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Odorous Assault

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While perhaps the increased emphasis on separate collections of organic wastes such as food scraps and other green waste has contributed to more odors, the development of neighborhoods closer to what was once a remote MSW operation is the overriding factor, say industry observers. Marc L. Byers, owner of Byers Scientific & Manufacturing, notes that odor is an ongoing challenge for landfills and compost operations, but not because of biological changes.

"Odors are still derived from all of the typical wastestreams," he points out. The prevailing issue, he adds, is progress: "As communities expand further out from previous areas, they eventually start to butt up against landfills."

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On a website for Sunshine Canyon Landfill Local Enforcement Agency (SCL LEA), in California, maintained by Eugene Tseng—an environmental engineer, attorney specializing in environmental sustainability infrastructure planning and environmental law, and teacher at UCLA—a September 2015 report outlines odors' myriad sources. Odors are not now just "fresh"—that is, odor from trash being dumped and spread on the working face during operating hours, but more significantly are emanating their own distinctive smell during non-operating hours from landfill gas (LFG) through the existing daily cover and intermediate cover, according to the report.

It goes on to say that, despite the application of compacted daily soil cover for many years, odors continue to be a problem and are coming from a variety of sources, mandating a more comprehensive approach.

Odors may be sourced from waste vehicles: from the incoming trash, from litter or liquids that may fall from the vehicles, while vehicles wait in queue to dump, and during the unloading process at the tipping face area. Odors also may be sourced from the fresh trash on the working face before it is covered, trash carried into neighborhood by winds, carried by LFG, which passes through the fresh trash that has been disposed or placed upon the working face during operational hours, the LFG through the daily cover, and the odor that passes during closed hours through fresh trash that has been disposed upon the working face and daily cover.

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Additionally, odors may be carried into the neighborhood via the water spray used to mitigate odors as odorous compounds attach to heavier droplets of water, from older decomposing trash not captured by the LFG collection system, or result from operational activities associated with landfill repair and maintenance such as LFG collection well installation, trenching, well repair, equipment breakdowns, and shutdowns.

Other odors occasionally present that may contribute to complaints from the community include leachate collection and treatment systems, portable toilets, naturally occurring sources associated with an adjacent oil field and from decomposition of plants that are part of the natural habitat areas or from plants that have not taken root on the intermediate (and other) cover areas, or from community sources such as manure from horse properties and curbside trash collection.

The agency recommends the most significant mitigation arises from an approach combining practical preventative programs, facility design features, operational practices, maintenance protocols, and odor alleviation programs providing for optimal operating conditions at the working face and of the LFG collection system.

In his presentation on an integrated strategy for effective odor control at WasteCon 2016, Ray Kapahi, odor control specialist at NCM Odor and Dust Control, pointed out how odors can be categorized by

character—"rotten egg," pungent, sweet—strength (parts per million), and duration.

Odors are classified as fugitive or point source, with most landfill odors classified as fugitive. They are transient or steady state.

The fugitive nature of odors makes them difficult to intercept and treat, notes Kapahi. Odors dilute in response to local winds and vary with atmospheric conditions, such as wind speed and stability. Dilution involves large air volumes, he adds.

Odorous sulfur-containing compounds such as dimethyl sulfide have a very low threshold of odor perception, notes Kapahi. For example: hydrogen sulfide (0.0047 ppm), ethyl mercaptan (0.00019 ppm), and dimethyl sulfide (0.1 to 0.01 ppm).

Visualizing movement of fugitive dust can help people understand movement of odors, which have a plume movement entailing height and distance, says Kapahi. "The fact that odor complaints persist in spite of our best efforts indicates the difficulty in controlling odors," he says, adding the use of appropriate technology, products, and monitoring can minimize but not completely eliminate odors.

For landfills handling MSW, odors can change "dramatically in intensity and character within minutes," notes Kapahi. He points out that landfill operators have no control on waste variables such as age, origin, and local temperatures. Additionally, one odor can overpower another depending on the specific situation.

