A Computerized Monitoring System for Pesticide Inventories used by Federal Departments and Crown Corporations in Western Canada

by

© P. Richard Perron

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ABSTRACT

As a result of a previous study under the direction of the Environmental Protection Service (EPS) there arose an apparent need for a computerized pesticide monitoring system. The main function of such a system was to monitor pesticide inventories used by Federal Departments and Crown Corporation in Manitoba.

The following report describes the pesticide monitoring system that has been developed for EPS The system that has been developed was based upon a generalized data structure that could be used by different agencies involved with pesticide use. The final output of the program was designed to meet the needs of EPS The Program has been tested by its author and is currently being tested by EPS users.

Further developments that would result from the development of a pesticide monitoring system may include improved methods of data collection to validate the monitoring procedure. Refinements to the program could include flexibility in record definition and size as well as user designed output.

ACKNOWLEDGEMENTS

First and foremost I wish to extend my gratitude to Michele E. Taylor for her help and cooperation in making this project a reality. There is little doubt that Michele was a principal force in the program development.

I also wish to thank the following people who served on my committee: Mr. H.C.R. Gavin, Director, Environmental Protection Service, Manitoba District, Environment Canada; Dr. H. Williams, Department of Computer Education, University of Manitoba; and Mr. C.B. Orcutt, Director, Environmental Control Services, Government of Manitoba.

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Chapter I

INTRODUCTION

In May 1983, Michele E. Taylor published The Use and Management of Pesticides by Federal Departments and Crown Corporations in Manitoba. As a result of this study Ms. Taylor recommended to the Environmental Protection Service (EPS) Environment Canada, that a computerized system for monitoring pesticides be developed. This report describes the development of such a system.

It was recognized at the beginning of the project that the long term value of a computer program was a function of its versatility. A program that met the needs of different user groups could over time enhance information exchange between the users. In order to assist the different users a method of information handling that met various needs would have to be established. Ultimately the information would be placed on large scale data banks where the same information could be used by different groups. Common information would prevent information duplication and lend to factual consistency between experiments and agencies. The use of common information could lead to better understanding of the source of errors within particular agencies. The use of common information systems would prevent considerable overlap of similar program development.

At the outset it was recognized that any program that could be developed would not meet all user needs. Although the method of information handling may facilitate a multitude of uses, the program would remain limited in terms of output format and hardware restrictions. The type of program output would have to specifically meet the needs of EPS while measures would be taken to encourage hardware versatility.

One of the major problems that had to be considered in the development of a common pesticide information system was that of hardware peculiarities between the potential users. A completely hardware versitile program was deemed impossible, yet care in program development would simplify the transfer to other systems. Particular computers have specific instruction sets that will not accept otherwise acceptable programs for different systems. The utilization of certain program design techniques, such as common data structure and similarities in data management proved important for related agencies. Such programming techniques did not imply that the programs would run on all systems. These programming techniques were adopted to enhance simple program modification from programs of one department to another and avoid program development overlap.

The development of any computer model was considered to depend upon restrictions imposed by the size of the computer. The current popularity of the micro-computer

usually with a capacity of approximately 64k would indicate that program design should be based on micro-computer limitations. Design of this nature resulted in many program size limitations, yet the final product proved to be the most versatile. Program size limitations ultimately became apparent in data restrictions (ie. array sizes etc.) while a program was not able to handle wide ranges of data without significant design modifications.

The manual burden of inventory monitoring has been significantly alleviated with the use of a computer. The computer is an extremely helpful tool for keeping track of inventory, generating rapid computation of modifications in large systems. The sorting and grouping of information based upon a given criteria, such as all pesticides on file of a given trade name, may often prove to be a rather tedious task if undertaken manually. The computer can perform the same tasks in a very short time with little manual effort.

The particular area of pesticide inventory monitoring if improved by computer methods could not only speed up work that took significant amount of time using conventional manual methods, but also work that may be too time consuming could be made more feasible. Agencies interested in pesticides would find a computer model extremely helpful in performing tedious yet relatively simple calculations, with the addition of communication linkages the computer could

help in transferring significant information from particular users rapidly. A program designed for pesticide monitoring would rapidly facilitate the transfer of information amoung agencies adopting the programs resulting in an improved control process.

1.1 PROBLEM STATEMENT

A computerized data base system was needed for the monitoring of pesticides used by various Federal departments in Canada. The term monitoring refers to the keeping track of inventories of pesticides stored for future use. The control of such pesticides remained a function of the individual agency and their particular methods and reasons for classification. The computer program would simply serve as a tool to assist in such a function. The Environmental Protection Service (EPS) was involved in monitoring Federal agencies with respect to pesticide storage and use. Such information had a tendency to be rather abundant and could be better handled by a computerized monitoring program. A computerized monitoring system could serve a variety of user needs, from a simple method of updating information to a method of rapidly grouping information according to specific criteria during emergency situations.

1.2 OBJECTIVES

The main objective of this study was to develop a working program to be used by the EPS for pesticide monitoring and control. The program was designed in such a manner that various user needs could be served without requiring significant restructuring. The program was user oriented, written for the user with the most basic understanding of computers. The program was developed on a Commodore Super Pet and required 'minimal' modifications in order to run on other operating systems. The project also included the development of both a user's manual and a programmer's manual to aid users and enhance future program development.

Chapter II

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews some of the literature that proved relevant to computer design as it pertains to pesticide inventory monitoring system. The review focusses upon factors involved in effective program development as well as consideration given to data definition.

The review serves as an aid in understanding theory behind structure of the program. The first part of this review focusses on attaining the information pertinent to the data structure. This has been accomplished by means of a survey and literature has been examined that dealt with survey methods. This was followed by a review of material related to computer program design. The final portion of this review pertains to literature specifically dealing with pesticide control. The intention in examining the pesticide literature was to form a basis for the survey and consequently the foundation for the program design.

2.2 THE SURVEY

The information gathered through a survey formed the basis for computer program development. The survey was used to determine current practices in pesticide monitoring, and identify the pertinent variables. The survey also served as a method to determine exactly which agencies were currently using computer programs to monitor pesticides in their jurisdictional areas.

Surveys can generally take on three purposes, namely description, explanation, or exploration (Babbie 1973). (The purpose of the enclosed survey was exploration.) The survey generated information about existing computer programs as well as particular methods of pesticide monitoring.

The next step in organizing a survey was to determine the nature of data that was used to describe the object of study. The primary concern of the survey was to determine the variables that were used for monitoring pesticides. The nature of such data can be defined for the most part beforehand and was submitted in the form of a list of common variables with additional entries for new variables. Other information that was relevant to the study involved information on existing computer programs and their functions. The description of programs that did exist was left to the individual respondent.

The 'universe' of the survey describes all elements that are defined in the survey (Babbie 1973). The universe included all agencies within western Canada that were interested in monitoring pesticides. This involved federal, provincial, and local government departments. The population that was subject to the survey would include federal EPS offices across the western region, the provincial counterparts, and the environmental agencies of the major urban centres across the region. Any other agencies chosen for the survey were associated with pesticide monitoring and interested in developing computer applications.

The design of the questionnaire was based on a combination of open-ended and closed-ended questions (closed-ended whenever possible) specifically related to pesticide monitoring. The questionnaire included a description of the research intention. The questionnaire was as clear and simple as possible. Care was taken when designing the questionnaire to avoid bias in the types of questions asked (Leedy 1980).

In applying the information gathered through the survey, there was no attempt to draw absolute universal conclusions about all pesticide monitoring procedures, but rather variables of common interest for the surveyed agencies were ascertained to form the basis of the program model.

2.3 PROGRAM DEVELOPMENT

2.3.1 Data Base

A fundamental concept to computer design is the data base. Data bases are large sets of data that are structured with the following two basic principles: (a) data accessible to a number of programs, (b) data referable in a variety of formats so as to facilitate future program development. This differs significantly from the original programming approach that had a unique data set for each program. The original approach proved to be extremely time consuming, due to constant repetition of data input. Each time a particular record was added or deleted from old data sets, revision would have to be made to all data sets for all programs that used the information. New forms of data can be added without affecting the integrity of old data (Squire 1980).

2.3.2 Data Management System (DMS)

A data management system refers to a software package that has been designed to manipulate data in a data base. The DMS used a logical structure for representing the data. Procedures for storing and accessing data in a physical storage device allow the DMS important versatility. The DMS also required associative structures that relate the particular data elements to one another within the data base as well as a set of rules for effecting actions against the data base.

The data base required a set of control cards that describe the data base to the DMS including such terms as data element name, length, type, accessibility (who can see it, who can modify it, who can add or delete it), mandatory or optional, multiple or single, as well as structural componants (Squire 1980). In interactive programming control cards are replaced by a system of questions and required answers that perform the same functions as the control cards.

The structural definitions in the DMS in turn includes:

a) ordering techniques

   ie. sequential or random.

b) associative techniques

   fixed explicit association or variable association using pointers

c) data structures

   ie. hierarchical or serial

d) search proceedures.

These components were the basis of data and software interaction.

Proper data management ultimately appears in program efficiency and versatility. In terms of inventory monitoring significant amounts of data require that efficient data control becomes a necessity. Data sets should never be

considered to be an end in themselves. Data files should be considered to be capable of evolution. This may vary from internal changes to links between data sets. The program should be capable of transactional variance in order to enhance multiple applications (Botory 1981).

Methods of accessing information will vary depending on the way in which the data has been stored. Sequential files will generally be accessed based in the order in which stored, while random access files can be accessed with the aid of randomizing algorithms (Squire 1980). Randomizing algorithms generally use sets of mathematical calculations to simulate random data. The most common randomizing algorithms are based on integer theory. Manipulations of integer keys can often generate unique remainders that serve as good data keys (Dudley 1978).

2.3.3 Storage Access

The techniques mentioned in the section 2.3.2 affect user access. Data should be accessible from multiple sources to enhance a variety of uses. Organizational techniques become major concerns for data access. Design considerations should involve such factors as frequency of use in order to determine which data should be made most easily accessible (Goog & Hartmanis 1982).

Data accessibility is not simply restricted to data management system definition. Accessibility becomes a function of the user. Aspects such as remote access and built-in data protection should not be ignored. The data should have a proceedure of immediate backup when data is produced, in order to prevent the event of something going wrong. (Squire 1981). Methods of transferring data to different remote locations will have to be developed. This may vary from communications interties to hard copy transfers.

2.3.4 Security

Security revolves around three general areas. These are system security, program security, and data security. Methods were developed to limit accessibility to various degrees. System security will probably be the most general of the three areas with access limited to the complete user group. Data security were reasonably strict in order to prevent accidental alteration or deliberate vandalism. Data can only be entered by a few users. Certain data may be confidential, hence internal data control may be rather sophisticated (Goldsmith 1981). Program security should be regarded the strictest of all. Preventative methods should be developed controlling user access to control features. Special care was taken in protecting the data management system (Hoffman 1977).

2.3.5 Programming in Basic

The advantages to programming in BASIC may be associated with the simplicity of the language on the one hand and its comprehensive use on the other. Simplicity in programming using BASIC is probably the greatest asset; however BASIC may not be as efficient as using another language (Munro 1974). BASIC lends itself to program modifications and additions with ease. BASIC is also advantageous in that it is probably the most widely used of all languages and is hence available on most systems. This is indeed an aid in making the program universally acceptable (Douglas 1972). The use of BASIC also may be advantageous in that most systems do have BASIC interpreters. Many computers have discrepencies in the interpretation of the form of BASIC used. Attempts to develop standards for all systems have not been completely successful but have demonstrated progress. The most widely accepted standards at present have been developed by the American National Standards Institute (ANSI). In an attempt to develop a program with a degree of universality, it is best to adhere to ANSI standards, whenever possible. The programming is for the most part in BASIC to the degree that it is acceptable on the system available.

2.4 PESTICIDE INFORMATION

The final portion of this literature review has focused upon methods of organizing and categorizing pesticides. There has be no attempt to determine the present practices concerning the use of the pesticides since the major concerns are the "when, where and who" characteristics of the pesticide use instead of the "why's" and "how's". The information gathered in this review has been used as a foundation for the survey questionnaire given to Appendix B. The determination of various components of pesticide classification was based on an overview of commonly used proceedures in some existing manuals.

The term pesticide can be described as "any chemical introduced into a biological environment with the intention of killing organisms or of altering biological function."[1] Agents not necessarily categorized as chemicals but still used to kill organisms are also sometimes reffered to as pesticides. Pesticides are most commonly classified under the following groups: insecticides, herbicides, fungicides, fumigants and rodenticides (McEwen and Stephenson 1977, Thomson 1977). These groupings are related to the actual biological kingdom or phylum targets. Many of the other particular classification characteristics will depend upon the particular phylum in question. For example, further

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[1] Rudd, R.L. Environmental Toxicology: A guide to information sources Gale Research Co.: 1977 p . Detroit.

classification of herbicides could include the properties of specific target plants, be they foliated versus nonfoliated. Other herbicide classification information could include application methodology that could be specific to the biological kingdom involved (Stevens 1971).

Classification criteria for pesticides can be based upon particular chemical characteristics such as, water solubility or persistence in different media. (McEwen and Stephenson 1979, Stevens 1971, Thomson 1977). The characteristics of the chemicals may be related to effectiveness measurement such as toxicity or lethal versus nonlethal substances. Effectiveness may be defined in terms of the side affects such as disease or associated items affected, and recommended treatment. (McEwen and Stephenson 1979).

Pesticides are often described in terms of their chemical makeup. This may include the actual chemical metabolic effect or may simply be based upon the active ingredient (Stevens 1971). Chemical makeup may be extended to become a part of a mixture that has been made available on the market. Chemical information is given in terms of chemical name, chemical structure and very often in terms of the common trade name.

Ideally all of the variables described above should be incorporated in the program developed. The usefulness of each of the parameters in a monitoring system may be questionable. Other variables that would be important in

the context of pesticide monitoring would include, location, amount, owner common usage as opposed recommended usage, and even licensing. These are items that are not included in common classification system.

Chapter III

METHODS

3.1 INTRODUCTION

The study consisted of four interrelated phases that together brought about the development of a comprehensive user-oriented computer program. The phases were conducted in the order listed.

3.2 PHASE 1: DATA RECOGNITION AND PROGRAM DEFINITION

The first phase of the study consisted of accumulation of information related to the proposed program development. The information was gathered via a questionnaire that was distributed to federal, provincial, and municipal agencies actively involved in pesticide use and/or management. This phase gave an indication of the variability of methodology and use. Program development was based upon defining a physical record that could be used by most of the agencies questioned. Information structured according to the specified record could be easily used by all agencies if required.

