ARTICLES

OF

INTEREST

2- DAY DECONSTRUCTION WORKSHOP

Date: 04/22/10– 04/23/10

Time: 8:30-4:30 both days

Location:

Sac Co Dept of Waste Management

9850 Goethe Rd, Sacramento

The entire process of deconstruction will be covered. Participants will receive a full color notebook, a hardbound book on deconstruction, and a certificate of completion. Lunch will be provided on both days, as well as transportation from classroom to jobsite. All interested parties invited– contractor to general public.

Cost is $275.

TRP

The ReUse People

CONTACT:

Kristin Williams
Sacramento Area Manager
209-241-3614
kristinwilliams@thereusepeople.org

Mary Pitto

From: SWANA Central California Sierra Chapter [bklatt@co.kern.ca.us]
Sent: Friday, March 05, 2010 9:05 AM
To: Mary Pitto
Subject: Invitation to the 39th Annual Western Regional Symposium

Annual SWANA Western Regional

Symposium

Solid Waste Management: Answers for California

SWANA®

SOLID WASTE ASSOCIATION of North America

39th Annual Western Regional Symposium

Dear Mary,

On behalf of the California Chapters of the Solid Waste Association of North America (SWANA), it is our pleasure to invite you to the **39th Annual Western Regional Symposium and Trade Show**. This year's symposium will be held April 19 – 22, 2010, in beautiful San Luis Obispo, Ca.

We are preparing a program that we hope will both educate and entertain you. Also, in our continuing effort to provide more bang for the buck, we have changed-up the symposium schedule. Our Monday Night Welcome Reception will be extended to 3 hours to allow those participating in the golf tournament and the trap shooting a chance to get their stories straight before joining their colleagues at the reception.

Tuesday will offer the exhibitors a 4 hours block from 10:00 am – 2:00 pm to provide information on their services and equipment. A special Exhibitor Show Only ticket will be available on Tuesday for those who just want to take advantage of this time to mingle with our exhibitors. Lunch will be included.

Technical sessions will be held on Tuesday morning and afternoon as well as all day on Wednesday. We will be providing updates to the presentations as they become finalized.

We appreciate all of the support our members, sponsors and friends have provided over the years which has made the Western Regional Symposium a premier event for solid waste professionals in California.

Hope to see you in San Luis Obispo in April 2010 for the **39th Annual Western Regional Symposium and Trade Show.**

WHEN
Monday, April 19, 2010 8:00 AM -
Thursday, April 22, 2010 5:00 PM

WHERE
Embassy Suites Hotel
333 Madonna Road
San Luis Obispo, CA

InsideBayArea.com

Berkeley's ardent recycling is costing the city money

By Doug Oakley
Berkeley Voice

Posted: 02/11/2010 09:48:34 PM PST

Updated: 02/12/2010 06:46:29 AM PST

Berkeley's environmentally conscious citizens who reduce, reuse and recycle are behind a $4 million budget deficit in the city's refuse department.

The amount of trash being picked up curbside and the amount of construction trash going in to the city's transfer station have fallen drastically in the past year, along with revenue the city collects from them.

Leaders are considering serious measures, including reducing trash pickup to every other week, a second rate increase in a year, or both.

The refuse department's deficit is the largest part of a $14 million shortfall in the city as a whole for the fiscal year that ends in June.

"Interesting issue is an understatement," said city Budget Manager Tracy Vesely. "Someone else already said it, but it's true: We're a victim of our own success."

Berkeley only charges residents to haul away their trash, but not their recycling and composting. Residents have been so diligent about reducing the amount of trash that goes to landfills by separating paper, cans and plastic and food scraps and yard waste that they now produce less trash and are using smaller trash cans.

Because the city charges trash pickup based on the size of can at the curb, revenues have fallen as customers have asked for smaller containers. But labor costs are still the same no matter what size can people use.

At the city transfer station on Second Street where people pay to bring construction debris, revenues are also down because of a slowed construction industry and builders who are increasingly conscious of separating recyclable items when they do demolition work.

Add to that a worldwide reduction in prices paid for recycled materials, and you have a problem.

The city is brainstorming a variety of ideas to bring in more money or reduce costs.

Rate increases are not being ruled out, even though rates went up 20 percent for curbside trash pickup in August and transfer station entrance fees went up 10 percent.

"If we don't increase rates, we have to decrease expenditures," Vesely said. "We either need to become more efficient or reduce services." One idea she said, is to pick up trash every other week as opposed to every week, which the city does now.

"We're looking at the legality of reducing pickups, that's one idea, but there are certain health and safety issues involved with that," Vesely said.

Another idea is to charge for picking up recyclables and composting, she said. No other city she knows of does that.

"We really need to look at our rate structure and

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consider the business model around that," Vesely said.

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The Mercury News
MercuryNews.com

Recycling centers fall victim to state's budget woes

By Lisa Vorderbrueggen and Bruce Newman
Bay Area News Group

Posted: 01/01/2010 12:00:00 AM PST

Updated: 01/05/2010 09:36:34 AM PST

Special Section

- News, resources about the California budget

Alan Tetenbaum still remembers the golden age of collecting cans, back in the '70s when people were free and easy with their trash, and the streets were lined with aluminum.

Tetenbaum roamed the byways and alleyways of San Jose, often for 12 hours a day, trailing a giant plastic bag behind him that looked like a zeppelin when it was filled with discarded beverage containers. But in 1987, California created a government recycling bureaucracy — nickel and diming consumers for every bottle and can — and in the process, opened a deep pocket for the Legislature to pick.

During the past several years of state budget shortfalls, that's exactly what the state did, borrowing more than $400 million from the California Beverage Container Recycling Fund, the proceeds of the nickel and dime deposits consumers pay on aluminum cans, plastic and glass bottles.

The fund ran out of money and on Nov. 1 stopped paying a recycling material handling fee, about half of the redemption center operators' income. That, say the large recyclers, has led to fewer neighborhood centers and shorter hours.

Now there are fewer recycling centers like the NexCycle "microsite" where Tetenbaum now works and was weighing bottles and cans over the weekend in a supermarket parking lot on Hamilton Avenue. Santa Clara County has lost six redemption sites since mid-June.

"I guess the state can do whatever it wants to do," said Tetenbaum, handing a receipt for $18.04 to Bobby Papadatos of San Jose, who then headed happily into Safeway to a cashier who gave him what he called "free money." He wasn't particularly happy to hear that such small collection sites, which the state defines as a "convenience zone," might soon be going away.

"They're hard enough to find at a time when they're open as it is," Papadatos said.

Californians bought 21.9 billion beverage containers last year and dumped $1.15 billion into the state bottle fund, according to the California Department of Conservation. Consumers pay a nickel deposit on each container less than 24 ounces and 10 cents for the larger ones. They may return those containers to authorized California recyclers and get their money back.

"The beverage deposit is a social contract," said Susan Collins, executive director of the nonprofit Container Recycling Institute in Culver City. "When the state charges a deposit on a container and says you can get it back, but they make it difficult for you to get it back, then that's not OK."

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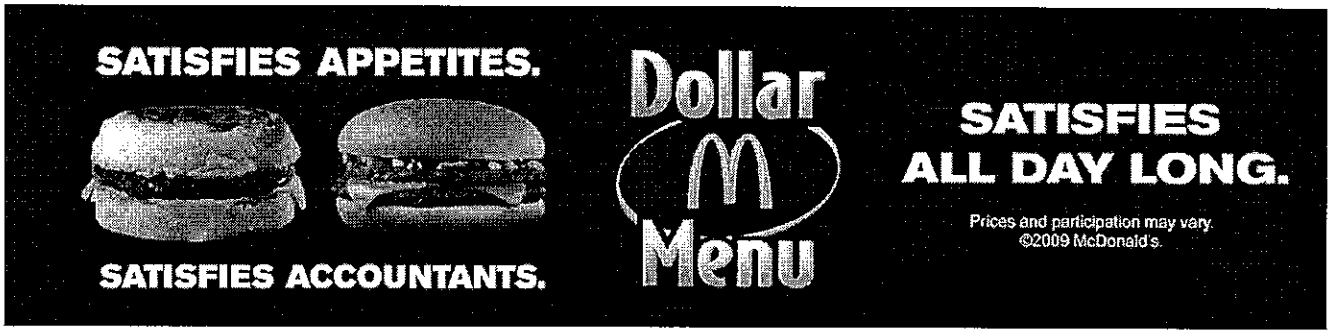

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The Mercury News
MercuryNews.com

Major recyclers Tomra Systems, NexCycle and Bigfoot Recycling sued California, calling the state's payment suspension illegal. They predict widespread closures of recycling centers and worker layoffs.

"We just reduced the operating days at 97 sites (statewide) from five days a week to two and three days a week," said Sunnyvale-based NexCycle President John Ferrari. "Everyone tells us there will be a fix, but I don't know. If this continues, I will have to look at more cuts."

Ferrari, among others, thought the fix was Senate Bill 402 by Sen. Lois Wolk, D-Linden, and Assemblywoman Nancy Skinner, D-Berkeley. But Gov. Arnold Schwarzenegger blocked the legislation in October, saying he opposed a provision that would expand the type of beverage containers that would come under the deposit requirement.

Recycling advocates say the closures are bad news for consumers and cast a pall over California's successful program.

Related Sections

- Green Energy: All about alternative energy
- Green Living: Consumer-oriented news you can use for a greener lifestyle

Not everyone is worried about the cutbacks, however. Saulman Valani, manager of Ranch Town Recycling Center in San Jose, points out that consumers will still be able to redeem bottles and cans for cash at businesses such as his.

"It's just the big companies that are affected," he said. "I have to pay a mortgage, while those guys are just sitting in a parking lot at Safeway or Lucky. Then the state pays them a bonus of $1,500 to $2,000 a month. That's a lot of money." Valani said cutbacks at big Silicon Valley companies, where free bottled water and meals were a standard pre-recession perk, have reduced his business by nearly 25 percent over the past year.

Hayward resident Jennifer Bittikofer, who dropped off $33.92 worth of recyclables at Union City's lone redemption center last week, was unhappy to hear of closures. She uses her recyclable redemption cash for food. "I'm a starving college student," said Bittikofer, who is preparing to transfer to a school in Southern California.

As Tetenbaum sifted through the contents of another garbage bag — "I don't pay for apple juice," he said, tossing a crushed container aside — Filmon Hailu fretted that his next Dumpster run might not be so lucrative. "It definitely would be a hardship for me if it closes," he said. "I want to help the environment, but the money is also important."

Contact Lisa Vorderbrueggen at 925-945-4773.

INFORMATION

To find an open recycling facility near you, enter your Zip code at www.bottlesandcans.com .

