TOOLS FOR EVALUATING INTEGRATED MUNICIPAL SOLID WASTE MANAGEMENT STRATEGIES

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Under increasing pressure to minimize potential environmental burdens and costs for municipal solid waste (MSW) management, state and local governments often must modify programs and adopt more efficient integrated MSW management strategies (see Figure 1) that reflect dynamic shifts in MSW management goals. In response to requests from state and local governments, the U.S. Environmental Protection Agency (US EPA) and the U.S. Department of Energy joined forces in 1993 to provide assistance that would provide the data, information, and tools needed to evaluate strategies for integrated waste management. The US EPA's Office of Research and Development has been responsible for the technical direction for this research, and the emphasis has been on objectivity and scientific credibility. This paper provides an overview of the major technical outputs and their schedule for completion.

The major outputs from this effort include:

- **Decision support tool:** is being designed to allow MSW planners to enter site-specific data (or rely on default data) to compare alternative MSW management strategies for their communities' waste quantity and composition and other constraints. This enables users to evaluate cost, energy consumption, and environmental emissions for a large number of possible MSW management operations including MSW collection, transfer, separation (materials recovery facility and drop-off facilities), composting, combustion, refuse-derived fuel, and landfill disposal. A framework for the tool is shown in Figure 2. A full prototype version is to be completed by May 1999, and the final commercial version is planned for release by June 2000.

- **Database:** includes life-cycle inventory (LCI) and cost data for individual MSW management operations and materials manufacturing operations. Also included are LCI and cost information for various types of vehicles and equipment. LCI data include energy consumption and environmental burdens (air, water, and solid waste). Cost data include a range of capital and operating costs borne by local governments based on the MSW management system design. The database allows users to search for data specific to a system unit operation, structure, piece of equipment, and LCI or cost parameter. A sample screen for the database is shown in Figure 3. A beta version is scheduled for completion in May 1999, and a final version is scheduled for release by May 2000.

- **Community Case Studies:** are being conducted to test the individual models (e.g., compost model) and the overall decision support tool. Initial case studies were begun in 1998 with Lucas County, Ohio, and the Great River Regional Waste Authority, Iowa. These were designed to test the methodologies developed for individual operations (e.g., waste collection, transportation, composting). Additional case studies are planned for 1999 and will reflect the issues of urban and rural settings throughout the U.S. to ensure that the decision support system is flexible enough to handle the wide range of variation among local communities.

The information and tools developed through this effort will allow the evaluation of the tradeoffs between environmental emissions, energy, and costs for different

integrated waste strategies for MSW management including collection, separation, transportation, material recovery facilities, remanufacturing, composting, combustion and landfilling. The landfill process module considers the difference in environmental burdens for combustion and landfilling with and without energy recovery. Many communities, planners, and policy makers often are faced with limited and unorganized information on which to base decisions regarding integrated MSW management strategies. These tools provide a framework for communities to conduct site-specific analyses in evaluating strategies for developing a solid waste management plan.

The US EPA has conducted this research in an inclusive process using stakeholders with representatives from state and local governments, industry, trade associations, academia, and environmental advocacy groups. All interim and final work products are being reviewed by an internal advisory group, stakeholders, life cycle and solid waste experts, and a formal peer review process. A peer review of the technical approach was conducted in September 1997 and concluded that the technical work conducted to date is sound and that the results from this effort could revolutionize how waste management plans are developed in the future. A final peer review is planned for November 1999.

General project information and detailed documentation is available including interim drafts and final reports being prepared. In addition, there is a power-point presentation of the decision support tool prototype available on the Research Triangle Institute's web site (http://www.rti.org/units/ese/p2/lca.cfm#life). The research team is also preparing a series of peer-reviewed journal articles and MSW Management plans to have a series of write-ups that focus on different aspects of this tool and provide summaries of findings from case studies in different communities where this life-cycle tool has been applied.

As work continues on this research, we welcome input into this research. Further questions and updates on this research should be forwarded to the Susan Thorneloe, US EPA, at Thorneloe.Susan@epa.gov.