3.3 PHASE II: PROGRAM DESIGN

The program design initially involved a description of the input data as well as a description of possible data limitations. Also associated with the data was the design of a data management system for efficient data storage and aquisition. The importance of efficient data management became evident with the addition of new subroutines. The program allowed as much flexibility as possible.

Other segments of the program design phase included any functional manipulations as well as the design of the various tables of output. The functional manipulations proved to be minimal while output consideration were rather involved. Special care was taken during the design process to ensure that the program was user oriented. This included simple instructions with any program defaults clearly defined. The program design also included internal data and program security to protect against misuse.

3.4 PHASE III: PROGRAM OPERATION

The most time-consuming portion of the study came during the phase when the program was written and tested. The program was run on the Commodore SuperPet BASIC system. Coding was in ANSI BASIC whenever possible.

3.5 PHASE IV: MANUAL WRITING

In order to enhance usage, two manuals were developed, a user's manual and a programmers manual. The user's manual was principally concerned with operation of a "canned" program with various levels of user security to protect the data. The programmer's manual includes coding information, flow charts and explanations of the various methodologies.

Chapter IV

DISCUSSION

The responses to the questionnaire were considered to be satisfactory in terms of percentage returned. It would have been overly optimistic to anticipate 100% response rate from all concerned; all agencies surveyed in the Northwest Territories and Manitoba did return a 100% response rate while that of Saskatewan with 37%. A compilation of the questionnaire responses has been recorded in Appendix D.

The compilation of the questionaire responses has led to a series of parameters for the computer program development. The limited use of computer programming techniques among the agencies concerned with pesticides pointed to numerous application possibilities for a program that could handle a "universal" pesticide data set. Such a data set would have to include all the relevant variables as defined by all the agencies that may prove to be future users. The design of the computer program for EPS encorporated all the parameters specified in the questionnaire responses. In order to enhance information transfer amoung the various user groups any future program development could be based on the EPS program itself or at least upon the parameters used within the program.

It should be noted that the actual uses of the program have been based upon a pesticide inventory as described by EPS. The limitations imposed by system peculiarities have placed certain restrictions on the immediate ability of the program to operate on other systems. Modifications to the program particularly for input and output operations, would have to be made for the program to operate on other computers systems. Limitations of this nature have been imposed by the hardware, and emphasis was on making the system operational for EPS. The program output is also designed specifically for EPS. Such output features would best be added by or for the particular users.

The variables that have been adopted for program development, based upon the questionaire responses, are listed below and further described in Appendix C as well as in the user's manual. The variables listed below constitute the basis for a physical record.

a) trade name
b) generic name
c) pesticide type
d) pesticide classification
e) p.c.p. number
f) department name
g) department subname
h) placename

i) geographic location

j) quantity stored

k) quantity purchased

l) purchase date

m) quantity applied

n) date of last application

o) formulation category

p) toxicity category

q) formulation category

r) licensee

s) licensor

t) date of license expiration

u) place license applicable

In order to reduce the physical record size the user was given the opportunity to choose a licensing option. A reduced physical record would ultimately make data handling a somewhat less tedious. The record size that has been adopted contains 16 fields. The fields that are most commonly used are those listed above from trade name to formulation category (a) to (o). These will be the fields listed if the default option of the program is chosen. It has been ascertained however, through the information attained in the questionaire, that licensing is an important factor in some monitoring systems. A provision for licensing has been developed. When the licensing option is chosen, information in the fields for department name to geographic

location (f) to (i) have been replaced by the fields license to place of license applicable (r) to (u) in the consecutive order as defined in the table above.

One of the more significant results received through the questionaire pertained to the limited use of the computer for a tool in the area of pesticide control. Of all the respondents only one agency was actively monitoring pesticides with the aid of a computer. The agency using the computer found that the computer proved to be a significant time saving device. While several agencies were monitoring pesticides, most used conventional manual data handling methods. Of those agencies actively monitoring pesticides only one quarter of the respondents were interested in aquiring a method of collecting pesticide information using a computer. The agencies seemed to be generally satisfied with existing methods and were not prepared to make the change over to computer file handling at the time of the study.

The lack of computer monitoring systems is ultimately linked to lack of computer access. Of the agencies actively monitoring pesticides, only two actually had access to a computer system. Since most agencies were not active in developing computer software the potential importance of user oriented software becomes more pronounced. As various agencies attempt to implement computer techniques, easily understood programs should prove to be an asset. In an

attempt to meet the potential needs of anticipated inexperienced users, program development should focus on the interactive approach. As well as making the program interactive, program development should also include a "help" subroutine to clarify user problems.

The program designed for the inexperienced user should serve as an educational tool as well as an instructional tool. In order to meet such a goal the following criteria have been incorporated into the "help" routine.

a) file description
b) field description
c) system description

A description of the program itself is not included in the help routine of an interactive program since it would likely confuse the inexperienced user. Program information is confined to the programmers manual.

A monitoring program is conceivably a file handling progam and should be composed of the following:

a) Program Control

-access point for all other programs.

-source of help information.

b) Create

-routine for creating new files

-routine used to add to existing files

c) Modify

-modify records on existing files.

-multiple modifications per pass

d) List

-list records according to specified record number

-list record according to common field criteria

-output according to specified formats

e) Search

-search files for records containing

specified fields

-search for list or modify

An additional routine would be incorporated into the system for each program to act separately, particularly in the case of the Commodore hardware used at EPS. The program allocates space for the other programs and define arrays initially. Access to this last program from other programs must be prohibited in order to prevent error. A schematic of the program has been given in the programmer's manual Fig f-1.

The applications of a program based upon a physical record like the one described above, are too numerous to mention and should really be left to the individual user.

Grouping information based upon common criteria may help in everyday information handling or else serve as a convenient method for determining an inventory at a site during an emergency situation such as a fire.

All the records can be listed according to any criteria such as location giving the user a list of all the pesticides in that location. All the records on file of a given trade name or generic name can be listed in the same manner. In this way a rapid analysis of what exists in Western Canada at a given time can be made. The user can also be more specific by first defining a location and then defining the trade name. In this way only pesticides with a given trade name at a given location would be listed.

A program that allows the user the versatility to group information based on any field or on a combination of fields may be used in ways not forseen by the programmer. For this reason all the possible program outputs cannot all be predicted. The program has been designed to facilitate specific EPS user needs allowing the addition of subroutines as required.

Chapter V

SUMMARY

The tedious process of handling pesticide data (Taylor 1983) pointed to a need for the development of a computerized pesticide inventory monitoring system. The benefits of such a system were anticipated by EPS staff and would vary from the ability to rapidly locate pesticides in storage to the instant evaluation of on site stores in emergency situations.

A computer model was developed to meet the needs of EPS. The progam was designed for inexperienced computer users. The program elicits user responses that manipulated pesticide inventory data files. The development of the program (PESTMON) was realized through discussions between a programmer and EPS staff and as well as from the questionnaire distributed to other potential users. The final product was a program that fulfilled the needs of EPS in Manitoba. The program could be modified to meet the needs of other users.

The major strength of the program PESTMON is in its ability to rapidly sort through files for records containing common information. In this way all records containing the same criteria such as a particular trade name of a given

location can be grouped. Grouped information can in turn be grouped again based on another criterium up to 16 times for the 16 components that make up a record. The simple interactive design of PESTMON allows inexperienced users access.

The limitations of PESTMON rest in its lack of direct connection with source data. All data must be transferred to the program manually. The labour of data entry by the EPS office may make long term program use impractical. The specific design of output for EPS restricts the programs use for other users.

The computer may prove to be an extremely valuable tool for pesticide inventory, control and regulation. The problem remains that the monitoring system is only as good as the data that are entered. The computer program can handle data as it comes in yet developments improving the system of data collection may prove to be an important next step. Communication links between a central computer and data sources (storage locations) may enhance the overall data base collection system. At the time of this study the cost of the hardware for such a limited use may not be justifiable. A system where pesticides purchased by Federal agencies could be reported to a central control agency by way of a written form may be more practical at this time. Linkages between the computer and the pesticide users might include the development of large scale continuously active data bases that hold information about the various pesti-

cides,inventories, descriptions,uses, and users. Other foreseable uses of information storage systems may include the control of pesticide containers and their disposal, as well the regulation of pesticides from the source such as the manufacturer or distributer.

The monitoring of pesticides may prove to be an extremely important in the protection of our environment. The development of PESTMON is simply a preliminary step towards computerized pesticide information use.

Appendix A

SURVEY LETTER OF INTRODUCTION

August 10, 1983

Dear Sir or Madam:

Early in May of 1983, you received a questionnaire from the Natural Resources Institute, University of Manitoba. The questionnaire asked what, if any, information on pesticides was being collected by your agency. In the questionnaire you indicated you would like a summary of results obtained from the questionnaire. Enclosed please find a summary to fulfill that request.

The information received from the questionnaire is being used to determine which information would be useful in a computer program for environmental control agencies. The computer program for processing pesticide information is being designed for the Manitoba District Office of the Environmental Protection Service, Environment Canada.

Thank you for your cooperation.

Sincerely,

Richard Perron

Encl.

Computer Systems Model for Processing Pesticide Use Information

The Natural Resources Institute in co-operation with the Environmental Protection Service, Environment Canada in Manitoba conducted a study during 1982 titled "The Use and Management of Pesticides by Federal Departments and Crown Corporations in Manitoba". This study focused on the following aspects of use and handling of pesticides at federal government establishments in Manitoba:

a) purchasing procedures,

b) storage and disposal practices,

c) information sources for pesticide users,

d) employee training, and

e) use justification processes.

As follow-up to the 1982 study, the Natural Resources Institute, again in co-operation with the Environmental Protection Service, Environment Canada, is examining the possibility and need for development of a computer program for processing information on pesticide use. This examination will be based on the formats used in the 1982 study but may be modified to enable environmental control agencies, other than the Environmental Protection Service in Manitoba, to use the information. Examples of tabulated information from the 1982 study are attached (Appendix A).

The enclosed questionnaire is designed to determine whether or not such information is being collected and used by the various environmental control agencies in Alberta, Saskatchewan, Manitoba and the North West Territories. The questionnaire is also designed to determine whether or not there is interest in starting, improving or restructuring such information systems. An information system in the form of a computer program will be developed to process and store information on pesticide use.

Please complete the questionnaire for your agency by June 15, 1983. If you wish to discuss any aspect of this study, contact Michele Taylor or Richard Perron at (204) 474-8373.

Yours truly,

Richard Perron

Appendix B

TITLE PAGE, ABSTRACT AND EXAMPLES OF TABLES FROM 'THE USE AND MANAGEMENT OF PESTICIDES BY FEDERAL DEPARTMENTS AND CROWN CORPORATIONS IN MANITOBA'

First Mailing May 24, 1983

Second Mailing June 27, 1983

The information provided by this questionnaire will be confidential, available only as a summary of results. If you would like a summary of results, please indicate yes or no.

Yes _____

No _____

A. AGENCY INFORMATION

Name of Agency _____

Address _____

_____

Name of Respondent _____

Telephone Number _____

Name of Recipient _____

(if different from above)

B. ACTIVITIES OF AGENCY

List the legislation for which your agency is responsible and outline your activities.

C. SYSTEMS INFORMATION

Are you currently collecting information on pesticide use? Yes _____

No _____

If yes, please go to section D.

If no, would you be interested in a method for collecting pesticide use information? Yes _____

No _____

Please go to Section G.

D. GENERAL INFORMATION

This area is to be completed if you are conducting a program for gathering information on pesticide use.

What methods do you use for collecting information on pesticide use?

inventory _____

sample survey _____

sample questionnaire _____

other (please specify) _____

How long have you been collecting data on pesticide use? _____

In which areas of pesticide use do you collect data on? _____

What are your objectives in conducting your program for collecting information on pesticide use?

Please summarize the findings of your program.

How have you applied the findings which have resulted from your program?

E. COMPUTER MONITORING

This section is to be completed if you are currently using a computer to store pesticide use information or to monitor pesticide use. If you are not using a computer for these purposes, please go to Section F.

What model(s) of computer(s) does your agency use or have access to? ___

_____

_____

_____

What is/are the language(s) (include version) of the computer program(s) being used? _____

_____

_____

Has the computer program assisted or improved your monitoring procedure?

Yes _____

No _____

If yes, explain in what ways the computer program has assisted or improved your monitoring procedure. _____

_____

_____

_____

_____

Could your computer program be improved to assist you in your monitoring procedure?

Yes _____

No _____

If yes, what improvements would you like to see in the computer program?

F. CRITERIA FOR CLASSIFICATION

The following questions are designed to determine the criteria by which you are currently classifying pesticide use information.

Do you classify information by pesticide class (for example, herbicide, insecticide, fungicide)?

Yes _____

No _____

Do you classify information by a particular target pest (for example, mosquitos)?

Yes _____

No _____

Do you use any of the following names in classifying pesticide

information?

a. common or generic name _____

b. trade name _____

c. chemical name _____

d. chemical formula _____

Do you classify by toxicity or toxic levels as a means of classification in your pesticide monitoring (for example, low, medium, high; danger, warning, caution)? Yes _____

No _____

If you answered "Yes" above, have you specified a boundary below which a pesticide may or may not be used? Yes _____

No _____

If "Yes", what boundary have you specified_____

_____

_____

Do you address any of the following?

a. storage procedures _____

b. handling procedures _____

c. application procedures _____

d. formulation of the pesticide _____

Does your monitoring system use quantity used or quantity stored as criterion? Yes _____

No _____

Does your classifying system use geographic location of use or

storage as criterion? Yes _____

No _____

Do you classify by any criteria not included above? Yes ____

No ____

If yes, please describe the criteria. _____

_____

_____

_____

_____

_____

G. FURTHER COMMENTS

If you have any questions, comments or suggestions, please list them here, or telephone Michele Taylor at (204) 474-8373.

_____

_____

_____

_____

Return questionnaire to: Natural Resources Institute

The University of Manitoba

Winnipeg, Manitoba, Canada

R3T 2N2

June 27, 1983

One month ago the Natural Resources Institute sent a questionnaire to you about pesticide use information.
If you have already completed this questionnaire please disregard this letter and enclosure.

