



## ADDRESSING CHALLENGES IN LANDFILL MANAGEMENT USING DRONES

### Abstract

The waste management industry deals with a variety of waste such as solid, liquid, biodegradable, non-biodegradable, hazardous, non-hazardous, and more. Community and household waste contribute to these categories and is adding significantly to the growing waste handling crisis. Grappling with weak profits, changing regulations and the need for strict safety protocols, means that environment solution providers are hard-pressed to keep operations efficient and safe. This perspective paper outlines how drones can be deployed to improve safety and efficiency across the waste management lifecycle. It also discusses other digital solutions that, when integrated with drone technologies, can take waste management to the next level.

## Introduction

Environment solution providers or waste management companies are being thrust by governments, citizens, and consumers to improve their waste management practices. This pressure is not only from a compliance perspective but from neighboring communities as well. Health hazards of handling toxic waste is a challenge for the waste management industry as well. Waste management lifecycles typically have many players interacting across sites to collect, handle, segregate, and dispose of waste. As the problem of waste grows more severe every year, there is a need for smart, autonomous solutions that do the job safely, efficiently and at scale. One solution is to use drones.

## Drones in waste management

Drones are increasingly taking on key roles in many industries from insurance to wildfire management. In the waste management industry, drones help waste management companies and their partners meet statutory requirements seamlessly and at lower costs. Here are five key commercial applications of drones in waste management:

- **Landfill monitoring**

Managing and monitoring landfills needs proper planning, equipment and compliance with government regulations. As an example, the decomposition of mixed solid waste in landfills can result in leachate,

- which is a liquid that may contain toxic biochemicals and pathogens. Left unchecked, this can seep into the earth and pollute the ground water in the vicinity (1). Managing leachate calls for strict and timely monitoring of waste, seepage, and gaseous emissions. Since landfills are hazardous environments for humans, drones help environmental engineers, inspect and stay updated on what happens in landfills. Drones can collect data in real-time by capturing high-resolution images and creating 3D models of the landfill. This is not only safer but is also more cost-effective than traditional solutions such as using helicopters outfitted with cameras and on-ground vehicles for monitoring.



- **Landfill management**

Landfills comprise of carefully engineered pits called 'cells' that are designed for compaction whereby maximum waste can be pressed into a single cell in an environmentally safe manner (2). Currently, most landfills use manual methods to calculate compaction rate and availability through aerial surveys, drones can calculate the compaction rate across each cells and support planning. This data along with weighbridge data provides information on the density of waste in each cell. When paired with predictive analytics, these datasets allow organizations to compare the volume of waste in every cell and meet compaction rates in compliance with top-of-waste (TOW) levels.

- **Airspace calculation**

Landfills need to keep most of the waste under the TOW level. Based on this, specific cells are chosen for overfill, if required. Erroneous selection of these sites based on faulty data and analysis could prove catastrophic for the environment surrounding the landfill. Reliable and data-driven assessment of each cell's overfill criteria is critical to keep operations effective. Drones can enable waste management organizations to accurately measure overfill capacity and the remaining airspace using 3D models to visualize the volume of waste overfill. Organizations can also view cross-sections of certain cells or entire landfills over time.

- This will give them clear information on the airspace utilization factor (AUF), an important indicator of the longevity of a landfill and its efficiency

Thanks to programmable flight paths and routes, drones take only two hours to survey 12 acres that would otherwise take nearly 100 man-hours . This makes the drone a markedly economical tool that delivers quick ROI.



## Insights from drone data

Processing the data from drones is an important step towards smarter landfill management. Once drones capture high-resolution aerial images of the landfill area, these images are fed into data processing models that use data science, computer

vision and machine learning technologies. Algorithms stitch the images together to create a 3D model of the landscape. Computer vision marks out areas and displays ambient parameters, allowing deep human-like visual understanding. Automation fosters repeatability so that models continuously process images for real-time updates. Analytics supports

faster and error-free insights compared to traditional surveillance. All of this culminates in smart landfill management where supervisors remotely track ongoing landfill activities, monitor utilization, mitigate environmental risk, and prioritize decisions.



## Conclusion

Landfill management is a science that relies on careful planning and design to meet a uniquely human requirement – the safe disposal of waste with minimum human intervention. Municipal regulations on safety may vary from region to region; however, safety protocols for collection, handling and disposal of waste are mandatory. Drone technology can help companies reduce the exposure of their personnel to hazardous waste. Beyond this, it delivers significant efficiency leveraging a combination of technologies. Integrating drone data with analytics, computer vision, and 3D imaging, further accelerates time to insights, giving waste managers critical information to enhance the effectiveness of landfill operations.

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Dr. Arun heads the domain consulting group for Energy, Utilities, and Services at Infosys. He has over 27 years of Consulting, Global Leadership, and Software Delivery experience. His core expertise is in assisting clients in the Energy Utility and Services industries.



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Chand is an accomplished client partner with 25 years of experience across multi-industries including Waste Management. He has expertise in leading multiple initiatives including client services in package, product, and outsourcing. He is also on the advisory committee of EdgeVerve, an Infosys subsidiary, where he guides them with their market strategies, including feedback from the marketplace.

Chand is adept at managing client relationships, involving the delivery of critical and high-impact projects cross-functional teams of various sizes. He has engaged clients in the US, Australia, SE Asia, and the Middle East. Chand holds an MBA in Marketing and an Engineering Degree in Electrical.



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Venkat has nearly two decades of experience working in Waste Management, Real Estate, Financial, and Retail Service industries. He specializes in business development, digital strategy, technology consulting, account management, and IT service delivery management. He helps his clients navigate large scale transformation programs and drive innovation. Venkat, has partnered with CXOs, CIOs, and Business and IT Leaders on strategy and planning and building solutions and ideas for revenue growth and improved profitability.

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