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THE CONCENTRATIONS OF INDOOR POLLUTANTS DATA BASE: A STATUS REPORT

S.R. Brown, R.A. Young, and D.T. Grimsrud

July 1984

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THE CONCENTRATIONS OF INDOOR POLLUTANTS DATA BASE: A STATUS REPORT

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July 1984

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Abstract

A computerized data base of field research in indoor air quality in the United States and Canada is being implemented in a microcomputer environment using IBM PC microcomputers and commercial software. The data base contains bibliographic information and summary data from the experiments cited. Programs have been written to provide extensive search and retrieval capabilities that are "user-friendly" and require minimal knowledge of microcomputers and data base software. This is a report of the design and progress of the project.

Keywords: indoor air-quality, computers, data base, field research, microcomputer, bibliographic, summary data

Concentration of Indoor Pollutants
Data Base Project

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1.0 Introduction

In the last decade, as many countries thoughout the world have begun to pay serious attention to their energy policies, the importance of conserving energy in occupied buildings, both residential and commercial, has been increasingly acknowledged. As various energy-conserving measures have been proposed and implemented (particularly those that reduce ventilation), there has been a growing awareness that such measures, when combined with the presence of pollutant sources, can change the air quality in the affected buildings, causing health and comfort problems for the occupants. Towards the end of identifying the sources of these problems and developing solutions to them, a significant amount of research has been carried out, mainly in Europe and North America, to monitor pollutant concentrations and other relevant parameters in a wide variety of building types and geographic locations.

Some of the results of this research have been published in journals or conference proceedings, some in internal reports, and some, for reasons of personnel shifts or program changes, have neither been formally collected nor published. The diversity of research sources and inaccessibility of some research results, combined with the rapid growth in the amount of research being carried out, has made it apparent that a centralized collection of these research results in an easily accessible form would greatly facilitate their exchange,

evaluation, and analysis.

The goal of this project, therefore, is to create a computerized data base of those field studies devoted to monitoring indoor air-quality in occupied buildings in the United States and Canada. (The term "data base" as used here means a collection of data files and command procedures which, together, comprise a data resource.) The Concentration of Indoor Pollutants data base (henceforth CIP data base) will contain research results, along with bibliographic references and information describing the experimental environment, research procedures, and validity of the data.

This is a report of project work accomplished through June, 1984, somewhat more than half way through the first project year. Therefore, what are presented are discussions of design, implementation, and progress. In addition, Appendix A contains some sample user interactions with the prototype version of the CIP data base and the resulting output.

2.0 Technical Approach

2.1 Design Elements

Several major elements require consideration in implementing the CIP data base. The first is to begin with and maintain a clear and

well-informed focus on the needs of the user community. Identifying and communicating with users in an ongoing fashion is important here.

The second element is the design of the data base itself. It must respond effectively and efficiently to a wide range of user skills and needs, from simple bibliographic searches to relatively detailed analyses of the data. It must be easy to modify and update. Finally it must be accessible to as wide a community of users as possible.

A third element is the content of the data base. Field monitoring studies from various laboratories, universities, etc. must be identified, and the data from these studies obtained. An evaluative review of the data is then necessary, followed by entry into the data base.

A fourth element is that users will approach the data base with various categories of queries. One such category might be simply what data exist and where the results have been published. Another might be specific information about the long-term average concentrations of monitored pollutants, the ranges of the concentrations, and an assessment of the quality of the data. A more complex query might require enough information to permit detailed analyses and correlations between site characteristics and observed concentrations.

Each of these categories requires of the data base system different levels of complexity and resources. Generally, the more detailed and extensive queries require more resources, more elaborate output formats, and significantly more development time. Identifying and implementing these different categories of access is one of the primary design goals.

A fifth element is that the system must be easy to use by persons with widely varying computer skills. This implies both customized "user-friendly" interfaces with the data for the novice or casual user, and access to more sophisticated capabilities for those who are more experienced.

The final major element is the speed with which the system responds to user demands. Response time is always a consideration, but along with quick response times one must consider the consistency of that response time, because being able to predict how long a task will take is often as important as the length of time itself. This relationship of speed and predictability is often critical in choosing either a time-shared or dedicated computer system. Time-shared systems are, on the average, often somewhat faster than dedicated systems, but their response time is unpredictable and sometimes very slow. Dedicated systems are much more consistent, usually more reliable, and sometimes slower.

2.2 Design Implementation

The CIP data base system is being implemented in a microcomputer environment using a commercially available data base management system. The particular choice is the IBM PC microcomputer running dBase II from Ashton-Tate. dBase II is currently the most widely implemented data base management system for microcomputers that is powerful enough for this application. The choice of the IBM PC is not restrictive; any microcomputer running dBase II would be able to access the data base.

Choosing a microcomputer environment for the data base requires acquisition of a computer system for use here at Lawrence Berkeley Laboratory (LBL), but offers significant long-term savings by eliminating time-sharing costs. In addition, the system is dedicated to this project, ensuring quick, consistent response. Finally, dBase II is both powerful and flexible, allowing the data base to be implemented, modified, and updated easily and quickly.

The major mode of user access will be via distributed and updated libraries of floppy disks containing the CIP data base system. The other mode will be via remote access to the system here at LBL over telephone lines. Together these modes will provide considerable flexibility and broad access.