If you have not done so already, we would encourage you to fill out this questionnaire and return it in the self-addressed envelope provided. The information received from the questionnaire is an important element in our effort computer model for processing pesticide use information.

Your answers will be kept confidential and your cooperation is greatly appreciated.

Thank-you very much.

Sincerely,

Richard Perron

/encl.

Appendix C

DESCRIPTION OF KEYWORD TERMS

GENERIC NAME - Common name not protected or no longer protected by trademark registration.

TRADE NAME - An adopted name that is given by a manufacturer to a pesticide product to distinguish it as produced or sold by him and that may be used and protected as a trademark.

SPECIFIC PESTICIDE TERMS - The term pesticide includes products which can kill a variety of pests. As a result, more specific terms may be used when describing a pesticide. Terms used by this program are:

a) acaricide - a substance which kills mites.
b) avicide - a substance which kills birds.
c) bactericide - a substance which kills bacteria.
d) botanical insecticides - insecticide made from the extracts of certain parts of plants.
e) desiccant - a drying substance or agent.
f) fungicide - a substance which kills fungi.
g) growth inhibitor - a substance which retards growth of plants.
h) herbicide - a substance which kills plants.

i) insecticide - a substance which kills insects.

j) molluscicide - a substance which kills mollusks.

k) nematicide - a substance which kills nematodes.

l) rodenticide - a substance which kills rodents.

m) seed treatment - addition of fungicides and/or insecticides to a seed prior to planting to protect the seedling against both diseases and insects.

PESTICIDE CLASSIFICATION - Pesticide product labelling regulations require that pesticides be classified by one of three class designations. The first designation is "RESTRICTED", used when additional essential conditions are to be shown on the label. The second designation is "DOMESTIC", used when the pesticide is intended for use in or around a dwelling. The third designation is (for this program) "OTHER", and may be any word or words which indicate activities as specified on the label. Examples of such designation include COMMERCIAL, AGRICULTURAL, INDUSTRIAL, or INSTITUTIONAL.

P.C.P. NUMBER - As specified in the Pest Control Products Act every pesticide registered for use in Canada must have a registration number. This number is commonly called the Pest Control Products number, and is found on the label of pesticide products registered and sold for use in Canada.

TEMPORARY RESTRICTIONS - Occasionally a pesticide may be under question because of new information which may indicate danger. A temporary restriction is placed on the chemical until the information is confirmed. This temporary restriction may be placed on a pesticide by federal or provincial authorities. Temporary restrictions on a product by one province are not binding on another province. This keyword has been designated to allocate space for a temporary or shifting restriction.

DEPARTMENT NAME - While this list is not exhaustive, some federal department and Crown corporation names used by this program are:

a) Agriculture Canada
b) Atomic Energy of Canada
c) Canadian National Railways
d) Canadian Wheat Board
e) Canadian International Grains Institute
f) Department of Regional Economic Expansion
g) Environment Canada
h) Fisheries and Oceans
i) Health and Welfare Canada
j) National Defence
k) Solicitor General
l) Transport Canada
m) Veterans Affairs

n) VIA Rail

DEPARTMENT SUBNAME - Some of the departments listed above have, in addition, subnames. These include Agriculture Canada (Food Production and Inspection, Animal Health Division and Research Stations), Environment Canada (Canadian Wildlife Service, Parks Canada) and Solicitor General (R.C.M.P., Correctional Services).

PLACENAME - This keyword uses the name of a city or town to locate a variable.

GEOGRAPHIC LOCATION - This keyword uses the universal transverse mercator grid to located a variable.

QUANTITY PURCHASED, QUANTITY STORED, QUANTITY USED - These amounts are listed in litres or kilograms.

DATE PURCHASED, APPLICATion, TESTED-

Appendix D

SURVEY RESULTS

A. Agency Information

Twenty-five questionnaires were sent to federal, provincial and municipal environmental control agencies in Manitoba, Saskatchewan, Alberta and the Northwest Territories. The response rate was 16/25 or 64%. The response rate for each province or territory was: Manitoba - 100%; Saskatchewan - 37%; Alberta - 78%; Northwest Territories - 100%. The percentage of agencies requesting a summary was 75%.

B. ACTIVITIES OF AGENCY

Q: List the legislation for which your agency is responsible and outline your activities.

A: The agencies were responsible for acts and ordinances dealing with:

- water pollution control
- water resources management
- regulation of use and disposal of pesticides
- fisheries
- park by-laws

- agricultural chemicals
- pesticide sales, use and handling
- provincial pesticide laws and regulations
- weed control
- public health
- environmental contaminants.

The agencies were responsible for:

- issuing permits for applications of pesticides on or near water or in forested areas
- issuing licences to pesticide applicators and dealers
- offering training programs for inspectors, applicators and retail operators
- information or extension services
- biting fly, nuisance abatement programs
- weed control
- park, tree, shrub maintenance.

C. SYSTEMS INFORMATION

Q: Are you currently collecting information on pesticide use?

A: Yes 8/16

No 8/16 If yes, please go to section D.

Q: If no, would you be interested in a method for collecting pesticide use information?

A: Yes 4/16

No 4/16

Blank 8/16 Please go to Section G.

D. GENERAL INFORMATION

This area is to be completed if you are conducting a program for gathering information on pesticide use.

Q: What methods do you use for collecting information on pesticide use?

A: inventory 1/8

sample survey 0/8

sample questionnaire 2/8

other (please specify) literature publications, records of department use, registration of use forms, field applications and summary reports.

Q: How long have you been collecting data on pesticide use?

A: no response from 2/8

1=1 years

1=2 years

1=4 years

2=8 years

1=13 years

Q: In which areas of pesticide use do you collect data on?

A: Provincial government departments and crown corporations, federal government departments and Crown corporations, municipal government departments and agents thereof, annual applicators' summaries, applications pertaining to waterbodies, rights-of way, biting fly abatement programs, surveys of selected pesticides and records of amounts and types of pesticides used in specific areas.

Q: What are your objectives in conducting your program for collecting information on pesticide use?

A: In support of licensing programs, to provide a monitoring system for restricted an pesticides, to provide a review of existing pesticide uses for environmental acceptability, to reveal current use patterns for pesticides.

Q: Please summarize the findings of your program.

A: Findings are submitted in annual reports. Findings are not necessarily complete all programs, and as a result summaries have not been written.

tlogon

Q: How have you applied the findings which have resulted from your program?

A: Findings have been applied in licencing programs, in placing pesticides in more restricted classes, in gearing training and enforcement to fit the needs of the province, in changes in management offctices, in proposals to committees recommending change, or are followed up on a case-by-case situation when necessary.

E. COMPUTER MONITORING

This section is to be completed if you are currently using a computer to store pesticide use information or to monitor pesticide use. If you are not using a computer for these purposes, please go to Section F.

A: Only one agency had access to a computer, an IBM mainframe. The language used was FORTRAN. The computer assisted the agency's monitoring procedure by saving time in the handling of large datasets.

F. CRITERIA FOR CLASSIFICATION

The following questions are designed to determine the criteria by which you are currently classifying pesticide use information.

Q: Do you classify information by pesticide class (for example, herbicide, insecticide, fungicide)?

A: Yes 6/8

No 2/8

Q: Do you classify information by a particular target pest (for example, mosquitos)?

A: Yes 7/8

No 1/8

Q: Do you use any of the following names in classifying pesticide information?

A: a. common or generic name 4/8

b. trade name 6/8

c. chemical name 5/8

d. chemical formula 1/8

(5/8 used combinations of the above)

Q: Do you classify by toxicity or toxic levels as a means of classification in your pesticide monitoring (for example, low, medium, high; danger, warning, caution)?

A: Yes 3/8

No 5/8

Q: If you answered "Yes" above, have you specified a boundary below which a pesticide may or may not be used?

A: Yes 3/8

No 5/8

Q: If "Yes", what boundary have you specified?

A: Boundaries were based on LD50, and oral and dermal toxicity.

Q: Do you address any of the following?

A: a. storage procedures 6/8

b. handling procedures 6/8

c. application procedures 6/8

d. formulation of the pesticide 5/8

(6/8 used combinations of the above)

Q: Does your monitoring system use quantity used or quantity stored as criterion?

A: Yes 3/8

No 5/8

Q: Does your classifying system use geographic location of use or storage as criterion?

A: Yes 3/8

No 5/8

Q: Do you classify by any criteria not included above?

A: Yes 3/8

No 5/8

Q: If yes, please describe the criteria.

A: Other criteria included name of applicant and use. Pesticides were also classifie chemical, i.e., all "chemicals" are recorded and stored in a prescribed manner

Appendix E

USER MANUAL

E.1 INTRODUCTION

PESTMON is a computerized pesticide inventory monitoring program that has been developed for the Environmental Protection Service. PESTMON is an acronym for pesticide monitoring. The program operates on the Commodore SuperPET SP8000 and requires dual 8050 or 8250 disk drives as well as a printer. This manual assumes that the user has little to no experience with the micro computer. Users experienced with Commodore menu driven hardware may by-pass the use of this manual. The program is interactive and for the most part self-explanatory. Experienced users should note however that:

1. Floppy Disk Drive 0 has been designated as the program.
2. Floppy Disk Drive 1 has been designated as the data disk.
3. All units should be turned on, including the printer, at the beginning of program operation.
4. The description of the types of output generated, are listed in this manual.

Special considerations are made for users of the hardware available at EPS in this manual.

E.2 SYSTEM OVERVIEW

E.2.1 Files, records and fields

PESTMON is basically a file handling system. A file is composed of a number of records. Each record in turn is made up of a certain number of fields. Although this may seem confusing to the novice computer user, the file structure is not unlike many of the files that one currently uses.

Example.

A file may consist of all the pesticide inventory information in Manitoba.

A record would be one entry in the file that would contain information about the user, the pesticide names, the storage location, etc. All this information in the record pertains to a particular pesticide, with a particular amount in a particular location etc.

A field would be a given particulars for a specific record. Examples of fields would include

1. generic name
2. user
3. quantity stored

etc.

In order to derive a better understanding of the file, the record and the field see fig. E.1. The file storage system for the computer is the diskette. The user must keep track of what is on his/her diskettes in order to manipulate the files. Keeping track of vast amounts of information on many diskettes may be a somewhat cumbersome task if the user does not adopt a system to keep track of large files. It is recommend that files be kept according to a given field, for example - user or - location. In this way all the information for a user (or in a location) would be stored in the same file. Although this is not necessary in terms of program operation, it may prove to be beneficial to the user.

RECORD STRUCTURE

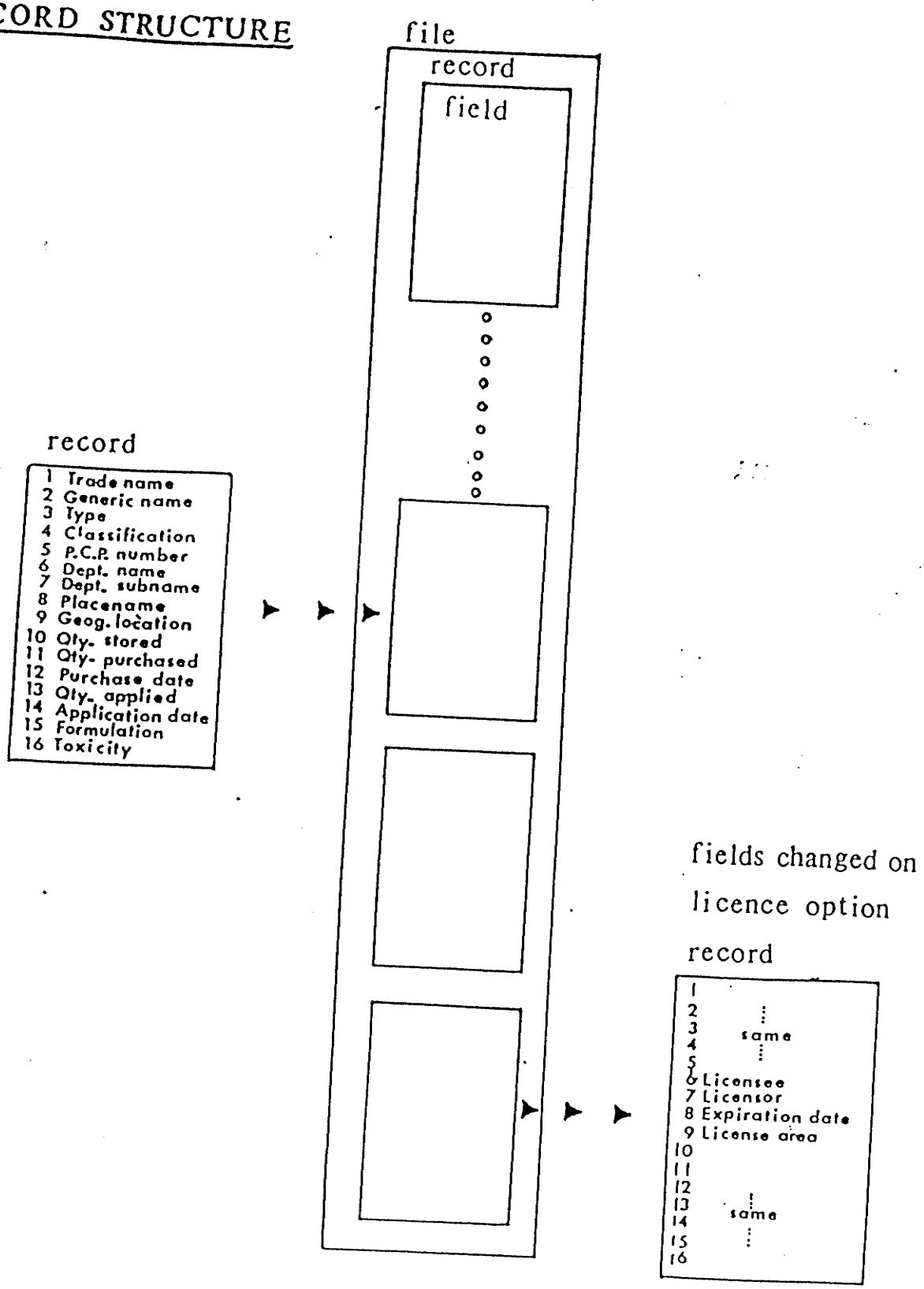

FIGURE E1

E.2.2 Field descriptions

The physical record (or keyword) as defined in program PESTMON will consist of the following fields based upon the criteria defined by EPS

1. Trade name
2. Generic Name
3. Pesticide type
4. Pesticide classification
5. P.C.P. number
6. Department name
7. Department subname
8. Place name
9. Geographic location
10. Quantity stored
11. Quantity purchased
12. Date of last purchase
13. Quantity applied
15. Formulation category
16. Toxicity category

Since proceedures for licensing have historically not been encorporated in the EPS monitoring system, licensing has not been used in the standard physical record. It has been recognized that licensing is an important factor in many monitoring systems. The program has therefore made provision for licensing through a program option that substitutes fields:

6. department name - becomes - licensee

7. department subname - becomes - lincensor
8. placename - becomes - date of licence
9. geographic location - becomes - place of licence

The fields may be defined as follows:

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SPECIFIC PESTICIDE TERMS - The term pesticide includes products which can kill a variety of pests. As a result, more specific terms may be used when describing a pesticide.