Acknowledgments

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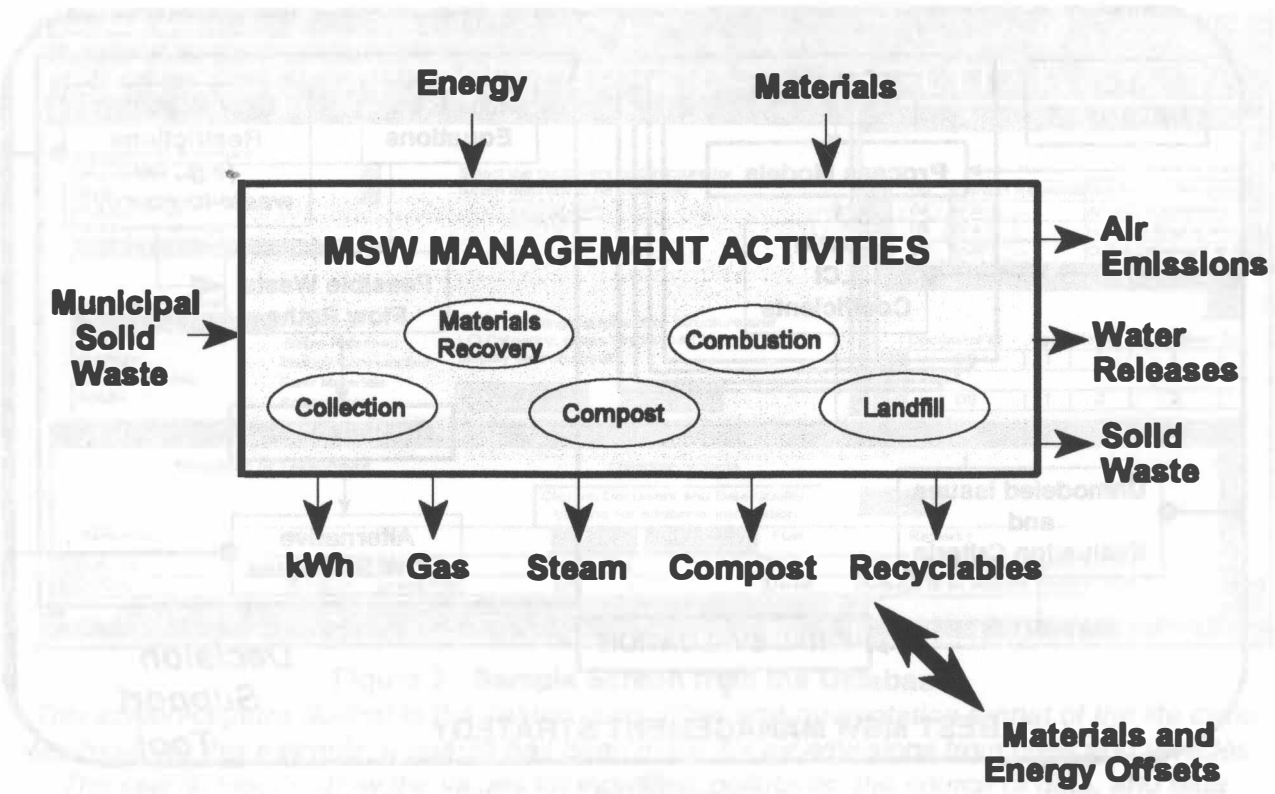

Figure 1. Integrated Municipal Solid Waste Management

Integrated MSW starts with waste generation from the use and disposal of materials by residential, multifamily, and commercial sectors. The MSW is then collected and transported for separation and recycling, combustion, composting, and/or landfilling. These activities consume energy and materials and result in environmental burdens. Any materials or energy that is recovered may create offsets of virgin materials in the manufacturing and energy sectors.