Menu-driven routines will be provided to simplify search and retrieval of data, and to provide online help facilities. In addition, the user will have access to the full capabilities of the powerful dBase II language. Because individual users will have their own copy of the CIP data base, they will be able to analyze the data at any level of detail they wish, either via dBase II alone or in concert with the various statistical, graphics, and other add-on packages available commercially.

The microcomputer system acquired to implement the data base system provides for design, development, and archiving of the CIP data base, and for remote-access over telephone lines. The system configuration is a local-area-network with the following major components.

Hardware

1. Three IBM PC's and one Compaq PC for staff use, network serving, and remote access
2. A 35-megabyte Winchester hard-disk subsystem with an integral 45-megabyte cartridge-tape backup device
3. A high-speed continuous-duty matrix printer capable of near letter-quality output at medium speed
4. Appropiate hardware and software to connect the above items into a local-area network

Software

1. Data Base Management System: dBase II from Ashton-Tate
2. Word Processor: Wordstar from Micropro
3. Macro Assembler: IBM Macro Assembler
4. Host Emulation: E-Term from 3Com Corporation
5. Network software: 3Com Corporation

This system offers considerable flexibility and potential for extensions as the CIP data base system evolves and expands. It is also in the mainstream of advancement of microcomputer development and will remain so for at least several years, thus ensuring upward mobility in terms of new hardware and software. We believe this system will be a valuable model for developing other similar systems.

2.3 User Relations: Advisory Committee and User Newsletter

Some of the most important users of the CIP data base are the three funding sources for the project: the US Department of Energy, the Gas Research Institute, and the Electric Power Research Institute. To facilitate their input and guidance, a technical advisory committee will be formed to meet twice a year and review all aspects of the project and its progress. This committee will be composed of one representative from each of the funding agencies and two members chosen from the user community in consultation with the three agency

representatives. These two members will be a strong link with the broader user community.

For maintaining direct contact with the user community, a newsletter has been initiated to address user needs, respond to questions, and, generally, provide a communications medium for users. Updates, changes, and enhancements to the CIP data base system will be announced in the newsletter. In addition, remote access to the system here at LBL will provide the potential for an electronic bulletin board for users.

3.0 Design of the CIP Data Base

3.1 Overview

The design of the CIP data base system, which is still evolving at this time, has been guided by several major considerations.

The first consideration has to do with the disparate nature of the data sources. Some experiments have measured one pollutant, others have measured dozens. Some experiments used continuous monitoring instruments, others used grab-sampling or integrated techniques. Some studies were conducted in depth at a few selected sites, others surveyed thousands of residences. To accomodate this large array of formats and techniques clearly requires a flexible and open-

ended system design.

Another consideration is that the CIP data base is intended to be an evolving resource rather than a finished product. The direction and design of research studies have evolved rapidly and will continue to do so as new techniques, such as improved passive monitors, become available, and as the focus of indoor air quality research shifts in response to new knowledge. Given these uncertainties, it is important that the system's design be flexible and that documentation be clear and thorough so that the data base can keep pace with the evolving research field.

It is expected that the user community will be quite diverse in terms of computer skills and familiarity with the data. For this reason, a major design concern is to create user-friendly interfaces between the CIP data base and the user (such as menu-driven search routines and pre-programmed output formats), and to provide clear and complete user manuals and documentation. The interfaces consist of procedures written in the dBase II command language, available to the user as an integrated software package. Users can go below this level to directly interact with the data via dBase II commands and build their own customized procedures. As mentioned earlier, many add-on software packages are available commercially in such areas as graphics, statistics, and so forth. The core of what is being provided is simply the data itself in a form that can be accessed and analyzed

by the user in a variety of ways, ranging from the procedures included in the data base system, to literally scores of different commercial software packages.

Another major design consideration is the constraints posed by the particular hardware and software being used. It is clear that a data base of this size will require a number of floppy disks for storage and distribution, and also that this number will grow as new data are entered. Therefore, the CIP data base must be able to accomodate expansion while maintaining convenient and straight-forward access.

3.2 Description

The CIP data base is divided into four distinct categories: bibliographic, numeric, site-description, and methodology, each of which are discussed in turn below. In this discussion <u>databases</u> (one word) refer to data files in the specialized format used by dBase II, and <u>procedures</u> refer to program modules written in the dBase II command language, whereas <u>data base</u> (two words) refers to a system of databases and procedures forming a data resource. Refer to figure 1 as a complement to the descriptions that follow.

3.2.1 Bibliographic Data Base

The bibliographic portion of the CIP data base is a resource in itself as well as an integral part of the overall system. Bibliographic searches will sometimes be all a user wants; at other times they represent the first step the user takes in retrieving more complete information on an experiment or class of experiments.

This bibliography contains citations of field studies monitoring pollutants in buildings. It does not include citations of articles describing data obtained solely in chamber studies. The references cited have been taken from journals, government reports, and conference proceedings, as well as unpublished communications and review articles. As a matter of course, the articles themselves have been acquired as a necessary resource in building the data base and as a potential user resource.

