable quality depending on feedstock
- May require additional processing
- Lime value in addition to nutrients

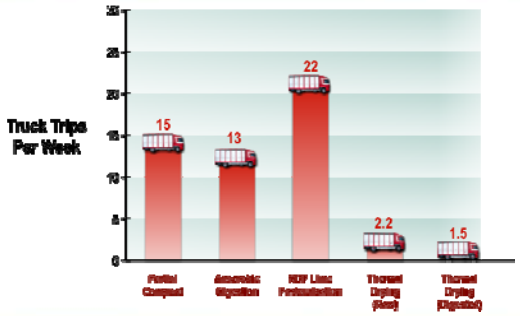

Thermal Drying Technologies

- Direct (hot air)dryer
- Indirect (hot oil or steam)
- Medium temperature belt dryers (indirect plus convection)

Medium Temperature Belt Dryers are Energy Efficient

Drum dryers produce a "pelletized" product

Product type affects quantity and distribution cost



Compost

More compost

Blended products (TAGRO)

TAGRO Products

TAGRO Mix - $8/CY
TAGRO Mulch - $30/CY
Green Roof media - (call for quote)

Cost Considerations

Description	Municipality	Biosolid class	Total cost, $/DT
WTF to local applicator	Olympia	B	152
	Pierce County	B	253
WWTF to east of Cascades	Seattle	B	118 to 136
	Portland	B	175
WWTF to processor [1]	Seattle	A	191
	Aberdeen	A	-
WWTF topsoil blending	Tacoma	A	125 (estimated)
Apply to City-owned land	Centralia [2]	A	30 to 50
Apply to nearby farmland	Centralia [3]	A	40 to 80

Note: Dry ton cost varies depending on percent solids.
Processors compost Class B biosolids into Class A material.
[2] Refers to biosolids applied to City-owned farm land
[3] Refers to biosolids applied to privately-owned farm land

OSU PNW 508, "Fertilizing with Biosolids", 2007

Table 4. Approximate first-year fertilizer replacement value for anaerobically digested biosolids.

Nutrient	Expressed as	Total nutrient	Available nutrient[a]	Nutrient cost[b]	Value per dry ton
		(% dry wt.)	(% of total nutrient)	($ per lb)	($)
Nitrogen	N	5.0	35	0.41	14.35
Phosphorus	P	2.5	40	0.94	18.80
Potassium	K	0.3	100	0.29	1.74
Sulfur	S	1.0	35	0.13	0.91
Total					35.80

[a] Estimated plant-available nutrient released in the first year after biosolids application.
[b] Approximate nutrient cost is based on Willamette Valley bulk dry fertilizer prices, June 2006. The actual cost of a pound of fertilizer N, P, or K varies depending on nutrient form and analysis (e.g., costs differ for anhydrous ammonia and calcium nitrate as a source of N), transportation charges, market conditions, and the quantity purchased. Cost of fertilizer application is not included.

Product Value

N &P @ $0.25/lb = $10/DT
Lime @ $50/ton = $10/DT
Total value = $20/DT
"as delivered" value = $5/ton
**value excluding delivery and application*

Treatment	*% Protein*
1X	15.1
2X	20.3
Control	7.9

Promotion


Depth	Field	NO3	NH4	P	K	pH	SMP	Ca	Mg
	ID	-N	-N	Morgan	Acet		Buffer	meq	meq
ft		#/ac	#/ac	ppm	ppm		pH	/100g	/100g
1	C	9	26	7	281	5.9	6.5	6.5	3.4
1	1X	21	25	10	324	6.5	6.8	20.8	3.7
1	2X	11	30	15	336	6.5	6.7	26.6	4.0

Promotion

APPROXIMATE NUTRIENT VALUE PER DRY TON OF CENTRALIA BIOSOLIDS

Nitrogen (N)[1] .... 20 pounds
Phosphate (P_2O_5) .... 41 pounds
Calcium Carbonate Equivalent (CCE) .... 63 percent
Lime score[2] .... 17 to 34 estimated

Value of Exceptional Quality Centralia Biosolids

Centralia biosolids, a processed product of the City of Centralia Wastewater Treatment Plant, are classed as exceptional quality biosolids by the State of Washington. As exceptional quality, the Centralia biosolids are considered environmentally safe when applied to the soil. They are useful as a soil amendment that improves plant growth by raising the pH of acidic soils and by supplying plants with essential nutrients.

