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# Advances in technology alter how we now plan and operate solid waste management facilities

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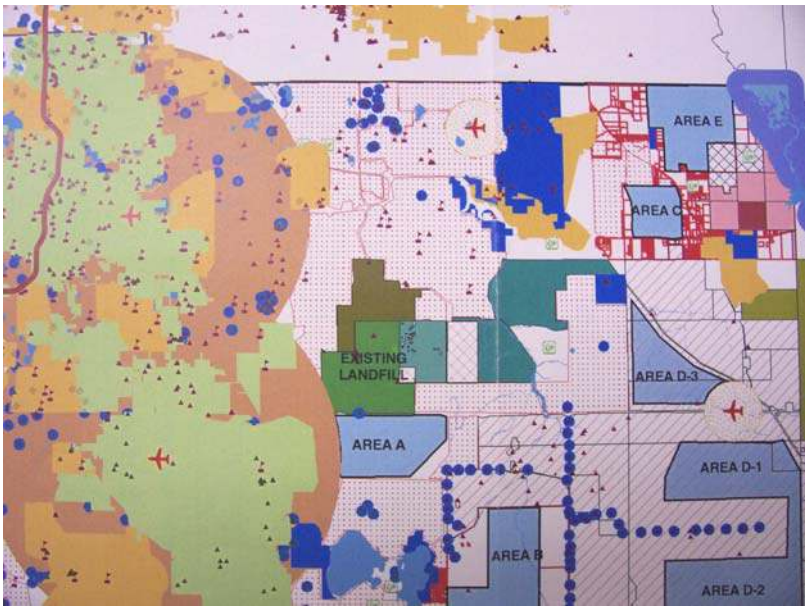
Solid waste management has come a long way from the days when refuse was collected in horse-drawn carts and disposed in open-air dumps located in marshlands outside of town. Today, it is almost hard to imagine how we were ever able to manage without high-tech gadgets such as Global Positioning Systems to pinpoint the locations of collection vehicles or to guide compactors on landfills to maximize air space.

But times are changing because of these advances in technology. No longer do we have to play "Where on Earth is Carmen Sandiego?" to guess where our collection fleet is located at any point in time. And no longer do we need to print out expensive acetate sheets to conduct an involved facility siting study. With so many of these advances in recent years, we decided to prepare a brief review of the best and most useful technologies in use for the solid waste industry today.

**Geographic Information Systems**
Geographic Information Systems (GIS) have been in use since the mid-'80s and, in recent years, are finding more useful applications in the solid waste industry. Simply put, GIS is a computerized system that integrates, analyzes, and models data from maps, surveys, photos, reports, and other sources and produces graphical maps, reports and plans for the decision-making process. Think of it also as a *visualization tool*.



Among other benefits, a GIS system makes interpreting many layers of complex data, like that shown, much easier and faster, from the convenience of a desk-top computer.

Assume that you need another landfill, or even a transfer station, and embark on a siting study. Before GIS, you would have to manually review hundreds of pages of parcel ownership at the Tax Assessor's Office and review one-by-one the maps and the reports to identify important natural features to avoid when identifying an appropriate site.

Then, after painstakingly drawing a new map or series of maps that contain all of the important siting factor data and sensitive areas, you would start manually measuring the distances from all of the sensitive features (if you could even interpret them after you have combined everything into one drawing) to any specific parcel area of interest for your facility.

If you are lucky, you may get all of this done in six months and with a very high price tag. Additionally, the accuracy of your analysis may be questionable because there is so much data out there to digest. If you had to investigate four other potential parcels you could easily add another four months of work.

In contrast, if you could utilize a GIS then that same assignment, on all four parcels, could be completed in about two months and likely produce far more accurate and useful information for the decision makers. If someone wanted to know who owned certain parcels and how large they are, you could provide the answer with just a click of your mouse.

Want to see all power corridors, every permitted potable well, every housing subdivision, floodplain and wetland? No problem, it's

right in your database. You decide which layers of information you need to show and it is all manipulated electronically. There is no labor-intensive and slow drafting process for each new drawing needed for analysis. So, what is eight months of time saved worth in dollars, especially when you may not have eight months to figure out your problem?

GIS has many other uses in this industry where the ability to "visualize" the data is key to optimizing operations and staying in compliance. These uses include:

- Landfill settlement patterns.
- Groundwater quality variations.
- Leakage monitoring - slurry containment wall.
- Landfill emission patterns.
- Fugitive odor detection monitoring.
- Gas collection well quality fluctuations.
- Collection customer location, complaint tracking.
- Industrial and hazardous waste generators.
- Collection routing efficiency studies.
- Recycling collection site location.
- Three-dimensional ("3-D") visualizations.

The ability to visualize and manipulate data to specific needs with a GIS can lead to better decisions and problem solving, improved community relations, and greater efficiency, which can all add up to cost savings at your solid waste facilities.

**Global Positioning Systems**
At first blush, satellites and lasers and typical solid waste management activities do not appear to have much in common. However, the transfer of this once secret military technology is increasing its impact on solid waste management as haulers and landfill operators strive to increase efficiency. Implementation of new software applications and Global Positioning Systems are currently being used to optimize collection routes, oversee truck movements, set grades on a landfill's working face, and guide compactor machinery for more efficient use of landfill cover with almost absolute precision.

The Global Positioning System or GPS is a worldwide radio-navigation system using a network of 24 satellites and associated ground stations. The GPS system, which was once developed for military applications by the Department of Defense, uses these "man-made stars" as reference points to calculate positions accurate with the latest technology to literally a matter of centimeters.

By fitting collection trucks with miniaturized GPS devices, many communities are able to accurately monitor the performance of solid waste collection vehicles back in the main office and to re-route these trucks, if need be, to maximize productivity. Coupled with out-of-the box, specialized routing or GIS software, GPS technology can eliminate bottlenecks and inefficiencies in a collection system in days that once took months using pencil and paper. This has meant that communities can now offer computer-aided dispatch programs, automate their work order management systems, and optimize fleet maintenance. Many cities have seen overtime costs and fleet needs reduced dramatically by implementing these technologies.

Similarly, GPS-based systems are being used increasingly on landfills to help accurately pinpoint survey stations and desired grade/slope, and guide earth-moving equipment to ensure a more even distribution of valuable cover soil with increased accuracy. These systems typically include a machine-mounted GPS unit to deliver real-time elevation, compaction and grade control information to landfill operators on an in-cab display. By monitoring grade and compaction progress, operators have the information they need to maximize the efficiency of the machine, resulting in proper drainage and optimum airspace utilization.

**Radio Frequency Identification**
Currently found in everyday applications from package tracking to vehicle security and the E-Z Pass for highway toll systems, radio frequency identification or RFID technology is increasingly becoming a familiar part of solid waste collection. Briefly, RFID is a highly reliable way to electronically control, detect and track a variety of items using FM transmission methods. A small tag, or transponder, affixed to or embedded into a solid waste container identifies the can using a unique code allowing an electronic reader to collect key data on the container's use. Recent pilot tests in the City of Philadelphia indicate that this technology works effectively in an environment where excessive dirt, dust, moisture and/or poor visibility would normally hamper rapid identification.

Although these new electronic technologies are not foolproof, they have great potential to increase the real-time efficiency of solid waste management. Clearly, applications by many cutting-edge communities have already proven their value for solid waste agencies from California to Maine. Undoubtedly, the future of solid waste will be tied directly to how these technologies and others like them can be successfully implemented for the solid waste market.

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