Each entry in the bibliography contains the following discrete items of information:

- Title
- Authors
- Reference
- Remarks (associations, special features, etc.)
- Keywords
- Pollutant(s) measured
- Date of publication
- Country
- State/province
- Geographic region
- Type of building measured
- Format of the data

Bibliographic resources typically include the title, authors, reference, and date of publication as standard items. The other information has been included so that a user will have a better idea of the content of the article. Currently, only citations relating to four building types have been included in the data base: residences (single and multiple dwellings, apartments, mobile homes, etc.), schools, office buildings, and other public buildings. Factories, hotels, and restaurants are examples of building types not included. The citations have been restricted to studies conducted in the United States and Canada. In order to enhance the flexibility of specifying geographic location in a search request, three items of relevant information are stored in the data base: country, geographic region (e.g. northeast or southwest) and state/province. (We have not yet completed the work necessary to classify the studies by region. In the future, a user will be able to request references that contain data in the United States, in the northeast, or in Massachussetts alone.)

Abstracts that often accompany a research article have not been included in the data base. One reason for the omission is space considerations -- abstracts are often quite long and would make the data base more unwieldy. Another reason is that discrete items such as pollutant and keywords offer the same information in a compact form that can be utilized as search parameters. If, in the future, it becomes apparent that abstracts are a worthwhile feature, they can be added.

At this time, the bibliographic data base supports the following functions via customized, menu-driven procedures:

1. Enter new references
2. Edit existing references
3. Print out references
4. Search the data base

The first two functions are, principally, used by the project staff. New references can be added at any time using the enter function and any errors or omissions can be corrected using the edit function. Customized hardcopy printouts or displays on a video monitor are obtained by executing the print function.

From the user's perspective, the heart of the data base is the search facility. Currently a user can search the bibliography using any of the following parameters: authors, date of publication, pollutant type, country, state, building type, and keywords. A search request can be either very broad or very specific, and may contain any number or combination of search parameters. Repeats are allowed, such as multiple authors, pollutants, states, etc. As in all computerized search operations, the rules of entry are very specific and must be observed. The burden of memorizing these rules is much reduced, however, by having relevant help messages displayed at all times during the search and retrieval processes. See Appendix A for an example of how a bibliographic search is actually conducted.

3.2.2 Numerical Data Base

The numerical portion of the CIP data base contains the actual data from experiments included in the bibliographic database. Since the data from different experiments can vary widely in both format and content, it saves space and reduces response time to have discrete numerical databases whose format is closely tailored to a particular experiment or class of experiments. Each numerical database has its own procedure for displaying the data on the terminal and/or having it printed as hardcopy. A typical example of this output appears in Appendix A.

Linking together specific databases and associated procedures during a search operation is accomplished using a linking database. Whenever a search command is invoked, this database is referenced for pointers to the bibliographic, numerical, site, and methodological data for a specific experiment. The data can then be retrieved and displayed.

One problem encountered in entering a numerical data set from a particular experiment is that some data sets are too large for convenient storage or printout and must be scaled down. One technique for scaling down continuous data has been to use daily averages.

Another common entry problem is with data that are only presented graphically in the journal article. In these instances the values from which the graph was derived are impossible to establish with accuracy, and the only recourse is to contact the author to obtain the original data.

Due to these and other similar problems, the entry of numerical data from a particular experiment can be a complex operation. As the CIP data base project proceeds from design and initial implementation to expansion and maintenance, the entry of numerical data will become one of the significant ongoing tasks.

At the present time numerical and site data must be accessed via the bibliographic search routines, which can only conduct searches based on information in the bibliographic database. Procedures to facilitate searching numerical and site databases directly are being designed, and will allow search parameters such as ranges of pollutant concentrations, experimental techniques, and building materials.

3.2.3 Site Description Data Base

The description of the experimental site is an important aspect of any field experiment. In some experiments it can be very detailed, including building materials , surface finishes, insulating materials and their R values, and many other parameters. In surveys conducted

in large numbers of homes, the description is generally limited and the houses studied fall into distinct categories. In other words, some site descriptions in the data base will refer to a particular residence or other building, whereas other site descriptions will refer to a group or class of houses. In a particular study, for instance, the surveyed houses might be divided into two groups; those with, and those without, portable kerosene heaters.

As with numerical data, different types of site descriptions require different procedures for generating output, and are linked to these procedures and the other data bases through the special linking database already mentioned. An example of a site description for a specific home appears in Appendix A.

3.2.4 Methodology Data Base

This data base is intended to provide specific information on the techniques and equipment used in a particular experiment or series of experiments, as well as some indication of the quality of the data. Once again no standard format can cover all possibilities; accordingly the format and content of this data base will vary from experiment to experiment.

An assessment of data quality and its inclusion in the data base is a difficult issue, both technically and politically. Experience

and the counsel of the advisory committee will be valuable in establishing techniques and criteria for making these assessments.

The methodology portion of the CIP data base is still in the design phase and therefore no examples of output are presented. Apart from the issue of data validation, however, its design and implementation is straightforward and perhaps even simpler than is the case for the site description.

4.0 Project Status

The CIP Data Base project has been in operation since November, 1983. In that time the following work has been accomplished.

1. 170 (approximately 50%) of the known bibliographic citations that meet project criteria for subject and location have been entered into the data base, and the source articles collected.

2. Numerical data and site descriptions from two field experiments have been fully integrated into the data base, and three more have been partially integrated.

3. The design and implementation of the bibliographic resource, although it will continue to evolve over time, is approximately 80% complete, relative to current plans.