Terms used by this program are:

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DEPARTMENT NAME - While this list is not exhaustive, some federal department and Crown corporation names used by this program are:

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c) Canadian National Railways

d) Canadian Wheat Board

e) Canadian International Grains Institute

f) Department of Regional Economic Expansion

g) Environment Canada

h) Fisheries and Oceans

i) Health and Welfare Canada

j) national Defence

k) Solicitor General

l) Transport Canada

m) Veterans Affairs

n) VIA Rail

DEPARTMENT SUBNAME - Some of the departments listed above have, in addition, subnames. These include Agriculture Canada (Food Production and Inspection, Animal Health Division and Research Stations), Environment Canada (Canadian Wildlife Service, Parks Canada) and Solicitor General (R.C.M.P., Correctional Services).

PLACENAME - This keyword uses the name of a city or town to locate a variable.

GEOGRAPHIC LOCATION - This keyword uses the universal transverse mercator grid to located a variable.

QUANTITY PURCHASED, QUANTITY STORED, QUANTITY USED - These amounts are listed in litres or kilograms.

E.3 FILE HANDLING

The maintenance of files in the PESTMON System consists of four different procedures.

1. you can create a new file
2. you can add to an existing file
3. you can change records in an existing file
4. you can get a print-out of records in the file.

The creation of files and the addition of records in a file must be done on a record by record basis. By this it is meant that each record must be submitted separately. Changing records and printing new records can be done on a multi-record basis. This means that by specifying certain field criteria, all records with those fields will be changed or printed according to the user's specifications.

Since the program is interactive in nature (i.e. it asks questions and the user responds) the rest of this program will concern itself with preparing for program use.

The four procedures described above are separate unique program options and have been illustrated in Fig E.2. In order to minimize the use of space by the program each of the options has been made into a separate entity (as illustrated by the circles in the diagram). From the user's point of view the passage from one procedure to another is simply a function of the program and problems may only arise when the program disk is removed from disk drive D0.

PROGRAM OPTIONS

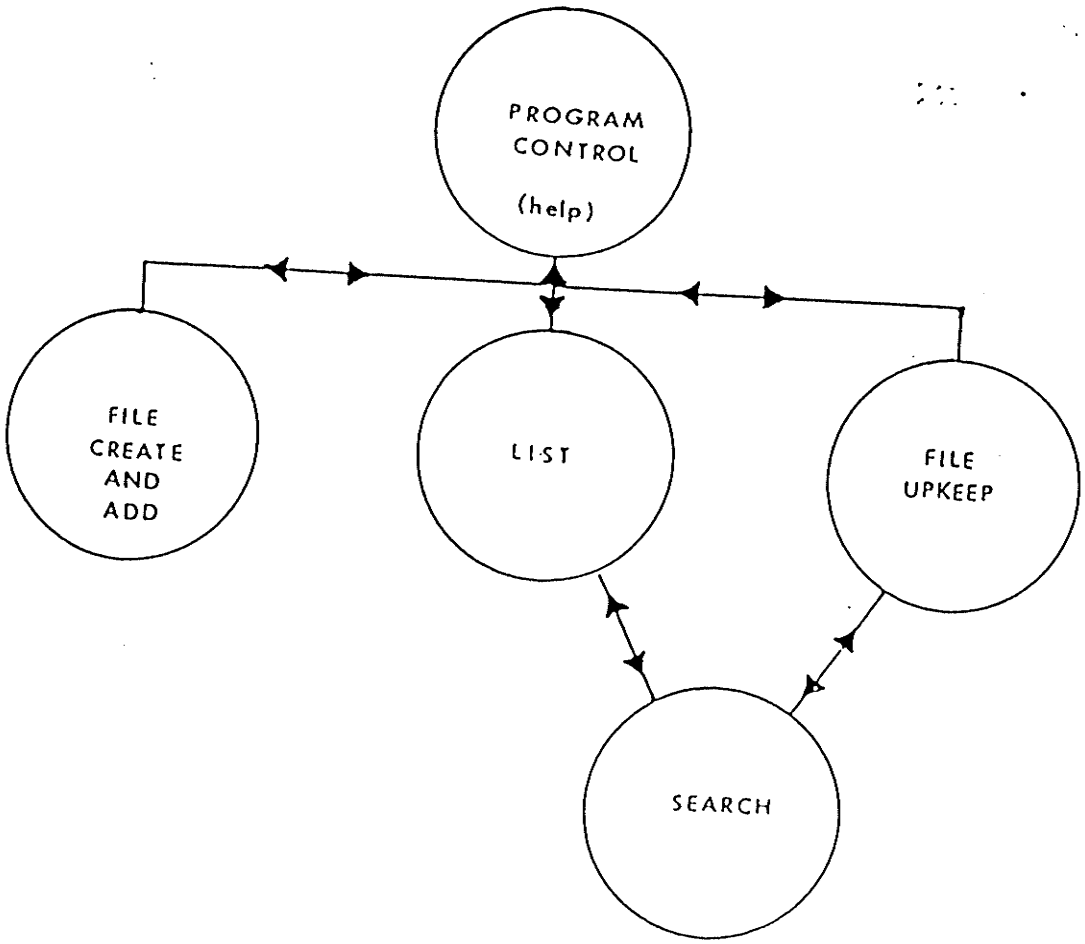


FIGURE E2

E.4 GETTING STARTED

Before you begin to use PESTMON you must ensure that all the equipment is turned on and ready to operate.

1. Turn on the Dual Floppy Disk Drives - Switch located at the back left hand side of the device (CBM model 8050)
2. Turn on the Central Processing Unit CPU ie. the computer/screen - Switch located at the back left hand side of the device (Commodore SP8000)
3. Turn on the Printer - Switch located at the back right hand side of the printer

When all of the devices have been turned on you must ensure that they are prepared to run the program. The Screen Must Read

Commodore Basic 4.0 Ready

If this expression does not appear on the screen you should test the switch at the bottom righ hand side of the screen ensuring that it is set at 8050. If it is not set at 8050 please reset it, and examine the screen. If the above expression does not appear please consult someone experienced with the operation of the machine.

Next, examine the printer in order to ensure that

1. the paper has been loaded
2. the alert switch is not illuminated

If the paper has not been loaded, please consult the printer instructions to load the paper.

If the alert switch is illuminated this may indicate any of three problems:

1. Paper out
   - this indicates that either there is no paper, the paper end is near (25 mm from the end) or paper has been improperly loaded (a small rod on the top right hand side of the printer falls into a hole activating the switch)
2. Cover is open
   - securely close front cover
3. Ribbon is out

- replace the ribbon, consult your manual.

When there are no longer any problems with the printer you should set the page

1. push the LF (line feed switch) until the carriage rests at the top of a new page.
2. push the SET PAGE switch

- the line on which the carriage rests at the moment becomes the top of your output page.

Once you have the CPU and printer operating properly load your program in Drive 0.

NOTE! do not load the program in Drive 1. If you are not familiar with the load procedures, refer to User's Manual for CBM 5 1/4-inch Dual Floppy Disk Drives p. 13.

Once the disk has been placed in the disk drive press the terminal keys

Shift Run

This will load the first program on the disk in this case the program is PESTMON.

After loading the program the rest of the instructions to operate the program involve responding to a series of yes/no questions or choose the appropriate number.

E.5 PROGRAM OPERATION

E.5.1 Program options

Once the user has loaded PESTMON (see section E.4 GETTING STARTED) in disk drive0 and initiated its operation, the screen will present him/her with the choice of either diplaying a brief intoduction to the program or directly moving on to the program operation phase. (In either case he/she will eventually end up in the program operation phase.

When the user enters the program operation phase, the screen will read as follows:

```
                Pesticide System


        You have the following options:

            1. help
            2. start a new file
            3. add on to an existing file
            4. modify an existing file
            5. list an existing file
            6. delete a data file
            7. terminate session


        Key in the number of the option that you want.
```

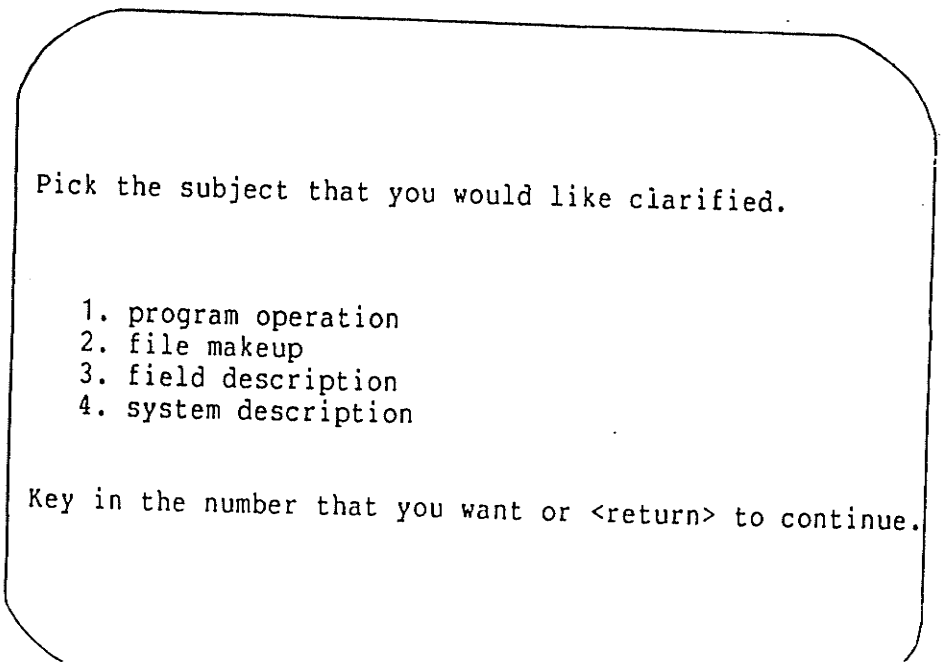
The options that are listed are the seven functions that PESTMON performs. As you choose a number the program will pass control to a subroutine that performs the chosen function.

NOTE! There may be a slight delay in loading the subroutine.

When the particular function is completed the program will present the user with tis same option list. The user may continue to perform the options until he/she enters option 7. When option 7 is chosen the program is erased from central memory. (The main program disk in drive 0 remain protected.) A description of options 1 to 6 follows.

E.5.2 Option 1. Help

Upon calling for the help option the following is displaye on the screen.



When the user enters 1 in response to the queary he/she will be given a brief review of the file handling capabilities of PESTMON. The program will also list a brief review of the program operation proceedures and restrictions.

When the user enters 2 in response to the queary he/she will be given a brief review of the contents of a file similar to that given in E.2.1 of this manual.

When the user enters 3 he/she will be given definitions of the fields used by the program. The field definitions ... correspond to those listed in section E.2.2 of this manual.

When the user enters 4 he/she will be given a description of the hardware that the program will run on similar to the introduction of this manual.

Upon pressing <return> the user is presented with program option list and allowed to perform another function.

E.5.3 Option 2. Start a new file

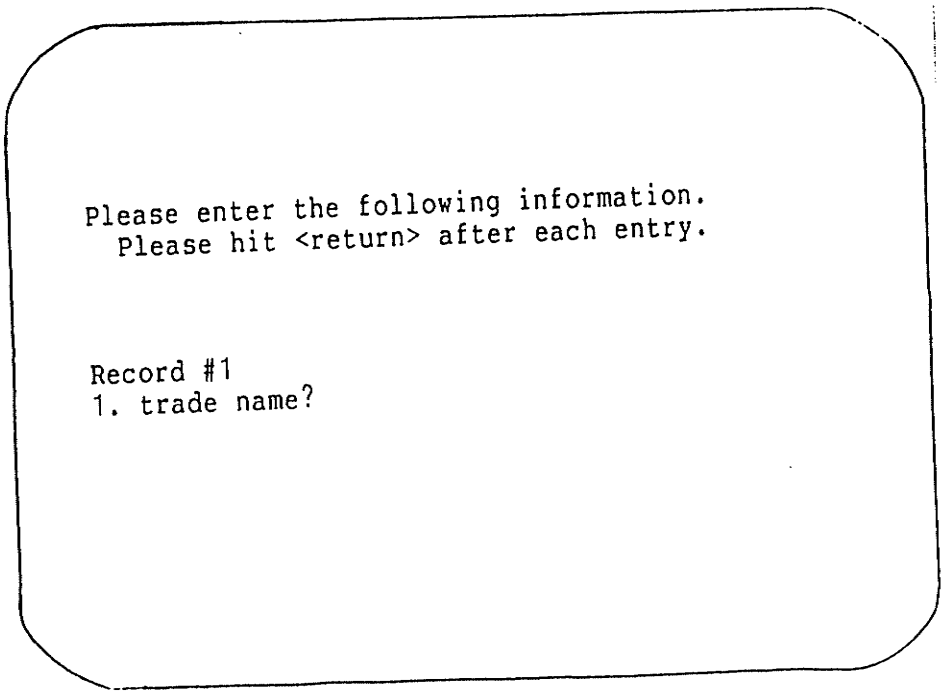
Option 2 is designed to create a new data file on the disk in drive 1. The program will begin by asking the user to load the data disk into the disk and then proceed to give a directory of the disk. The program will then ask the user for a file name.

NOTE! The file name cannot be the same as one of those already on the disk.

