Until the last decade of the 20th century, the life of an average wooden pallet was a drab and short-lived affair. Confined to a cold warehouse or shanghaied on a couple dozen voyages in the dark hold of a tractor-trailer, overloaded with everything from books to barrels of 90-weight oil, pallets quickly became cracked, broken, and stacked out behind their last port of call or pitched in the Dumpster with the rest of the trash. New trends in woodwaste recycling, however, have given new life and value to pallets, crates, yardwaste, construction and demolition (C&D) waste, sawdust, bark, paper-mill sludge, and wood chips.

In the mid-1960s, state and federal legislation designed to reduce air pollution from burning woodwaste at landfills, paper mills, and sawmills created a need for alternative ways to dispose of what was then considered waste products. “Sixty years ago, most of our business was delivering sawmill waste to residential customers so they could burn it as heating fuel,” says Jack Hoeck, vice president of production at Rexius Forest By-Products Inc. in Eugene, OR.

As always, necessity is the mother of invention. Today’s dramatic rise in the number of companies turning woodwaste into usable landscaping and horticultural products in the United States and Canada is a direct result of legislation in the late 1980s and early 1990s to reduce the landfill waste volume. States such as California have mandated that communities decrease their landfill input by 50% by 2000.

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quickly developed whenever economically feasible, given willing landfill owners.

The information provided for this database has been collected under a voluntary basis. The data presented in this paper are being updated and verified for release in an electronic version. Future updates and maintenance are also planned.

The database is also being expanded to provide data on Canadian projects to create a complete set of data for North America. Anyone interested in providing additional data or information is encouraged to contact SWANA (301/585-2898). The goal is to provide up-to-date and credible data to help track trends occurring as a result of LFG utilization.

References


Susan Thorneloe is with the USEPA Office of Research and Development/National Risk Management Research Laboratory/Air Pollution Prevention and Control Division in Research Triangle Park, NC. Alex Roquetta is past chairman of the SWANA Database Committee on Landfill Gas, National Survey Systems in Irvine, CA. John Pacey is with IT Group in Concord, CA. C. Bottero is the reviewer for the LFGTE database project.

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The City of San Jose is seeking proposals from qualified proposers for residential garbage and recycling collection and processing, residential yard trimmings collection and processing, and street sweeping services to begin July 1, 2002. The current program serves more than 250,000 households and has a diversion rate of 47%.

The Request for Proposals is scheduled to be released in April, 2000, with the official proposal deadline expected to be July, 2000. There will be a mandatory Pre-proposal conference in May of 2000.

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The posting of this announcement is for information only and does not obligate the City of San Jose with regard to any further action.

Present-Day Alchemists: Spinning Straw Into Gold

In a perfect world, a company that makes mulch and compost would do for the community what a backyard compost bin does for a family: take unwanted waste and turn it into usable products that enhance the surroundings and keep reusable waste from entering the landfill stream. The people at Long Island Compost have taken this perfect scenario one step further—they've also become a one-stop shopping center for the landscapers who tip their yardwaste (grass clippings, brush, tree limbs, and so on) at any of Long Island Compost's centers.

“We don't get our raw material from municipalities,” says Vigliotti. Most comes from independent landscape contractors. These contractors pay Long Island Compost a tipping fee to drop off their yardwaste. Long Island Compost uses these raw materials to make compost, potting soils, soil mixes, and mulches, which it sells back to the same landscapers who provided them with the raw materials. These landscapers then use the company's products at the homes and businesses where the yardwaste came from in the first place. It's a perfect recycling circle—and a profitable one too.

Not only does Long Island Compost sell its bulk mulches and composts back to the very golf course divots to azaleas, compost has become the soil amendment of choice for millions of commercial and residential growers. The reason for compost's rise in popularity is simple: "Plants grow better in compost," states Charles Vigliotti, president and CEO of Long Island Compost in Westbury, NY. "There are countless university studies comparing compost mixes to topsoil. Compost has all sorts of organic particles."

Ask any farmer, and he'll tell you that compost's effectiveness has never been an issue. Availability, however, has been. The rise in availability, and therefore in the demand, for top-quality, competitively priced compost, growing media, and other soil amendments has everything to do with a certain cheap, readily available stabilizing agent that is also a good source of carbon: woodwaste. The irony is that the woodwaste used to stabilize and add carbon to state-of-the-art compost has been available for more than 100 years, being burned by mills and farmers or buried in landfills. The interesting part is that it took unwanted state and federal environmental regulations to open up new opportunities for composters, landscapers, and entrepreneurs.
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contractors whose trimmings helped make these soil amendments, it also sells fertilizers, irrigation pipes and fittings, lawn mowers, leaf blowers, weed whackers, and a complement of replacement parts to the contractors. In other words, Long Island Compost makes money on both sides of the wholesale recycling equation (tipping fees and selling the products made from the tipped waste), and it adds value to its customers by providing them with equipment needed to create the yard trimmings in the first place. In addition to quality soil amendments and ground covers, Long Island Compost offers a level of professional service that independent garden centers, home-improvement superstores, and wholesale chain stores can’t touch.