4. Most of the computer hardware and software necessary to implement the data base system has been acquired and installed. The exceptions are a high-speed printer and a remote-access capability, which will be purchased when all the funding has been received.

5. The user-newsletter has been initiated and the first issue sent to persons on the CIP Data Base mailing list, which presently includes 35 persons.

Although most of the programming for the bibliography has been completed, a considerable amount of work is needed in four areas: (1) classification of citation by region, (2) description of the data, (3) keywords for the articles, and (4) on-line help and error messages. Adding a keyword facility is particularly difficult because most articles do not have a list of keywords, and must be read to determine appropiate candidates.

5.0 First Year Goals

The first project year will end November 1, 1984. By that time it is anticipated that the following tasks will have been completed:

1. The bibliographic data base will be complete in design and contain about 75% of the projected entries.

2. The design of the site, numerical, and methodological data bases will be about 80% complete. These data bases will contain data from 20-30 experiments, mainly from LBL, but also from other sources.

3. The CIP Data Base computer system here at LBL will be complete, with acquisition of a high-speed printer and remote-access capability.

6.0 Acknowlegement

This work was supported by the Assistant Secretary for Conservation and Renewable Energy, Office of Building Energy Research and Development, Building Systems Division of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

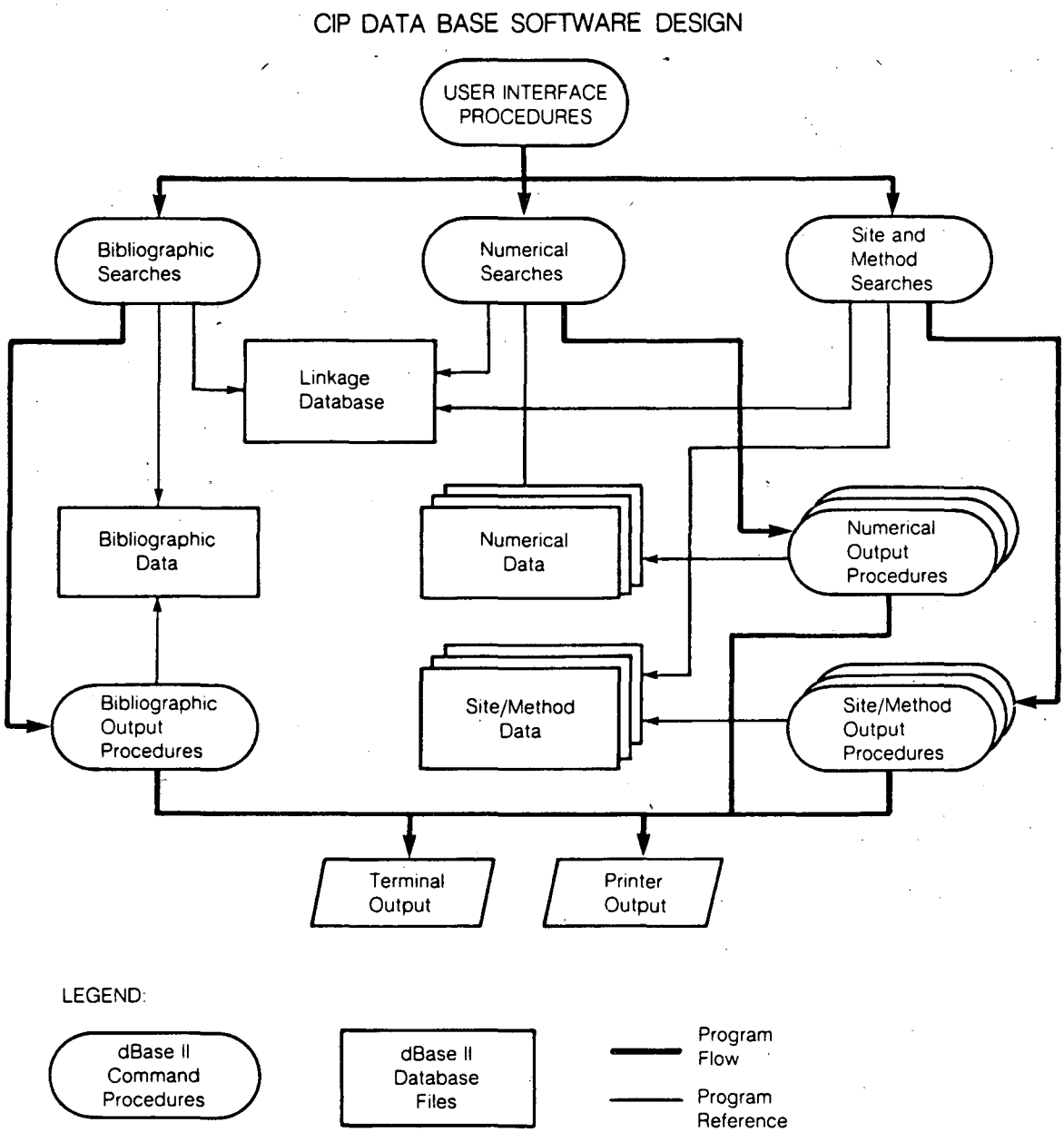

Figure 1. This figure is a graphic illustration of the CIP Data Base design. Where boxes have multiple "shadows", that means that there are multiple databases or procedures performing the same function for different data formats.