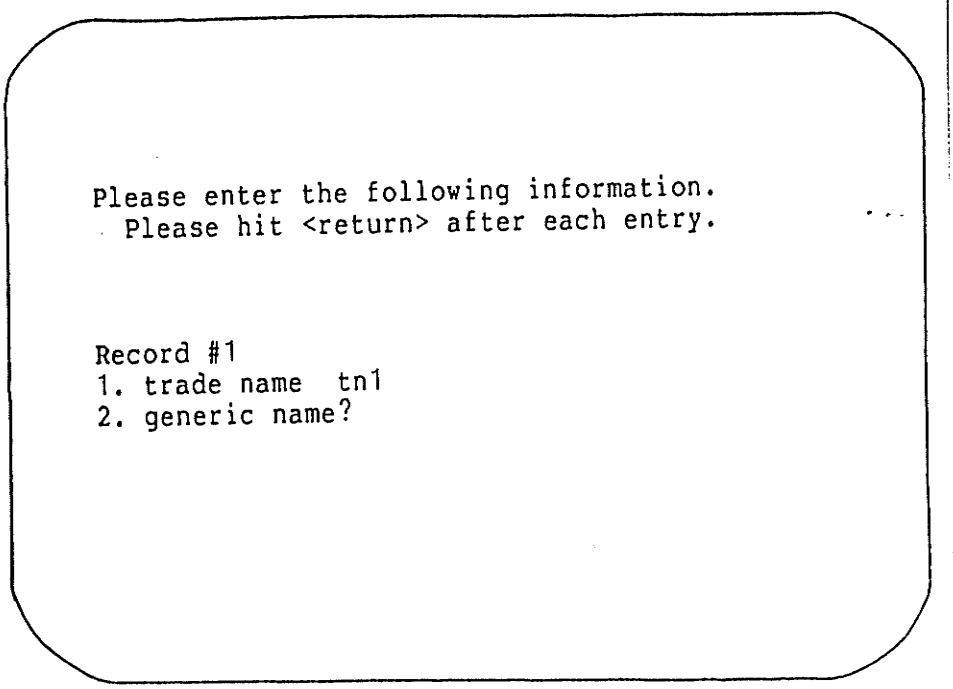
If all the data currently residing on the disk is obsolete the user is allowed to destroy all of the old files in a single pass.

NOTE! Be sure that the data that you are destroying is obsolete.

The data file would at this point be ready to accept new data. The screen will read as follows:



The user is expected at this point to enter the trade name of the first record in the data file.(for example assume the first trade name is tn1). The user is then prompted to enter the next field for this record and the screen reads:



The user should enter the generic name for the first record. The process continues for the 16 fields that make up a record.

NOTE! If information for a field is not available please enter n/a. If the user enters <return> without entering information the program will terminate in error.

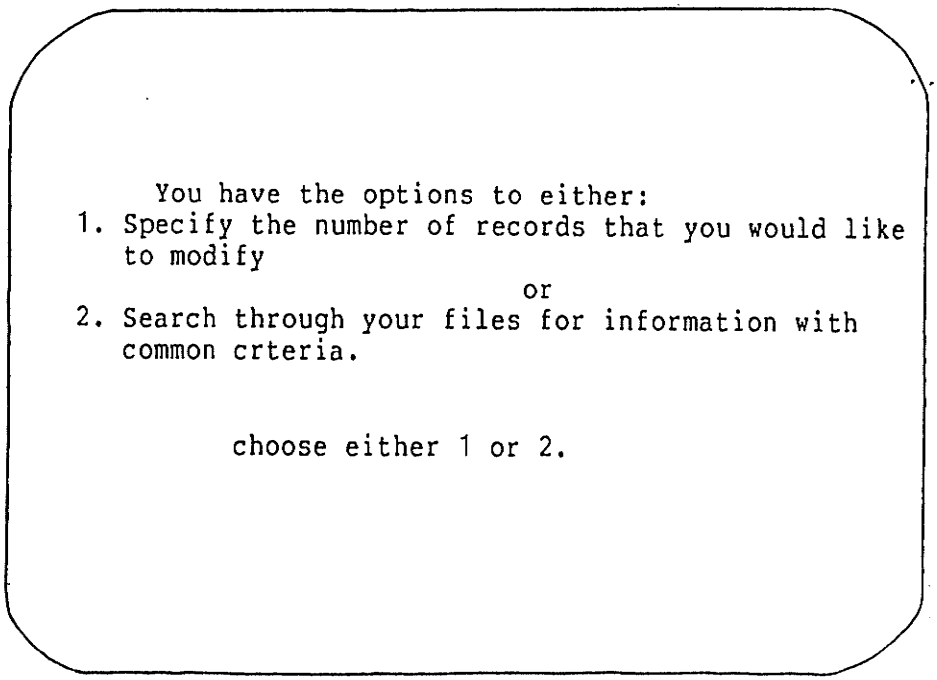
When the record has been completed the record is listed and the user is given the opportunity to modify any field within the record. The user is next permitted to add another record until he/she is satisfied. Next he/she is allowed to inspect any of the records entered and make corrections. Finally control is passed to the option list.

E.5.4 Option 3. Add on to an existing file

Similar to creating a file, adding to an existing file is accomplshed through a series of field prompts. The user must first identify the file and ensure that the data file exists and resides on drive 1. The additon of records is the done the same way as when creating a file. Following the addition of records control is passed back to the program control option list.

E.5.5 Option 4. Modify an existing file

Entering the modification portion of PESTMON the user is asked to ensure that the data disk is loaded in drive 1 and that the proper data file resides on the disk. When the user has ensured that the file to be modified is in drive 1 the screen will read:

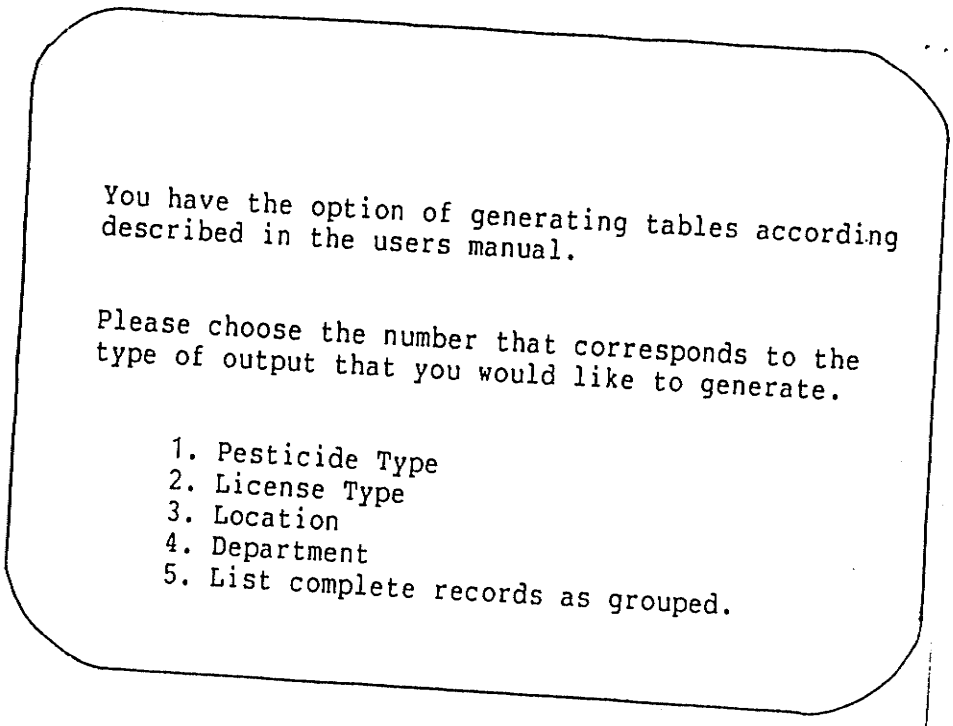


If the user chooses 1 he/she must then specify the record numbers that he/she would like to modify. In which case the records would be found on tne data disk, displayed and the user may specify the field to be modified, and then the user may make the modification. The user may continue the process

In many cases the user may not know the record numbers corresponding to the fields that should be modified or the user simply wishes to modify all the records with fields of a specified criterium. In these cases the user may search through the file for all records of containing the field criterium. All records with the given criterium are grouped and a search may be undertaken on these records for another field criterium. In this way for example all the records for a given trade name in a certain location may be grouped and modified all together or one at a time.

E.5.6 Option 5. List an existing file

PESTMON allows the user to generate five unique tables. In order to list the records the information must first be grouped in the same manner as to search in the modify option previously described. Records to be listed may also be specified manually. Once the records have been grouped the screen will read:



The tables that can be generated correspond to those that have been given at the end of this manual. The fifth table will generate complete records on a record by record basis. Once the information has been grouped the user may make as many tables as desired.

make tables based on another grouping the user must return to program control.

E.5.7 Option 6. Delete data files

Entire data files may be deleted by the user of PESTMON. Care should be taken in deleting files as deletions are permanent. Confirmation is required for deletions to take place. Following deletions the screen displays the program option list.

E.6 LIMITATIONS

Due to the limited amount of memory on the micro computers, certain limitations have been placed on the user.

1. When creating or adding records to a file the user will be limited to 100 records at a time. After adding 100 records the program will transfer to the control segment and automatically copy the records to disk. If the user wishes to add more records to the file then he/she simply has to choose the add option and continue.
2. The tables that can be generated have been specifically designed for use by EPS Examples of the tables have been included at the end of this report. (Note! Tables illustrated have been taken from Michele Taylor's The Use and Management of Pesticides by Federal Departments and Crown Corporations in Manitoba).

3. The size of data storage files have ultimately been restricted by the amount of available storage on disk. If the user wishes to use multiple files on a data disk, he/she must keep track of the available space on the disk. This can be done preceeding program operation by entering:

Catalog D1

or

Directory D1

It should be noted that disk drive 1 has been reserved for data disks. A limit of 771 records per file has been established due to disk limitations.

4. It is important to answer all questions precisely. In certain rare cases the wrong type of answer will lead to program termination.

TABLE 1. HERBICIDES PURCHASED AND STORED BY THE FEDERAL GOVERNMENT, INCLUDING CROWN CORPORATIONS AND CONTRACTORS, 1982

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Aatrex Nine-0	atrazine	Department, Location have been deleted.	1.80	---	9.10	---
			3.00	---	113.00	---
Amitrol	amitrole		---	360.00	---	360.00
Alanap 3	naptalam		---	---	---	4.50
Atrazine	atrazine		---	40.00	---	40.00
			---	---	---	36.40
Atrazine 80	atrazine		---	---	40.00	---
Atrazine 65	atrazine		---	---	22.70	---
Avadex BW	triallate		---	35.00	---	35.00
Avenge	difenzoquat		---	---	---	15.00
Banvel	dicamba		---	100.00	---	60.00
			---	---	---	68.00
Basagran	bentazon		---	---	---	3.75
Brushkill 2,4,5-T	2,4,5-T		---	---	---	22.50
Brushkiller 96	2,4-D & 2,4,5-T		---	137.00	---	137.00
Buctril M	bromoxynil octanoate and MCPA ester		---	20.00	---	20.00
			---	---	---	9.00

TABLE 1.(Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Torch	bromoxynil octanoate	Department, Location have been deleted.	---	20.00	---	20.00
			---	120.00	---	120.00
Torch & MCPA amine 80	MCPA & bromoxynil octanoate		---	1.13	---	0.56
Tordon 10K	picloram		---	---	25.00	---
Totril	ioxynil octanoate		---	---	---	5.00
Treflan (liquid)	trifluralin		---	20.00	---	51.85
			---	31.50	---	21.00
			---	---	---	14.00
Treflan (granular)	trifluralin		50.00	---	15.00	---
Ureabor	sodium metaborate tetrahydrate, sodium chlorate & bromacil		45.50	---	181.80	---
Weed-All	mecoprop & 2,4-D		---	---	0.90	---
Weed All Liquid & Compitox Plus	mecoprop & 2,4-D		---	160.00	---	140.00

--- = None purchased or stored in 1982, or not applicable

Source: (Taylor, 1983)

TABLE 2: INSECTICIDES PURCHASED AND STORED BY THE FEDERAL GOVERNMENT, INCLUDING CROWN CORPORATIONS AND CONTRACTORS, 1982

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Abate	temephos		---	---	160.00	---
Ambush 50 EC	permethrin		---	0.25	---	1.00
Ant & Grub Killer	chlordane		---	0.05		0.04
Atox (dust)	rotenone		5.45	---	4.30	---
Baygon	propoxur		11.40	---	11.40	---
Belmark	fenvalerate		---	---	---	364.00
			---	---	---	728.00
			---	---	---	1638.00
			---	---	---	40.00
Bovaid Ear Tags	fenvalerate		---	1.00	---	2.00
Chlordane	chlordane		---	---	---	1.00
			1000 tags		---	---
Co-Ral	coumaphos		---	---	---	23.00
			---	---	---	4.55
			---	---	10.00	---
			---	---	---	91.00
Crawl-tox	propoxur		---	224.00	---	224.00
			---	91.00	---	91.00
			---	---	0.42	---

Department, Location have been deleted.

TABLE 2.(Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Safer's Insecticidal Soap	potassium salt of fatty acids		---	4.00	---	4.00
Sanfax Liquid 580	malathion		---	---	---	50.00
Sangx-D-Pest	piperonyl butoxide D-trans allenthrins		---	---	3.60	---
Sapho	piperonyl butoxide, n-octyl bicycloheptane dicarboximide, pyrethrins		76.80	---	61.44	---
Sevin 80P	carbaryl		9.10	---	7.70	---
Tedion	tetradifon		---	---	---	2.27
Temik	aldicarb		45.50	---	38.60	---
Thimet	phorate		9.10	---	9.10	---
Thiodan 4EC	endosulfan		---	23.00	---	32.00
			---	1.13	---	0.56
			---	9.10	---	45.50

Department, Location have been deleted.

--- = None purchased or stored in 1982, or not applicable

Source: (Taylor, 1983)

TABLE 3. FUNGICIDES PURCHASED AND STORED BY THE FEDERAL GOVERNMENT, INCLUDING CROWN CORPORATIONS AND CONTRACTORS, 1982

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Benlate	benomyl	Department, Location have been deleted.	---	---	2.73	---
Benomyl	benomyl		---	---	---	0.56
Bravo	chlorothalonil		---	---	---	4.55
Captan 50WP	captan		15.00	---	15.90	---
			0.45	---	0.15	---
			---	---	5.00	---
			---	---	0.85	---
			---	---	1.81	---
Captan (Vita-Vax)	captan		0.45	---	---	---
Copper Sulfate	copper sulfate		---	---	1075.00	---
Cyprex	dodine		9.10	---	20.00	---
Difolatan 4.8	captafol		---	36.40	---	70.00
Dithane M-22	maneb		---	---	93.00	---
Garden Fungicide	captan		0.90	---	0.45	---
Industrial Borax	borax		---	---	45.00	---
			---	---	181.80	---
Karathane WP	dinocap		---	---	6.82	---
Lesan 35 WP	fenaminosulf		1.00	---	0.90	---
Maneb	maneb		0.25	---	---	---

TABLE 3(Cont'd.)

