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MANPOWER PLANNING MODEL

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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by

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SECTION I

INTRODUCTION AND SUMMARY

This report presents a manpower planning model developed by GCA/ Technology Division for the Control Programs Development Division of EPA. The model is a computerized system designed to estimate the manpower requirements of nonfederal air pollution control (APC) agencies and thereby to serve as a planning tool for projecting the effects on manpower levels of various policy options and other decisions.

MODEL DEVELOPMENT PERSPECTIVE

This model is intended to build upon and to replace the simpler model in current use, which was developed, over a number of years, from an original DHEW-NAPCA study in the late 1960's. That initial study made use of experience from the major agencies in existence at the time to project manpower requirements for each of 17 categories of agency activities. The projections were based on empirical information relating the manpower of an agency to several economic-demographic characteristics of the geographic region within which the agency had responsibility - specifically population, land area, number of manufacturing establishments, and the rate of new capital expenditures for industrial plants.

Since the development of the first manpower model, several changes in the philosophy of air pollution control have taken place. The Clean Air Act placed primary program responsibility on the states, and therefore on the state agencies, whereas formerly the most active programs had been carried out by the local agencies in the large urban areas.

When the first model was formulated, the nature of the typical control program was necessarily a matter of assumption; it was assumed, for instance, that all agencies would operate complete construction and operating permit systems. Subsequently, the approach in some agencies has been to work with no permit system, and other agencies are working with only one of the two systems. In other areas, such as monitoring, minimum program standards were developed and set forth by EPA. When possible, these concerns were met by making modifications to the model. Ultimately, however, continuing experience with air pollution control programs unavoidably raised concerns about the model that could not easily be accommodated by adjustments within the existing structure. Consequently, it was decided to undertake the development of a wholly new model, based on newly-gathered data from a larger group of agencies; the model described herein is the result of that effort.

The aspects of the existing model that had raised questions fall generally into one of two types. Some of the existing predictive relationships were becoming less applicable, largely because agency practices were changing (such as the decreased emphasis on field patrol), and because of regional differences in the applicability of relationships that were developed from urban agencies' experience (such as the extra time consumed in travel in sparsely-developed parts of the country). Beyond this, it seemed an appropriate time to undertake the effort because there were a growing number of relatively-new agency functions that were not provided for in the existing model - functions such as transportation control planning, "indirect source" review, air quality maintenance, and so on. And a final requirement of the new model was that it be computerized; this would provide greater usefulness of the model and would also permit greater sophistication in detail and complexity than was possible with manual calculations.

OVERVIEW OF STUDY APPROACH

As had been done before, the relationships to be formulated for use in the model were to be based on empirical information determined from the experience of existing agencies. The two primary aspects of such an effort are the development of the empirical information and the formulation of the relationships to be used. Both of these were given extensive consideration, as is discussed subsequently. However, in order to achieve the maximum reliability and utility of the data to be gathered, special attention was given to the data gathering process, the delineation of the activities for which information was sought, the selection of the agencies to be visited, and the format and conduct of the visits themselves.

The selecting and defining of activities was an iterative process, thoroughly involving EPA staff members, aimed at ensuring that all current and potential functions of a nonfederal control agency were included, and that the definitions of the activities were clear and unambiguous. This effort resulted in a comprehensive listing of 72 activities categorized according to whether they were expected to be predicted from a relationship dependent on the monitoring network, on the number of pollutant sources in the agency's jurisdiction, or on some other parameter, such as those support activities which are functions of the overall size of the agency staff.

As there were constraints on the number of agencies that could be contacted in the course of the study, the selection of the agencies to be visited was also extremely important. With the increased emphasis on the role of the States in air pollution control, seven state and two local APC agencies were chosen for review. All of these agencies were among those considered by the EPA Regional offices to be doing an overall adequate job. The final selection of these agencies, from a larger list, was made with regard to the characteristics of each agency and its jurisdiction to help provide a balanced view in the data gathered.

The actual conduct of the visits to the agencies relied heavily upon a questionnaire-style data form developed for use in the visits. The questionnaire defined each activity, to the exclusion of other similar or related ones, and asked questions pertaining to the total manpower used in this activity, its adequacy, reasons for changes, etc; the questions were directed to the senior person in each agency immediately familiar with the specific activities under consideration.

Following the study visits, the empirical data was analyzed to formulate the predictive relationships. Although care had been taken in the data gathering to achieve the best available information, it proved necessary to exercise a certain amount of judgement in the interpretation of the data; for instance, there was significant rearrangement of the activity list, usually by combining separate activities to larger ones. The types of predictive relationships that evolved ranged from simple linear or directly proportional ones, to very nonlinear expressions, usually as a result of economics of scale, to step-type functions which provided increments of manpower based on the number and characteristics of the Air Quality Control Regions (AQCR's) in the state.

The model which resulted from these efforts consists of three major sets of such predictive relationships, corresponding to the three major groupings of agency activities. The first group of air quality monitoring-related activities includes five activities applied to 12 types of sensors in a matrix format, and a few additional activities not related directly to the number of sensors. The second group, the source-related activities, involves six activities applied to 23 source-type categories in a matrix, plus others not directly based on the number of sources. The third major group, administrative and support activities, is comprised of 12 specific activities involving management, training, and clerical support functions. The projections for these activities are based on the manpower estimates made for the activities in the first two groups. There are in addition a few

activities which do not fit into this three-group structure because they are most appropriately estimated from other predictor variables (e.g., travel time, estimated in part from land area); these are estimated wherever appropriate in the model and are discussed correspondingly in the text.