Appendix A

Sample User Interaction with CIP Data Base and Resulting Output

Presented in this appendix is an example of a typical user interaction, or session, with the CIP data base. It focuses on accessing the data via the bibliographic function, the most complete function at this time. Adding to and editing the bibliography, a function intended primarily for staff use, is also illustrated. The user manual, to be developed, will provide numerous similar examples covering all available program options and extensive information on the design of the data base (database format, flowcharts of how the various procedures link with each other and with the data, and the well-commented procedures themselves).

A session with the CIP data base begins with starting dBase II by entering "dbase" after the "A>" prompt. The user will see a copyright message from dBase II and receive a "." prompt. Reply by entering "do startbib". The screen will clear and the main menu of functions will be displayed.

In the sample session that follows, computer output is as it would appear on the terminal screen and user input is <u>underlined</u>. Explanatory comments have been inserted that wouldn't appear in a real session; these are in [**boldface**] and are enclosed in brackets.

```
A> dbase

Copyright (c) 1982 RSP Inc.

*** dBASE II/86    Ver 2.4      1 July 1983

     . do startbib

         Bibliography of Indoor Air Pollution Field Measurements

                          --- Menu of Commands ---

         1 = ENTER a new reference

         2 = EDIT references by reference number

         3 = PRINT out references

         4 = SEARCH bibliography for certain keywords

         5 = HELP (gives a description of bibliography fields)

         6 = QUIT

Enter your request:
:
```

[If you want to see a description of the items in the bibliographic records, enter 5 for a short HELP message. The description is given on two pages. There is a pause after the first screen display. The "WAITING" message that you see here and throughout the program is to allow you time to read and will remain on the screen until you enter something. When you are ready, you can enter an "S" to return to the main menu or any other key to continue.]

Enter your request:
:5

Description of Data Base Bibliography: Field Lengths and Contents.

Field name	Length	Description
Pollutant	12 chars	Code numbers are input for pollutant names: 1=Radon, 2=Formaldehyde, 3=Other Organics 4=NOx, nitrogen oxides, 5=CO, 6=CO2, 7=Particulates, (TSP,RSP), 8=SO2, 9=all or many pollutants
Authors	70 chars	Author names: last name followed by initials with no periods. Authors separated by commas
Title	140 chars	Title of reference: For Journals & reports, only 1st letter capitalized. For books, all major words are capitalized.
Reference	40 chars	Journal reference: abbreviations for journals are found in file ******* , volume & page numbers separated by colon, no date here
Date	4 num	Month/year entered: 00/00 is default for unknown date

--- Enter S to stop or Hit any other key to continue
WAITING c

Remarks	70 chars	Group affiliations, etc.
Country	12 chars	USA or Canada (CN)
State/Province	20 chars	State or province is entered using 2 letter US postal abbreviations. Separate each entry with commas
Building Type	15 chars	Residences = homes, apts, town houses, & mobile homes: Also included are Schools Office Bldgs, & Public Bldgs
Data type	50 chars	Indicate presence of types of graphs, histos scatter plots, etc

--- Hit any key to continue

WAITING c

[When you hit any key, you will return to the main menu.]

Bibliography of Indoor Air Pollution Field Measurements

--- Menu of Commands ---

1 = ENTER a new reference

2 = EDIT references by reference number

3 = PRINT out references

4 = SEARCH bibliography for certain keywords

5 = HELP (gives a description of bibliography fields)

6 = QUIT

[If you wish to enter new references, enter request 1. You will see a very short message about entering the title. After you have read this message and hit any key, you will see the data fields displayed with highlighted blanks. The length of the blank is the length of the item you can enter. If you have made a number of errors, you can go to the bottom and request to delete all of the entry. If you choose to enter the reference, the program will indicate that is has entered the reference and return a unique identification code, which will be use to link the bibliographic data with the other data types for a given reference.]

Enter your request:
:1

This procedure allows you to input new references.

Note that for author, title, reference, and keywords, the information is divided into 2 or more lines. Do NOT use a semicolon on any line.
Also do NOT split words using hyphens over two lines.
To enter all blanks, hit the carriage return.
Type s to stop the procedure or hit any other key to continue

Type s to stop the procedure or hit any other key to continue
WAITING c
Enter the numbers corresponding to the pollutants: 1=radon, 2=formaldehyde
3=other organics, 4=NOX, 5=CO, 6=CO2, 7=Particulates, 8=SO2, 9=all
Pollutant
Authors

Title

Reference

Remarks
Keywords

Describe data format
Date of publication (mo/yr)
Country State(s)/Province
Type of building
Have you xeroxed the article? (Y/N)
Have you checked the article references ? (Y/N)

Do you want to enter this reference? (Y/N)

type s to stop or hit carriage return to continue:
WAITING s

[An example of an entry is given below. Note that the pollutants must be entered by code numbers and the states by the two-letter postal code.]

