BROWN BEAR

PINERY WASTEWATER PLANT PRODUCES CLASS A COMPOST FOR COMMERCIAL APPLICATIONS

Unique (But Simple) Procedure Produces High-Quality Compost

Using a very simple, very economical procedure of their own design, Pinery Water/Wastewater District, Parker, Colorado, is producing sludge compost which ever since its introduction in 1995 has continued to be in full compliance with all State and Federal regulations—including the new EPA 503 standards.

Thanks to the turning and aeration provided by the District's Brown Bear auger tractor, liquid sludge changes through natural drying and natural decomposition from a pressed cake averaging 12 to 15% by dry weight to a rich black soil additive averaging 70 to 80% by dry weight.

No bulking agent is added at any time, eliminating all the costs of buying, transporting, handling and removing the material—and reducing the space required.

Frequent turning accomplishes digestion with the development of minimal odors and insects. Complaints from neighbors have been virtually eliminated. And end-users—residents, governmental units and, mostly, a private 18-hole golf course—get a product that's far more user-friendly. Drier and easier to apply, the material, they report, looks, smells and acts like good high-quality black dirt.

Costs of achieving these benefits have been very low.

For all the years before incorporating their new system, processing and distributing sludge materials onto farm fields had been costing the District around $76 per ton. Processing now BRINGS IN $15 a ton.

Granular and dry (up to 95% solids) finished compost is odor free.

More recently, as in fiscal 1997-98, sludge handling (from digester to composting to load-out) costs the District $114.46 per ton—$54.14 for polymers, $7.93 for testing, $1.27 for power, $3.07 for fuel, $48.05 for labor and supervision. Conventional sludge handling, digester to composting to loadout in the Denver metropolitan area (which includes Parker) ranges from $200.00 to $400.00 per ton.

Under the direction of Kevin Clark, plant superintendent, the Pinery Water/Wastewater District crew has refined their sludge processing system to the following simple steps:

1. The District's 1.0 mgd primary - secondary-tertiary wastewater treatment plant holds incoming sludge in a 156,000 gallon tank for approximately two weeks. Flows currently come from the District's 2,000 homes. The same procedure will be followed as housing density increases to a forecast 6,000 homes.

2. When sludge deposits reach a tank depth of 12 to 15 feet, air is shut off for 24 hours, allowing for decanting, thickening, de-nitrification and the injection of a flocculant colloidal polymer. Solids content at this point averages 1.5 to 2%.

3. Dewatering, accomplished indoors by a 1.5 meter belt press system, directs filter cake, now at 12 to 15% solids content, via conveyor to top-load a conventional 5-yard dump truck.

4. Cake is hauled 600 feet to a 135 x 300-foot on-site drying pad. A built-in 2 to 5% slope and sump collect and drain free water. Paved with 4 inches of asphalt, the hard surface eliminates dirt contamination and provides good footing and traction

Blending cake biosolids in a 50/50 mix with previously composted biosolids.

under all weather conditions for the Brown Bear auger tractor.

5. This "Wonder Machine" — as Superintendent Clark describes it — mixes the new deliveries of sludge cake with older, drier sludge left in place on the drying pad. It's high 70 to 80% solids-to-moisture ratio is the key to speeding drying of the new material, minimizing odors, and eliminating the need for bulking agents.

6. The combined material is augered, mixed and repositioned about three times per 8-hour work day. Processing all the material on the pad takes the Brown Bear about an hour per cycle. To speed drying and minimize odors, windrows are kept small, about 18 inches deep and 18 inches wide.

7. Under good weather conditions typical of Colorado from May through October, continuation of the same turning frequency, three times per day, brings solids to the desired 70 to 80% dry-weight-to-moisture level in about 7 working days.

8. Dried biosolids are stacked by the Brown Bear and a farm-type tractor loader in a single windrow. About half the total is made available for field and garden usage. The other half is retained for mixing with incoming dewatered filter cake.

9. Nothing is done between November and April when freezing temperatures, snow and other adverse weather conditions severely hamper natural drying and decomposition. By mid-spring, six months of non-augering produces a separate non-processed sludge-cake stockpile up to 7 feet high and 300 feet long. It contains about 80 dry tons (120 cubic yards @ 1,500 pounds). Solids content averages the same 12 to 15% as achieved in the belt press system in summer, though in places prolonged natural cold-weather drying raises some of the volume to a solids content as high as 25%.

10. Full processing starts again with the return of consistently warm weather in May. The big stockpile is broken down and augered out by the Brown Bear tractor into windrows about 2 feet high and 2 to 4 feet wide, a mass which best retains desired heat at this time of the year.

11. Both the winter accumulation and newly-pressed sludge-cake are Brown Bear mixed with fully-cured solids. As air temperatures naturally increase, windrows are further reduced to the 1 1/2 x 1 1/2 foot cross-section previously mentioned. The goal, material temperatures of 55°C or higher, has been found to achieve the best processing results.