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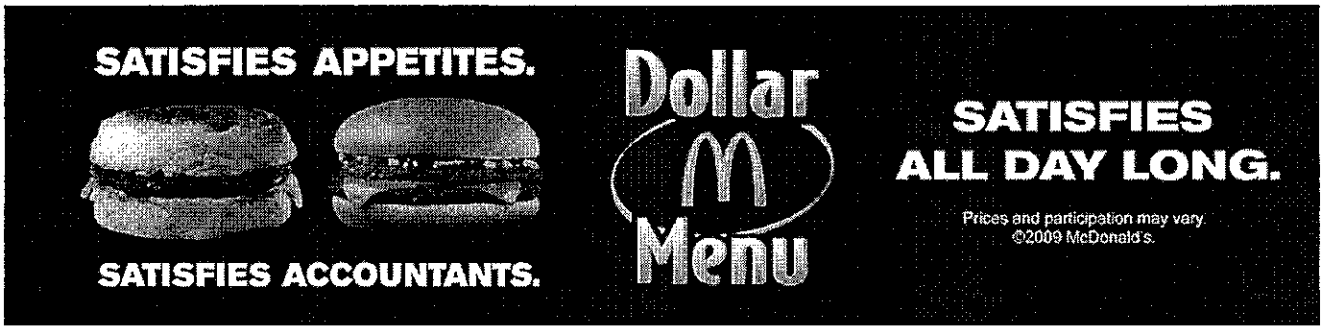

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At press time

Black liquor boondoggle battle continues

With Democrats in both houses of Congress hunting for ways to fund health care legislation, the controversial "black liquor" tax credits – both current and proposed – are in their cross hairs.

To bring the reader up to speed, the virgin paper industry has been exploiting an alternative energy tax incentive that's allowed the industry to pocket multiple billions of dollars (see "Tax credit hurts paper recycling" under the At Press Time section in the May '09 of *Resource Recycling*). Known as black liquor, a pulp byproduct mixed with small amounts of diesel fuel that's used as a fuel source, the recycled paper industry contends that the tax credit – itself an unintended result of a 2005 highway bill – amounts to an unfair advantage for virgin paper, artificially depressing the price of virgin products.

Presently, the 50-cent-per-gallon tax credit is to conclude at the end of the year; but, there are efforts to have the credit extended in perpetuity by Representative Steve Kagen (D-Wisconsin), who says the move would save jobs and assist growth for the paper industry. On the other side of the fight, in the Senate, Max Baucus (D-Montana) and Chuck Grassley (R-Iowa) have issued a draft proposal calling for an end to the current credit.

Complicating matters, a recent ruling by the Internal Revenue Service states that the use of black liquor as fuel qualifies for a $1.01-per-gallon subsidy for biofuels – as part of the 2008 Farm Bill – as long as it meets U.S. Environmental Protection Agency (EPA) standards as a biofuel. Some estimates find the credit would cost taxpayers $24 billion if paper producers take it. The paper industry says it has no plans to do so, because black liquor likely would not meet EPA standards and is not currently listed by EPA as an approved biofuel.

Wanting to block any potential use of those tax dollars, as well as count the aforementioned $24 billion as savings, a House Ways and Means Committee amendment by Representative Chris Van Hollen (D-Maryland), to the healthcare reform measure, bars the $1.01-per-gallon credit being used for black liquor.

California recycling centers close doors

Recycling centers across California continue to close shop because of previously reported funding woes, stemming from over $400 million being taken from the Golden State's recycling fund, which is financed by the state's beverage container redemption program (see "Bottle bill veto could have severe results" under the State & Province Watch section in the November '09 issue of *Resource Recycling*).

The unredeemed deposits funded the state's approximately 2,100 recycling centers, which process around one-third of the beverage containers recovered in California. An estimated 160 recycling centers have closed since July 2009 – with attendant job loss – due to funding cuts, with more likely to follow.

Two of the state's largest recycling operators, Tomra Pacific and NexCycle, have already closed around 90 return centers. As a result, Tomra has joined with several other firms to file a lawsuit against the state, seeking the return of $451 million borrowed from the fund over the last decade, with $99 million taken in this year alone. Governor Arnold Schwarzenegger says he will offer a plan to pay back funds to the program when he submits his budget plan in January.

However, until that happens, more supermarkets could be forced to redeem containers due to return centers shutting down. And, according to state law, supermarkets redeeming containers, because of the lack of an on-site return center, are supposed to pay the state $100 per day for each day they redeem containers. Unfortunately, though, the state doesn't enforce the law to the highest of extents.

Resource Recycling will continue to follow this story.

Activity	2009	Percent change, year over year
Recovered paper producer price index through October	268.9 (1982=100)	-23.7
Recovered paper exports through September	14.11 million metric tons	-1.3
Recovered paper exports average price through September	$131 per metric ton	-22.9
North American primary aluminum production through October	4.78 million metric tons	-18.0
Aluminum beverage can shipments through October	73.89 billion cans	-1.0
UBC exports through September	28.07 million pounds	+11.4
UBC exports average price through September	67 cents per pound	-34.5
Aluminum scrap exports through September	2.56 billion pounds	-31.4
Aluminum scrap exports average price through September	57 cents per pound	-28.2
Steel production through October	46.55 million metric tons	-43.7
Ferrous scrap exports through September	17.26 million metric tons	0.0
Ferrous scrap exports average price through September	$308 per metric ton	-39.3
Glass scrap exports through September	25,000.6 tons	-58.7
Glass scrap exports average price through September(1)	$299.48 per ton	-5.8
Scrap plastics exports through September	3.31 billion pounds	+19.5
Scrap plastics exports average price through September	17.86 cents per pound	-26.1

(1) Includes cullet and other scrap glass, including glass in mass.
Sources: U.S. Department of Commerce; U.S. Department of Labor – Bureau of Labor Statistics; Aluminum Association; Can Manufacturers Institute; International Iron and Steel Institute; *Resource Recycling*; 2008.

THE RECORD SEARCHLIGHT
redding.com

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State's borrowing crippled recycling business, operators say

By David Benda

Monday, January 4, 2010

Anderson-based Big Foot Recycling Center is among three firms suing California in an effort to keep their businesses going and revive the state's recycling program, which they claim is on life-support.

The $415 million that California has borrowed over the past several years from its recycling fund to help balance the budget has decimated the program and plunged it into a nearly $100 million hole in fiscal 2008-2009, the suit claims.

Money from the California Beverage Container Recycling Fund is used to reimburse companies like Big Foot Recycling - handling fees that offset the cost of running a recycling center, industry experts say.

"Recent operating deficits in the Recycling Fund would have posed no threat to the recycling program if the Legislature had not made 'loans' totaling $415.7 million from the Recycling Fund to the General Fund," the suit, filed Nov. 9 in Alameda County, contends.

The loans must be paid back immediately and the failure to do so violates state law, according to the lawsuit.

Tomra Pacific Inc. of Delaware and R.B. Recycling Enterprises of San Diego have joined Big Foot Recycling in the suit.

Reimbursements to recyclers were eliminated in November, industry representatives say. This came after an 85 percent reimbursement reduction in July.

More than 150 recycling centers closed in 2009 and without the subsidy, more recyclers across the state will be forced to shut down, said Susan Collins, executive director of the nonprofit Container Recycling Institute.

"Scrap sales revenue doesn't cover the cost of recycling, or the cost of operating a center - the labor, insurance," Collins said.

Consumers pay CRV (California Refund Value) when they purchase beverages from a

retailer, which is refunded when they redeem the containers at a recycling center.

In October, Gov. Arnold Schwarzenegger vetoed a bill that would have increased incentives in California's recycling program.

Meanwhile, Big Foot Recycling, which operates 20 centers in Shasta and Tehama counties, has had to close its recycling facilities on Sundays - a first for the company, which has been in business for more than 20 years.

Big Foot Recycling also periodically closes some centers during the week, a strategy co-owner Jim Smith refers to as "rolling closures." The company has laid off four workers, about 10 percent of its work force.

The cost-cutting has saved Big Foot Recycling about $20,000 a month, Smith said.

While he vows to keep his centers open, Smith said the business will have to change dramatically if the state's recycling fund isn't reimbursed and fees the state pays to operators don't return.

For Steve Holdorff, who operates two recycling centers in Modoc County, the situation is even more dire.

The handling fees he gets from the state are so crucial that Holdorff has lost about three-quarters of his income and is down to one employee who works 35 hours a week.

"If things don't change, I don't know. I've been here since 1984, so I want to stay positive," Holdorff said. "If I had another good job right now, I would get out of it (recycling)."

Ironically, the reduction in handling fees comes at a time when recyclers are busier than ever as more consumers flock to centers in effort to make an extra buck.

"Customers are waiting longer and unfortunately we can't help customers sort as much as we used to," Holdorff said. "This coming summer, it will be busy and without handling fees, I don't know how I will be able to keep up."

Collins, whose group promotes programs and policies that increase recycling, said this month that the governor could propose to re-establish the recycling fund in the state's new budget.

Ultimately, the cuts in recycling will force consumers to drive farther, spending more money on gas in an effort to help the environment, industry experts say.

Reporter David Benda can be reached at 225-8219 or at dbenda@redding.com.

WASTE & RECYCLING NEWS

Calif. coalition issues report on single-use, reusable bags

March 8 -- A California government coalition has issued a new environmental assessment on single-use and resusable bags.

Green Cities California, a coalition of 10 California cities collaborating to help other local governments work toward sustainability initiatives, released the Master Environmental Assessment today.

The report summarizes existing studies on the environmental impacts of single use plastic, paper, compostable and reusable bags, as well as the impacts of policy options such as fees and bans on bags.

The MEA includes studies that reviewed environmental impacts from the use of the four types of bags, including greenhouse gas emissions, litter problems, marine life impacts, water consumption and ozone formation.

Notably, the report finds bag usage drops up to 90% when retail outlets charge for bag usage.

"We're not going to recycle our way to a sustainable society," said Dean Kubani, GCC Steering Committee member and director of Santa Monica's Office of Sustainability. "We need to orient away from single use and towards durable products. We are confident that this report will provide the documentation local governments need to adopt policies that encourage the use of reusable bags and phase out single use bags."

The full report, an executive summary and background information is available at www.greencitiescalifornia.org/mea.

Contact Waste & Recycling News reporter Amanda Smith-Teutsch at 330-865-6166 or asmith-teutsch@crain.com

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WASTE & RECYCLING NEWS

WM subsidiary approved for mail-back sharps services

Feb. 22 -- One of Waste Management's subsidiaries, WM Healthcare Solutions, has been approved to offer mail-back sharps services in California.

