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Don't Be a Nasty Neighbor

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"Not in my backyard" is a familiar phrase in the solid waste industry. People don't want a landfill in their neighborhood, but it's inevitable that these facilities are going to have some type of neighbors—whether residential, commercial, or industrial—so keeping those neighbors happy by reducing dust, odor, and noise is an important part of doing business.

Letting the Dust Settle

Landfills generate mud and dust, which can be carried offsite, creating issues on roadways. Dust is a huge issue, both with regulations and neighbors, states Jesse Levin, vice president with NCM Odor Control. The most common method of combatting it is to roll out the water truck, although that comes with a price: the cost of fuel and operator, and periodic shortages of water.

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To offset those costs, a high-pressure fan system can be used instead. "At the working face, you can use a stand system with water tanks and generators to knock down dust," explains Levin.

The drawback is that the fan system isn't effective everywhere. "The working face has only one area, so it works for that, but hitting access road is key to controlling dust."

Because studies question the effectiveness of water in dust and odor control, biodegradable dust control products can be added with little environmental impact. The benefit, Levin says, is that the dust control usage rate is below the mark when not using the product. That's important because the goal is to minimize applications and, in turn, operating costs. "Some sites use the water truck all day," he observes.

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A product that controls dust better than water does will result in fewer applications and savings. "We're the only company that offers an atomized vapor system for odor and dust control that's waterless," he adds.

Rinse, Repeat

The severity of the dust issue depends on geographical location, which affects the evaporation rate and soil composition. For example, red clay breaks up into small particles that are difficult to control, according to Tony Knight of New Waste Concepts Inc. (NWC), which designs, builds, and installs evaporation and misting systems for controlling odors and dust in the solid waste and other industries.

Knight says they're testing products to make the particles heavier. One product, HydraGuard, helps control dust on haul roads, as well as in other areas around the landfill. It can even be used as an additive to the daily cover for additional resistance to extreme weather. The proprietary liquid formulation of polymers is effective for long-term dust control in high-traffic areas because the polymers bond particles of dust into larger particles that are too big to become airborne.

Knight says that "Customers using our products reduce the amount and times of application," thereby reducing wear and tear on the equipment.

Quality access roads to the working face and well-maintained site access roads can help diminish the amount of dust and mud that get spread around. Road sweeping contributes to mud abatement and is particularly effective if the road surface is concrete or tarmac.

To further control mud and dust on haul roads, MobyDick Washing Systems remove solids from tires to minimize "track out." The closed-loop water-recycling wheel-washing system incorporates high-volume flow and low pressure to get solids so wet, they fall off.

"Dust is a huge problem," insists Robert Lodi, national sales director for the company he says is the market leader in the supply of heavy-duty truck, tire, and wheel-washing equipment.

The amount of dust created varies in relation to the type of items being unloaded and if the truck tires are dry or wet. "By making significant strides in management practices, you can halt the creation of dirt," he says.

A wheel wash at the exit of a landfill or the entrance to a transfer station can remove 80–90% of dust-creating solids. "The goal is to get the tires on the spray wash rack," explains Lodi.

An average wash in the drive-through system is 35 seconds. While the systems are customizable, the typical footprint averages 12–13 feet wide for the wash platform, a concrete pad slightly below grade to help manage water. An undercarriage wash and fresh water rinse 12 feet up the side can be added. Lodi says 10% of the facilities require a chassis wash.

Wheel-washes should be situated a reasonable distance from public roads to diminish a "skim" of mud left by trucks exiting the site. The skim may freeze in winter.

Dust control cannons designed for long-term operations in rough working conditions emit fine droplets of water that capture dust in the air and drop it down without creating mud. Energy-efficient, the cannons feature low decibel fans and a dual filter system to combine low water consumption with optimum water droplet size and extended throw distance. They can be mounted on pillars to elevate them at transfer stations.

Conventional Wisdom

Sometimes it's just as important to be proactive as it is to innovative. Firms like Ecolo, provider of odor control solutions, offers several solutions considered conventional practice in the integration of odor management systems.

