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Project Summary

Microcomputer Programs for Particulate Control

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The growth of the microcomputer industry has made it possible for anyone to have a relatively fast and easy-to-use computer. Unfortunately, the specialized software needs of the air pollution community have not been met. In an attempt to address this need, the Research Triangle Institute, under contract to the USEPA, has developed a set of programs especially for air pollution problems. User benefits, hardware/software requirements, and brief descriptions of the theoretical models are given in the report. A sample problem, which gives detailed instructions, is included for each program.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Microcomputers are beginning to appear in the offices of engineers and scientists. The tasks of data management and word processing are now routine. One area in which microcomputers have not been heavily employed is modeling. This is largely due to limited memory capacity and speed. The strong points of microcomputers, small size and manageability, can be exploited in making easy-to-use programs. This potential can be used to produce simplified models for air pollution control research. These programs can provide a fast and easy means to test different strategies before going on to run more complex models. In this way, a microcomputer does not eliminate the need for a mainframe but serves to make more efficient use of it. An hour spent using a simple model on a microcomputer can save the researcher many hours of valuable time.

Programs have been developed for modeling electrostatic precipitator (ESP) performance, predicting stack opacity, and predicting the opacity of detached plumes. In addition, the GCA/EPA baghouse model has been modified to run on a microcomputer. In order that these programs be convenient and easy to use, a great amount of effort has been invested in their development and documentation. All of the programs use a menu format for program execution and data entry, and default values are supplied. Input parameters can be stored in disk files or listed on a line printer. The program printouts are formatted for clarity.

Discussion

This report describes five programs (Table 1) available for use with the TRS-80 microcomputer. In order to make them more available, four have been converted to run on an IBM-PC. (The minor differences in versions are covered in an Appendix.) User benefits, hardware/software requirements, and brief descriptions of the theoretical models are given.

Table 1. Microcomputer Programs for the TRS-80

ESP Section Failure Model[a]
ESP Dynamic Display Model
GCA/EPA Baghouse Model[a]
Plume Opacity Prediction Model[a]
In-Stack Opacity Calculator[a]

[a] *Also available for the IBM-PC.*

A sample problem, which gives detailed instructions on how to use the menus and obtain desired results, is included for each program.

The ESP Section Failure Model calculates the steady state emissions from each section of an ESP as well as stack opacity. The program can estimate the effect of non-idealities such as gas sneakage, rapping reentrainment, electrical failures, and maldistribution of gas velocities. The weakness of the program is that it is not as accurate as a mainframe model, but it is much more convenient and easy to use.

The ESP Dynamic Display Model presents a real-time simulation of an ESP. The program includes the effects of sneakage and rapping reentrainment while showing the effects of the rapping schedule on instantaneous and average opacities and emissions. This program is suited for a microcomputer because it uses a simple model and relies heavily on user interaction.

The GCA/EPA Baghouse Model is a microcomputer version of a mainframe model of fabric filter performance developed by GCA Corporation that uses modeling baghouses with glass-fiber fabrics. The program predicts instantaneous and cycle-average emissions and tube-sheet pressure drops. The advantage of this program is that, although slower, it is easier to use than the mainframe version.

The In-Stack Opacity Model predicts the opacity that would be measured by a transmissiometer in a stack. It performs a rigorous calculation of the in-stack opacity based on particle size distribution. The results of this program are more accurate than the approximate results provided by the ESP models. This program provides a number of options for calculating the particle light extinction efficiency factors, depending on the desired degree of accuracy. In general, the quality of the predicted results will be limited only by the quality of the available particulate data.

The Plume Opacity Model predicts the opacity of a plume of stack gas as it travels from the stack exit and mixes with the atmosphere. This program is useful for predicting the presence of a condensing plume based on the stack gas and ambient conditions. The program implementation of the model is relatively fast and thus it has not been run on a mainframe computer.

This report lets the user determine if his machine can use the individual program. The descriptions of the theoretical models provide an introduction to the programs. References are given for those who wish in-depth information. Sample problems are provided to walk the user through a typical case. Instructions are given on how to use the menus and which options give what results. Printouts of the screen appearance at various points are provided to check for correct use. Printouts are also available so that the user can check program results.

Conclusions and Recommendations

Microcomputers are rapidly becoming standard tools. However, the air pollution community suffers from a lack of convenient and useful software. These programs should be a first step in meeting those needs. Future plans include developing these programs into an integrated package such that input data can be shared by all programs and the output from a control device program can be directly read into one of the opacity programs. Standardized menus will also be adopted.

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***Leslie E. Sparks** is the EPA Project Officer (see below).*
The complete report consists of the following:
"Microcomputer Programs for Particulate Control," (Order No. PB 86-146 529/AS; Cost: $28.95, subject to change)
"Microcomputer Programs for Particulate Control: Section Failure, Baghouse, Plume Opacity Prediction, and In-stack Opacity Calculator (4 Disks)," (Order No. PB 86-146 511/AS; Cost: $120.00, subject to change)
The above report and disks will be available only from:
National Technical Information Service
5285 Port Royal Road
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The EPA Project Officer can be contacted at:
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