This same entrepreneurial spirit also helped Long Island Compost develop a way to turn paper-mill residue (paper-fiber sludge) into a cost-effective and quality compost post ingredient.

Perhaps the ultimate in efficiency is a perpetual-motion machine—one whose waste creates the energy necessary to generate new products. A good example of this kind of process is the Monterey Regional Waste Management District’s 470-ac. materials recovery facility (MRF) in Monterey, CA. Since 1983, the facility has transformed the methane derived from its own landfill gas into enough electricity to power the entire facility—with plenty left over to sell to Pacific Gas and Electric. The methane runs a Waukesha internal-electric engine.

It is already overwhelmed by record commercial and residential growth. This compost with charisma is sold in 3-lb. cans at the zoo’s gift shop and at local garden centers, helping the zoo to turn a major waste product into a revenue stream.

“Most of the greenwaste is sold to Sunland Garden Products, which has its own mulch and compost operation. We sell our larger wood chips to a local outfit that colors the chips for us at 5 dollars per ton, then we buy back the chips and sell them to landscapers. We make a good profit on both ends of the deal, particularly for the redwood-colored chips.” (For more information about the Monterey Regional Waste Management District’s site, read “The Best Solid Waste System in North America” in the July/August 1999 issue of MSW Management.)

From Golden to Greeley, CO, A-1 Organics uses ground wood from pallets, crates, tree trimmings, cabinet makers, door and truss manufacturers, and construction waste as a bulking/stabilizing agent in its composts, custom-blended potting soils, composted topsoils, and environmentally friendly peat-moss substitute called Repeat, which gives consumers a better alternative to Rocky Mountain peat—a nonrenewable resource. The remaining ingredients include brewer’s waste, biosolids, yardwaste, and a variety of animal manure.

Each of A-1’s compost products has different qualities that lend themselves to different applications. For example, EverGrow—a compost made from turkey manure, sawdust, and wood shavings—is high in nitrogen and sodium and makes an excellent top dressing for lawns because it provides organic material, micronutrients, and nitrogen, phosphorus, and potassium.

By far A-1’s most interesting product is Zoop, a compost made from Denver Zoo manure and animal bedding such as straw, sawdust, and wood shavings. Zoop is an example of a true win/win situation that doesn’t require one party to compromise its position. Zoop helps the zoo keep manure and animal bedding out of Denver’s landfill system, which is already overwhelmed by record commercial and residential growth. This compost with charisma is sold in 3-lb. cans at the zoo’s gift shop and at local garden centers, helping the zoo to turn a major waste product into a revenue stream. The cans are filled by Shaffer Enterprises, an employment service for disabled workers. A-1 even donates some of the profits to offset the zoo’s transportation costs.

Another example of this kind of entrepreneurial energy is A-1’s entry into the rolloff-container business. Even with six locations and a transfer station, A-1 found that certain customers, including the University of Colorado at Boulder, preferred to have a rolloff container on site for pallets, C&D waste, and landscaping waste. This mutually beneficial service helps the university solve the problems of temporary waste storage, transportation costs, and tipping fees and allows A-1 to create a new revenue stream and a reliable source of raw materials for its mulch and compost production.

“Perhaps the ultimate in efficiency is a perpetual-motion machine—one whose waste creates the energy necessary to generate new products.” (For more information about the Monterey Regional Waste Management District’s site, read “The Best Solid Waste System in North America” in the July/August 1999 issue of MSW Management.)
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wood, cedar, and hemlock bark. Now Gro-Bark selects its cleanest wood waste (no paint, plastic, metal, coating, and so on), grinds the wood, and trucks it to G-P. Instead of losing money on transportation costs, payroll, and depreciated equipment, Gro-Bark now earns between $640 and $880 (Canadian) per 16-ton load, which more than pays for the process and the freight of the bark.

Gro-Bark also partners with a Toronto-area wood waste producer to create colored mulch. “We said, ‘If you get the coloring machine and color to our specifications, we’ve got the markets and the distribution channels,’” recalls McKague. “We worked out an arrangement where they sell all the colored mulch to us, and we move the product through our 20 distributors in Ontario.”