These include perimeter vapor or high-pressure misting, portable misting cannons—self-contained with heaters for winter use, topical application of odor-neutralizing solutions on roads and working faces, spot treatment of "smelly loads" as they arrive at the working face, biochemical odor control on the working face or temporary open-cell application with foam tracing and leachate treatment, says Michael Beckley, president.

Ecolo allows site operators to efficiently reduce site-generated odor through misting and fogging or by applying topical treatment in areas such as:

- perimeter,
- door and bay openings,
- tipping floors,
- working face,
- roads and scales,
- leachate, and
- windrows.

Their dust control cannons come in many configurations with varying ranges. A site assessment determines what is most suitable for each application.

Going to the Source

Dust and odor are connected, so what helps control one often helps control the other. The law requires landfills to cover the working face daily; many use dirt to do so, which can contribute to dust. NWC offers a variety of cover materials that contain odor control agents to eliminate landfill odors.

Odors come from previously deposited waste disturbed by digging activities; malodorous wastes, such as industrial or agricultural wastes and sewage sludges; landfill gas; stagnant leachate ponds and evaporative ponds; and leachate treatment systems, particularly aerial spraying.

Methods of minimizing landfill odors include effective compaction; adequate cover; rapid deposition of malodorous wastes, using covered trenches where necessary; landfill gas collection and subsequent combustion; burial of excavated wastes; and prevention of stored leachate becoming anaerobic. "We focus on the surface of the landfill," explains Knight.

They create a geomembrane that restricts odor-causing gas coming out and moisture going in. The sprayable material is mixed with water. "It's a good 'film former,'" he says.

The best preventative, Knight believes, is a gas collection system, but it's expensive.

Sealed geomembranes are also good—and also expensive, and if the landfill is reused, must be thrown away. “Our solution is less expensive,” says Knight. “It does 90% of what a geomembrane does for less cost and only requires maintenance every three to four months.”

Bacteria and enzymes use microorganisms attack organics in the landfill, eliminating the cause of odors rather than merely masking them. “A lot of landfills use masking agents,” indicates Knight. “It’s a waste of money.”

Instead, he advises adding oxygen to raise the biological activity. “Leachate from rain must be treated. Nitrogen and phosphorous must be treated—it takes a lot of oxygen to degrade them; you must aerate.”

It’s also important to minimize moisture. Knight estimates that 20% of all rainfall ends up in the bottom of the landfill. Left untended, it creates odor. “You should restrict the amount of rainwater.”

On the other hand, perimeter misting systems are reasonably effective, although chemistry and barometric pressure affect their performance.

Weather the Storm

Weather affects the time of day and length of odor issues. Humidity, as well as wind speed and direction, factor into the odor equation. It’s important for landfill management to evaluate data in order to predict the weather. “You have to track weather,” insists Knight. “Do you have portable equipment?”

Using science to develop an odor control plan will “take things to a new level,” he continues. In order to mitigate odor and dust, you must know where they go. Tools such as three-dimensional (3D), topography, and computational fluid dynamics modeling show the air flow, miles per hour, direction, and density as air moves around buildings.

“There are lawsuits all over the place,” observes Levin. “Communities organize for class action suits against landfills. This industry is heading to court. People smell with their eyes; the psychological aspect is huge.”

Be prepared, he advises. “You need to have a plan in place.” First, determine which are valid odor issues through monitoring.

Conduct health and risk assessments, do tracer studies, gather data to be ready for potential legal questions. “A site can use scientific and legally defensible data in court.” Tracer studies identify the sources of odors, which are not always from the landfill.

Whether a landfill is preparing a legal defense or merely trying to be a good neighbor by reducing and containing odors, a consultant like OlfactoExpert Inc. can provide necessary information.

First, an audit is conducted in order to determine the source of odors. “We study them one by one,” explains Yann Contratto, owner. “We collect samples from different sources—the surface, the wastewater pond, and the arrival of fresh waste—and analyze them.”

Once the odor samples have been analyzed, teams prioritize the sources, analyze the data, and generate level II impact studies, including mapping that makes quantitative and qualitative studies possible.