Environmental and geographic conditions can magnify odor problems, Kapahi points out, adding environmental effects include weather and temperature inversions that lead to odor buildup.

Location also affects odor movement, says Kapahi. "Odors from landfills located in hilly terrain pose a unique challenge to operators due to changing wind conditions, both spatially and temporarily," he says. "Under these conditions, the odor mitigation system needs to be responsive to changing conditions."

Michael Lannan, president of Tech Environmental, notes a general trend regarding landfill odors "is that the expectations from neighbors are that thou shall not be a nuisance are based on not being a nuisance and they're not necessarily numerical definitions."

An example of areas that do have numerical definitions would be a dilution to thresholds, such as how much air does it take to dilute an odorous segment of air to become non-odorous, he says. "That's an indication of the strength of an odor," adds Lannan. "Areas that have those types of regulations tend to establish an understanding of what would and would not be a nuisance."

Tech Environmental trains regulators and MSW operations' owners and operators in understanding what is an odor and what could potentially be a nuisance. In the initial training stage, regulators tend to hold the opinion that if they can smell something, it must be a nuisance, says Lannan. Eventually, those going through training understand odor is everywhere every day, but when it changes behavior, that's when it starts to become a nuisance, he adds.

"If facilities have an expectation of a nuisance threshold, that is very advantageous," says Lannan.

Laura Haupert, director of research and development for OMI Industries, points out that compared to other industrial applications such as wastewater treatment and asphalt production, landfills face more challenges in fighting odors. "Landfills often encompass many acres and are constantly changing, with new areas being continually filled in with waste," she says. "As they also become higher in elevation over time, keeping foul odors from being carried off by often-erratic wind patterns becomes all the more difficult."

While landfill odor problems typically remain consistent, certain times of the year such as hot summer months can intensify the foul smells as food items rapidly deteriorate, attracting the bacteria that causes foul odor, says Haupert.

In rainy periods, extra moisture can lead to the trash decomposing much faster. Wind can carry the foul odors into neighboring residential and commercial areas, she adds.

Whether one odor can start to overpower another is not so much an issue as the mixture of multiple odor sources, says Haupert.

"The number one influence to odor issues at any solid waste facility is most definitely the proximity of their neighbors," she adds. "Also having impact are moisture, humidity, agitation, and temperature, which makes the summer months obviously more difficult. Receiving different types of solid waste such as food-related garbage can make odor management a challenge for any landfill. If neighboring houses

are at a lower altitude than the landfill—in a valley-like environment—the foul odors can travel down and essentially get stuck in these areas."

Other factors such as distance driven to the landfills and the financial obligations in collections contribute to odor challenges, says Todd Dunderdale, vice president of marketing for Komptech Americas. "There are tipping fees and tipping fees drive recycling," he says. "There's also the issue of landfill space. If you have a landfill that is 100 years and you are concerned about diversion and your landfill tipping rate is $25 a ton, it doesn't leave much more to recycling."

Komptech Americas' equipment is used for everything from shredding for volume reduction at landfills to windrow turning for compost, as well as reclaiming various wastestreams. The company bases its approach on European waste practices and the issues that have occurred overseas. "They've run out of landfill space and have had a lot of incentive to recycle because of legislation requiring them to do that," says Dunderdale. "The tipping fees are astronomical. You put that all together and you've got a lot of diversion. We've got to find a way to keep everything we can out of the few landfills we have left.

"We have a very large population density with a very small landfill space," he adds. "If you look on the East Coast, there are very few landfills and they're shipping their waste to Ohio. All of the waste is going to be transported by rail to the center of the country."

Permitting for a landfill is difficult as is expanding an existing one and no one wants one by their neighborhood, Dunderdale points out. "Odor shouldn't be a problem if it's being treated right and the landfill is located where there aren't many people," he adds. "The reason it continues to be an issue is that people have moved away from cities to places where they are close to the landfill. At some point, they can't transfer the trash further and there's not economics in doing it that way. Eventually, all of the landfills are going to have to start pre-treating their waste."