Hoeck believes that colored mulches and wood chips make sense depending on where you are. “We’ve experimented with adding color to natural mulches to help the product hold its color longer, but the process is expensive. And with all the naturally colored mulches we have in Oregon, coloring isn’t as cost-effective. The Midwest doesn’t have a lot of naturally colored mulches available, and transportation costs from the West Coast would raise the price of the product, so coloring becomes a great alternative. Any color looks better than ground-up pallets by themselves.”

Berm Mulch is another of Rexius’ innovative ideas. “Blanketing a slope with standard mulch helps prevent erosion, but additional controls are sometimes necessary on steep slopes or longer slopes,” Hoeck points out. “To control erosion in these situations, we add Berm Mulch in a pyramid shape 2 feet wide at the base and 12 to 16 inches high.” This type of mulch is combined with low-nitrogen compost, made from yard clippings, that has been screened to 0.5-in.-minus particle size. The berm acts as a physical barrier to erosion, as a sediment fence would, while the fine compost holds the runoff long enough for the sediments to fall out of suspension, which lessens the erosion.
To create a berm made out of mulch, Rexius “blows it in” with its Express Blower System. This system allows Rexius to offer customers right-where-you-need-it landscape support. The Express Blower System uses a wide-mouthed, pressurized hose that spreads large quantities of dry bark, compost, planting soils, playground chips, and a variety of other landscaping materials. Seeds and other soil amendments can also be added to the dry mix, which eliminates the need for all kinds of equipment and several hours of labor when planting a lawn, top-dressing a park or athletic field, or covering a garden with mulch.

“With hydroseeding you could cover a dirt parking lot with grass seed and enough fertilizer to get a lawn started, but everything would probably die because it couldn’t take hold,” states Hoeck. “With the Express Blower System, you could lay down enough soil and compost with the seed to grow a lawn right on top of a dirt parking lot.”

Thanks to the remote-control blower system, the entire operation can be done by just one person. By linking several hoses together, a single operator can access areas that heavy equipment simply can’t reach. In addition to providing customers with this service, Rexius also sells these Express Blower trucks to commercial landscapers.

Casting Wood Before Swine

Hogged fuel is cheap and abundant and gets rid of a waste problem (huge piles of wood chips and sawdust). Burning hogged fuel today, however, requires sophisticated emission-control equipment to stay in compliance with federal air-pollution standards. Today’s natural-gas prices make the upgrade to natural gas a cost-effective, cleaner-burning, and more responsive alternative to burning wood waste as fuel. Steam derived from natural gas also eliminates the need for large wood waste piles that can now be used for greener purposes. Still, hogged fuel remains a revenue source for wood waste processors.

Overall, Hoeck estimates that hogged fuel represents 25% of the company’s revenues. As do several composting and mulching operations, Rexius sends its low-grade ground pallets and C&D wood waste to cogeneration facilities at local paper mills that combine the ground wood with other paper byproducts and burn the mixture to create steam. The steam turns a turbine, which makes electricity for the mill.

Similar to Rexius, Living Earth Technology (a wholly owned subsidiary of Republic Services Inc.) of Dallas, TX, also grinds and
sells as hogged fuel to paper mills, sawmills, and plywood mills the angular lumber, pallets, and C&D waste it receives. "The State of Texas deregulated the electric industry, so there's a big demand for industrial steam," notes Living Earth's president, Mark Rose. He estimates, however, that 90% of his company's revenues comes from bulk sales of horticultural products, such as decorative mulches, compost, soils, and soil amendments, to professional landscapers and nurseries. Only 10% comes from tipping fees.

The reason that tipping fees account for such a small percentage of Living Earth's revenues is that the company does not charge for clean materials, such as leaves, grass clippings, rice hulls, animal bedding, manure, sawdust, and wood shavings that go directly into making its compost. It does, however, charge $3/yd.² to tip brush, pallets, and other wood-waste that require additional processing.

Living Earth manufactures one main compost type that is sold separately and goes into six specific soil mixes. It also markets nine different decorative mulches, some of which contain composted materials.

Unlike Living Earth and Rexius, Gro-Bark combines wood chips from ground pallets with foodwaste, leaves, yardwaste, manure, and grass to make its compost products and nursery soils. The company also uses pine, hardwood, cedar, and hemlock bark to produce decorative composted mulches and growing media. In an effort to streamline operations, Gro-Bark only sells its products in bulk. "It's simpler that way," McKague remarks. "Bagged compost, mulch, and soil amendments are a different market—and a very competitive one too."