12. Since its purchase in 1995, the Brown Bear has handled 100% of the on-pad processing. It has delivered nearly 100% availability, losing practically no assigned work time to mechanical problems.

13. Though finished material averages 70 to 80% solids by dry weight, some "batches" have tested 85 to 95%.

14. The final product has *always* met Class A 503 standards not only for solids content but also for all other specified parameters, per tests conducted continually by the University of Arizona, Colorado State University, an independent laboratory in Denver and Pinery's own on-site lab. Currently, most is purchased under contract by a local 18-hole private golf course. This organization handles its own loading, trucking and distribution. The plant generally keeps about 20 ready-to-apply tons in inventory for sale to residents. Where purchase quantities are small, this group handles its own loading. Pickups and other trucks are serviced by the plant's farm-type tractor loader.

Putting a price on the product has, amazingly, greatly increased demand over an original no-charge policy.

"Despite its obvious high quality, we couldn't *give* the material away when we started our processing system in 1995," recalls Superintendent Clark. "When it was free, even such sophisticated users as landscapers and the golf course identified the stuff as sludge. As soon as we put a price on it, it became a valuable biosolid soil supplement. All we produce now is sold as it's made. A price increase had no effect on sales, nor on our rather sizeable customer waiting list."

History of progress

Pinery's wastewater treatment facility is designed for a flow of 1.0 mgd. Current flow averages 0.54 mgd. and 1,181.5 pounds of activated and alum sludge per day. Biosolids volume last year totalled 163.58 tons. Three full-time and one part-time employee handle plant management, operations, maintenance and testing.

From April 1991 when the plant opened to April 1993, dewatered sludge was stacked in large inverted-V windrows and allowed to air dry. The

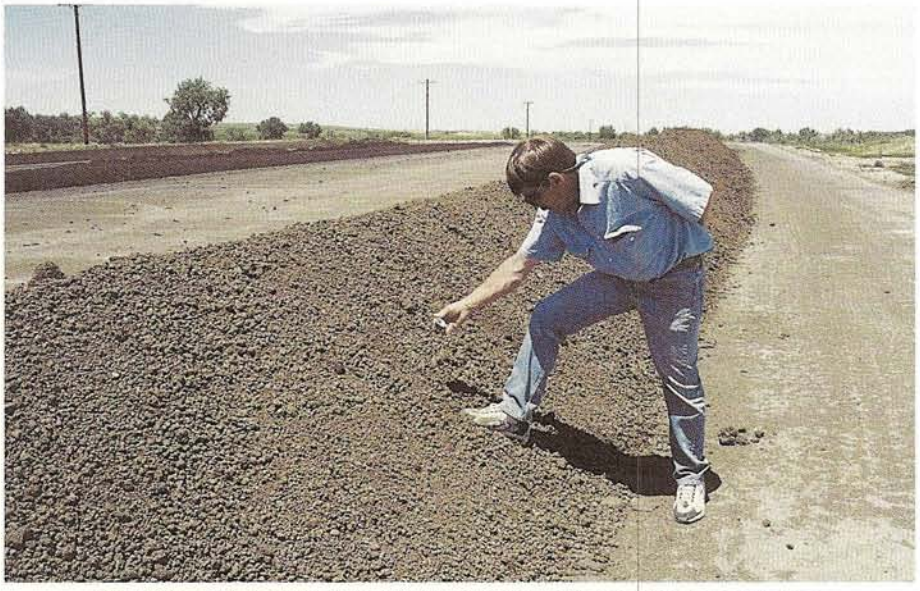
material was turned several times by front-end loader. Some of the material remained in this condition for as long as two years. Though the process significantly reduced pathogens to comply with Class A requirements, it also produced heavy odors. Agricultural land owners, to whose fields the product was applied, did not consider the lumpy, partly-digested solids to be user friendly.

Over the next year and a half, to October 1994, the District tried several other methods of drying. A tractor-mounted box spreader distributed filter cake over existing sand beds to a depth of 3 to 4 inches. "The process dried the cake somewhat more effectively," Clark recalls, "but it required a large drying area and was very labor intensive." More frequent turning by the tractor-loader provided a small improvement. Then came a tryout of a rented Brown Bear auger unit. Its application produced "very encouraging results", Clark states. Its batch of biosolids was applied to agricultural land in November 1994.

By July 1995, the District had purchased its own Brown Bear and soon was answering what Clark considered the most important application questions...

- Such as, what size drying bed would be best?
- What size windrows?
- How to control odors?
- What to use as amendment, or should the District amend at all?
- What to do during winter months?
- What markets should be targeted for the final product so that disposal would not add much, if anything, to total costs?

Initially, the District's asphalt-paved pad measured 65 x 300 feet, curbed on three sides and sloped for containment, evaporation and drainage into abandoned lagoons previously used for aerated wastewater treatment. Within a year, the size was increased to 130 x 300 feet to improve drying and provide more adequate on-site storage space prior to product removal.



Plant Superintendent Kevin Clark taking windrow temperatures.

Still, air drying to a 30 to 40% solids-to-water content produced objectionable odors.