Lannan says changing wastestream is affecting odors, especially in the Northeast. Pulling organic material out of the waste stream has a positive effect on landfill odor generation, he says, adding that the odor does transfer into wherever the organics is being processed.

In situations where waste is moving further away from its generation point to the disposal location, "that added time takes away from the time when you apply the fresh material before it has a significant amount of cover on top of it," points out Lannan.

The number one solution to dealing with odors is having a standard odor control plan, notes J. T. Bielan III, director of sales and marketing for Rusmar. "The most successful landfills are the ones that are proactive about their odor control policy," he says.

Rusmar offers technologies that include alternative daily cover systems of cover material, application equipment, storage, and dilution equipment designed to meet the performance criteria of Subtitle D.

The cover material, RusFoam ADC, is designed as a non-hardening protein-based foam that can be adjusted to last from overnight to over a weekend by changing dilution ratio and depth of coverage.

The application unit, PFU2500, is a self- propelled, single operator, Caterpillar-based system designed to cover a 28,000-square-foot working face with a single fill in 40 minutes. The BSD7000 storage and dilution system is designed for bulk deliveries of RusFoam ADC and connects to PFU2500 with a single hose.

The BSD7000 automatically dilutes the RusFoam ADC concentrate, pumps the desired volume of diluted material to the PFU2500, which uses compressed air to generate 50,000 gallons of foam per fill.

Rusmar also offers various-sized trailer-mounted foam generation units to meet the smaller landfill needs. They are fitted with hose reels or turrets for ease of application. Supplemental solutions include perimeter odor control methods such as RusScent Odor Neutralizing Granules that can be applied with the company's nozzle spray or mist stick systems.

Kapahi contends that most facilities are not using the most up-to-date odor mitigation systems available today. According to Kapahi, three elements of an odor control strategy include identifying their source, monitoring them at the facility and treating them near the source, such as a landfill's working face, fugitive LFG, and compost windrows.

An operation should continually monitor odors and wind, says Kapahi. In monitoring odors, an H2S analyzer such as Arizona Instrument's portable Jerome 631 Gold Film Hydrogen Sulfide Analyzer is designed to display low level concentrations within seconds. It offers an analysis range of 0.003 to 50 ppm for odor and corrosion control, safety, and leak detection. Locked in survey mode, the instrument

can display concentrations every three seconds. It comes with an internal rechargeable battery pack or alternating current (AC) power.

Current odor technologies can be divided into three main categories, says Kapahi:

- Topical sprays: This type of system is a spray-bar type application allowing sites to directly apply odor control neutralizing agents to the odorous source. This is used for treatment of sludge odors, working face odors, or aids in treating odors when landfills are conducting odor-causing events.
- Portable odor control systems: There are multiple types of portable odor control systems that disperse neutralizing agents, from waterless vapor units, to misting systems. Landfills use these to treat areas that don't have readily available power and water. These units are also beneficial for landfills to aid in spot treatments or small areas that have breakouts.
- Perimeter systems: These are used to treat potential fugitive odors by positioning the odor control system in a location that is going to allow the neutralizer to mix with the odors. The release of odor neutralizer in a liquid or gaseous form into the air can be achieved by using a water-based atomizing system or a waterless vapor system.

Both odors and wind should be monitored onsite, says Kapahi, adding that such monitoring should encompass frequent onsite and offsite staff patrols. Control odors at or near the source, he says, adding the greater the distance between odor controls and the source, the lower the effectiveness.

Landfill and compost operators should consider a two-tier odor control system that includes source- and perimeter-based approaches. The delivery system of odor neutralizers is as important as the neutralizer, he says, adding that an odor control system must be dynamic and respond to changing levels of odor emission.