Since September 2008, disposing of home-generated sharps in the trash has been illegal in California. The California Department of Public Health approved WM Healthcare Solutions' "MedWaste Tracker Safe Solutions for Sharps" services for state residents last week.

WM Healthcare Solutions provides a special container that allows customers or businesses to package and dispose of used medical sharps then ship them using a U.S. Postal Service-approved box.

For more information call 1-866-931-6321 or visit www.thinkgreenfromhome.com.

Contact Waste & Recycling News reporter Amanda Smith-Teutsch at 330-865-6166 or asmith-teutsch@crain.com

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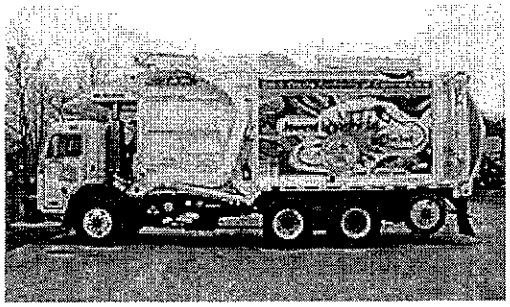
WASTE & RECYCLING NEWS



SWACO uses vehicles powered by methane from landfill

Feb. 11 -- The Solid Waste Authority of Central Ohio now has 10 vehicles powered by methane harvested from its landfill.

The newest member of SWACO's renewable fuels fleet is a recycling truck powered by compressed natural gas. The truck, which combines a Peterbilt 320 chassis and a McNeilus 4385 cab, is the first of SWACO's recycling trucks to run on a dedicated CNG engine.

The solid waste authority built a "Green Energy Center" in Grove City, Ohio, harvesting methane from the nearby landfill. The Green Energy Center cleans the gas to pipeline quality and then compresses it for vehicle use.

In addition to the recycling truck, SWACO also has passenger cars, pickup trucks and a riding lawnmower that it powers at the center. The Green Energy Center has a full capacity of 250,000 gasoline gallon equivalents of CNG. Planning for phase two of the project is under way, which will expand capacity 5 to 10 million gasoline gallon equivalents or used to power local homes in place of natural gas.

Contact Waste & Recycling News reporter Amanda Smith-Teutsch at 330-865-6166 or asmith-teutsch@crain.com

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WASTE & RECYCLING NEWS

Study examines city composting as diversion method

Jan. 20 -- A new study released today, funded in part by the U.S. EPA, examines city-based composting as a method of waste diversion.

The Center for a Competitive Waste Industry examined composting programs in 121 U.S. cities in its study, "Beyond Recycling: Composting Food Scraps and Soiled Paper."

The 79-page report provides best practices for expanding beyond recycling and advice on processing food scraps and soiled paper.

Cities included in the study reported increases in overall waste diversion rates and reductions in greenhouse gas emissions and groundwater pollution threats.

The study offers techniques used to reduce costs associated with composting and finds while food, soiled paper and yard trimmings make up half of household solid waste, up to 75% of this material can be composted instead of being sent to landfills.

Copies of the report are available at http://beyondrecycling.org/pdf_files/FinalReport.pdf

Contact Waste & Recycling News reporter Amanda Smith-Teutsch at 330-865-6166 or asmith-teutsch@crain.com

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WASTE & RECYCLING NEWS

Web sites announce partnership to increase recycling

Jan. 21 -- Two online recycling portals have announced a new partnership to increase recycling efforts.

1-800-Recycling.com has added UsedCardboardBoxes.com to its nationwide network of recycling resources, the companies announced today.

UsedCardboardBoxes.com rescues truckloads of quality used boxes from large manufacturers that might otherwise throw them away. Companies also use the service when recycling cardboard isn't commercially viable.

The 1-800-Recycling.com Web site provides U.S. recycling locations, searchable by ZIP code, and allows consumers to find recycling locations for specific materials.

Consumers can also call the Web site at 1-800-732-9254 to find responsible recyclers of cardboard, electronics, tires, oil, paint, glass, plastic, household hazardous waste, wood, mattresses, carpet and other materials.

Contact Waste & Recycling News reporter Amanda Smith-Teutsch at 330-865-6166 or asmith-teutsch@crain.com

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WASTE & RECYCLING NEWS

Oregon e-recycling law goes into effect

Jan. 6 -- It is now illegal for Oregon residents to trash their old computers, monitors or TV sets as the state's mandatory electronics recycling law became effective Jan. 1.

The new law bans electronics waste from state landfills, transfer stations or incinerators. The state offers free drop-off points for computers, monitors and TV sets at 220 locations.

While peripherals, such as keyboards and mice, are not covered in the ban, these items can also be recycled at the state drop off points.

Violating the ban is punishable by fines of up to $500 for each device.

For more information call 1-888-532-9253 or visit http://www.deq.state.or.us/lq/pubs/docs/OREcyclesDisposalBanQA.pdf.

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WASTE & RECYCLING NEWS

WM demonstrates solar-powered trash compactor in Calif.

Dec. 21 -- Waste Management Inc. is demonstrating its new solar powered trash compactor at Mission Viejo, Calif.'s city hall.

Installation of the trash compactor is part of the company's pilot program to test the compactor that allows for reduced collection frequency, the company said.

The unit uses built-in solar panels to power compaction of trash, allowing the container to hold five times more waste than a traditional trash can.

This reduces collection costs, fuel use and greenhouse gas emissions, the Houston-based company said.

The compactor also includes space for collection of recyclables.

Contact Waste & Recycling News senior reporter Jim Johnson at 937-964-1289 or jpjohnson@crain.com

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Mary Pitto

From: Smart2BeGreen [greentips@smart2begreen.com]
Sent: Wednesday, January 13, 2010 7:11 AM
To: Mary Pitto
Subject: Solar Powered Trash Cans

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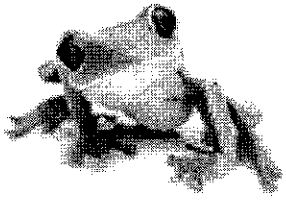

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Garbage trucks consume over 1 billion gallons of diesel each year in the US alone. On average, they get only 2.8 mpg and are one of the most expensive vehicles to operate.

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January 13, 2010

Solar Powered Trash cans

Garbage is all around,
Full trash cans abound.
Want to help your town?
Solar cans will astound!

Sunny Days Keep Trash Trucks Away

Every day, millions of trash cans around the U.S. are filled, collected, and emptied. Garbage trucks running on fossil fuels make countless daily pick-ups of our refuse and transport it to overfilled dumpsites.

- **The Big Belly Solar Compactor** is a revolutionary trash receptacle that uses solar power for 100% of its energy needs. It is safe, easy to use, keeps out pests, and is designed to withstand all weather conditions.
- The capacity of the Big Belly is 5 times greater than standard trash bins. This reduces the number of required collection trips and can cut fuel consumption and greenhouse gas emissions by 80%.
- Depending on collection frequency, a standard trash bin costs between $7,300 and $30,000 over its lifetime. The lifetime operational costs of the Big Belly are between $6,000 and $12,000.
- **Over 2,000 Big Belly systems** have been sold across the U.S. and in 17 countries around the world. **For example,**

the city of Philadelphia has reduced its trash collection trips by 75% by replaced 700 trashcans downtown with 500 Big Bellies.

Check It Out

Big Belly Solar, is combating our garbage dilemma with their innovative and cost effective Big Belly on-site solid waste solar compaction systems.

Newsweek has a great article detailing the Big Belly solar compactor.

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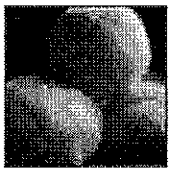

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EPA to investigate cluster of birth defects in Kettleman City, Calif.

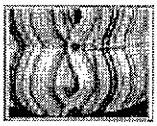
Some residents blame a nearby toxic waste dump for health problems. U.S. says the study shows the Obama administration's commitment to environmental justice.

By Louis Sahagun

January 27, 2010

The U.S. Environmental Protection Agency said Tuesday that it plans to investigate a cluster of facial birth defects and other health issues among migrant farm workers in the impoverished California enclave of Kettleman City as part of the Obama administration's pledge to shift the agency's attention toward issues of environmental justice.

Healthy Living



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Residents suspect the facial deformities are linked to a nearby toxic waste dump. The dump is set to be expanded to accommodate waste from large population centers, including Los Angeles, and residents have filed a lawsuit against the Kings County Board of Supervisors challenging its approval of the expansion.

In an interview, Jared Blumenfeld, administrator for the EPA's Pacific Southwest region, said the case meets the standards of the Obama administration's decision this month to make environmental justice a priority.

"Kettleman City is a very vulnerable community at the confluence of large agriculture and pesticide use, heavy truck traffic, a chemical waste facility accepting PCBs and a proposed 600-megawatt power plant," Blumenfeld said. "This is also a community trying to be represented in a way to get its voice heard.

"Our job is to make sure that we look under every rock and try to see if there is a causal relationship between all these activities and the health impacts on the ground," he said. "We need to provide real information, based on science, not just from the company proposing a project."

When informed of the EPA's announcement, Kings County assistant administrator Deb West said: "Wow. Wow. Jeepers. I need to find out more about this."

The EPA's announcement was welcomed by Chemical Waste Management, which owns the toxic waste facility about 3 miles southwest of Kettleman City, according to company spokeswoman Kit Cole. "We think our site is very protective of human health and the environment," she said. "But we also recognize that the families of Kettleman City need and deserve answers."

Blumenfeld cautioned against unrealistic expectations of the federal government's study of Kettleman City, a town of about 1,500 mostly Spanish-speaking residents located just off Interstate 5 about halfway between San Francisco and Los Angeles. "We may not find a smoking gun when we do our health

analysis, or pinpoint the exact causal relationship between the environment and harm," he said. "But that should not hinder our ability to act."

Blumenfeld also vowed to use the EPA's influence to "strongly recommend" that state and local regulatory authorities "step up to the plate" and share some of the expenses for environmental reviews at Kettleman City and at other "environmental hot spots."

Blumenfeld was expected to address a protest today on the steps of the EPA's San Francisco headquarters, which will include hundreds of Kettleman City residents.

"We believe the new EPA leadership, with support from Washington, can start fulfilling the EPA's mandate to protect health and environmental justice," said Bradley Angel, a spokesman for Greenaction, which is leading the protest. "But we are not taking a wait-and-see attitude toward this situation -- people are getting sick and dying in these communities."

Chemical Waste Management has made some concessions to residents. In September, the company voluntarily decided not to accept solid or hazardous wastes from the Santa Susana Field Laboratory in Ventura County because of concerns about possible radioactive content in the materials.

The company continues to accept carcinogenic PCBs from old transformers under a special permit that has been under EPA review since it expired about 12 years ago. The company blamed the EPA for delays in the approval process.