Trade Name	Generic Name	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Manzate 8% dust	maneb		---	---	1.36	---
Mertect	thiabendazole		100.00	---	100.00	---
Morestan	quinomethionate		---	---	---	12.00
No-Damp	benzoate oxine		---	---	1.82	---
Phaltan WP	folpet		---	---	---	2.50
Quintozene 75 WP	quintozene		3.00	---	1.82	---
Rovral 50 WP	iprodione		1.36	---	1.25	---
Tersan SP	chloroneb		---	---	0.88	---
Tersan 1991	benomyl		5.54	---	5.54	---
Tersan LSR			60.00	---	27.30	---
Thiram 75 WP	thiram		---	---	81.80	---
Thiram 80 WP	thiram		---	---	1.82	---
Truban	etridiazole		1.00	---	---	---
Zineb	zineb		---	---	0.91	---
			---	---	6.82	---

Department, Location have been deleted.

--- = None purchased or stored in 1982, or not applicable

Source: (Taylor, 1983)

TABLE 4. OTHER PESTICIDES PURCHASED AND STORED BY THE FEDERAL GOVERNMENT, INCLUDING CROWN CORPORATIONS AND CONTRACTORS, 1982

Trade Name	Generic Name	Type of Pesticide	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
				---	---	---	1.13
A-Rest	ancymidol	growth inhibitor		---	---	6.80	
Agrox NM	lindane & maneb	seed treatment		23.60	---	---	---
Avitrol	4-amino pyridine	avicide		18.40	---	---	---
				7.20	---	---	---
				---	---	---	0.56
B-nine	daminozide	growth inhibitor		---	4.00		4.00
				6 tins		12 tins	
Gopher Poison	chlorophacinone	rodenticide		---	114.00	---	137.00
MH 30 amine	maliec hydrazide	growth inhibitor		---	---	2.72	---
Metaldehyde	metaldehyde	molluscicide		39.30	---	---	---
				7.20	---	---	---
Prolin	warfarin & sulfa-quinoxiline	rodenticide		17.60	---	---	---
				2.72	---	---	---
				9.12	---	---	---
				4.54	---	2.27	---
				44.00	---	39.00	---
Rodent Doom	chlorophacinone	rodenticide		---	---	31.80	---
Rat Bait	chlorophacinone	rodenticide		---	---	0.75	---

Department, Location have been deleted.

TABLE 4.(Cont'd.)

Trade Name	Generic Name	Type of Pesticide	Department, Location	Quantity Purchased kg	Quantity Purchased L	Quantity Stored kg	Quantity Stored L
Rat Kill	diphacinone	rodenticide		---	---	45.50	---
Slug-em	metaldehyde	molluscicide		---	---	0.22	---
Strychnine	strychnine	rodenticide		18.30	---	9.85	---
				---	---	2.50	---
Warfarin	warfarin	rodenticide		0.22	---	---	---
				63.00	---	31.00	---
				---	---	2.00	---

Department, Location have been deleted.

--- = None purchased or stored in 1982, or not applicable
(C) = Contracted Application
C.N.R. = Canadian National Railway

Source: (Taylor, 1983)

Appendix F

PROGRAMMER MANUAL

F.1 SYSTEM OVERVIEW

PESTMON is primarily a data base management system that has been designed for pesticide inventory control. The main focus in developing PESTMON has been to establish a system to keep track of pesticide inventory information for use by individuals who are not familiar with computer programming. During program design and development there has therefore been a great deal of emphasis placed on establishing an easy to use interactive program based upon a standard record size.

The size of the physical record established in PESTMON has been based upon a questionnaire sent to various government agencies involved in pesticide use. The questionnaire established the criteria by which the particular agencies classify pesticides. The criteria were compiled into 21 categories, of which, 16 categories were chosen to make up the various fields in a physical record. The remaining four categories were then allowed to be substituted into the physical record since such a substitution did not interfere with basic user needs

(ie. licensing information was allowed to be an option replacing fields that were specific to E.P.S. monitoring. As EPS was the main client, their needs were met first and licensing was designed as an option.)

In order to establish program versatility in terms of quick access and easy record modification, the storage of information is accomplished on relative access files. The field length that has been established in the relative file record is forty characters. Hence the physical record has a size of 680 characters (or 85 bytes). The number of records allowed in a relative file has been limited by the disk to 771 as recommended in the Commodore Business Computer User's Guide p. 31. The maximum number of files of this size per diskette will therefore equal 16, based upon the capacity of the disk system 8050. (Commodore disk reference manual p. 9.)

The program has been written for Commodore hardware in Commodore BASIC 4.0, and has been tested on the Commodore SuperPET SP8000, with Commodore CBM disk drives Model 8050 and a serial printer Model F10-40/55 Series. It should be noted that due to the nature of the Commodore Basic language certain commands will have to be modified for the program to operate on different systems. Special care should be given to I/O commands on other systems.

The program has been divided into six sub-programs five of which interact directly with the user. The sixth sub-program is used at the outset to allocate program space and to define the various arrays. In this manner the user is allowed to move from one program to another without the re-definition of arrays causing errors. Although each sub-program acts in a similar manner as would a subroutine, each sub-program is stored as a separate file on the program disk. The sub-programs will allow the transfer of variables from one to the next.

The movement from one program to the next is not conventionally acceptable on Commodore Systems and a code was devised to 'fool' the computer into loading another program. The coding sequence listed below performs the program transfer function and will be found throughout the different sub-programs whenever a new sub-program is being called.

Note! All circled characters are as per the keyboard on the Commodore system.

```
print " clr "
print "  "
print "  "
print "  "
dload "filename", do
print "run"
print "home"
print "poke,623,13"
print "poke,624,13"
```

```
print "poke,158,2"
print "end"
```

This code is unique to the Commodore system and should be deleted and replaced for other systems.

The subprograms that are encorporated in the system are as follows:

1. Program Control - this is the pesticide system control all help info is stored here, as well this program is used to control the access to other programs.
2. Filecreate - subprogram used to create new files as well as adding on to already existing files.
3. File upkeep - sub-program to change already existing files.
4. List - subprogram to generate output from information stored on data disks.
5. Search - subprogram used to group information based upon common criteria in given fields.
6. Initialize - this is the largest program that allocates program space that will be used by the other programs.
   - program also dimensions all arrays (a return to this program after its first pass will cause an error.

The interaction of the various subprograms has been illustrated in Fig F.1 The sequence in which sub-programs are accessed is first to last from top to bottom. The directional arrows indicate the availability of access from one sub-program to another.

The physical record used in the program has been designed according to commonly used pesticide classification criteria as established via a questionnaire submitted to agencies involved with pesticides in Canada's Western Region. Fig. F.2 illustrates the physical record. All entries to the

physical record are alpha-numeric in nature and have a maximum field length of 40 characters. In order to perform calculations with records stored on disk, the appropriate information must be converted to numeric preceeding any operations.

The rest of this manual will be concerned with discussion of the parcticular sub-programs.

SYSTEM OVERVIEW

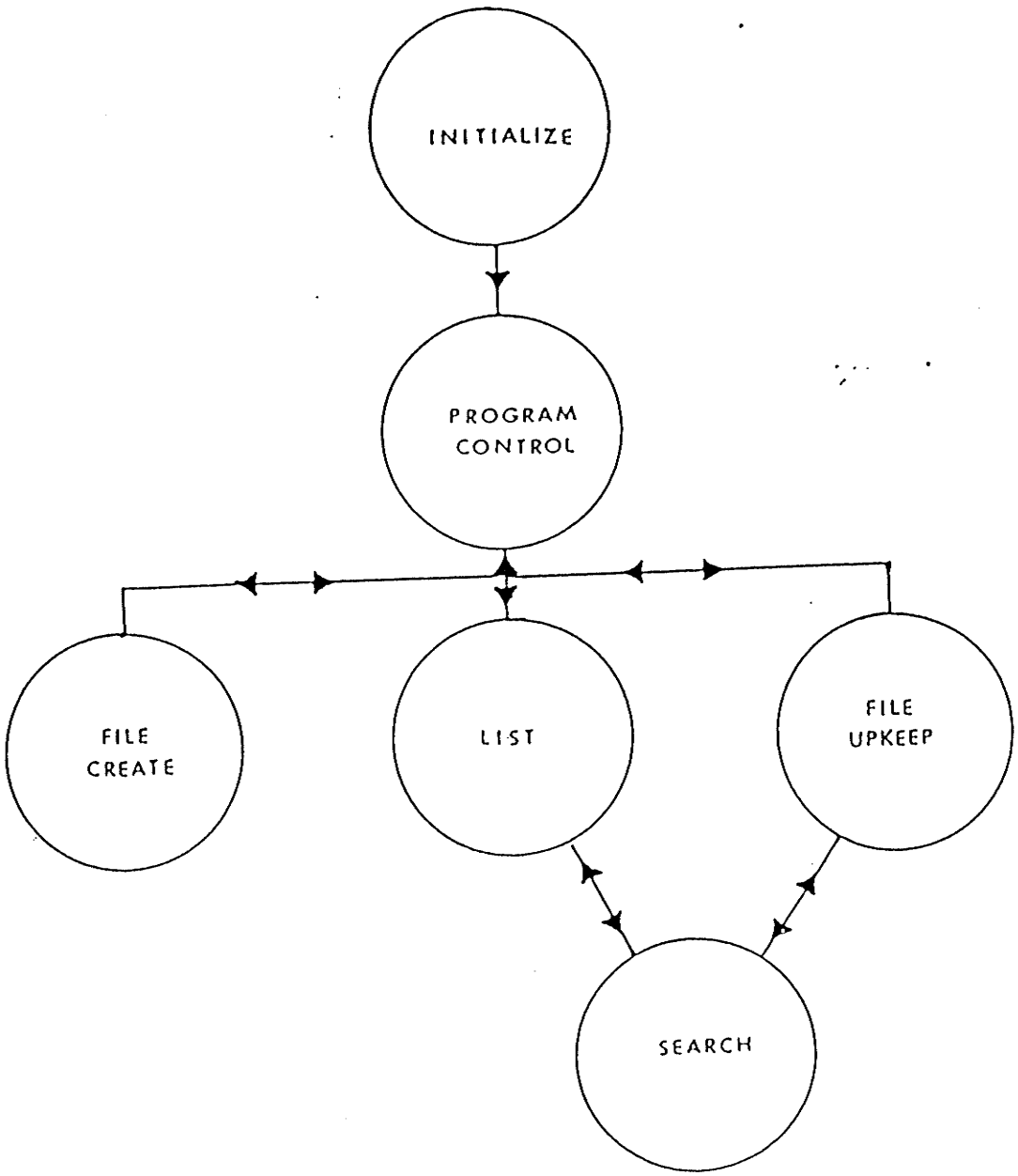


FIGURE F1

RECORD STRUCTURE

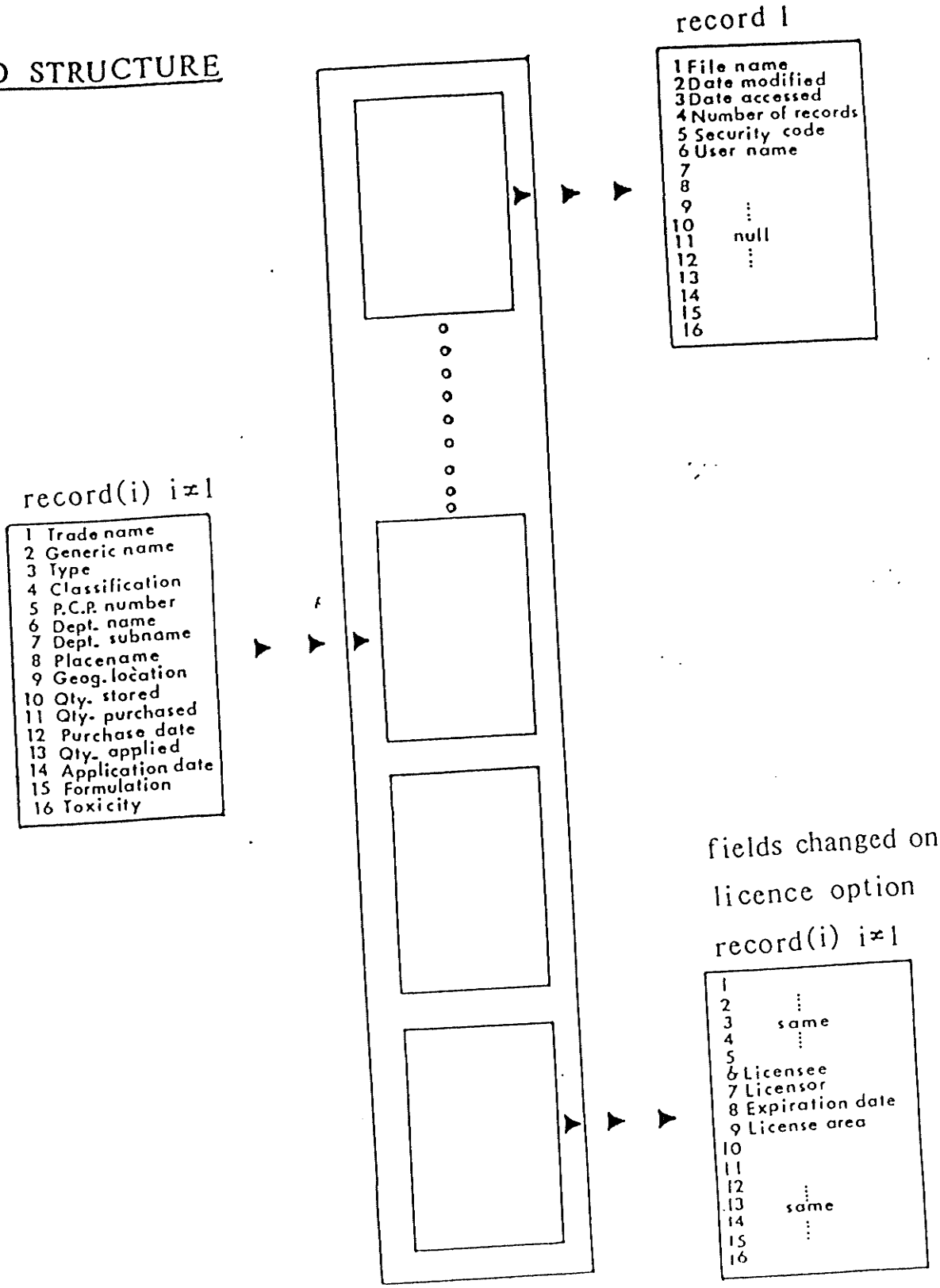


FIGURE F9

F.2 PROGRAM DESIGN

The following section describes the various sub-program processes, as well as defining the program terms and variables. The main process of the sub programs have been illustrated with the aid of flow charts.