The best way to counter landfill odor problems is to seek out solutions that are both effective and safe for employers and the community, Haupert points out. "There are solutions that use natural ingredients to eliminate industrial smells without the need for harsh chemicals or masking fragrances," she says. "These solutions can be dispersed through oscillating fan systems, vaporization, atomization nozzles, and even sprayed on waste being transferred by trucks."

OMI offers Ecosorb technology, a blend of plant extracts, food grade surfactant, and water designed to eliminate organic and inorganic odors on a molecular level without the use of harsh or hazardous chemicals, emission control systems, or masking fragrances.

In transfer stations, Ecosorb often is dispersed through vapor systems that can be ducted to exhaust fans, doorway perimeters, and any other areas where odors might escape. Landfill operations use Ecosorb through the use of perimeter vapor systems and oscillating fan systems for direct application to the workface.

Ecosorb Spray Gel solution is used to cap odors from escaping into the atmosphere and can be dispersed onto trucks hauling solid waste or sludge and around landfills to effectively and safely neutralize malodors, says Haupert.

Tech Environmental helps its clients work on air quality, odor, noise, and dust issues affecting landfills, neighbors of landfills, and regulators. The company focuses on nuisance potential relative to odor, examining such factors as the existence of a regulation that specifies odor numerically and if not, what would be an appropriate regulation. "We help people understand that, help with some control technologies if necessary and help them get permitted," says Lannan. "In many landfill cases, the key is to establish an odor prevention and response program defining the odor baseline. As the landfill changes, the operators and management can monitor that."

Monitoring the amount of odor considered acceptable onsite that doesn't result in offsite nuisances enables landfill operators to modify those onsite odors before a change occurs in offsite odors, he adds.

Tech Environmental does not promote one odor technology over others on the market. In most cases, the best approach is a mix of odor control technologies, says Lannan, adding from a source point of view, landfills are area sources, whereas composting can be area, point or volume sources, depending on the technologies used, of which one may be more beneficial than the other.

The primary issue for all landfills is managing expectations, says Lannan. "Very often, landfill operators feel they are managing expectations relative to their job descriptions and tasks and they very well might be doing that, but it's getting everybody understanding what the expectations are, and managing them together."

Byers Scientific and Manufacturing first conducts an odor assessment to establish an immediate understanding of whether the odor is working face or LFG. "If you're not using an odor panel and just being binary, it's either this odor or that odor," says Byers. "It's the first step in an assessment—is it landfill gas, or is it garbage odor? Those two are distinctive. If it's garbage—which is working face odor—it all smells the same from one landfill to the next."

However, everyone's sensitivity is somewhat different, Byers points out, adding what really affects odor more than the waste stream is landfill practices. "Even the best-run outfits with gas wells can still have landfill gas that percolates up through the ground that they're just not able to pinpoint and that can get into the airstream," says Byers.

If a determination is made that there is a fair amount of fugitive malodor, Byers Scientific & Manufacturing's waterless vapor phase technology is installed. "We put a perimeter around the landfill inasmuch as we can," says Byers. "It doesn't mean 360 degrees. It's really more putting a virtual wall of deodorizer in its vapor state downwind of the emissions source and upwind from an affected community."

The waterless vapor system can go 500 feet or 4,000 feet continuous, says Byers. The equipment takes a third-party liquid formulation, transfers it to its vapor state and delivers it through a piping system, creating what Byers calls a "virtual curtain."

The malodors being addressed is why the company focuses on vapor technology, says Byers. "It's never pure H2S [hydrogen sulfide]—it's H2S with something attached to it," says Byers. "You can't see those odors because they're a gas. If you can't see them, that means they're traveling in the wind stream. The best way to combat them is to increase the probability of contact of the deodorizer molecule with the odorous molecule as opposed to a misting system."

Byers contends that with misting systems, "the fact that you can see it right there is a bit of a weakness, because clearly, those droplets are heavier than air, and while they're going to carry in the air for a short time, they're going to fall eventually.