"The EPA issued some kind of permit extension that allows us to legally continue to take those materials," said Cole, the company spokeswoman. "We continue to operate in a legal manner while the new permit has been in progress."

Kings County medical authorities were doubtful that the EPA would pinpoint the cause or causes of at least five cleft palate or cleft lip cases among 20 live births in a 14-month period beginning September 2007. That amounts to about 250 cases per 1,000 live births, far above the national average of about 1 per 1,000, calculated by the National Institutes of Health.

"Each of these cases is different, and it has been my contention from the beginning that there is no science that will answer the question of why those five events happened within that time period," Kings County health officer Michael MacLean said. "No matter what resources you put into it, the problem is that the number of cases is so small."

County officials said the California Department of Public Health recently turned down their request to investigate the cases.

FOR THE RECORD:
A spokesman for the California Department of Public Health on Tuesday night disputed that characterization. He said the agency is actively looking into the concerns of the community and will be making its findings known in the coming weeks.

Blumenfeld said the EPA's intervention in Kettleman City underlines the agency's commitment to, as he put it, "revolutionize the way we do business" by channeling resources into "often forgotten" areas, including urban communities, the U.S.-Mexico border and tribal nations.

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Waste-To-Energy and Greenhouse Gas Emissions

By Jeremy K. O'Brien

The SWANA Applied Research Foundation's (ARF's) Waste-to-Energy (WTE) Group identified the issue of the perception and inclusion of waste-to-energy as a "green" solid waste management option as one of high importance to the group.

As a result, a report was prepared in 2009 that quantifies the environmental benefits associated with the processing of the waste remaining after recyclable materials have been removed by the consumer or business (non-recycled waste) through waste-to-energy plants for electricity generation rather than disposing of this non-recycled waste in landfills. This report is in final draft form and will be published by SWANA in December 2009.

This article focuses on one of the environmental impacts of WTE that is addressed in the report: namely, greenhouse gas emissions.

Five organizations subscribed to the SWANA ARF's WTE group in FY2009, each of which made a funding commitment to the conduct of collective applied research in the WTE area (if the jurisdiction or organization was already an ARF subscriber and had made a penny per ton funding commitment to another group, the funding rate for the WTE group was reduced to $0.005 per

Table 1 SWANA ARF FY2009 Waste-to-Energy Group

Organization	Contact	Title
HDR Engineering	John Williams	Senior Vice President
I-95 Landfill Owners Group	Carl Newby	Arlington County WTE Contract Manager
	John Snarr	Metro Washington COG Project Manager
Lancaster County Solid Waste Authority	Gary Forster, P.E.	Senior Manager, RRF Contract Administration
Waste Management/ Wheelabrator Technologies, Inc.	Mr. Frank Ferraro	Vice President of Public Affairs
Three Rivers Solid Waste Authority	Colin Covington	General Manager

Waste-To-Energy and Greenhouse Gas Emissions (cont.)

ton). A listing of the five WTE Group subscribers and their contacts are provided in Table 1.

Recent Analyses of WTE's Greenhouse Gas Impacts

The analysis of greenhouse gas impacts of waste-to-energy facilities conducted by the ARF is based, as well as builds on, data and information presented in three recent publications.

2009 EPA ORD Article–In March 2009, the EPA's Office of Research and Development (ORD) published a peer-reviewed journal article that compared the theoretical air emissions associated with the landfill disposal of 166.7 million tons of MSW to the air emissions associated with the processing of this waste in WTE facilities (Kaplan, P. O., DeCarolis, J., and Thorneloe, S. "Is It Better To Burn or Burn Waste For Clean Electricity Generation," *Environ. Sci. Technol.*, 2009, 43 (6)). To conduct the analysis, the EPA utilized its "Municipal Solid Waste Decision Support Tool," or MSW-DST, which is a computer model developed for local-government solid waste managers to determine the life cycle evaluation of integrated solid waste management options.

2006 EPA Report–In September 2006, the EPA published its third edition of the report, "Solid Waste Management and Greenhouse Gases–A Life Cycle Assessment of Emissions and Sinks". This report presents the life-cycle GHG emissions associated with the management of 23 types of waste products and materials that represent more than 65% of the wastestream on a weight basis. The model covers five waste management options: source reduction, recycling, combustion, composting, and landfilling. The GHG emission factors developed for each option include the upstream energy and non-energy emissions, collection and transportation of waste and recyclables to disposal and recycling facilities, carbon sequestration, and utility offsets that result from landfill gas collection and combustion.

2003 Wheelabrator Report on the Saugus WTE Facility–In October 2003, Wheelabrator Technologies Inc. issued a report on the greenhouse gas reductions that were attributable to its waste-to-energy facility in Saugus, MA. This facility processes 440,000 tons per year of municipal solid waste, generates 33 MW of electrical power, reduces the volume of waste landfilled by 90%, and recovers ferrous metals from ash. The report documents the GHG emissions from the facility as well as the avoided GHG emissions due to the displacement of oil and coal combustion by the local utility and the avoidance of the rail hauling of this waste to a remote landfill in Lee County, South Carolina (870 one-way miles) for disposal. To conduct its analysis, Wheelabrator utilized the MSW-DST described above.

Key Input Parameters

The key inputs regarding the data and assumptions utilized in each of these analyses are presented in Table 2 and discussed below:

Determination of Non-Biogenic GHG Emissions from Waste Combustion–A key input parameter in the analysis of WTE's GHG impacts is the percentage of GHG emissions that are attributable to the combustion of non-biogenic organic wastes (The GHG emissions from biogenic wastes are assumed to be offset during the growing stage of the biogenic source).

As indicated in Table 2, the EPA ORD determined the non-biogenic GHG emission based on an analysis of the heating value of each waste component while the EPA OSW based its estimate on the respective weight percentages of non-biogenic materials. The waste-to-energy industry has subsequently conducted extensive sampling and analysis of carbon-dioxide emissions from WTE facilities and determined that 60%–65% of the emissions are biogenic.

Table 2. Assumptions Regarding Key Input Parameters Utilized In WTE GHG Analyses

Input Parameter	2009 EPA ORD Analysis	2006 EPA OSW Analysis	2003 Wheelabrator Saugus WTE Facility Analysis
Determination of Non-Biogenic GHG Emissions from Waste Combustion	Based on heating values of non-biogenic waste components	Based on weights of non-biogenic waste components	DST Default
Utility Fuel Displacement	Coal, Oil, and Natural Gas	Coal, Oil, and Natural Gas	Actual Fuel Mix (Coal and Oil)
Electricity Generation – WTE Facilities	590 kWh/Ton	550 kWh/Ton	555 kWh/Ton
GHG Credits for Steel Recycling	Yes	Yes	Yes
Long-Haul Transport of Waste For Disposal	No	No (Assumed)	Yes
Credit for Carbon Storage in Landfills	No	Yes	No

Waste-To-Energy and Greenhouse Gas Emissions (cont.)

Utility Fuel Displacement—The generation of electricity by WTE facilities avoids the need to combust fossil fuels for electricity generation. In this regard, both the EPA ORD and the EPA OSW assumed that the national fuel mix of fossil fuels should be used to estimate the GHG reductions that would result from this displacement. For the Wheelabrator analysis, the actual fuel mix of the local utility was assumed.

Electricity Generation Rates—The electricity generation rates assumed in all of the analysis were in the range of 550–590 kWh per ton.

GHG Credits For Steel Recycling—Both of the EPA analyses assumed that ferrous metals were recovered from WTE ash for recycling and credited the WTE facility with the GHG reductions associated with recycling. As steel recycling is conducted at the Saugus facility, GHG reductions were credited for this activity.

Long-Haul Transport of Waste for Landfill Disposal—The EPA ORD analysis assumed that the landfill would be the same distance at the WTE facility from the collection service area, indicating that the waste would not have to be long-hauled for disposal. While it is not specifically stated, it is likely that the EPA OSW analysis is based on the same assumption. Alternatively, the Wheelabrator analysis assumed that MSW—if not processed in the Saugus WTE facility—would be railed hauled to Lee County, South Carolina for disposal—a distance of 870 miles since there is insufficient disposal capacity in-state.

Credit for Carbon Storage in Landfills—The most significant assumption affecting the outcome of the three analyses presented in this article regards the credit given for the long-term storage of non-decomposable biogenic carbon in landfills. In this regard, the EPA ORD and Wheelabrator do not include this credit, while the OSW analysis does. As is indicated below, the impact of this credit is very significant in its impact on the GHG analysis of solid waste

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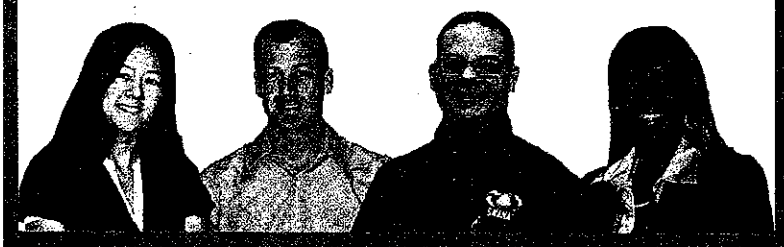

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Waste-To-Energy and Greenhouse Gas Emissions (cont.)

Table 3. Waste-To-Energy Emissions

Pollutant	Chemical Abbr.	Gross Emissions		Avoided Emissions: Fossil Fuel-Generated		Avoided Emissions: Steel Recycling		Avoided Emissions: Landfill Disposal		Net Emissions	
		Lbs/ Ton[1]	MTCE/ Ton	Lbs/ Ton[1]	MTCE/ Ton	Lbs/ Ton[1]	MTCE/ Ton	Lbs/ Ton[1]	MTCE/ Ton	Lbs/ Ton[1]	MTCE/ Ton
MSW-DST											
Greenhouse Gases											
Carbon Dioxide - Biogenic	CO_2-Biogenic	1,183						(350)		833	
Carbon Dioxide - Fossil	CO_2-Fossil	728		(1,051)		(91)		135		(280)	
Carbon Dioxide - Total	CO_2-Total	1,910									
Carbon Dioxide Equivalents	CO_2-E	728	0.09	(1,108)	(0.14)	(91)	(0.01)	(246)	(0.03)	(717)	(0.09)
WARM											
Landfill With LFG Recovery											
–Without Carbon Storage	CO_2-E	889	0.11	(1,131)	(0.14)	(81)	(0.01)	(566)	(0.07)	(889)	(0.11)
–With Carbon Storage[3]	CO_2-E	889	0.11	(1,131)	(0.14)	(81)	(0.01)	162	0.02	(161)	(0.02)
Year 2003 National Average Landfill Emissions											
–Without Carbon Storage	CO_2-E	889	0.11	(1,131)	(0.14)	(81)	(0.01)	(2,182)	(0.27)	(2,505)	(0.31)
–With Carbon Storage[3]	CO_2-E	889	0.11	(1,131)	(0.14)	(81)	(0.01)	(1,455)	(0.18)	(1,778)	(0.22)
Wheelabrator Saugus Waste-To-Energy Facility[4]											
Carbon Dioxide Equivalents	CO_2-E	1,286	0.16	(1,671)	(0.21)	(110)	(0.01)	(845)	(0.10)	(1,341)	(0.17)

1. Based on average stack gas limits. Units reported in pounds of emissions per short ton of MSW.
2. Based on 590 kWh/Ton MSW combusted.
3. Carbon storage in WARM model calculations based on revised carbon storage estimate of 0.11 mass/dry mass (average of 0.07-0.15) based on 10/27/08 memo from Dr. Morton Barlaz of NC State University. Assuming 25% moisture content, this equates to 0.09 MTCE ton/wet ton.
4. Wheelabrator Technologies, Inc. Greenhouse Gas Reductions from the Wheelabrator Saugus Waste-To-Energy Facility. Draft Paper - 10-14-2003.

management options. A noteworthy point regarding the carbon storage credit estimates included in the 2006 EPA OSW report is that they may be grossly overestimated. A memo issued by Dr. Morton Barlaz in October 2007 provided guidance for correcting these estimates. The carbon storage analysis presented in this article reflects the corrections recommended by Dr. Barlaz.

