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A SUMMARY OF TWO RECYCLING TECHNOLOGY EVALUATIONS COMPLETED UNDER THE MITE PROGRAM

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INTRODUCTION

Through the Municipal Solid Waste Innovative Technology Evaluation (MITE) Program, EPA has evaluated a number of promising innovative technologies for municipal solid waste (MSW) recycling. These technologies have varied from collection and processing methods to evaluations of products made from post-consumer material. The MITE program was conceived with the purpose of providing objective, third-party evaluations on environmental performance and costs of innovative municipal solid waste management technologies and this program is administered for EPA by the Solid Waste Association of North America (SWANA), representing the public sector solid waste management needs. The technologies are selected via an annual solicitation and review by an Advisory Group made up of recycling coordinators and solid waste managers.

Once the technologies are selected and the evaluation is performed, the results are published in a report that is distributed to the information users or the general public. The benefit for technology developers in participating is that they receive objective, published information to assist them in the commercialization and marketing of their technology.

One unique point separating this innovative environmental technology evaluation program from others is that it is often the public sector (the municipality, county, or solid waste district) advancing MSW technology through research and development, and partnerships with private companies and trade organizations. A significant number of applicants to the MITE program have been cities or non-profit groups. This is the case with the two evaluations profiled below.

This summary will address two evaluations focusing on the collection of municipal solid waste and designs that foster cost-effective recycling and source reduction.

METHODOLOGY

The first project profiled is a weight-based municipal solid waste collection system. The second project is an evaluation of three co-collection systems for solid waste and recyclables.

Weight-Based Collection Pilot in Farmington, Minnesota

The City of Farmington, Minnesota applied to the MITE program for an evaluation of their proposed pilot for a weight-based MSW collection system. The purpose of this collection system is to charge waste generators according to the weight of the solid waste placed at the curb for disposal. The more waste generated, the higher the disposal costs would be. There is an economic incentive in generating less waste for disposal and Farmington theorized that this type of system would increase the amount of material set out for recycling, a service for which there is no charge, and also foster source

reduction at the residential level.

In order to implement this type of collection system with a minimum additional collection cost, the City attempted to retrofit a side loading collection vehicle to provide weight information for billing purposes. This vehicle was already in service, providing fully automated solid waste collection. The retrofit had three main components: the first consisted of load cells mounted to the vehicle's gripper mechanism. These load cells would weigh each refuse container during pick-up. The second component of the retrofit was the use of a Trovan radio-frequency identification (RFID) transponder attached to each refuse container. The transponder released coded information containing the address of the container when placed in proximity of the antenna, mounted on the refuse collection vehicle. These two components were tied into the third item, an on-board computer, which translates the information into an address identification and container weight. Thus, the weight of the refuse is correlated to an address for billing purposes.

It was agreed that Farmington would obtain the vehicle retrofit and pilot test it prior to the MITE evaluation. Unfortunately, there were many difficulties encountered in the development of this system. It was discovered that the load cells were not durable enough for Farmington's collection needs. There was also a problem with the accuracy of the weight measurements. The National Institute of Standards and Technology (NIST) has established national weights and measure requirements for on-board weighing systems. These systems have to meet Class III requirements, or an allowed tolerance level of accuracy of one pound for the first 500 pounds, two pounds for 501 to 2,000 pounds, and three pounds for 2,001 to 4,00 pounds.

Through pilot testing it was determined that approximately 90 percent of all weights recorded on the truck were within two pounds of accuracy. However, since full residential containers weighed less than 500 pounds, the project was not consistently conforming to Class III standards. Accuracy testing was performed by weighing the refuse containers first with a certified digital scale, then weighing the containers with the on-board system.[1]

There were also other factors affecting the accuracy of the load cells. Considerations such as the slope of the road surface, excessive wind speed, and shifting weight due to liquids in the container caused unpredictable errors in measurements. Because of noncompliance with the Class III standard, billing was never permitted by the Minnesota State Department of Weights and Measures.

Based on EPA's assessment of this pilot, there are a number of recommendations that can be made to municipalities and others attempting to conduct a weight-based collection pilot. Most important is to establish performance specifications for system development. These allow more control that design specifications. A second recommendation is to involve crew and staff in the development and implementation of the system. This will allow a smoother transition during implementation. It is also important to provide adequate training to staff and education to the waste generators.

The pilot, though not fully successful and not able to be fully tested, was a valuable learning experience for Farmington and other municipalities and companies. In 1994, a number of private firms, both here and in Canada made significant progress in the development of truck mounted systems for weight-based collection for solid waste. In fact, a number of systems have applied to, and are expected to receive NIST certification for their equipment, and allow public marketing of the systems. There is no doubt that the research and development done by the City of Farmington contributed to this rapid development.

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[1] Evaluation of the Weight-Based Collection Project in Farmington, Minnesota: A MITE Program Evaluation. EPA/600/R-94-164.

Co-Collection of Solid Waste and Recyclables

At the present time, the majority of community recycling programs that use of curbside collection utilize a separate vehicle in which to collect recyclables. These vehicles vary in design, depending on the overall recycling system. If the recycling program makes use of a Materials Recovery Facility, or MRF, to separate recyclables for market, the recyclables are often collected commingled in a single compartment collection vehicle. If the program makes use of a curb sorting system, the collection vehicle can take on a number of multi-compartment designs, depending on the amount and type of recyclables included in the recycling program.