"Anything they don't come into contact with, such as fugitive malodor compounds, are free to travel the air stream and ultimately make their way to a neighborhood. Better to put a vapor up in the same airstream so they travel together further."

Deodorization is predicated on physical contact, notes Byers. "The deodorizer has to come into physical contact with the malodor and a number of different chemical reactions such as absorption or displacement can take place," he says. "In its gaseous state, the only thing that's going to keep up with it effectively is another gas. That's why we deploy vapor systems."

In applications where the goal is for the deodorizer to fall out quickly, the company will employ a fan system using atomization. "That's what we call closed quarters fighting—the working face as an example," says Byers. "In that case, we want products that are heavy, getting right out over the top of the working face and falling down onto it. That way, we're increasing the probability of contact. We apply that same methodology—whether it's vapor or misting—to material transfer stations where we do a virtual vapor curtain around the doors."

Byers points out that while communities surrounding landfills may be put off by the odors, another concern is whether the "cure" is worse.

Byers Scientific & Manufacturing has undergone and passed the highest level of EPA guideline testing for toxicity in addition to engaging in third-party research showing the product significantly exceeds acceptable standards, Byers says.

Timothy K. Nytra, principal with Civil & Environmental Consultants, points out when it comes to landfill odors, "an ounce of prevention is worth a pound of cure. The proper management of these items minimizes offsite odors through the design and installation of active LFG systems, final cover caps and a well-maintained working face."

It is much easier to prevent offsite odors from becoming a problem rather than correct the problem after it's become an issue, Nytra points out. "Most of the offsite landfill odor issues that become a public nuisance are the result of an ineffective LFG system that needs to be improved and or expanded," he says. "The elimination of offsite LFG odor is not readily resolvable with a quick fix."

The solution is accomplished at a considerable financial cost to the landfill and may take weeks to resolve, much to the anger and resentment of the affected residents complaining of odor, and the governing regulatory agencies receiving public complaints on a daily basis, he adds.

As odors are a function of the waste that was and is being disposed of at the landfill, they change and evolve during the landfill's life, says Nytra. "For example, if the landfill begins to accept sewage sludge from a municipal wastewater treatment plant for the first time and does not take the proper precautions to quickly bury the sludge or mix it with other waste types when it arrives, then it is possible for the smell of sludge to migrate offsite," he points out.

Persistent offsite odors are not standard operating procedure for a landfill, Nytra contends. "Properly operated landfills do not generate persistent offsite odors," he adds. "That's not to infer that an occasional odor won't be detected. Landfills are complicated and there are many variables—including weather—that impact offsite odor."

If the landfill doesn't properly maintain its active LFG system, construct final cover shortly after waste reaches permitted grade or manage the working face on a daily basis by covering the waste at the end of the day, then it is possible that odor could migrate offsite and become an intense nuisance issue, says Nytra.

Some wastestreams are "much more fragrant than others" and as such, their smells could dominate all the other wastestreams.

Nytra points out that of all of the technologies available to combat shifting or changing odors, they all have varying degrees of effectiveness. "It is best to use a neutralizer and not a masking agent," he says. "Dispensing a cherry- or lemon-scented fragrance into the air of the surrounding neighborhoods will generate as many complaints as the landfill odor itself. Each landfill is unique given its location, prominent wind direction and the type and amount of waste received. Odor products that have some degree of success at one landfill may not work at another."

Incoming wastestreams are a "huge" factor that landfill operators must understand and be ready to handle, says Nytra.

Compost has its own unique odor generation. Dunderdale notes that the decomposition of organics results in greater odors.

"It's like putting green waste in a trash bag and tying the top of it," he points out. "It creates ammonia gas and when you open it up again, it reeks." A primary preventative approach is diversion through a dedicated green waste program and proper composting that addresses the underlying odor problems caused by anaerobic conditions.