Results And Discussion

The findings of each analysis regarding the GHG impact of WTE facilities are summarized in Table 3 and discussed below:

Gross GHG Emissions—The gross GHG emissions refer to the GHGs that are generated at the WTE facility by the combustion of non-biogenic wastes and the production of nitrous oxides during the combustion process. As indicated in Table 3, the gross WTE GHG emission estimates are fairly close: 0.09–0.11 metric tons of carbon equivalents per ton of MSW (MTCE/ton), with the differences in the estimates likely due to the different methodologies used to determine the biogenic fraction of the waste. The gross GHG emission factor used in the Wheelabrator analysis is significantly higher: 0.16 MTCE/ton.

Avoided Emissions: Fossil Fuel Generated Electricity—The gross GHG emissions from a WTE facility are offset by three benefits associated with WTE—namely, the avoidance of fossil fuel combustion for electricity generation, the recycling of ferrous metals from WTE ash, and the avoidance of landfill disposal of the combusted waste.

Waste-To-Energy and Greenhouse Gas Emissions (cont.)

With respect to avoided utility emissions of GHGs due to electricity production from the WTE facility, both of the EPA analyses provide identical credits—namely, 0.14 MTCE/ton. As discussed above, this factor is based on the avoidance of the combustion of a national fossil fuel mix for electricity production consisting of coal (69%), oil (2%) and natural gas (28%). The Wheelabrator analysis assigns a higher credit—0.21 MTCE/ton, due to the fact that the Saugus plant electricity production is responsible for reduced coal and oil combustion by the local electric utility.

Avoided Emissions: Steel Recycling—With respect to the credit given for the recycling of ferrous metals from WTE ash, all of the analysis assumed the same credit—namely, 0.01 MTCE/ton.

Avoided Emissions: Landfill Disposal—Each of the analyses developed substantially different estimates regarding the GHG impacts of avoided landfill disposal. The value assumed in the EPA-ORD analysis was 0.03 MTCE/ton. This value is based on a scenario presented in the EPA article in which waste was landfilled for two years without landfill gas recovery, after which an LFG electrical generation facility was used to combust the collected LFG for 60 years. The crediting of avoided GHG utility emissions is included in this value.

Additional benefits include waste stabilization, metals recovery, avoidance of long-haul transport, and the long-term local control of pricing.

The results of the EPA-OSW analysis are presented for two scenarios—namely with and without the credits applied for carbon storage in the landfill. As shown, for the scenarios without carbon storage credits, the carbon credit estimates for avoided landfill GHGs range from 0.07 MTCE/ton for a landfill with an active LFG recovery system to 0.27 MTCE/ton, with the latter estimate based on national average landfill emissions for 2003. If carbon storage credits of 0.09 MTCE/ton are included, these estimated credits are reduced accordingly.

For the Wheelabrator analysis, alternative disposal was assumed at a South Carolina landfill that collected and flared the landfill gas yielding an estimated GHG carbon credit of 0.10 MTCE/ton.

Net GHG Impacts—As indicated in Table 3, all of the scenarios analysis result in GHG reductions due to the implementation of a WTE facility. These reductions vary from a low of 0.02 MTCE/ton for a landfill with an LFG recovery system where carbon storage credits are applied to a high of 0.31 MTCE/ton for a landfill where no credit for carbon storage is given and where average LFG emissions for the year 2003 are assumed. The latter value equates to 2,505 pounds of carbon dioxide equivalents (CO_2-E) per ton or 1.25 tons CO_2-E per ton, which is close to the rule of thumb of 1 ton CO_2-E per ton that has historically been used by the WTE industry.

The analyses presented in this article indicate a number of important points that should be considered with respect to the estimation of the GHG impacts of WTE facilities. The first is that the impacts will vary significantly depending on the types of fossil fuels that are displaced and the type and location of the landfill that would be used for disposal if the WTE facility is shut down or is not implemented.

The second point is the significant impact that the assumption regarding the counting of landfill carbon storage credits has on the outcome of the analysis. In this regard, the EPA OSW did not include landfill carbon storage credits, stating that "there is still a debate on how to account for any biogenic "sequestered" carbon." In addition, the Intergovernmental Panel on Climate Change (IPCC) published a guidance document for estimated GHG impacts of solid waste management in which it recommends that the long term storage of carbon in landfills should be reported as an "information item."

Conclusions

All of the analyses presented in this article indicate that the implementation of WTE reduces GHG emissions when compared with the alternative of disposing of non-recycling waste in landfills and generating electricity through the combustion of fossil fuels.

Not reflected in the evaluation of GHG impacts is the role that WTE can play in renewable energy. The Wheelabrator Saugus WTE facility presented in this article generates 38 MW of baseline (24 hours per day, seven days per week) electricity. Assuming that over half of the MSW combusted in the Saugus plant is biogenic, this means that over 19 MW of base load electric power from renewable energy sources are generated at the facility.

Additional benefits of WTE include waste stabilization, metals recovery from WTE ash, avoidance of long haul transport of waste, and the long-term local control over disposal capacity and pricing. These additional benefits should be considered by local solid waste policy makers as they evaluate the WTE alternative as a means to reduce GHG emissions and generate local renewable power.

Jeremy K. O'Brien is the director of applied research for the Solid Waste Association of North America. For more information about this report, contact Jeremy at jobrien@swana.org.

Landfill Gas to Energy: Means and Methods

The EPA's Landfill Methane Outreach Program (LMOP) is spearheading efforts to maximize LFGTE programs.

By Daniel P. Duffy, PE

Maximizing LFG capture and utilization requires a wide range of different but compatible equipment to perform the tasks of collecting, extracting, cleaning, storing, transporting, and flaring the gas. Their proper application and coordination can help a landfill largely avoid significant environmental issues and safety concerns while providing the landfill with an opportunity for additional income. The following is an introduction to these systems and their proper engineering applications.

LFG Characteristics

What we typically think of as landfill gas is the product of the fourth stage of a five-stage life cycle of alternating aerobic and anaerobic activity that takes place in the landfill. This first stage is driven by aerobic bacteria and begins almost immediately after waste disposal. While producing both carbon dioxide and water vapor, aerobic microbes consume the available oxygen in the newly deposited waste.

Once the oxygen has been almost completely removed, an anaerobic state is achieve and triggers the next stage. Stage two involves hydrolysis by anaerobic bacteria that produce organic acids, hydrogen, carbon dioxide, water vapor, and ammonia nitrogen. During this stage, acidogenesis of the simpler organic monomers previously produced by aerobic hydrolysis during the first stage occurs. Also during this stage, sulfur reducing bacteria produce hydrogen sulfide. Stage three continues with anaerobic bacteria converting the volatile fatty acids produced by the previous stage's acidogenesis activities into acetic acid, carbon dioxide and hydrogen.

The first three stages are of relatively short duration and set the stage for the long term production of landfill gas in the fourth stage. During the fourth stage, available acetate is converted to methane and carbon dioxide while using up hydrogen. This stage lasts the longest, often lasting as long as or longer than all the other phases combined and constituting the bulk of the landfill's operational lifetime and post-closure care