Enter the numbers corresponding to the pollutants: 1=radon, 2=formaldehyde
3=other organics, 4=NOX, 5=CO, 6=CO2, 7=Particulates, 8=SO2, 9=all
Pollutant: 9
Authors: Young RA, Berk JV, Brown SR, and Hollowell CD

Title: Energy-conserving retrofits and indoor air quality in residential housing
Reference: LBL-12847. Presented at the DOE/ASHRAE Semi-annual meeting, Houston TX, January 1982.
Remarks :
Keywords: energy conservation, infiltration, retrofits, ventilation weatherization
Describe data format: 6 tables, 1 histogram
Date of publication (mm/yr): (9/81)
Country: USA State(s): OR,NJ
Type of building : Residences
Have you xeroxed the article? (Y/N) : y

Have you checked the article references ? (Y/N) : y

Do you want to enter this reference? (Y/N) y

Reference entered as Record 153 IDCODE 1YOUN1.81-1
type s to stop or hit carriage return to continue:
WAITING s

[To print out references request function 3 and choose the print function that best fits your needs

1. Allows you to obtain a hard copy of the records in consecutive order starting at the record you specify after receiving the prompt message.
2. Allows you to see displayed on the screen a single record at a time in any order you wish.
3. Allows you to print several consecutive records on the screen by specifying only the beginning record and the number of records you wish to print out.
4. Allows you to print all the records in consecutive order by specifying only the first record. This function is similar to # 1 but no hard copy is obtained.

The example below shows the output to the screen of just 2 records. Menu item 2 was chosen and after the prompt for the record number, record 55 was requested. After the reference was displayed, you are asked if you wish to continue and a "WAITING" prompt is given. A "c" was entered to continue printing records. Then record 6 was requested. When you enter an "s" to finish printing, you are returned to the main menu after a message "FINISHED PRINTING RECORDS"]

Enter your request:
: 3

--- PRINT MENU ---

1 = HARDCOPY PRINTOUT OF RECORDS

(The following 3 routines send output to the screen)

2 = PRINT A SINGLE RECORD BY REQUESTING A RECORD NUMBER

3 = PRINT SEVERAL CONSECUTIVE RECORDS

4 = PRINT ALL THE RECORDS STARTING AT A SPECIFIED RECORD

5 = QUIT AND RETURN TO DBASE
enter your choice :
:2

ENTER RECORD NUMBER:
:55

RECORD NUMBER: 55 ID number: 1ROES1.83-1

Roessler CE, Roessler GS, and Bolch WE

Indoor radon progeny exposure in Florida phosphate mining region: A review
Health Phys., 45:389-396

Date of publication: 8/83
Keywords:

Pollutant: Radon
Country: USA Region: States: FL
Building Type: Residences

Description of Data: 1 table, no new data
Xerox copy? T References checked? F
enter s to stop or c to continue selecting records:
WAITING c

ENTER RECORD NUMBER:
:6

RECORD NUMBER: 6 ID number: 1DOYL1.83-1

Doyle SM, Nazaroff WW, and Nero AV

Time averaged indoor radon concentrations & infiltration rates sampled in four U.S. cities
LBL-16595

Date of publication: 10/83
Keywords: infiltration, pollutant source strength, radon integrated measurement

Pollutant: Radon
Country: USA Region: States: CO,ME,ND,SC
Building Type: Residences

Description of Data: scatter plot, 2 tables
Xerox copy? T References checked? F
enter s to stop or c to continue selecting records:
WAITING s

FINISHED PRINTING RECORDS

[To search the bibliography for references, enter 4 when in the main menu. You will see displayed a message describing what items or "fields" you can search for. Please read the NOTE carefully because it lists the restrictions on building type, year, and the form of entry for requests of pollutant type and state.]

Enter your request:
:4

You may search the database for as many fields & as many search words as you wish. Enter each word separately.

Fields that can be searched are: pollutant, author, building type, year, country, state/province, and keyword.

NOTE: For pollutant you must enter the proper pollutant code.
For state/province you must use the 2 letter postal codes.
For building type, you can request residence, school,office or public building
For year, you must enter a date after 1960 (there are no references before then)

To advance the cursor while entering words, hit carriage return

Hit any key to continue

WAITING c

[After you have hit any key, you can start requesting items. A short message is kept on the screen to remind you of the items that you may search, the type of building, the pollutant codes, and what to enter for state and country. After the message you can enter the field that you wish to search and the particular word or code. The example below shows that the user has requested references of radon (using pollutant code 1), in residences, in New Jersey, in 1983. Note that for a request of year, there is a further prompt which allows you to specify before, after, or just in that year.]

Fields : pollutant, author, building type, year, country, state, & keyword

Pollutant codes: 1 = Radon, 2 = formaldehyde, 3 = other organics, 4 = NOX
5 = CO, 6 = CO2, 7 = Particulates, 8 = SO2, 9 = all

Building type: enter residence, school, office, or public building
(Only the first 4 letters are necessary.)

For country, enter US = United States or Canada: for state, enter the
2 letter postal code for the states & provinces: e.g. FL = Florida

```
In field =  pollutant       find code/word = 1          More ? (Y/N) Y
In field =  state           find code/word = NJ         More ? (Y/N) Y
In field =  building type   find code/word = residence  More ? (Y/N) Y
In field =  year            find code/word = 1983

Enter: '<' for references before (& including) date
       '=' for references in that year
       '>' for references after (& including) date =     More ? (Y/N) N
```

[If there are any references that fit the search request, the user is then asked it he wants a hardcopy of the output. The example below shows that an 'N' was entered to indicate that only a screen display was desired. Note, that if you request a hardcopy and do not have the printer turned on, you will hang up the computer and have to restart the computer.]