F.2.1 PROGRAM CONTROL

The options available to the PESTMON program are ultimately accessible to the user via the sub-program PROGRAM CONTROL Fig F.3. PROGRAM CONTROL is the main mechanism of interaction between other sub-programs as well as the source for help information and programs as well as the source for help information and program termination. The termination of any other subprograms will result in the loading of Program Control and the display of the following list.

1. help
2. start a newfile
3. add on to an existing file
4. modify records in an existing file
5. list an existing file
6. termination session

Items 1 and 6 have been encorporated in the Program Control sub-program while items 2, 3, 4 and 5 transfer control to other sub-programs temporarily. Item 2 transfers control to sub-program FILECREATE. Item 3 sets a by-pass switch then transfers control to sub-program FILECREATE. Item 4 transfers control to sub-program FILEUPKEEP. Item 5 transfers control to sub-program LIST.

Item 6 terminates the session. The program is not made accessible since the NEW statement serves in unloading the program.

Item 1 offers a set of information to the user that may aid in the understanding of the program. The items described in 'Help' have been defined and include

1. Program description
2. File description
3. Field descriptions
4. Hardware description

The Help portion of the program is primarily designed for inexperienced users and will not be further described in this manual. A great deal of the help information has been given in the user's manual.

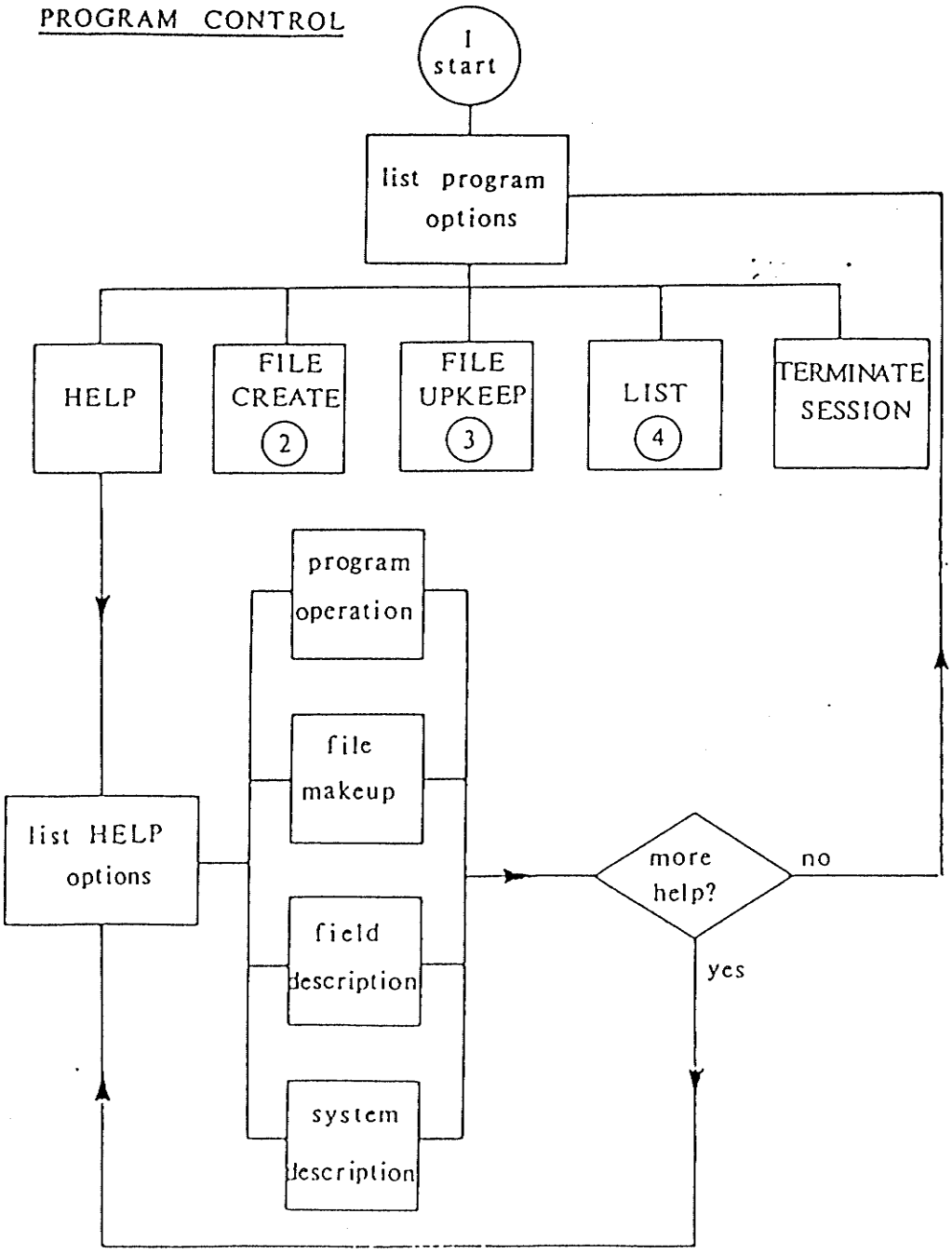

PROGRAM CONTROL
1
start
list program options
HELP
FILE CREATE
2
FILE UPKEEP
3
LIST
4
TERMINATE SESSION
program operation
file makeup
field description
system description
list HELP options
more help?
no
yes

FIGURE F3

The variables used in PROGRAM CONTROL are as follows.

a$ -- alphanumeric choice of program option

Switch % -- numeric equivalent of a$1

r$ -- alphanumeric choice of help option

Switch -- numeric equivalent of r$

licswtch$ -- switch for licensing option = on or off

Switch 2 -- numeric equivalent of licswtch$1.

All other variables are used to indicate program options for yes/no questions.

F.2.2 FILECREATE

Subprogram FILECREATE (see fig. F.4) is used to create new data files as well as to append records on existing data files loaded in disk drive 1. FILECREATE will initialize new disks if necessary or else create new data files on already established data diskettes. Individual records are entered manually by the user when prompted. Records are entered on a field by field basis with appropriate review options built in so that information may be manually verified before being placed on disk. All field information is associated with a particular record number and stored temporarily in working arrays. System limitations have restricted the size of the arrays to approximately 100 entries, therefore files that contain more than 100 records will have to return to FILECREATE via the Add option. The

only exit point of subprogram FILECREATE is a return to PROGRAM CONTROL. Files created through the use of FILECREATE must be limited to a single disk. Each file cannot contain more than 710 records. All arrays dimensioned for FILECREATE have been allocated in sub-program INITIALIZE.

The first record in all files has been reserved as a control record. The following fields in record 1 will contain the following information

Field Information

1. Filename
2. Creation date
3. Date of last access
4. User name

5-16 null

All other records will contain field information as described in the user's manual.

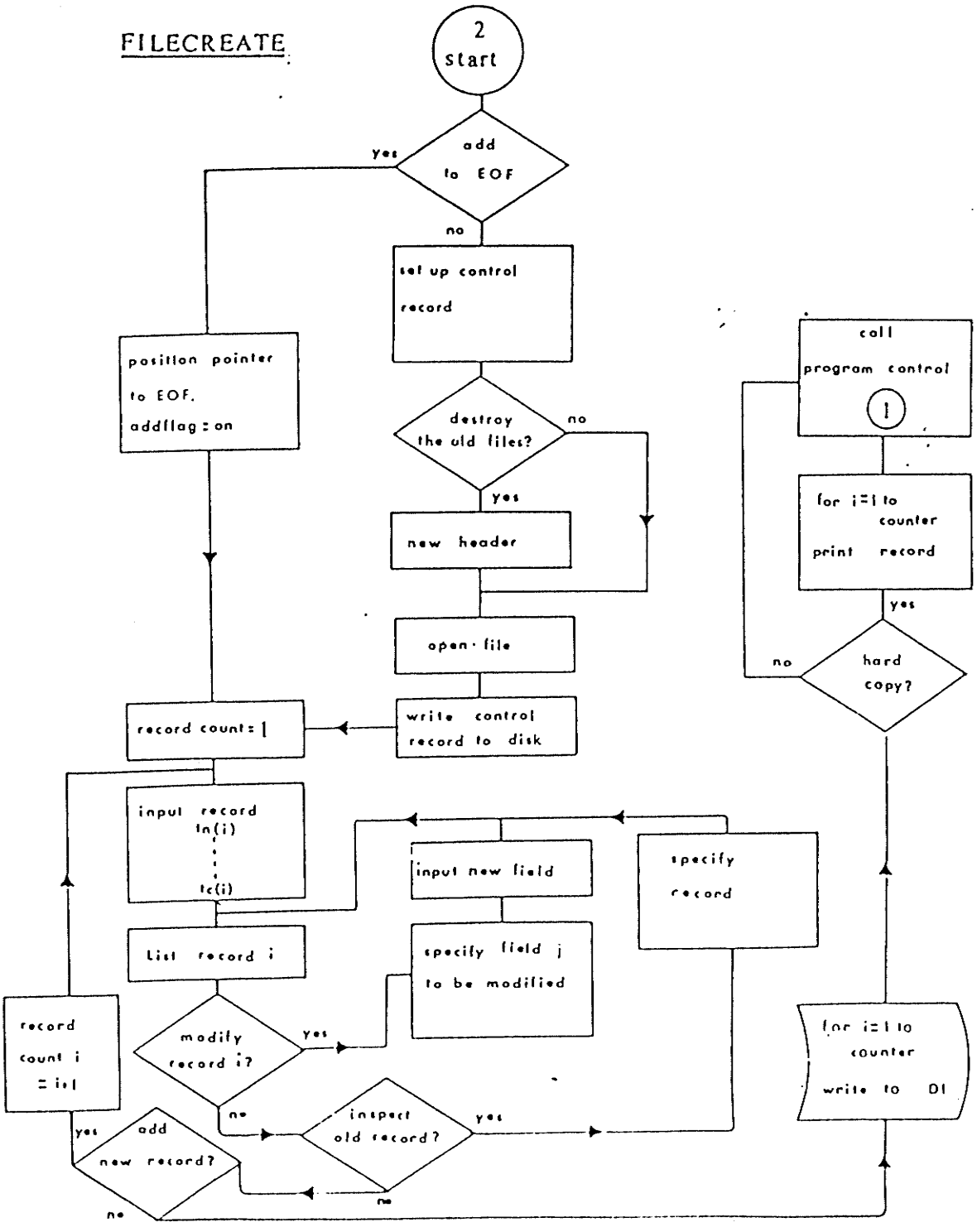

FILECREATE
2
start
add
to EOF
yes
no
set up control
record
position pointer
to EOF.
addflag : on
destroy
the old files?
no
yes
new header
open file
write control
record to disk
record count = 1
input record
fn(i)
fc(i)
List record i
modify
record i?
yes
no
input new field
specify field j
to be modified
specify
record
inspect
old record?
yes
no
add
new record?
yes
no
record
count i
= i+1
call
program control
1
for i=1 to
counter
print record
hard
copy?
yes
no
for i=1 to
counter
write to DI

FIGURE F4

The variables used in the sub-program FILECREATE are as follows.

```
tn$(i)    -- trade name array

gn$(i)    -- generic name array

pt$(i)    -- pesticide type array

pc$(i)    -- pesticide classification array

ppp$(i)   -- P.C.P. number array

dn$(i)    -- department name array
                    or
             licensor is licswtch$='on'

ds$(i)    -- department subname array
                    or
             licensee if licswtch$='on'

pn$(i)    -- placename array
                    or
             date license applicable is
             licswtch$='on'

gl$(i)    -- geographic location
                     or
             license location if
             licswtch$='on'

qa$(i)    -- quantity stored array

qa$(i)    -- quantity applied array

da$(i)    -- date of application array

qp$(i)    -- quantity purchased array

dp$(i)    -- date of purchase array

fc$(i)    -- formulation category array

tc$(i)    -- toxicity category array

flag$     -- first pass flag

ddn$      -- diskette name

nf$       -- file name

ic        -- record numer to inspect
```

All other variables will be used to indicate program options for yes/no questions.

F.2.3 FILEUPKEEP

FILEUPKEEP Fig F.5 is a sub-program designed for the purpose of making modifications to existing files. Modifications can be made to single records or to all records in a file or many files that contain fields with specified information. The records that are to be modified can be identified either through the manual entry of specific record numbers; or searching through files for common field criteria. The search through existing files is done with the use of the SEARCH sub-program. A flag indicates to the SEARCH sub-program that when the search is complete the program should return to FILEUPKEEP. The user may also search through his/her files by using the list program. Common criteria will be searched for and then listed. The program in this case will however pass back to PROGRAM CONTROL and the user must reinitialize the file upkeep procedure.

When the records that are to be modified are identified in a work set, the user has the option to either modify records on an individual basis or all at once. Modifications are performed for all or one record on a field by field basis. The specific fields that are to be modified are chosen by the user via a field list. A simple list of

the modifications is made available on a record by record basis without accessing sub-program LIST.