To Tub or Not to Tub: That Is the Question

Turning landscape trimmings, pallets, and C&D waste into splinter-sized particles for compost, mulch, or hogged fuel requires a modern, industrial-sized grinder. The first grinders used for this purpose were tub grinders. The original tubs were designed for grinding hay and cattle feed, where there was minimal risk from flying projectiles. These grinders were smaller and less powerful than today's giants that can shred a telephone pole into toothpicks in under a minute.

As grinders were adapted by the wood-products industry in the mid-1960s to help create alternatives to burning woodwaste, they have grown in horsepower and size. Debris thrown from one of these tubs soon became a significant safety issue. For example, if a hand-
This midsize grinder has a totally enclosed grinding chamber to prevent flying debris, making it ideal for use in congested areas and urban collection centers.

ful of hay gets pitched from a tub grinder and hits someone in the face, it's no big deal. Replace the hay with a 2x4 or an acorn-sized rock, and there are potentially lethal consequences.

Tub grinders are naturally efficient at crushing wood, but the very design that makes them so productive also tends to push material up and out of the tub, occasionally at very high velocities. One look at the lid of any tub grinder that has seen a season's worth of service on woodwaste will verify the force with which a tub grinder can expel a piece of wood or a rock. "The biggest problem with tub grinders is that they throw material," says Rose. Hoeck agrees: "We converted to a horizontal grinder for safety reasons."

"We go beyond the call of duty with safety controls and devices," says Senior Marketing Representative Sam Ozuna of Diamond Z in Nampa, ID. "Our new E-6000 and E-4800 tub grinders eliminate the majority of airborne debris—significantly more than horizontal grinders—and most of the dust too. It's basically a tub with a lid, which has a feed tray that adds materials into the tub. You still have the large-volume capability and high-production capacity of a tub grinder without the intake size restriction of a horizontal grinder."

Despite these safety innovations, there are those who believe that tub grinders are not as efficient. "We've had several tubs, and we found that there is a better way to do it. They just can't keep up when producing more than 100,000 cubic yards per year of heavy production," states Vigliotti. "There may be situations and volumes that tub grinders are appropriate for, but just not our particular use." Long Island Compost is currently using two CBI grinders: one horizontal and one vertical-feed type.

When horizontal grinders were introduced five years ago as a safer alternative to tubs, they were nowhere near as productive as tubs. "Early horizontal grinders got a black eye because they weren't that efficient," says Dave Benton of Peterson Pacific Corporation in Eugene, OR. According to Benton, early horizontal designs worked against themselves because the rotor and the feed systems didn't work in harmony, which resulted in lower yields.
Recent design innovations in horizontal grinders allow them to push material up and into the grinding chamber so material arrives in smaller bites and the rotor basically feeds itself. Today's horizontal grinders also break the wood into smaller pieces before it's pulled into the grinding chamber. Horizontal grinders' enclosed grinding chambers retain up to 99% of the material, so little debris is pushed back out. Hoeck states, "Horizontal grinders contain materials better and don't throw objects out, so they're better for overall safety."

Many manufacturers have rotated the anvil 90-150° from where it was in earlier designs, so there is more room between the anvil and the point of impact, which helps prevent clogging once the wood is in the chamber. Engine-speed sensors are another innovation that helps keep horizontals grinding away. "Today's horizontal grinders are just as efficient, if not more so, than tub grinders," remarks Benton. "So now you can have safety and productivity too."

But for every devout horizontal convert, there are just as many fervent tub users who wouldn't trade their machines for a chance to grind all the tea in China. Michael Hill, a principal at Thelin Recycling of Fort Worth, TX, is a firm believer in the superiority of tubs. "We run four Diamond Z tub grinders, two of them 24 hours a day. I've watched our machines run alongside [those of] other manufacturers, and I'll take on anyone head to head. I just can't say enough good things about Diamond Z's equipment, and the company has done everything it could to take care of us. I feel fortunate that I made the right decision when we got started four years ago."

Thelin Recycling is a contract grinder. "We're not in the landscape-materials business," emphasizes Hill, but the company grinds and screens 100,000-150,000 yd.³ of 0.5-in.-minus material a year at its Fort Worth facility alone. The company just completed a 200,000-yd.³ job for Living Earth Technology.

In addition to the work at its Fort Worth facility, Thelin has contracts in Jacksonville, FL, and Houston, Lubbock, and New Braunfels, TX. The company even sent a grinder to Puerto Rico to help clean up the debris from Hurricane George. "There isn't anywhere we won't go to grind," Hill insists.