You can obtain a hardcopy of the records if you have a printer
and you have it turned on. But if you do NOT have a printer
and request a hardcopy, you will hang up the computer & will

have to turn the power off with possible damage to the files

Do you want a hardcopy of the records? (y/n) :n

[These are the references from the bibliography that met the search condition.]

Record No: 13 ID Code: 1GEOR1.83-1

George AC, and Eng J
Indoor radon measurements in New Jersey, New York, and Pennsylvania
Health Phys., 45:397-400

Date: 8/83
Pollutant: Radon
Country: USA
State: New York, New Jersey, Pennsylvania
Building type: Residences
Data format: one table

Record No: 162 ID Code: 1HARL1.83-1

Harley NH, and Altman SM
Progress report June 1, 1982 to May 31, 1983 - radon study
Report DOE/EV/10374-3 from Institute of Environmental Medicine,
New York University Medical Center, NY, NY 10016.

Date: 5/83
Pollutant: Radon
Country: USA
State: New Jersey
Building type: Residences
Data format: many tables

Hit any key to continue:
WAITING c

-- That's all!

Another search? (Y/N) :n

[You are now returned to the main menu, with its 6 choices. If you are ready to exit the bibliography, enter request 6 and you will exit the bibliography and dBase II. The second message is the signoff message from dBase II.]

Finished already? Goodbye!

*** END RUN dBASE II ***

[The several following pages are the printer output from a similar query requesting experimental data. It is presented as an example of numerical and site data being retrieved. First the bibliographic entry is retrieved, then the user is asked if he wants site and numerical output; he answers affirmatively and the data is retrieved and is displayed on the screen and printed.]

RECORD NUMBER: 141 ID number: 9BERK1.81-1

Berk JV, Young RA, Brown SR, and Holowell CD

Impact of energy-conserving retrofits on indoor air quality in residential housing
LBL-12189. Presented at the 74th Annual Meeting of the Air Pollution Control Association, Phila. PA, June 1981.

Date of publication: 1/81
Keywords:

Pollutant: All pollutants
Country: USA Region: States:
Building Type: Residences

Description of Data: 8 tables, 2 histos
Enter s to stop or c to continue selecting records:
WAITING

Do you wish to retrieve site and numerical data? y/n :y
OK. Data being retrieved and formatted

Description of Experiment Site

State: Oregon City: Medford Region: Pacific NW

Climate: 2500 deg-days/y Altitude: 150 ft.

Dates of experiment: Aug 15-29, 1980

==========

General Structural Characteristics

Building type: Detached residence, private

Structural material: Wood frame structure Cladding: Wood
Floors above ground: 1 Total floor area: 1370 Sq.ft.
Number of rooms: 8 Total volume: 350 Cu.meters
Windows: 10 Window area: 90 Sq.ft.
Attic: yes 2 Attic windows na Sq.ft.

Attic vents: yes
Interior surfaces:
Walls: Plaster Board Floor: Wood Ceiling: Wood

1 Fireplace/s 1 with vent 0 with doors

Comment:
Ranch-style home, several trees on site

Solar energy features:
none

Heating system:
Type: Central, forced-air Fuel: Oil Capacity: na

Air-conditioning:
Type: Heat pump

Infiltration Characteristics
Air-exchange-rate: 0.22 ACH Test: Tracer-gas decay
Exhaust fans: 1 In: kitchen
Fluevents: 1 At: furnace

Insulation features:
Attic: R-38, Cellulose Subfloor: R-19, Fiberglass
Weather-stripping: Doors

Other: Post-retrofit; storm-doors & windows added

Daily Averages for Measured Pollutants
And other Parameters

Date	Site	CO ppm	CO2 ppm	NOX ppb	NO2 ppb	NO ppb	SO2 ppb	O3 ppb
8/15	Out	.3	319	2.7	3.8	0.0	0.0	28.8
8/15	Kit	0.1	707	9.1	5.7	3.5	11.6	5.6
8/15	Bed	0.1	706	9.9	6.2	3.8	11.5	18.5
8/15	Liv	0.0	716	10.7	6.5	4.2	11.4	5.0
8/16	Out	.1	367	6.6	6.6	0.1	11.4	19.3
8/16	Kit	0.1	960	14.8	4.9	10.0	11.3	5.9
8/16	Bed	0.0	1283	13.7	4.0	9.7	10.6	5.2
8/16	Liv	0.2	1115	19.2	4.4	14.8	10.6	7.8
8/17	Out	0.0	397	2.3	1.9	0.4	5.2	16.8
8/17	Kit	0.6	1103	13.3	2.8	10.5	5.2	5.9
8/17	Bed	0.5	1351	13.2	1.9	11.3	4.2	4.0
8/17	Liv	0.6	1228	13.0	1.3	11.6	4.5	6.9
8/18	Out	0.1	355	4.7	5.7	1.0	0.1	15.9
8/18	Kit	0.5	969	14.2	5.0	9.1	.2	4.4
8/18	Bed	0.5	1125	14.7	4.6	10.1	0.9	4.2
8/18	Liv	0.6	1084	16.7	4.5	12.2	0.2	7.2
8/19	Out	0.1	347	6.0	5.8	0.1	4.5	14.9
8/19	Kit	0.3	666	7.6	2.5	5.1	4.3	5.1
8/19	Bed	0.5	1178	11.1	1.4	9.7	3.8	5.2
8/19	Liv	0.3	701	11.0	2.8	8.3	3.2	6.7
8/20	Out	0.4	359	17.3	9.2	26.5	.9	13.4
8/20	Kit	0.6	726	17.5	4.6	22.1	1.5	.6
8/20	Bed	0.8	1183	13.5	4.4	17.9	.8	.6
8/20	Liv	0.5	786	17.2	4.7	21.9	.7	.2
8/21	Out	0.2	364	1.9	6.1	8.1	4.4	35.8
8/21	Kit	0.5	719	1.6	2.3	3.9	3.9	30.6
8/21	Bed	0.5	930	.3	1.6	1.9	3.4	16.5
8/21	Liv	0.4	768	.6	2.0	2.6	3.2	16.4
8/22	Out	0.1	367	7.8	8.6	.8	18.3	20.1
8/22	Kit	0.2	714	7.8	4.3	3.5	18.5	2.9
8/22	Bed	0.2	806	8.1	3.9	4.2	18.1	2.5
8/22	Liv	0.2	765	7.7	4.4	3.3	18.3	3.0
8/23	Out	0.3	354	9.0	9.3	.3	0.1	24.1