Odor is one of the more difficult facets to manage on a compost site, "and is one of the issues that can cause a facility to be fined or shut down, so it's critical to them," notes Nathan O'Connor, marketing and product manager for compost products for Reotemp Instruments.

Reotemp Instruments offers an oxy temp probe which samples oxygen and temperature. The probe is inserted into a compost pile; the sample drawn is analyzed for the percentage of oxygen that is present. "It allows them to know if their pile has gone anaerobic or has a very low level of oxygen, which can be very relevant to odors," he explains. "If the oxygen levels go to the point where it's gone anaerobic, odor issues can be a lot more prevalent."

SCARAB International offers a variety of windrow composters from 8 feet wide 4 feet tall, to 27 feet wide 11 feet tall. The machines are self-propelled, straddle-type turners that will turn 6- through 27-foot windrows. They are belt- or hydraulic-driven machines with a track design and independent suspension, designed to allow the machine to "float" across many varieties of terrain. Drive systems options include front-drive tires with castors in the back or transverse configuration, four-wheel drive, rubber tires, and full track 14 to 30 inches wide. Drums are available in six sizes with eight flail designs and various configurations. SCARAB constructs the machines to facility specifications and accounts for the type of material that is going to be turned, notes Richard Miller, sales manager for SCARAB.

The rule of thumb for using the machines is that no matter the composition of the material, the windrow should be turned two to three times a week for six to eight weeks at 60% humidity, Miller says. "By doing so, you're helping nature along its pathway to decompose and to create compost. We also recommend using a thermometer to measure the heat of the mixture. We always recommend that somewhere around 137 degrees Fahrenheit you can start, and that starts to erode and starts eating up all of the bad bugs in there. At 165 degrees, you're reaching greenhouse quality compost, which means it's killed all of the weeds, spores, and the bad bugs, no matter what you are turning."

In some composting operations, temperatures reach 137°F in two days, says Miller. "The more you turn it instead of letting it sit there, you put more air with it and it cuts the odor down. If you let it sit there, it's going to start losing its aeration, which goes into making an odor. It's going to trap the gasses.

When you aerate it, you're letting those gasses go. It mixes with the air, but with that process, you're reducing the odor."

He says the method is "simple, basic composting," which company founder Marvin Urbanczyk has taught at United States Composting Council conferences.

"Some companies might use bugs to enhance it," adds Miller. "That might speed the process up by two weeks, but if you can compost it naturally, that's the way to go."

Humidity is an influencing factor in the process. "The natural climate humidity will always affect whether the air is heavier or lighter. Arid climates are going to have to inject water into the piles to get it to compost. Dry matter can't really decompose. It has to have some type of moisture in there to act as the generator of the composting," says Miller.

A Florida operation produces compost in 20 days because the product is turned quite a bit in the high humidity climate, notes Miller. "They're under roof and they turn their raw sludge with yard waste. Anywhere you go, once you have that smell, you know what they're turning. You'll recognize the odor. The way they turn it as quickly as they turn it, their odor is very minimal."

Another operation in an arid area around Fresno, CA, has to inject water into the compost piles, Miller adds.

The occurrences of odor issues have become more numerous as municipalities fail to integrate odor and annoyances when they plan new buildings and infrastructure close to composting plants or landfills, says Yann Contratto, president and senior odor expert for OflactoExpert. "Most managers of a compost plant or landfill will tell you 20 years ago, they had no issue. This wasn't because people weren't less attentive to the odor, dust, or to the noise. The sites were implemented far enough away from cities to avoid any of these annoyances. Due to cities wanting to have more tax revenue, they've established more neighborhoods closer to these plants."

Another impact: the waste material. Case in point: Toronto. "In a few months, the city successfully moved ahead for the sorting of the organics to compost instead of going to landfill and the campaign had been very efficient—in fact, too efficient," he says. "Very quickly, the compost facilities in Toronto closed because they were completely full and then they were obliged to start to send the materials far away."