Exceptional quality biosolids have been processed to destroy pathogens. This material is suitable for unrestricted use as a fertilizer and soil amendment.

Unlike Class B biosolids, the exceptional quality materials do NOT need

- A waiting period prior to crop harvest
- Posting of sites and buffers
- Preparation of land application plans
- Land application records

Exceptional quality biosolids **must** be applied at agronomic rates that are consistent with Washington State University fertilizer recommendations.

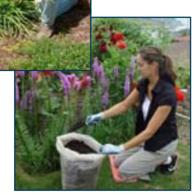
Centralia biosolids contain significant amounts of N, P_2O_5, and calcium as calcium oxide or lime. High amounts of lime in this product make it suitable for raising soil pH. Organic matter levels in the biosolids are also beneficial for improving soil productivity.

This product is not a commercial fertilizer. Nutrient estimates are averages and are not guaranteed.

[1] Refers to first year available N.
[2] Lime score has not yet been determined for Centralia biosolids. Lime score is an index for comparing one liming material to another. A high lime score for a product indicates a high neutralizing ability. Less material would be needed to raise pH compared to another product with a low lime score. Lime score is found by multiplying CCE times a fineness factor (FF) times a moisture factor (MF). See below

Lime score = CCE X FF X MF

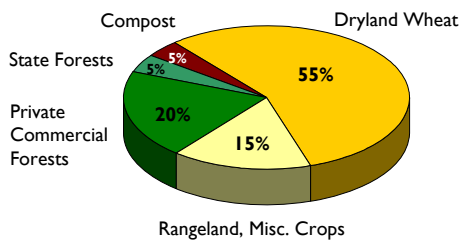
The CCE of pure limestone, or $CaCO_3$, is 100 percent. Some liming products have CCE exceeding 100 percent. The fineness factor is related to the particle size of a liming material. Lime particles that are less that 7/100 inch in diameter (particles this size will pass through a #10 sieve) are considered soluble enough to be effective. If the material is thoroughly mixed with the soil, the lime particles will react completely within 1 year or less. The moisture factor recognizes that the neutralizing power of a liming material decreases with increasing moisture. The moisture factor = 100 percent water in lime/100.

Keys to Success (King County)

- Go where you're wanted
- Work with respected farmers
- Use community spokespersons
- Support university research
- Build rapport with regulators
- Stay diverse – locations and uses
- Network with other utilities
- Continually improve - EMS

King County mixed product distribution



Class A product advantages

- Better market acceptance
- No regulatory constraints; "commodity"
- Convert from "sludge" to "product" to maximize demand

Key factors for biosolids marketability

- Class A
- Soil-like appearance
- Granular texture for blending with other materials
- Testing and promotion

Actual Biosolids Program Revenue

City of Portland (Class B)- $5/DT

King County (Class B) - $6.40/DT or $0.18/#N

Pierce County (Class A, bagged) - $3 per 50#

TAGRO (Class A bulk soil product) – up to $30/CY product

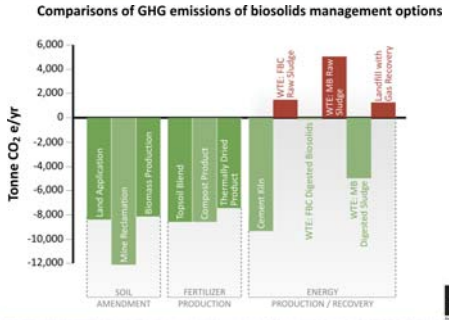
Cost reduction vs. "revenue"

- Highest value products have high production cost
- Production cost often energy dependent
- Marketing product requires vision and commitment

WWTP operation vs. public/private partnership

- Private firms such as topsoil blenders have an advantage
- WWTP marketing requires commitment and vision
- Don't count on profit in either case, focus on cost reduction

Does sustainability count?



Questions?

CLASS A DOES IT PAY?

Issues, Technologies, and Solutions for Class A Biosolid Production

Parkson Strainpress Installation

- Raw primary sludge screening
- Installation Capacity
  - 200,000 lb/d solids
  - 600,000 gpd flow