An odor impact study integrates sources of smells, the topography of plant, wind, climate, and where odor goes, using 3D odor dispersion modeling software. “It demonstrates why one neighbor is more affected than another,” says Contratto. “Measuring at the source of emission establishes the impact of all these factors.”

He says the study is “very representative of the reality of emission,” and that simulation source by source enables them to determine what works best and what costs the least.

The Smell of Success

According to Contratto, 20% of sources are responsible for 80% of odor complaints. “Complaints usually come from new neighbors, and it’s usually the same: less in winter, worse in summer, when it’s humid and hot.” Because wind and climate escalate the problem, it becomes a “major issue” if the location is close to a city or ocean. . . or where cities authorize new development.

“New residential complaints make up about 80% of all complaints.” That’s because people who work at the landfill become accustomed to the odor. “After five years, you can’t detect a lower level of odor,” says Contratto.

He lists four dimensions of odor:

1. Concentration per square meter or square foot
2. Intensity on a scale of 0 to 10
3. Quality, or the name of the smell: fresh waste, biogas, pond odor, compost, leaves, and herbs
4. Hedonic tone, or the degree of pleasantness or unpleasantness (This is the only dimension that is subjective.)

Considered a legal expert in olfactometry since 2006, Contratto says odors are often a legal issue more than a technical one. Because odor can affect the value of your house, class action lawsuits arise with frequency. In fact, he says they have multiplied by three each year for the last four years in the US. That's why his services are so valuable.

Measuring odor is a new branch of science. "The level of error was too high until 10 years ago," indicates Contratto, "but tools have changed everything."

These tools record a very precise measurement of odor concentration, similar to decibels in sound measurement. Using specific materials, OlfactoExpert measures the landfill surface, liquids, the flare, and leaks. He even measures the difference of emission with different amounts of cover.

But it has taken time to be accepted. "We have to educate the customers and the courts that the tools are reliable," acknowledges Contratto. "Few are specialized and knowledgeable at that level to give advice. You must know chemistry and math." Although he considers it a niche market, he says business is growing and expanding into other industries, such as agriculture, tires, wastewater, and the kind of plant.

He says that if you follow his recommendations, up to a 40% reduction of emissions is possible. Suggestions can include covering with sand or dirt to reduce the impact on neighbors, adjusting duties during the hours of operation, or making changes to accommodate the prevailing winds.

But, beware, he cautions: "Most managers make the same mistake—they trust product salesmen. Most products are masking agents, not controlling agents." Contratto makes clear: OlfactoExpert hires legal, technical experts who make recommendations on actions, but not specific products.

Fugitives on the Lam

Manufacturers, however, recommend products as well as actions. For example, Byers Scientific & Manufacturing's patent-pending Uniform Vapor-Distribution Technology provides a measurable, controllable, and uniform creation and distribution of odor-eliminating vapor.

"State-of-the-art odor control is misting," says Marc Byers, CFO of Byers Scientific & Manufacturing, "but the challenge with misting systems is that odor is lighter than air; it travels with the wind stream. If you can see mist, it's not traveling with the odor; it's falling to the ground. Mist needs time and space to act with malodor."

Odor is a lightweight vapor that needs to be combatted with vapor, he insists. Misting systems produce big droplets, but mist doesn't travel as well as vapor.

"The atomization can't keep up," explains Byers. "It needs to travel with malodor." Byers Scientific's patent-pending technology delivers a chemical designed to do that.

The proprietary formula, which is similar in weight to the odor, is distributed through 4- to 6-inch piping around the perimeter of a landfill and changes the chemical composition of the molecules to change the nature of odor at a molecular level. Benefits of the system include minimal maintenance needs, no water needed, quiet operation, and lack of clogged nozzles. Since implementation at a landfill in Russberg, VA, that had "big odor issues," Byers says the system reduced the number of odor complaints from 36 to 9.

"Odor is a significant issue," emphasizes Byers. "It's the biggest externality, more than dust. Dust is rare."

Managing and controlling such a big problem requires a two-pronged approach: reduce odors at the source and develop an airborne barrier to capture fugitive malodors. Vapor barriers help contain odors on the landfill's surface, but odor control on the working face of a landfill is a challenge when the equipment is working. "In the future, I think managers will put the nozzle on the compactor to spray while they're working," speculates Byers.

