

Needed Research and Development in the Field of Solid Waste Management

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Overview

Research and development (R&D) has contributed substantially to improvements in modern solid waste management practices over the past 30 years. Examples of the importance of R&D can be found in the design, operation, and performance of sanitary landfills and a wide variety of resource recovery systems. Research and development will remain a key tool supporting waste management due to a number of reasons. The reasons include: 1) the changing nature of the waste stream as increased waste reduction occurs and as manufacturers produce more environmentally-friendly products, 2) the need to design and operate efficient systems such that costs are minimized while performance is not compromised, 3) shifting policies and regulations related to solid waste management, and 4) new advances in waste management techniques are oftentimes identified and proven at the R&D level. R&D is needed in areas related to waste characteristics, collection, processing, and disposal.

Waste Characteristics

Improved and cost-effective methods are needed to characterize and monitor the waste stream (and products derived therefrom) as a result of many factors, including: 1) the “greening” of some manufactured products (e.g., building materials), 2) the introduction of new products into the marketplace (e.g., herbicides and pesticides), 3) the emergence of new pathogens (e.g., mad cow disease), and 4) the need to produce marketable, high-quality products.

Potential areas of research: remote waste characterization and sampling and analytical methods for new types of pathogens.

Collection

The costs associated with waste collection typically are much greater than those of processing and of disposal. Thus, improvements in collection management, technologies, and methods of operation can result in enormous reductions in cost, even for small percentage improvements.

Potential research areas: Does the cost savings of commingled collection of paper and containers offset the higher processing costs? Is co-collection of MSW and

recyclables (i.e., in one compartmentalized collection vehicle) more cost efficient than collection of these two types of materials in separate vehicles? Can accurate and cost-effective on-board weigh systems be designed and operated to accurately and reliably determine the mass of materials collected?

Processing

Processing and collection must be properly and efficiently integrated, but there is a lack of analytical methods for ascertaining the best combination of collection and processing systems as a function of fundamental, site-specific operating conditions. Thus, research in fundamental models is indicated.

The greater levels of waste diversion being sought by communities mean that additional materials in the waste stream must be recovered and recycled. New, high-efficiency, high-yield, and cost-effective technologies are needed for separation and beneficiation of material types and subtypes, including building materials and electronic components.

Methods of detection are needed to alert facility operators to new pathogens and types of materials that can adversely affect the health and safety of the workers and of the public, and the quality and marketability of recovered products.

Disposal

While modern landfill technologies are well developed, there is always competitive and public pressure to control and reduce landfill costs, both in the short- and long-term. Also, the pressure to reduce long-term financial risks has resulted in the exploration of methods to reduce these risks, e.g., the use of bioreactor landfills to accelerate the stability of landfill environments.

Potential research areas: What are the better designs and operating conditions for a bioreactor landfill? Identification and development of new, cost-effective methods of leachate collection and treatment, and of increasing the efficiency of energy generation equipment fueled by landfill gas.

Conclusions

In the United States, relatively few financial resources are currently being dedicated to R&D related to solid waste management; thus, in recent years there has been a lack of substantive innovation in the solid waste industry. However, as indicated in this discussion, the industry is not lacking in areas that could use and benefit from improvements in design and operations. The improvements include potential, substantial reductions in the cost of solid waste management, better product quality and yield, and improved worker and environmental protection. The envelope of research areas runs the gamut from generation to ultimate disposal.