**Keeping Your Eye on the Bottom Line**

"Whether we are coloring wood chips, turning landscape waste into compost, or delivering ground pallets for particle board, quality is what counts," McKague stresses. "If an 80-million-dollar particle board plant with 200 employees had to shut down production and fix a problem caused by some metal that was mixed in with our ground wood, we wouldn't be in business very long."

"Our emphasis is on the sale of quality products," says Rose. "Our commitment to service means that our customers get the right products, right when they want them. We'll customize any of our soil mixes right there on the spot. And we have sales of our final products before we actually make them."

Regardless of whether you use a tub or horizontal grinder, turn pallets into hogged fuel, or make the most innovative and environmentally sound compost on the planet, the bottom line is still the bottom line. And staying in the black is still a matter of entering lucrative markets, producing quality products, providing excellent service, utilizing every available resource to the fullest, and keeping your customers coming back for more.

Guest author Mark Saunders is a newspaper and magazine journalist based in Denver, CO.
A Brief History of Solid Waste Management in the US During the Last 50 Years

Part 4: Building a National Movement. Part 3 discussed the development of a new replacement technology, the sanitary landfill.

In the 1950s, the United States Public Health Service (USPHS) began a national effort to eliminate open-burning dumps. In time, the USPHS expanded its efforts to address all aspects of refuse management. (For the balance of this series, the term solid waste will be used, replacing refuse as the term of choice. See Note 1.) This part will chronicle the emergence of the USPHS as the catalyst that brought about what we know today as integrated solid waste management and the emergence of institutions to build a national movement.

World War II Ends
Growth of the US industrial base during and after WWII and changing American lifestyles brought about major increases in air, water, and solid waste emissions. In the late 1940s and early 1950s, when the war effort was over and domestic issues once again became important, the impact of these emissions gained national attention. Air-pollution health alerts occurred in the east and west. Major fish kills occurred in many rivers, and some rivers actually caught on fire. Federal action in the form of national legislation (Clean Air Act, Clean Water Act) occurred, establishing for the first time a federal presence and role in cleaning up the nation’s air and surface waters.

USPHS Enters the Arena
The responsibility for implementing the air and water statutes was assigned to the USPHS (the federal agency charged with protecting the nation’s public health). Principal authorities included research, technical, and financial assistance to state agencies and support for states to regulate air and water emissions. By the mid-1950s, the USPHS air- and water-pollution-control programs were flourishing.

In the late 1940s, the USPHS solid waste program—while small, underfunded, and undersupported—was directed to address the issues associated with health impacts from open-burning dumps. In 1948, this effort was modest as one employee worked on this effort as well as other assignments. This modest effort, however, would in time lead to a major effort by the USPHS.

By the early 1950s, the American Public Works Association (APWA) had restarted its solid waste efforts. The USPHS established a partnership with APWA to optimize the use of both organizations’ limited funds. This partnership was key to the eventual passage of national solid waste legislation. It became evident to this partnership that the elimination of open-burning dumps was not going to get done with current federal legislative authorities and funding levels. The sanitary-engineering leadership in the USPHS concluded that in order to be successful in its efforts to protect the public health from improper solid waste management practices, (1) passage of national solid waste legislation was needed to have the resources to get the job done and (2) the public-health impacts from solid waste management practices, especially open-burning dumps, would have to be demonstrated to justify passage of that legislation.

A number of initiatives were started to implement two conclusions as the USPHS took steps to:
• increase its solid waste program investments under its limited authorities,
• assist states and local governments to replace open-burning dumps with "sanitary landfills;"
• promote the sanitary landfill to replace dumps,
• examine all solid waste management practices for possible harm to public-health issues,
• develop a national coalition to support a federal solid waste management program and national solid waste legislation.

Implementing Strategy
The USPHS was a public-health organization (see Note 2). Key to any expanded solid waste effort within the USPHS depended on demonstrating ties between public-health impacts and improper solid waste management practices. The small cadre of USPHS people working on solid waste issues, who fully believed that ties existed, began a concerted effort to document those ties.

During the late 1950s and early 1960s, the USPHS pursued its strategy of creating the necessary technical, professional, and political support that would lead to passage of national solid waste legislation. The Division of Environmental Engineering and Food Protection, under the leadership of Wes Gilbertson (see Note 3), led the strategic effort. Efforts included the development of new publications, interaction with state and local governments, and increased partnering with APWA. Dialogues were opened with academia. Research on improved methods for disposal and the application of sanitary landfill methods were advanced. The Communicable Disease Center, through its in-place state assistance programs, began training in improved landfill practices. Surveys were conducted to report on practices and progress in solid waste management in the US, and national conferences were sponsored to help foster a national consensus on the need for a na-