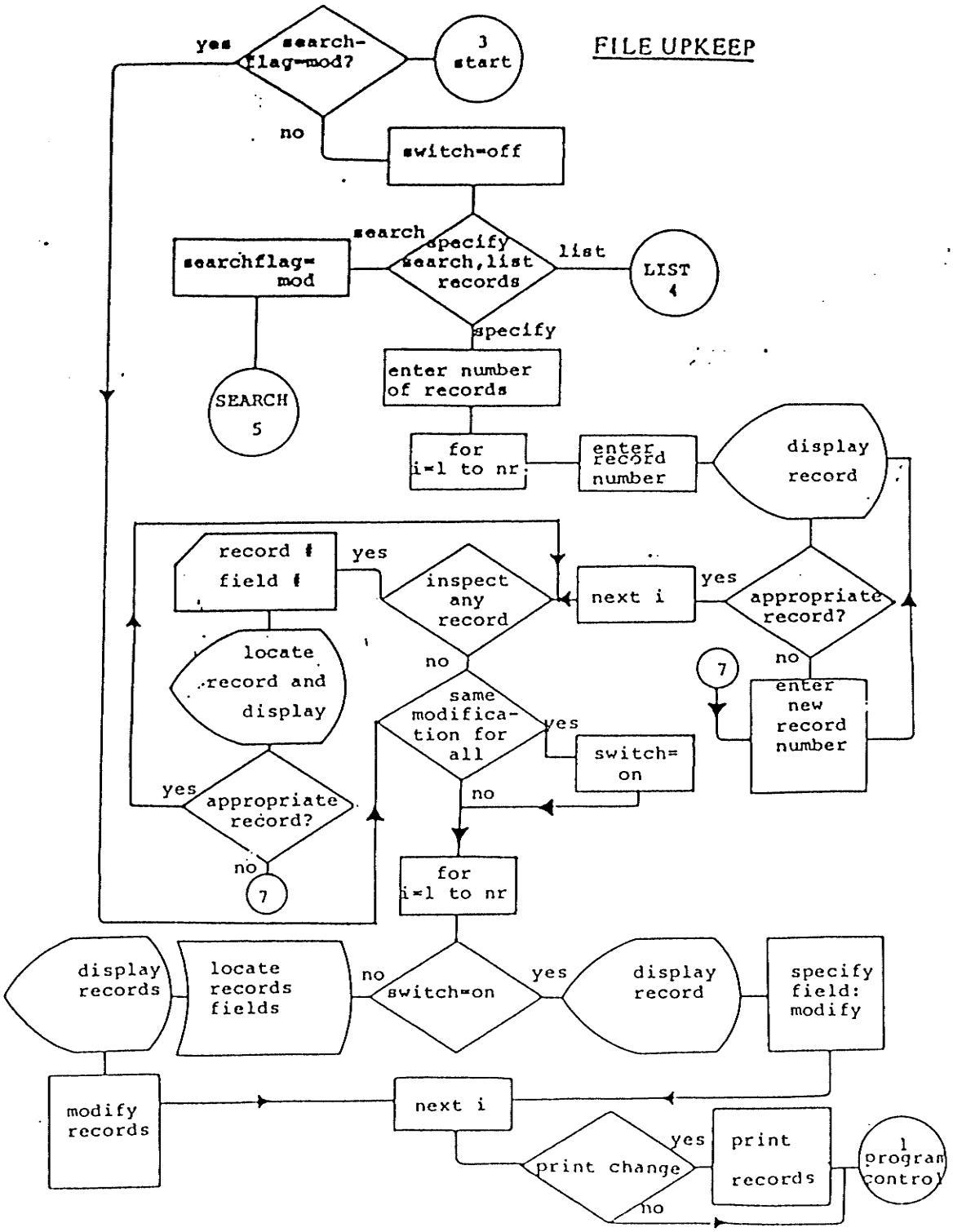

FILE UPKEEP
yes
search-flag=mod?
3 start
no
switch=off
search
specify search,list records
list
LIST 4
searchflag= mod
specify
SEARCH 5
enter number of records
for i=1 to nr
enter record number
display record
record # field #
yes
inspect any record
next i
yes
appropriate record?
no
7
enter new record number
locate record and display
no
same modification for all
yes
switch= on
yes
appropriate record?
no
7
no
for i=1 to nr
display records
locate records fields
no
switch=on
yes
display record
specify field: modify
modify records
next i
yes
print change
print records
no
1 program control

FIGURE F5

The pertinent variables in FILEUPKEEP are as follows.

lo$ -- option for search, list or specify

nfile$ -- name of file to be modified

searchflag$ -- flag indicating to SEARCH to return to FILEUPKEEP hwn set to 'mod'

modswtch$ -- switch to makde some modifications on all records

nr -- number of records to be modified

ncn -- number record to be changed

nfm -- number corresponding to field that is to be changed

mfile$ -- multifile upkeep switch

nn$ -- variable to control modification listing of record name

tt$ -- record taken from disk to be modified

rnum -- number of records on disk

Other varaible names represent options to yes/no questions and temporary field storage locations.

F.2.4 LIST

Sub-program LIST Fig F.6 is used to list records according to either specified records or records based on common field criteria through SEARCH. LIST will allow the users to choose from a list of possible tables illustrated in the User's Manual. LIST transfers control back to PROGRAM CONTROL upon completion.

LIST

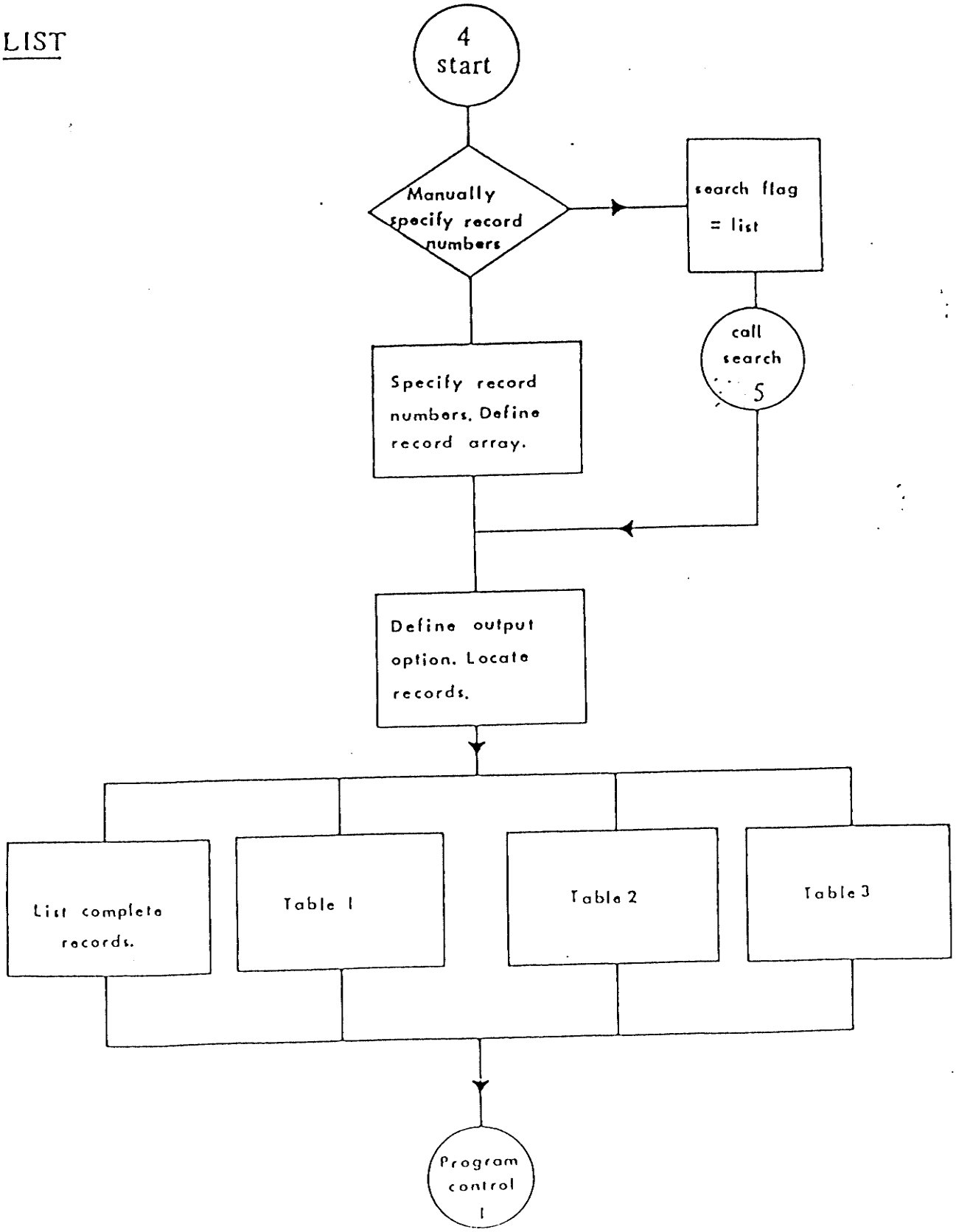


FIGURE F6

F.2.5 SEARCH

Subprogram SEARCH fig F.7 is used to search through files for records with specific field criteria SEARCH is made accessible for sub-program LIST and FILEUPKEEP. Control is passed back to the particular sub-program based on a program call flag.

SEARCH essentially creates a temporary array that maintains record numbers for appropriate records, as well as file names in specified situations. The array is then transferred to the other sub-programs for use.

If the user wished to search through more than one file then a multifile switch is set and the user is requested to unload the program disk. A special string of characters in the array indicates that the next record to be read is a file name.

SEARCH

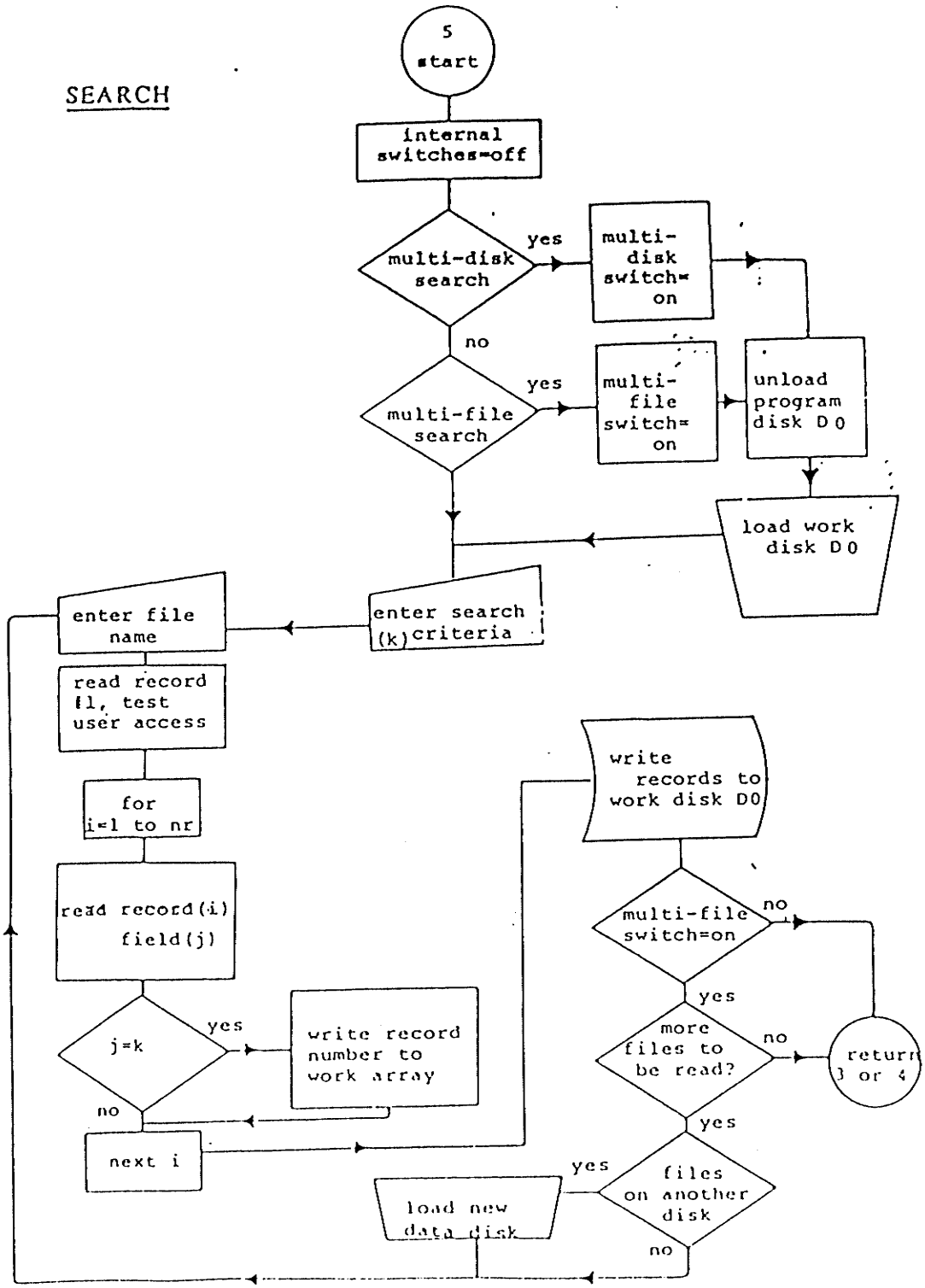


FIGURE E7

F.2.6 INITIALIZE

Sub-program INITIALIZE fig F.8 is used at the outset of the program to allocate program space, and to dimension all arrays. Control is then passed to PROGRAM CONTROL and access back into INITIALIZE via other routine is prohibited. Although INITIALIZE is the longest sub-program the majority of INITIALIZE is simply padding and of no real use.

F.3 RESTRICTIONS

The user should recognize that PESTMON is designed to operate on Commodore hardware and one should anticipate difficulty with running the program on other systems.

The program has used particular I/O statements that will have to be charged for certain Commodore hardward, specifically disk management may require an INITIALIZE statement when using other disk drives.

A file handling system based upon a certain fixed record length such as PESTMON may serve other purpose, however the interactive nature of PESTMON has enforced a defined record set. A programmer may by-pass such interactive information by deleting or by-passing a great deal of print information.

INITIALIZE

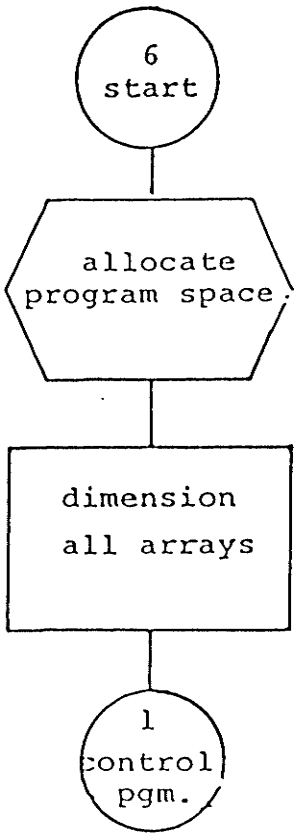


FIGURE F8

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