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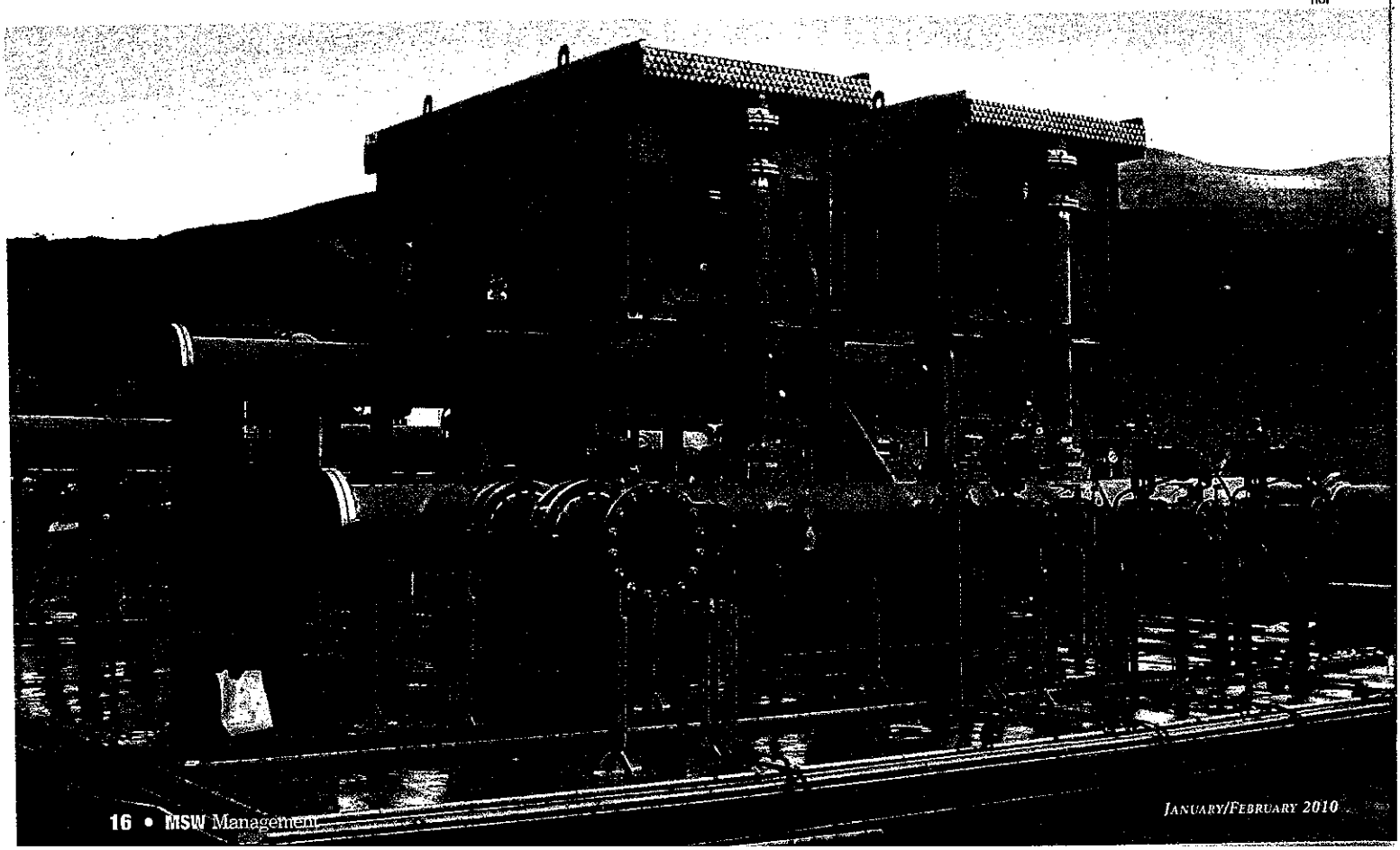
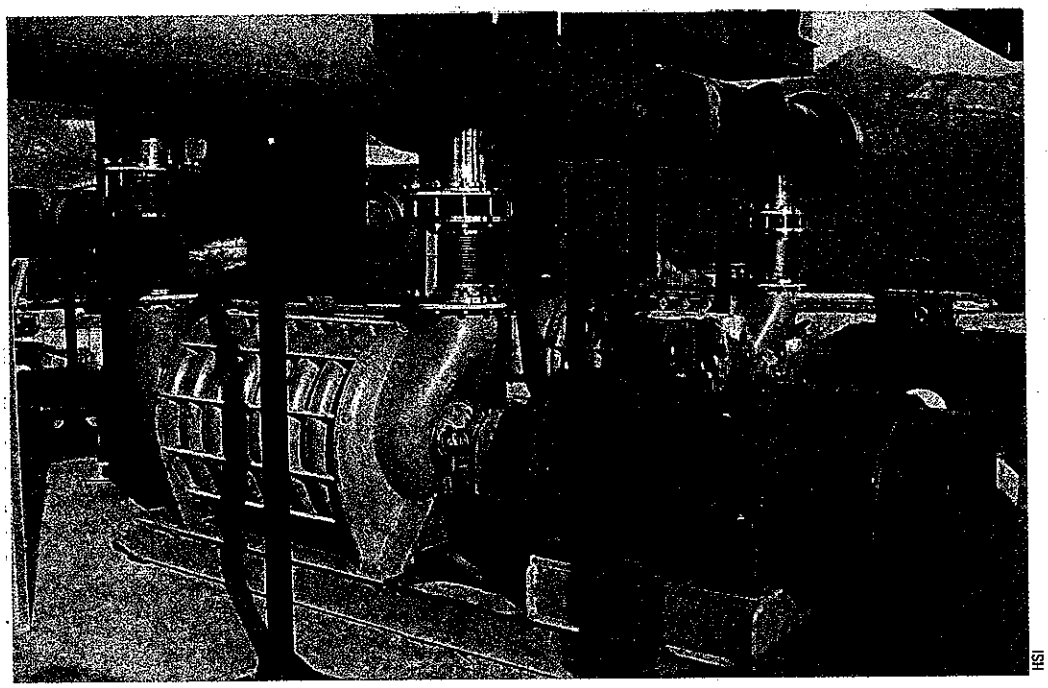


period. Following stage four, the landfill is ready to return to stage five when the initial aerobic stage is reestablished as methane production drops off. Most landfills have not been in existence long enough for this last stage to represent a significant portion of their lifetime.



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The blower for a landfill gas extraction system

The landfill gas produced during stage four consists primarily of carbon dioxide (50%–55%) and methane (45%–50%). In addition to these two primary components, approximately 1% of landfill gas consists of trace chemicals (hydrogen sulfide, benzene, ethyl benzene, toluene, vinyl chloride, dichloromethane, trichloroethylene, 1,2, -cis-dichloroethylene, tetrachloroethylene, etc.). Oddly enough, neither methane nor carbon dioxide has an odor (which is why the gas company adds an odor to its gas pipelines to warn people of leaks and why every house should be protected by carbon dioxide detectors). What people smell when they pass a landfill is the hydrogen sulfide and various esters that give off a "rotten egg" odor. Of these components only the methane has any real energy potential. The aim of any efficient landfill gas to energy system would be to separate the methane for m the rest of the gas stream prior to its utilization as a fuel.

LFG Energy Potential

So how much potential energy is there in the methane portion of the landfill gas stream that can be utilized as a fuel source? Predicting how much landfill gas will be generated by a given waste mass over a set period of time is more art than science. This is because municipal solid waste (and its organic contents generating the landfill gas) is heterogeneous with highly variable constituents.

A computer model developed by the EPA, "Landfill Gas Emissions Model," or LandGEM, makes some simplifying assumptions based on empirical data in order to project gross estimates of landfill gas production over time. First it assumes for simplicity that exactly 50% of the landfill gas stream is methane and the other 50% is carbon dioxide, with trace elements assumed to be insignificant. The projected methane generation rate is a factor that determines the rate of methane production for each sub-mass of waste in the landfill and varies depending on several landfill characteristics (climate, waste moisture content, the abundance of nutrients for the anaerobic microbes, the pH value of the waste and the temperature of the waste, operational procedures such as leachate recirculation, etc.).

The model's assumptions are put into an equation that estimates the amount of gas generated annually as new waste is deposited and some portion of the old waste decomposes. These estimates continue until the end of the landfill's operational lifetime, when it stops receiving new waste. Peak production of landfill gas occurs at this point, and the rate of landfill gas formation then slowly declines. Given typical assumptions concerning the characteristics of the deposited waste, the average annual methane production rate would equal to approximately 272 cubic feet per ton of waste. Methane (not including the other landfill gas components) has a heat value of 1012 Btus per cubic foot. The 272 cubic feet of methane produced each year by a ton of disposed waste would therefore have a potential heat value of over 275,000 Btus. This figure represents potential maximum energy content. The actual energy recovered and put to use will depend on the overall efficiencies of the landfill gas to energy system equipment.

Collection and Extraction

Often neglected in the evaluation of landfill gas collection technologies because it is not directly part of the landfill gas management system is the necessity for an impervious final cap and cover. This prevents atmospheric infiltration into the landfill (with potentially catastrophic consequences as the intake of oxygen makes fires within the waste mass much more likely). This barrier greatly improves the efficiency and the radius of influence for individual gas extraction wells. In turn, this means that fewer gas extraction wells will be necessary to provide complete coverage of a landfill's limits of waste.

Active landfill gas extraction wells are typically located within the limits of waste and set at depths of approximately 75% of the waste thickness at the well locations. The deeper wells tend to be located in the center, with shallower wells around the waste perimeter. The changes in depth also result in changes in the zones of influence of the respective wells, so placing them to ensure proper overlap and coverage is critical. The wells themselves usually consist of 6- to 8-inch-diameter polyvinyl chloride (PVC) pipes, both solid a slotted segments with the lower portion of the piping consisting of the slotted segments. The pipe assembly is set in a borehole with a typical diameter of 3 feet.

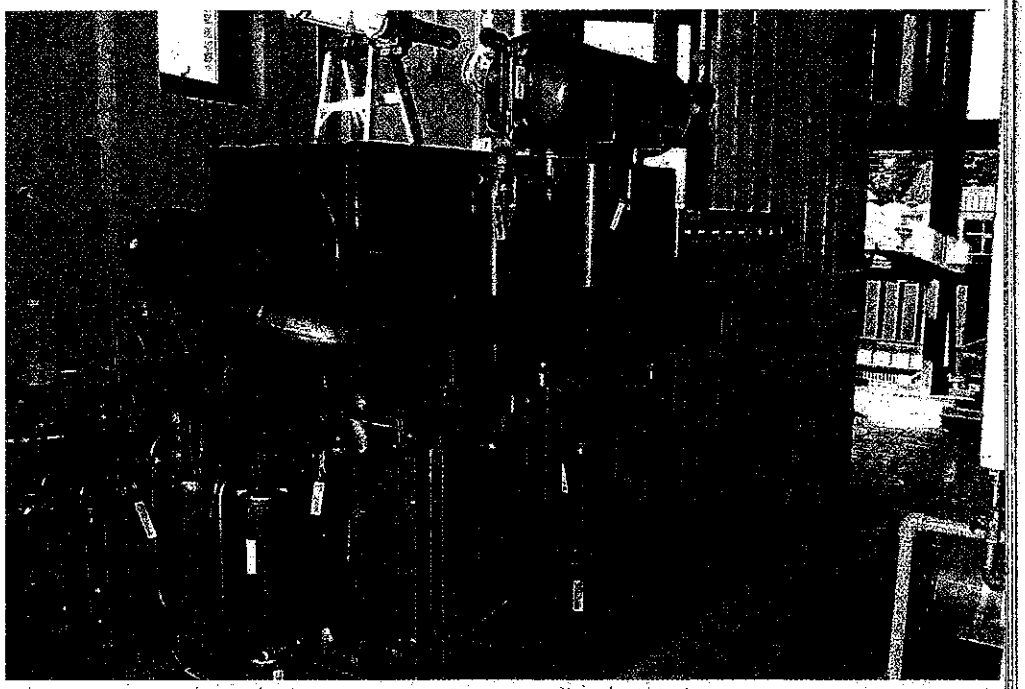
The borehole outside of the lower, slotted pipe section is backfilled with gravel to allow both the passage of gas to the well and provide the well with a filter medium. Above the gravel backfill is an isolation ring topped by a plug of bentonite to provide a tight seal against air infiltration. The seal usually extends up into the final cap-and-cover layer and ties off to this layer in order to provide a complete seal at the well borehole. The well piping extends up and through both the seal and the final cap-and-cover to an exposed wellhead assembly. The well head consists of a valve to adjust

flow rates, a port for sampling the landfill gas and a flexible connection to the adjacent lateral pipeline.