Even if managers treat daily and cover topically, odors can become fugitive, airborne beyond the working space. "It comes in on the trucks," remarks Byers. "Food waste is already odorous before it

gets to the landfill.”

Gases such as methane, carbon dioxide, ammonia, sulfides, and various unpleasant odors are released. “Unless you’re treating the source, there will be odor,” he concludes.

Treat Me Right

It’s pointless to treat odor if you’re not doing it properly. Benzaco Scientific Inc. designs and manufactures chemical and equipment technology that incorporates essential oils, relying on their naturally occurring compounds to counteract odors.

These are not masking agents, which the chemists at Benzaco say only make the problem worse because they can create a more odorous situation. Instead, a limited selection of oils is chosen specifically for their ability to eliminate odors.

One Pennsylvania landfill found out just how unsuccessful masking agents can be. The Pennsylvania Department of Environmental Protection documented over 200 odor complaints from neighbors of the landfill in just one year. The site was required to install an enhanced landfill gas collection system with temporary flares to burn off odorous gas. In addition to the significant expense of this process, they were fined almost \$75,000 in civil penalties for past odor violations.

Since then, they have implemented operational solutions, including use of Benzaco Scientific vapor phase odor control measures, which have drastically reduced odor complaints.



[3]

Credit: Moby Dick
A dirty undercarriage



[4]

Credit: Moby Dick
A clean undercarriage

According to Benzaco, “the oils used in odor control display certain chemical properties that allow an oil to have a physical or chemical effect on odorous compounds. These properties are what make the oil effective at eliminating an odor.” Their effectiveness depends on how well the oils are chosen and blended to produce the correct chemical or physical reaction on the odorous compounds.

Use of neutralizing chemistry is the preferred method of odor elimination, according to Benzaco, and can be both effective and economical if done correctly with the right application equipment. Their units are designed only for fogging odor control products.

Can You Hear Me Now?

While Byers and others consider noise second in importance to odor, it is always a major concern of landfill neighbors.

Landfills are busy places with multiple pieces of equipment at work— all of which have backup alarms in the 112-decibel range. It’s a safety measure; there’s a lot of backing up at landfills, drivers frequently get out of the cab, and material is being crushed, Benson Davenport, vice president of regional sales for Autocar, points out. “There’s nothing you can do about alarms, especially if you’re working above grade,” he says.

But, he adds, ear protection is necessary when decibel levels reach 85 for more than eight hours a day. “The only way to lower the alarms is to reduce the total noise,” believes Davenport.

That can start with the type of fuel a vehicle runs on. “Diesel versus gas fuel makes a big difference. A spark-ignited engine is quieter, and with every 10-decibel reduction, the range is 10 times quieter.”

For example, he says, Cummins' natural gas engines at idle are 10 times quieter than diesel engines—85 decibels, versus 95 decibels.

Because green fuels are better for the environment, there are grants and funding for taking diesels out of commission. "There are several incentives to de-commission diesel engines as a way to encourage the switch," states Davenport.

Nevertheless, most municipal haulers continue to use diesel. "You need a big fleet to justify the cost of natural gas. The capital costs are considerable."

Hindering the move away from diesel trucks are low diesel fuel prices. Davenport believes that's temporary, though. "Surplus production ends this year; oil prices will go up." He urges fleet owners to weigh the fluctuation in diesel prices against the 10- to 12-year investment of a truck.

CNG provides another advantage because there's no regen. A regen increases sound 5–10 times because it requires increased RPM to create: more noise, more fuel. "That goes away with CNG," says Davenport.

Among engines that need to perform a regeneration, he says Autocar does fewer regens, due to their unique onboard diagnostics that monitor the level of soot in the system and alert the operator when regen is needed. The advanced notice allows the operator to choose where and when to do, enabling them to leave the landfill and thus, reduce noise levels at the site.

