♻EPA   Project Summary

Indoor Air Quality Simulator for Personal Computers

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The results of this project are the IAQPC (Indoor air quality simulator for personal computers), a User's Guide, and a Technical Manual. The IAQPC was developed to address the problem of indoor air contamination. The program requires a large amount of data, but all values have defaults, many of which will be applicable to many situations. The program uses menus for the data input and to specify output.

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 two separate reports and one computer diskette (see Project Report ordering information at back).

Computer Requirements

The minimum required computer setup which will run the IAQPC includes an IBM-PC or compatible with two floppy disk drives, DOS Version 2.0 or later, and 350 K of memory. The recommended hardware configuration includes a PC (or a PC-compatible) with a hard disk, a math coprocessor, and a color monitor (e.g., an Enhanced Graphics Adapter [EGA]). Other computers or less memory may work but have not been tested.

Input/Output Options

The IAQPC gives concentration profiles to cover up to 62 days based on information entered on a building layout, the HVAC (heating, ventilation, and air-conditioning) system parameters, and source (machines, cigarettes) and sink (walls, floors) data.
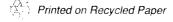
The general building layout is chosen from one of six standard configurations. The building must be single-story and may have up to 20 rooms. The room volumes and the cross-sectional areas of the interconnections between the rooms (doors, vents, cracks) may be entered. The HVAC parameters include the amount of outdoor air entering the building and the schedule of the HVAC system. Airflows for the building are calculated by the program.

The IAQPC can model up to six pollutants. These are selected in one menu. Note that at this point no pollutant interactions are modeled, so any of the pollutant slots may be used for any pollutant; however, it is much simpler to keep track of the output if the pollutants are referred to by name. Source production rates are entered, then the locations for the sources are chosen. Sinks are modeled through the same process.

The IAQPC provides graphical representations of the layout, source/sink locations, calculated airflows, and source cycles. The concentrations calculated by the program may be displayed both as linear and semilog plots.

Program Design/Menu Setup

The IAQPC uses a series of menus (as shown in Table 1) to enter data, run the program, and select output(s). The menu approach was chosen so that the data can be entered in an easy, simple to understand way. The menus were prepared so that related information can be entered in

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the same location. A great deal of data is needed to describe an indoor environment. This means that data input could be messy and difficult. However, the approach used in IAQPC makes this input as easy as possible.

The IAQPC's menu system begins with the Main Menu or the Preliminary Menu, as chosen in the Reconfigure Program option. The Main Menu gives access to all the data input, modeling, output option menus, and the Preliminary Menu. The Preliminary Menu contains the master file options, the exit options, and a program configuration menu. Data entry begins with the Main Menu where the user chooses the type of data to enter. The arrow keys, pressing the first letter of the choice, or a mouse may be used to select a choice. From this step the data entry may be in the next menu or may be three more menus

deep. The on-screen instructions and the user's manual will help the user find a way through the program.

Another part of this approach to make data entry as simple as possible is the data file structure. This program saves the data in a series of files. One of these files, the Master File, saves the names of the other data files that were used for the particular run. In this way, a system of data files may be built up to operate as a library. For example, a source strength file with values that apply to several buildings or cases could be set up, then used with several different building design files to determine the effect of the building layout on the concentrations. At least one set of files is included with the program. As the experimental data base grows and the number of analyzed test cases increases, more sample cases will be provided. With these,

a case similar to the user's own building may be chosen as a base to simplify data entry.

The User's Guide

The guide introduces the IAQPC and contains menu instructions, a step-by-step tutorial, and brief descriptions of the meanings and reasonable inputs for the variables. It should be extremely helpful for fist-time users, but will also act as a quick reference for experienced users.

The Technical Manual

The technical manual provides the theoretical background of the program, offers details on the algorithms, and includes the program listings. This manual should be useful to the experienced user and to those who are interested in the fundamentals of the program.

Table 1. Program Flowchart Showing Menus and Functions [a]

```
                    ┌── PRELIMINARY ──┬──────────── Master File Options
                    │   (DOS exits)   └──────────── Reconfigure Program
                    │
                    ├──                ┬──────────── Interconnections
                    │                  │             (data input)
                    │                  └──────────── Building Statistics Display
                    │
                    ├── HVAC System   ┬──────────── On/Off Times
                    │   Description    │
                    │   (data input,   └──────────── Basic Building Design [b]
                    │   airflow balancing)
   MAIN ──┤
                    ├── Pollutant     ─── Pollutant Choices
                    │   Characteristics ── Generic Sources ──────── Source Strength
                    │                   ── Averaging Periods          Menus
                    │                   ── TLVs or Limits             (data input)
                    │                   ── Outside Concentrations
                    │                   ── Cyclic Variations
                    │
                    ├── Air Cleaners  ─── Choose Cleaners
                    │   & Sinks        ── Efficiency levels ──────── Efficiency Input
                    │                      (choose cleaners)          Menus
                    │                   ── Passive Sinks ──────────── Efficiency Input
                    │                      (choose sink)              Menus
                    │                   ── Reemission from Sinks ──── Reemission Rate
                    │                      (choose sink)              Input Menus
                    │
                    ├── In-Room       ─── Room Sources
                    │   Locations      ── Passive Sinks
                    │
                    │                   ── Air Cleaners
                    │                   ── Cyclic Variations
                    │                   ── Initial Concentrations
                    │                   ── Building Statistics
                    │
                    ├── Runtime
                    │   Configurations
                    │
                    ├── Start Simulator
                    │
                    ├── Continue Simulator
                    │
                    ├── Graphical Output
                    │   (choices)
                    │
                    └── Output Results ──────────── Output Device Selection
                        (choices)
```

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[a] Menus are in bold print.
[b] This menu can be reached in two ways.

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