The lateral pipeline is set in a horizontal trench either above or below the final cap-and-cover system. Placing the pipeline above the final cap and cover allows for ease of repair, while setting it below allows for ease of construction. The pipe itself is solid-walled and is typically 8 to 12 inches in diameter and constructed of either Schedule 80 PVC or SDR-11 high-density polyethylene (HDPE). The lateral pieces act as branch lines, connecting the wellheads to a main header pipe that is typically encircling the landfill. The header pipe is of similar size or larger diameter than the lateral pipelines and is serviced by cleanout risers that extend to the surface and are located at regular intervals along the length of the header pipe.

The header pipe is connected to the landfill gas management system typically via one or more condensate knockout traps. Condensate is a liquid produced in the landfill gas extraction system. According to the EPA: *"Production of condensate may be through natural or artificial cooling of the gas or through physical processes such as volume expansion. Condensate is composed principally of water and organic compounds. Often the organic compounds are not soluble in water and the condensate separates into a watery (aqueous) phase and a floating organic (hydrocarbon) phase. This organic fraction may comprise up to 5% of the liquid."* Therefore, condensate typically contains toxic impurities at much higher concentrations than the gas itself. Condensate is collected in knock-out drip legs that either discharge the condensate back into the waste where it becomes leachate (if allowed) or is piped off separately to a storage tank for eventual treatment and disposal.

After discharging its condensate, the landfill gas continues along the header pipeline to the blower flare assembly used by most landfills. The blower is the mechanism that applies the negative atmospheric pressure to the entire landfill gas pipeline system and extracts the LFG from the various wells comprising the extraction system. These are high-volume industrial blowers adapted to landfill work from their original purpose of rapid removal of noxious or corrosive gases and fumes. Blower performance is typically rated in terms of flow rate (scfm of LFG), minimum negative pressure applied at the base of the flare stack (measured in inches of water column), maximum noise level while operating (decibels measured at a fixed distance, typically 3 feet from the blower) and electrical power requirements (typically three-phase where available). Blower fan production should be relatively smooth across the flare's range of flow rates to ensure efficient combustion and operate at minimum rates without surging.



Pneumatech

A landfill gas dryer from Pneumatech

Blower inlets and outlets are typically oriented horizontally. The blower impellor is rated by maximum tip speed (feet per second) with the blower limited to a maximum vibration during operation (with equipment movement measured in mils). The housing and general construction of the blower unit should allow for long-term exterior operations in adverse environments. Often, extracted landfill gas is simply flared away as a safety precaution, eliminating the methane as a danger (sufficiently high levels of accumulated methane can lead to explosions or asphyxiation in confined spaces) and at least partially combusting some of the trace constituents. However, for energy production a more complex operation is required that produces a purified gas stream consisting mostly of energy-bearing methane, without the noncombustible carbon dioxide or other toxic impurities.

Purification Methods

Purification of the landfill gas is a necessity before it can be effectively utilized as a fuel or an energy source. A comparison between typical landfill gas properties and standard utility pipeline quality gas specifications illustrates why this is necessary. Landfill gas typically has about half the Btu value of an equivalent amount of pipeline gas. Its hydrogen sulfide content can be as much as 250 times the maximum allowed under pipeline specifications, with 500 times the allowed amount of water vapor. The landfill gas can have carbon dioxide, oxygen, and nitrogen quantities 10 to 12 times greater than those allowed by the gas utilities. Lastly, the purified methane has to be delivered under pressure that meets pipeline requirements (100 psi to 600 psi).

The goal of a landfill gas purification process is to produce a stream of methane with levels of purity as high as is physically and chemically possible. The purification process usually involves several steps. First, intrusion of atmospheric nitrogen and oxygen into the well field must be limited as much as possible. Second, the moisture content of the landfill gas stream must be removed. Next to be eliminated is the hydrogen sulfide and the other trace contaminants. The last—and most significant—component to be removed before the conversion to useable methane is complete is the carbon dioxide, which can constitute the bulk of the landfill gas stream. Various methods are available for removal of each type of unwanted compound from the gas stream.

Solvent absorption is a preferred method of extracting carbon dioxide from industrial gases in general and for purifying natural gas in particular. In this process, liquid chemicals

are used to absorb carbon dioxide, which is then released when the absorbing liquids are subject to higher temperatures. The first step occurs in an absorption column filled with the extracting liquid. As the landfill gas is bubbled through this column from below, the carbon dioxide is stripped from the gas stream, the rest of which continues to the top of the column in purified form. The carbon dioxide laden liquid is pumped to a desorption column where it is heated to 120°C, releasing the carbon dioxide. The stripped liquid is then recycled back into the absorption column.

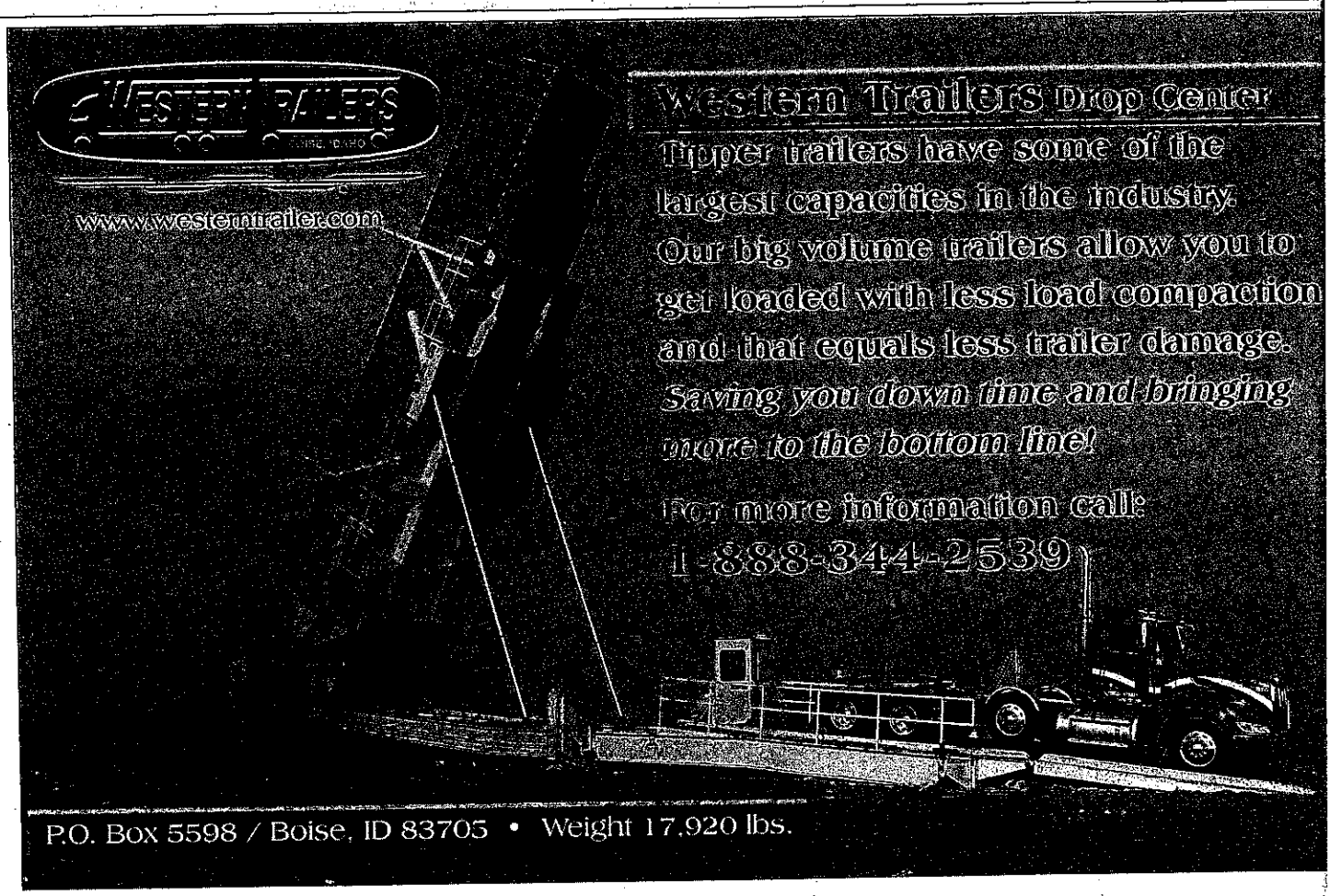
Pressure swing adsorption (PSA) is a non-cryogenic separation process that functions under near ambient temperatures. It is based on the fact that different gases have different propensities to be attracted to different materials and surfaces. A nitrogen removal process utilizing PSA would involve the use of an adsorption bed consisting of porous materials with a natural inclination to attract nitrogen. Most of the nitrogen will remain in the bed, allowing the passage of a purified gas stream. Later, the nitrogen can be removed for the adsorption bed by means of reducing its pressure. A variation of this process is temperature swing adsorption where gas release is triggered by changes in temperature, not pressure.

Membrane separation is often used in conjunction with other gas separation techniques. This technique is an absorption process that utilizes hollow fiber membranes as contact media for gas flows. Porous polymer membranes are the preferred contact media. The membranes can operate at 2,000 psi pressure differential and at temperatures as high as 200°F to 400°F. Operationally, membrane separation is based on the physical principle that certain gases permeate across a barrier faster than others. The hollow fibers utilized by these membranes are no bigger than twice the diameter of a human hair. By applying gas flows at given operational pressures and temperatures the desired impurities can be forced through the membrane (or conversely retained by the geomembrane) for later sequestration.

"CO_2 washing" is an innovative new approach that takes advantage of the different reaction of the landfill gas components to lowered temperatures. At the same pressures, carbon dioxide gas tends to liquefy at a higher temperature than methane. So when the landfill gas stream is subjected to refrigeration, carbon dioxide will transition to liquid while methane remains gaseous. In a vent stack, the now liquid carbon dioxide falls backwards, counter to the upward direction of the gas stream, as a mist of small droplets. As they fall, the droplets act as a carbon filter, picking up the trace impurities as they drop. Meanwhile, the now almost pure stream of methane continues upward through the vent stack to its final destination. The chilled liquid carbon dioxide can be utilized as a commercial refrigerant (dry ice).

Storage and Transportation

The preferred form of transportation for methane recovered from landfill gas is the standard natural gas pipeline utilized by the local gas utility. This is practical only in those situations where a landfill generates enough gas in sufficient quantities to make it worthwhile for the utility to include it in the pipeline. Even for large landfills, only those with a conveniently close pipeline can hope



to make an economical connection. However, the piping of even purified methane into natural gas pipelines is often forbidden by many states due to the potentially high nitrogen content of the methane. The utility will have very stringent quality standards for the purity of the methane that it accepts. Even purified natural gas can have significant nitrogen content.