Toronto now picks up organics and takes them to an organics processing facility, one of which is the Disco Organic Processing Facility. An anaerobic digestion process is used to break down the organics, producing a digestate sent to contractors to be converted into compost for use in parks and gardens.

Odor was a byproduct of the quick success of the organics collection program, Contratto says. "We not only had traces of fish, chicken, vegetables, and fruits—we also had a lot of diapers. We had a lot of very odorous material inside these sortings and it was an absolute nightmare to treat everywhere."

He recommends consulting with the US Composting Council for information regarding what can and can't be composted, and to convey that information to the general population. "A compost manager would have tremendous difficulties to do that job appropriately because there would be too many odors and the compost would have decreased quality to it. When the information is not properly given to the population, it can very quickly become a huge odor issue."

The type of feedstock and the technologies utilized at a compost operation also can impact dust and odor emissions, he says.

An initial odor may be "acceptable," but after waiting three or four weeks before turning the material in the windrow, "the odor emission explodes during the operation, which can take three to four," says Contratto. "[The odor] can move very far into the population," he says, adding that the weather conditions also will play a factor and given the changing intensity of odors in reaction to temperatures, it's critical for a compost operator to be cognizant of the threshold.

Geographical placement also is a consideration, says Contratto. A compost operation in Maine may not have the same humidity concerns as one in California, he points out.

Topography is another issue. "There are a lot of land features that can change odor emissions," he says. "The best way to deal with that is through regulation of what can and cannot be emitted."

His company conducts odor impact studies. "If each state establishes a few odor impact studies on a compost facility, that can help them to regulate what can be acceptable and what cannot be acceptable in terms of compost features," says Contratto.

OlfactoExpert helps compost facilities and landfills by conducting olfactory audits and diagnoses, measuring emissions, and providing support. The company uses emetrics, a tool that draws together the operations of independent or assisted odor measurements, integrated sampling tools, outcome mapping, and real-time, reverse modelling calculations.

Rotochopper offers a line of grinders and shredders to process wood waste, food waste and other green waste inputs used to make compost, notes Nick Korn, West Coast regional sales manager for Rotochopper.

Wood waste can be ground up and added to other components that create a biofilter to help control odor, he adds. The machinery also serves to properly size waste so when it is put into windrows or aerated piles to compost it, it composts efficiently and in such a way that odor is minimized.

Some end users of Rotochopper technology are located close to residential areas "and are trying to prove urban composting can effectively be done even in a sensitive environment," he says, adding that the issue of controlling odors will take on increasing importance.

Odors evolve and change as the "tremendous growth and interest in food recycling" moves forward, notes Korn. "California, for example, has an upcoming mandate to move from 50% landfill diversion, up to 75%. One of the next key arenas to help accomplish that goal is food waste. Odor control is difficult for a lot of different materials—food waste in particular. Being able to process the food waste properly through our Rotochopper grinders, having the right mixture of food waste which is nitrogen dense and having the right ratios of the food waste with the carbon base and with the wood material is crucial."

Korn points out that some regions have flow control laws restricting the outbound movement of waste. "On the West Coast, it's that classic challenge of the majority of waste gets generated in the densely populated urban areas, and it costs money to move waste out of that area, so the goal is to show how it can be done most efficiently—how it can be recycled, turned into soil and mulched, or produce other products right in the local area. It doesn't make sense to incur a tremendous amount of transport costs when the compost and mulch that could be produced could be used by folks in the same area."

The Brown Bear Corporation's potassium permanganate product is used in situations where a sludge product from a wastewater plant is taken to a landfill and blended with green waste material to mitigate the odor that results from the initial mix into the composting processes as hydrogen sulfide and ammonia is given off. The company has a spray system for its composting equipment that applies soluble potassium permanganate to help knock down the odor, "which is really the bad odor you get a lot of complaints on," notes Stan Brown, owner of Brown Bear.

A 2–5% solution is used depending on the strength of the odor. "It doesn't mask it—it oxidizes it," says Brown. MSW