8/23	Kit	0.3	869	7.3	3.6	3.6	0.1	1.9
8/23	Bed	0.3	973	7.1	3.1	4.0	.3	2.0
8/23	Liv	0.3	888	7.2	3.6	3.6	0.3	1.9

Daily Averages for Measured Pollutants
And other Parameters

Date	Site	CO ppm	CO2 ppm	NOX ppb	NO2 ppb	NO ppb	SO2 ppb	O3 ppb
8/24	Out	0.2	457	5.7	5.6	0.1	3.5	23.1
8/24	Kit	0.3	760	5.4	2.9	2.4	3.7	2.3
8/24	Bed	0.4	1195	7.2	2.8	4.5	3.7	2.4
8/24	Liv	0.3	800	5.5	2.7	2.7	3.9	2.2
8/25	Out	.1	345	6.1	6.4	.3	13.4	21.9
8/25	Kit	0.0	696	1.7	0.9	0.8	13.4	2.2
8/25	Bed	0.1	1014	2.6	1.3	1.3	13.3	2.0
8/25	Liv	0.0	732	1.6	0.9	0.7	13.4	2.1
8/26	Out	0.2	338	13.6	10.7	2.9	0.5	20.8
8/26	Kit	0.3	798	10.2	5.4	4.8	1.5	1.8
8/26	Bed	0.4	1126	10.8	4.5	6.3	1.8	2.1
8/26	Liv	0.3	862	10.5	5.3	5.2	1.8	1.5
8/27	Out	.1	317	9.2	7.0	2.2	11.6	16.6
8/27	Kit	.1	751	12.7	3.6	9.1	11.3	4.6
8/27	Bed	.1	809	10.6	3.1	7.5	10.9	4.3
8/27	Liv	.1	773	11.6	4.2	7.4	11.6	4.5
8/28	Out	0.1	332	10.9	9.3	1.6	9.3	18.0
8/28	Kit	0.1	745	11.3	5.6	5.7	9.1	1.9
8/28	Bed	0.1	817	10.4	4.3	6.1	9.4	2.1
8/28	Liv	0.1	802	10.8	5.1	5.7	9.5	2.0
8/29	Out	0.4	354	22.1	17.8	4.3	4.5	9.4
8/29	Kit	0.4	749	20.8	6.5	14.3	4.1	4.7
8/29	Bed	0.4	996	19.1	5.7	13.5	4.0	4.6
8/29	Liv	0.3	761	20.4	7.0	13.3	3.8	3.9

Daily Averages for Measured Pollutants
And other Parameters

Date	Temp. Deg. C Out	Kit	Bed	Fam	% Humidity Kit	Bed	Fam	Dewpt Out	Wind Spd mph	Dir deg
8/15	22.9	26.1	25.7	29.3	37	38	30	33	6	320
8/16	18.6	25.2	24.3	28.0	39	42	34	48	3	302
8/17	18.4	24.4	23.4	26.9	37	41	33	49	3	304
8/18	17.0	25.0	24.4	27.7	37	39	33	44	5	337
8/19	17.9	24.9	24.4	27.3	37	40	32	43	3	260
8/20	19.4	24.8	24.2	27.5	38	41	32	40	3	283
8/21	18.3	24.6	23.9	27.5	36	39	31	35	4	272
8/22	17.5	24.0	23.3	26.7	36	39	31	43	3	254
8/23	19.5	24.7	24.2	27.4	37	39	32	42	3	268
8/24	19.8	24.6	23.6	27.0	35	39	30	41	4	281
8/25	18.7	23.9	23.0	26.7	35	39	30	45	3	281
8/26	18.0	24.2	23.3	26.8	37	40	31	44	4	320
8/27	17.3	24.0	22.6	26.4	37	41	31	46	4	347
8/28	15.2	23.4	22.7	25.8	38	40	33	44	3	288
8/29	10.6	22.3	21.8	23.8	40	43	35	51	2	206

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