For those situations where purified natural gas is to be used locally (usually by the landfill itself), storage in pressurized tanks is a necessity. Further refrigeration is often required for compacted storage of the now purified methane in standard liquid natural gas storage tanks. For the most part, the storage of large quantities of landfill gas onsite is often uneconomical and landfill gas not intended for direct and continuous use as fuel or as an energy source will typically be flared off. However, since landfill gas production rates can be highly variable over the operational lifetime of the landfill, onsite tank storage facilities can provide a useful surge capacity, evening out the process flow rates.

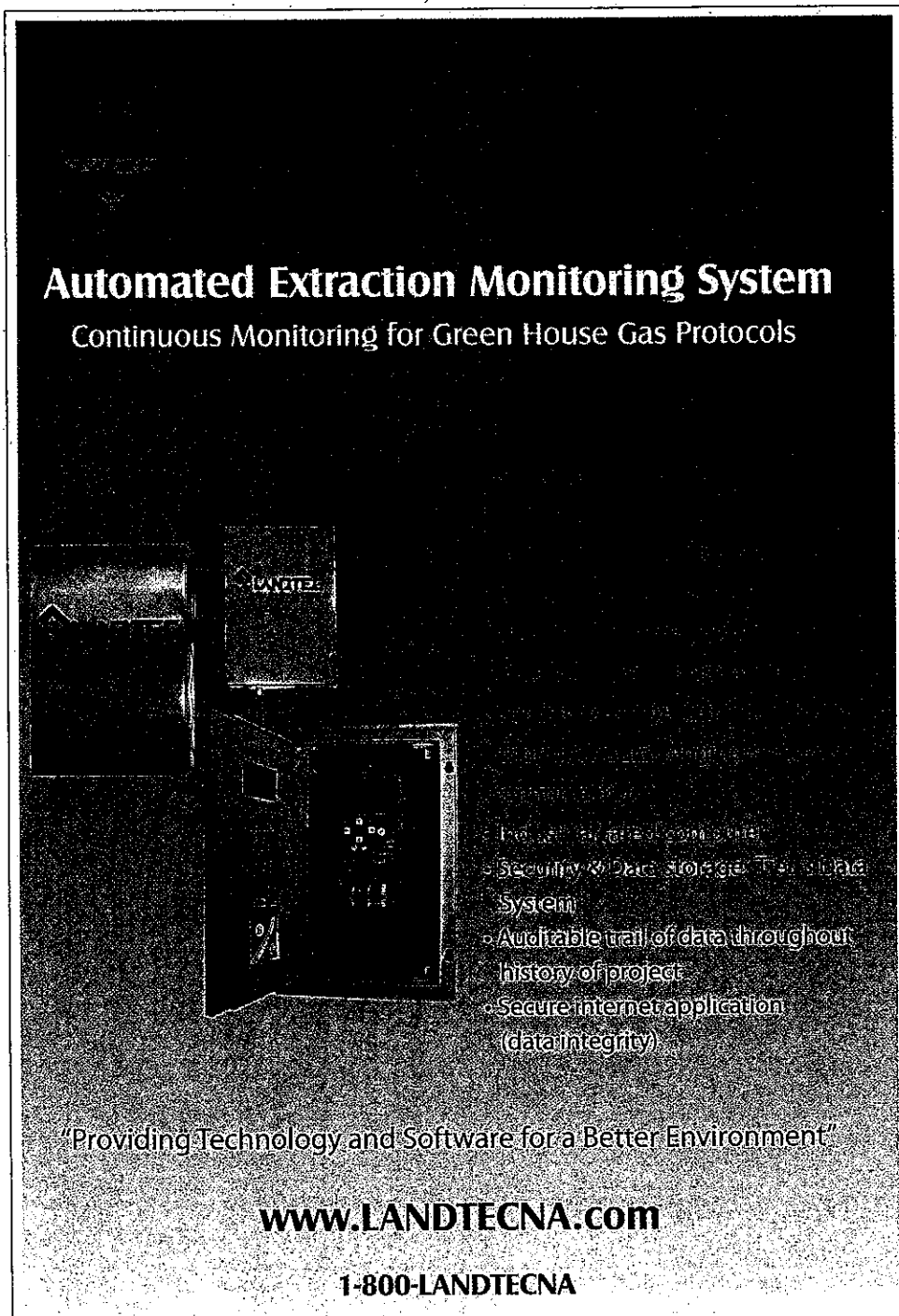
Electricity and Fuel

As mentioned above, for most moderate to small landfills, collected and extracted landfill gas is simply flared off as a nuisance. However, on larger landfills producing significant quantities of landfill gas, the heat from the flare can be utilized to heat a boiler, which in turn runs a turbine, or used directly as fuel to run an engine,

There are also situations where methane extracted from the landfill gas is of sufficient purity to meet local pipeline gas specifications and can be sold directly to a natural gas utility. In this scenario, purified methane that meets the specifications for commercial natural gas sale and transport is pumped under high pressure into a nearby natural gas pipeline system. Flow gauges measure the quantities of recovered methane that are distributed to the pipeline network. In addition to the technical hurdles described above, the economic viability of this approach depends greatly on natural gas prices, with higher prices making the use of methane from landfills more financially attractive.

Methane used as fuel in the form of compressed natural gas (CNG) in another option. CNG vehicles can be used as a clean alternative to gasoline and petrol. CNG is made by compressing natural gas to 1% of its volume under normal atmospheric pressures. CNG has a much higher octane rating than gasoline and utilizes a standard internal combustion engine, but CNG-powered vehicles require pressurized tanks for fuel storage. Fears of explosions, however, are unfounded. In fact, CNG vehicles are safer than gasoline vehicles, since CNG is lighter than air, and a leak would quickly disperse.

The simplest application of landfill gas energy is the production of direct heat. Even landfills that don't produce large quantities of methane can utilize the heat from a modified flare to operate a radiant hot-water heating system for nearby offices and buildings. In such a system, the landfill gas flare is used to heat tubes filled with water or air that carry the heat to radiators located inside neighboring buildings. Such a system becomes economical when the capital cost of the piping and radiators is compensated by the reduction in the costs of other utilities providing heat. Other innovative direct-heat applications utilizing landfill gas as a fuel source include evaporation of industrial liquids, creation of dehydrated products and



dry powders, incineration of sludges with a high moisture content, and the curing and processing of commercial and industrial products ranging from animal feed to bricks.

America's Energy Mix

LMOP is the US EPA's Landfill Methane Outreach Program. Its mission statement is to provide *"voluntary assistance program that helps to reduce methane emissions from landfills by encouraging the recovery and use of landfill gas as an energy resource."* It does so by forming partnerships with landfill gas and energy industry players (communities, landfill owners, utilities, power marketers, states, project developers, tribes, and nonprofit organizations) to encourage project development. They assess technical feasibility of landfill gas to energy proposals, investigate market demand for the resultant energy, and provide financing to underwrite the proposal. Its ultimate goals are to effectively develop landfill gas as a viable alternative fuel while reducing greenhouse gas emissions.

As an overall solution to America's energy needs, the methane from landfill gas is far from a silver bullet. Overall quantities remain small compared to consumer energy needs and the sources of landfill gas (the landfills themselves) are often located in areas that make access to the power grid inconvenient. On a per capita basis, the amount of energy generated by methane from the waste thrown out by individuals is only a fraction of an individual's energy needs. Bioreactor landfills (where water is deliberately introduced into the waste mass to accelerate rate and amount of waste decomposition and landfill gas formation) change the equation somewhat. But bioreactor landfills are relatively new and have significantly higher operational needs than a typical "dry tomb" landfill.

For typical landfill-gas-fired steam boiler turbines operating at acceptable efficiencies, approximately 11,700 Btus of heat energy are required for each kWh of electricity produced (source: USEPA Landfill Methane Outreach Program, LMOP). The average American household utilizes 11,232 kWh (the United States consumes approximately 3,656,000,000,000 kWh per year. Source: Energy Information Administration, 2007). If all the waste that Americans dispose in landfills could be efficiently tapped to run a steam boiler turbine, it could provide only 0.1% of America's total electrical needs. Methane extracted from landfill gas by itself will not meet that growing energy need.

However, these nationwide averages are not very meaningful when evaluating individual landfill-gas-to-energy projects that could provide energy for local populations. In such local niche markets, landfill gas to energy can play a significant role in cutting overall costs and providing a more diversified energy mix. Local economics and energy needs will be deciding factors. For example, it may not make sense for an isolated landfill to utilize its landfill gas to generate electricity to sell back to the power grid servicing its waste market area. But it may make perfect sense for that same landfill, facing rising fuel costs or wild springs in price, to install a landfill gas to compressed natural gas fuel system to help run its equipment fleet.

Furthermore, the indirect payoff in the utilization of the methane portion of the landfill gas stream is an overall reduction of its effectiveness as a greenhouse gas. In addition to creating heat energy, the combustion of methane in an oxygen environment yields carbon dioxide and water [CH_4 (gas) + $2O_2$ (gas) → CO_2 (gas) + $2H_2O$ (liquid) + 890 kilo Joules/mol]. Methane released into the Earth's atmosphere will have a much greater impact on climate change than carbon dioxide (the gas most people associate with global warming). Methane's effectiveness as a greenhouse gas is 25 times greater than that of carbon dioxide. Assuming a landfill gas flow consisting of half methane and half carbon dioxide, complete combustion of its methane portion will result in a reduction of its overall greenhouse impact by a factor of 13 to 1. This in turn will indirectly reduce the impact of global warming, reducing the energy needs required to keep our homes and places of work comfortable and livable. **MSW**

Daniel P. Duffy is an environmental engineer employed by CEC Inc. in Cincinnati, OH.

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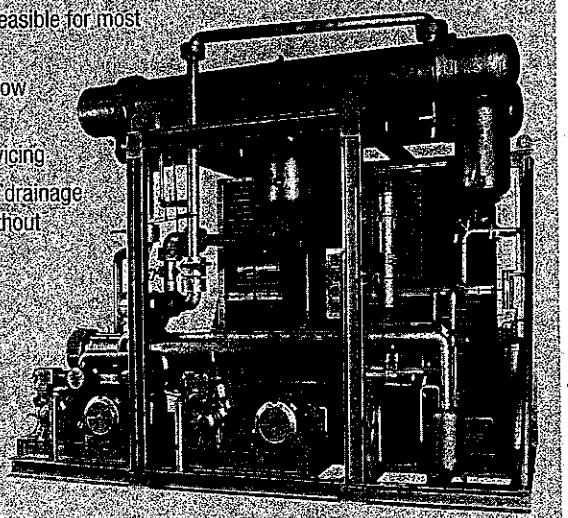

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