It has been shown in numerous cost studies that collection costs are a significant portion of the total solid waste management cost. It has also been concluded in a number of instances that the "add-on" of the curbside recycling collection -- separate facilities, crews, and collection vehicles -- may not be the most efficient solid waste management system design. Simply speaking, all solid waste services should be considered in an integrated manner, looking at long term program needs. In an attempt to minimize collection costs, several communities across the United States are changing to a "co-collection" system, where the solid waste and recyclables are collected simultaneously in the same vehicle.

There are several co-collection system designs. The first and simplest system uses a collection vehicle (perhaps already in use for MSW only) with a single compartment. Recyclables and waste are separately bagged by the waste generators, picked by concurrently, and placed in the same vehicle. The bags of recyclables are separated from the bagged waste at a centralized facility. The second system is the use of a vehicle with separate compartments, the number depending on the number of items that are collected and the amount of curb-side sorting that occurs. The third unique system uses a dual compartment refuse container designed and manufactured for use specifically with a dual compartment automated collection vehicle.

Three separate systems will be evaluated in this project. They include a co-collection vehicle manufactured by Oshkosh Truck Corporation as utilized by Durham, North Carolina; the Western Curbside Collector co-collection truck manufactured by May Manufacturing Company, as utilized by Loveland, Colorado; and Ruckstell California Sales, Inc. co-collection refuse container system as utilized by Visalia, California.

One component of the evaluation consists of on-route data collection by the vehicle crew. Crew training and all data management will be done by RW Beck and Associates. RW Beck will also perform a sort of the recyclable stream for both the pre-existing two truck system and the co-collection system to evaluate any changes in quality of recyclables. Information to be collected includes times on and off route, time between stops, unloading and break time, the number of pick-ups, estimated distance between stops, pounds collected, driver distance, and crew number. A number of different routes will be evaluated over the two week data collection effort.

The information collected will be used for an economic analysis and a comparison of the quality of the recyclables. Costs per household will be calculated for each of the systems and they will be compared to the more traditional two vehicle systems for refuse and recyclable collection. There will also be an attempt made to identify key factors that determine system cost effectiveness and efficiency.[2]

The co-collection system evaluations are presently underway and it is expected that draft results will be available by May 1995.

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2. Co-Collection System Evaluation, Draft Scope of Services. RW Beck and Assoc. 10/94.

CONCLUSIONS

US EPA's MITE Program, in cooperation with its partner, the Solid Waste Association of North America (SWANA), seeks to perform objective assessments of innovative technologies for solid waste management systems. Through these efforts, information on environmental effectiveness and costs on these technologies is spread to the user community, in the hopes that it will foster environmentally and economically sound municipal solid waste management.

REFERENCES

1. RW Beck and Associates. Draft Scope of Work: Co-Collection System Evaluation, October 24, 1994.

2. SCS, Engineers. Evaluation of the Weigh-Based Collection Project in Farmington, Minnesota: A MITE Program Evaluation. EPA/600-R-94/164, U.S. Environmental Protection Agency, Cincinnati, Ohio 1994. 17 pp.

3. Steuteville, R. Early Results with Co-Collection. Biocycle. February 1993.

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FULL-SCALE LEACHATE-RECIRCULATING MSW LANDFILL BIOREACTOR ASSESSMENTS

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INTRODUCTION

The integrated waste management hierarchy philosophy continues to develop as a useful tool to solve solid waste issues in an environmentally responsible manner. Recent statistics indicate that approximately two thirds of municipal solid waste in the United States is disposed in landfills. EPA research has continued to develop and refine the variety of technologies, materials, and operational techniques to further reduce risk from this most often used form of waste disposal.

Current landfill operational technique involves the preparation of a waste containment facility, the filling of the waste unit, installation of the final cover, and the maintenance of the unit. The goals being to isolate the waste from people, and to minimize infiltration of water, thus minimizing releases of moisture and decompositional gases into the environment. This method of operation has proven to be reasonably effective in waste disposal, effectively minimizing risk by collecting the liquid that percolates through the waste, called leachates, at the bottom of the landfill, and controlling landfill gas with collection systems. Effective gas collection often results in utilization of the gas for other purposes.

Concerns over the longevity of containment systems components present questions that cannot be answered without substantial performance data. Landfills, as currently operated, serve to entomb dry waste. Therefore, the facility must be maintained in perpetuity, consuming funds and ultimately driving up waste collection costs. Further, there is a concern about rare but possible environmental impacts from leakage through lining or cover components and possible catastrophic failures of the landfill system.

This presentation will describe a new form of solid waste landfill operation, it is a technique that involves controlled natural processes to break down landfilled waste, and further minimize risk to human health and the environment.

A landfill operated in an active manner will encourage and control natural decomposition of landfilled waste. This can be accomplished by collecting leachate, and reinjecting it into the landfilled waste mass. Keeping the waste mass moist will lead to a largely anaerobic system with the capacity to rapidly stabilize the landfilled waste mass via physical, chemical and biological methods. The system has proven the ability to breakdown portions of the waste mass, and to degrade toxic materials at the laboratory scale.

METHODOLOGY

Experiments are designed to compare similar landfill cells as each is operated in a different manner, either wet or dry. The experiments are time consuming and require long-term commitment to research. The projects are also very costly because of their magnitude. To gather data and analyze results, U.S. EPA embarked on a research program to study this operational technique for MSW landfills in the early 1980s. Bench-scale laboratory research on the anaerobic bioreactor in MSW landfills was conducted with the assistance of The Georgia Institute of Technology (1). Researchers found that by simply reinjecting common MSW landfill leachate under controlled sequences that the following benefits could potentially be realized at full scale:

- expansion of landfill capacity through volume reductions induced by biological decomposition of MSW in the landfill, reducing the actual number of landfills that must be sited