Reducing the windrow size (and increasing the rate of drying) helped only a little.

Brown Bear mixing 50% dried finished biosolids with 50% press cake, ended the problem. Now, the machine operator can easily increase windrow size to promote composting action, or reduce windrow size to stay in an air-drying mode for better odor control.

With the advice of local EPA regulators, the District now divides its processing schedule:

- April-November: small windrows, 18 x 18 inches, and air drying create all of the amended biosolids to continue the process through the year. Brown Bear turns, mixes and aerates the material about three times per day. Processing to the desired 70 to 80% takes one to four weeks. Final-product storage is in one large windrow where the material is satisfactorily protected from the elements and odor-producing composting ceases.
- December-March: weather permitting, Brown Bear amends press solids with some of the cured stockpiled air-dried solids. Continual re-piling maintains one large windrow.
- April: the one big stockpile is Brown Bear windrowed out. The spring sun warms the rows and resumes the natural biological process of composting. By May, the biosolid mix is at or above EPA required temperatures. Temperatures are recorded daily at 12 locations in all windrows. The continual monitoring insures strict adherence to 503 standards. Increases in turning frequency are determined by indications of falling temperatures. Operators use common sense, restricting mixing as much as possible to times when wind direction and weather conditions are favorable for minimizing odors for nearby residents.
- Early summer-November: all winter-time biosolids and current month-old biosolids are ready for pickup by customers.

All sampling, chains of custody, holding times and test methods are performed as mandated by EPA and by the latest revisions of Standard Methods for the Examination of Water and Wastewater.

- University of Arizona, Tucson, performs all testing for enterovirus (PFU).
- Colorado State University, Fort Collins, performs salmonella and pathogenic ova testing.
- Commercial Testing & Engineering Company, Denver, handles metals, nutrients, pH and solids testing.
- Pinery District's on-site wastewater laboratory performs pH, solids, digestion, composting temperature and other daily tests related to dewatering. During operation of the belt filter press, plant technicians record flow rates,

Finished material stock pile.

percent of press, polymer feed rates, total solids in the feed sludge and post-press solids prior to transfer to the air drying and mixing bed. Weekly SOUR readings are made on digester, total and volatile solids. Bench scale versus reduction is performed annually on aerobic digested sludge and MPN coliform levels.

- Only after minimum requirements are equalled or exceeded does the District make its finished product available to the public. Testing supports the fact of "an exceptional, most beneficial biosolids product."

Pollutant Concentration	EPA Standard	Attained at Pinery in 1997
Arsenic	41 mg/kg	6 mg/kg
Cadmium	39	5
Chromium	not specified	7
Copper	1500	600
Lead	300	6
Mercury	17	0.5
Molydenum	4	4
Nickel	420	3
Selenium	100	5
Zinc	2800	180

Nutrient Concentrations

pH	7.83 %
Total solids	73.67 %
Volatile solids	39.42 %
Potassium	0.372%
Phosphorus	1.532%
Nitrogen	1.226%
Ammonia-N	0.057%
Nitrate-N	0.021%

Pathogen and Vector Destruction

Vector #3	41.58%
Vector #9	73.67%
Fecal coliform	626.80% mn/gr
Salmonella	under 1 mpn/4 gm
Enteric viruses	under 0/4 gm
Helminth ova	under 1.4 gm
Composting	55°C/days

Highly-useful end product

Biologists identify the Pinery Biosolids as a natural soil conditioner which increases soil moisture retention and creates favorable conditions for plant root development. Very beneficial for landscaping and home gardening, the product works best when incorporated into existing soils where the combination delivers increased viability. Polymer content adds to water retention abilities of a soil, thus reducing irrigation requirements.

- Establishment of turf grass: user should broadcast 1 inch of biosolids (3 cubic yards, 4,500 pounds) per 1,000 square feet and work into the top 3 to 4 inches of soil.
- Repair of turf grass: broadcast 1/4 inch (3/4 cubic yard) per 1,000 square feet before seeding bluegrass and other small seeds and after seeding zoysia and other large seeds.
- Maintenance of turf grass: broadcast 1/4 inch (3/4 cubic yard) per 1,000 square feet in fall and early spring.
- Vegetable gardens: broadcast 1/2 inch (1 1/2 cubic yards) per 1,000 square feet and rototill into soil surface one to two weeks before planting or in previous autumn.
- Shrubs and trees: broadcast 1 inch deep over root area and incorporate into top 4 to 5 inches of soil.
- Mulch: broadcast 1/4 inch on surface soil above root area.
- Potting mix: 1/3 Pinery Biosolids by volume with other potting materials. For hanging plants: on 1:1:1 ratio with peat moss and vermiculite. For floor plants: on 1:1:1 ratio with peat moss and sand.

The process utilized for Pinery Biosolids passes all prescribed test levels for Class A final use or disposal. Continual monitoring assures the applier of continued environmental and hygenic safety.

Three Brown stripes . . . the sign of quality

NEW AREA CODE 641

BROWN BEAR

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