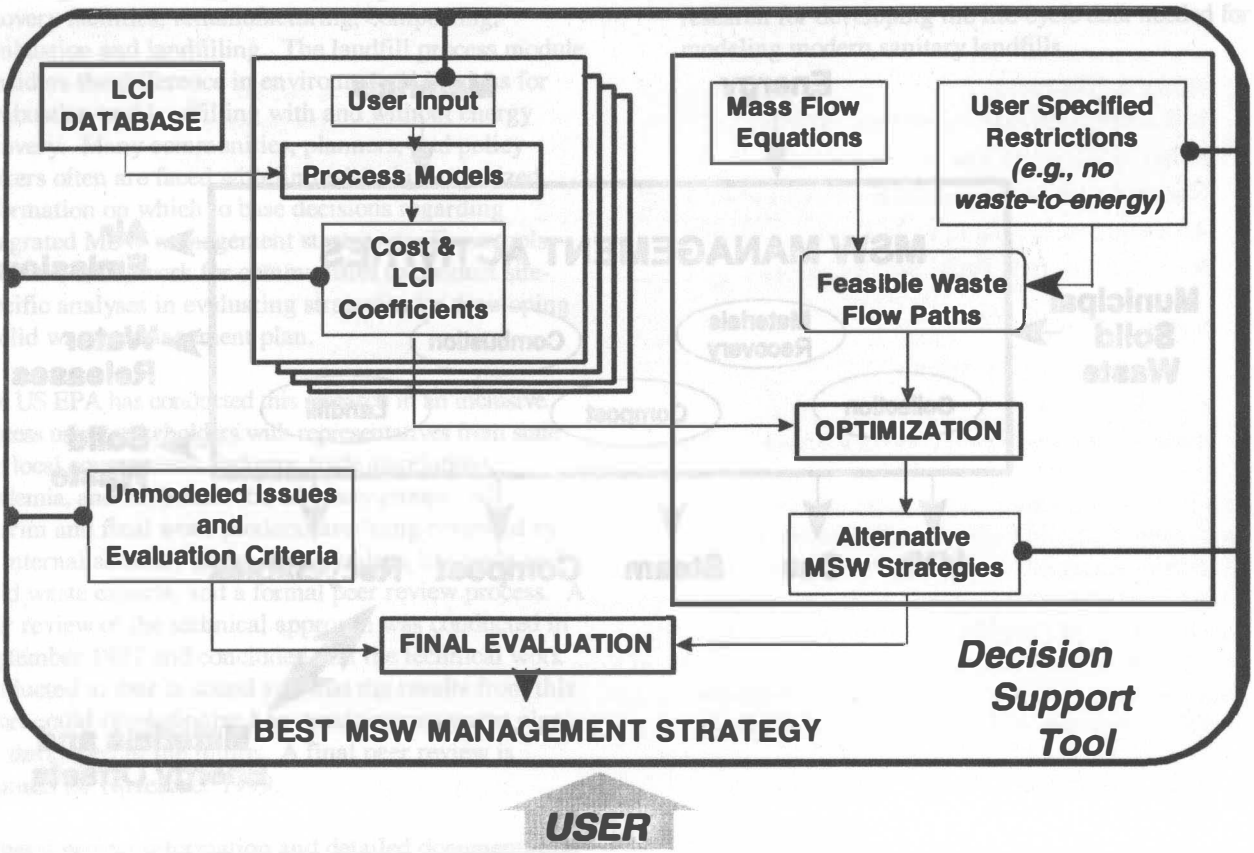

Figure 2. Framework for Decision Support Tool

The decision support tool consists of several components including process models, waste flow equations, an optimization module, and a graphic user interface. The user interface integrates all model components to allow easy user manipulation of the spreadsheet models and the optimization module. It allows for additional user constraints to be specified and provides a graphical representation of the MSW management altematives resulting from the optimization.

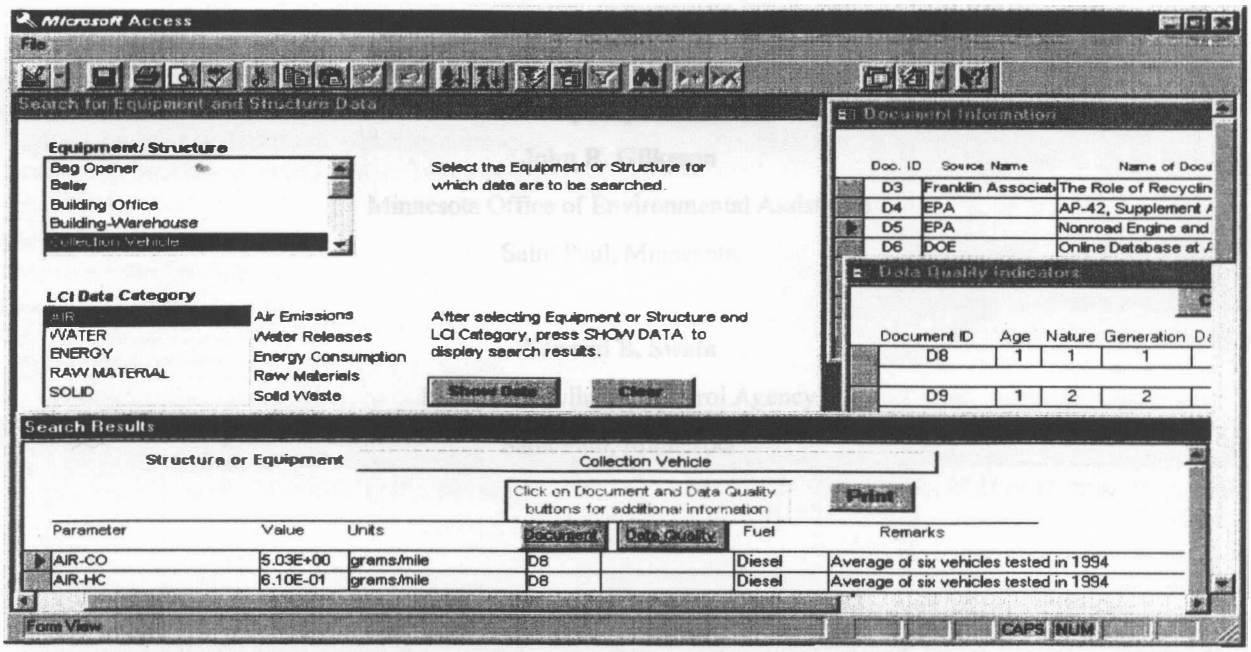

Figure 3. Sample Screen from the Database

This screen capture illustrates the search capabilities and presentation format of the life cycle database. In this example, a search has been made for air emissions from collection vehicles. The search results show the values for individual pollutants, the source of data, and data quality information.