CNG trucks also get a weight advantage of 2,000 pounds—an exemption on federal roads that allows for the trucks to be heavier than the posted weight limit due to the CNG technology, which is somewhat offset by the added weight of the CNG tanks. Davenport thinks it still leaves room for some extra payload.

Better payload translates to fewer trips to the landfill, and if a truck isn't at the landfill, it isn't contributing to the noise there. Autocar trucks carry about 2,000 more pounds of payload than their competitors, Davenport points out, allowing them to pick up 44 more houses on average. "That's 15% fewer trips if you carry 2,000 more pounds in a 20-yard truck," he says.

Once the trucks go to the landfill, there are some noises that simply cannot be gotten rid of, like those backup alarms. But a better turning radius can help a driver avoid backing.

"Autocar has the best turning radius and visibility in the industry," states Davenport, acknowledging that it may apply more on the route than at the landfill, but still may contribute to lessening noise.

The air brake release is another unavoidable noise, along with the general sounds of traffic, gas flares, and bird scarers. High-quality road surfacing and speed limits can reduce noise. Limiting hours of operation reduces complaints. Sound reduction equipment fitted to power tools and machines muffles noise and acoustic screens can deflect the sound of generators and pumps.

Natural noise control can be implemented by landfills and their neighbors. Trees filter noise, providing natural sound reduction.

"It's like putting up a wall," indicates Davenport. To be mandated, decibels must be over a certain level for a period of time, but adjacent landowners could plant trees to mitigate noise pollution.

Berms and other types of vegetative screens help confine noise within the landfill if properly situated on the site to blend in with the topography and surrounding landscape. They also serve as a visual barrier.

Incorporating see-no-evil, hear-no-evil, smell-no-evil measures to appease neighbors can save landfills money and trouble in the long run.

If You Knew, You'd Floc Your Wheel Wash, Too

Neptune Automated Wash Solutions, understands the importance of clean water. As part of an automated wheel wash system, the wash water is automatically recovered into a tank, cleaned, and recycled. Neptune Systems use Floc, a granular flocculent, that coagulates the solids so they rapidly fall out of suspension and into the bottom of the tank. Once the solids reach the bottom on the tank, a double scraper conveyor belt scrapes the solids out of the tank, dewatering them in the process so that the water remains optically clear.

One of the biggest hurdles to overcome during the decision making process is convincing a client the importance of a scraper conveyor. As Jeff Dworek, Director of Operations at Metro Waste Authority in Des Moines, IA, explains, "When we installed our wheel wash, we decided we could handle the solids ourselves and elected not to include the scraper conveyor system. We felt with the large wheel loaders

and heavy equipment operators onsite removing mud from a drive in concrete basin would be a simple task; however, we underestimated the amount of solids that we were removing from the trucks leaving our site.

"We had Neptune come back and add a 10,000-gallon scraper conveyer tank before our 40,000-gallon concrete tank. They also added their dry flocc system; it was the difference in night and day as far as maintenance goes. The dirty water now flows into the scraper tank where it mixes with the flocc, the heavy solids fall to the bottom and are removed to a sludge pit by the automated scraper system, allowing much cleaner water to weir over into the concrete tank where we get final settling."

Odor complaints at Rustburg, VA's Livestock Road Regional Landfill were growing in numbers sufficient to raise notice at the state legislature level. In early 2016, Region 2000 Services Authority, the landfill's managing entity, began conducting pilot programs with atomized misting systems using a variety of different masking agents to arrest fugitive airborne odors.

Failing to achieve satisfactory results, the authority contracted with Byers Scientific & Manufacturing to introduce its odor mitigation system that relies on a dry vapor formulation to contact and deodorize offending malodors. The system converts a Byers' proprietary liquid chemical formulation into a dry vapor that is subsequently inserted into the local airstream through a network of pipes. The vapor then travels at roughly the same speed and direction as the malodors greatly increasing the probability of physical contact and odor destruction.

Byers Scientific & Manufacturing customized a solution particular to the landfill's unique features, bringing the system online in March 2016. "As a landfill operator, we track and record complaints rigorously," says Clarke Gibson, P.E., the Region 2000 solid waste manager. "Upon installation of the system, odor complaints have subsided and have remained that way to the present."

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