The computer application of the model is designed to provide estimates of manpower by State, with EPA Regional and National summaries. Basic calculations are made for each separate AQCR or state portion of an AQCR, based on AQCR-level information entered into the program from an input file and State-level information built into the program by data initialization (DATA) statements. The majority of the manpower projections are made at this level, with others made at the State level, and some made at both levels, depending on the nature of the relationships involved. The AQCR-level results are first accumulated into State totals, and when a State is completed, the additional activities are estimated and the manpower included, and then a detailed State summary is printed. EPA Regional and National summaries are accumulated and printed in turn; no additional activities are considered at the EPA Regional or National levels.

SUMMARY ASSESSMENT

In general, the gathering of the empirical information and the development of projection relationships proceeded satisfactorily, and the resulting model appears to be an adequate tool, both for projecting aggregate manpower needs and for use in studying the impact of proposed hypothetical changes in agency practice.

The portion of the model that is least firm is the set of relationships concerning stationary source surveillance and enforcement activities, due to some inadequacies in the information obtained. Another area where less-than-optimum information and relationships were obtained is in the often-intricate interactions between state

and local agencies, although this area involves only small amounts of manpower. The only difficulty that is expected to significantly affect the on-going usefulness and accuracy of the model is the quality and format of the data bases on which it operates, particularly the NEDS file of emission sources. The most urgent recommendations for further development involves ameliorating this problem.

STRUCTURE OF REPORT

The subsequent sections of this report present the complete development of the model and discuss the various considerations inherent in this development, the model itself and its applications. The report is organized as follows:

Section II - The process of the development of the empirical data base is presented, outlining the methodology of the study, the delineation of activities and the development of the questionnaire used in the agency visits; the conduct of the agency interviews, including the process of selecting the agencies; and a general discussion of the handling and interpretation of the data gathered.

Section III - This section discusses in detail the development of the actual activity projection relationships used in the model and the interactions which occur within the model structure; i.e. data inputs and the model operations.

Section IV - The data inputs and results of a trial application are described and analyzed in this section to provide a better understanding of the outputs expected and a rough validation of the model.

Section V - An overall assessment of the data-gathering and model development process, with some recommendations for further development and future improvements in the data base on which the model operates.

Appendices

SECTION II

DATA BASE DEVELOPMENT

The purpose of the model developed under this study effort is to utilize predictive equations that project the manpower needed for various activities of nonfederal air pollution control agencies. These predictive equations were to be based on appropriate predictor variables for which data was readily available and could be input. The relationships utilized in the equations were to be derived from empirical information determined from the experience of existing agencies.

From the outset, there were several elements of the design of this study which needed to be properly addressed before the determination of the predictive relationships could be made: the study methodology, the selection of agencies to be visited, and the interpretation of the data collected. The approach and the considerations involved in handling these elements are discussed in this section.

STUDY METHODOLOGY

Activity Delineation

The initial task in the study was the development of a comprehensive list of the functional activities of nonfederal air pollution control agencies, with their corresponding definitions. This task was felt to be an integral part of the study methodology as the selection and definitions of the activities, as well as the resulting structure, provide the basis from which quantitative data on manpower requirements would

be sought from the various agencies. The information gathered on these activities, together with a base of other data on parameters relevant to the agencies and their jurisdictions, are what were used to formulate the quantitative manpower planning model used for projecting agency staffing requirements.

The selection of a functional activity framework for activity delineation, rather than a people-oriented occupational category framework, was made because it was felt that the more abstract functional approach would be less constrained by the existing personnel structure of the agencies and would be more flexible for any new responsibility and any future decisions regarding these responsibilities. Nonetheless, the underlying awareness that real people will perform the activities did have some influence on the way the activities were defined. This approach to the activity delineation therefore provides a functional rather than an occupational view of the manpower requirements of an air pollution control agency and decisions on staffing can be more accurately made by matching the functional requirements of the agency with the applicable experience of potential employees.

Activity Determination - While the determination of activities to be included in this study and the defining of such activities are an integrated process, to some extent, the selection of the activities can be considered separately. To ensure a comprehensive listing of the activities of nonfederal air pollution control (APC) agencies, the task of compiling the list was approached by considering both those activities that have traditionally been performed by almost all APC agencies, termed "current" activities, and those that arise primarily from relatively recent developments in national pollution control policy, termed "anticipated" activities. As expected, the division between the two classes was not distinct; in particular, there are a number of activities performed by some agencies for some time past that are recommended to other agencies for the future.

In general, there was little disagreement over the list of current activities, and they were compiled on the basis of general knowledge and a search of the literature. There was, in contrast, little readily-available material and little detailed consensus on what further activities should be anticipated as a result of recent developments. The approach to including these activities was to first identify those general areas of new agency responsibility, primarily those defined by federal regulation, then to attempt to develop a detailed list of activities needed for the satisfactory accomplishment of these areas of responsibility. The reasonableness of this latter list was tested, where possible, against the experience of those agencies that have conducted such activities; facilitating such consultation and feedback was in fact a major purpose in the questionnaire development as discussed later.

Current agency activities - The definition of a list of traditional, or currently-performed, agency activities was primarily based on general knowledge in the field and a literature search, conducted on the APTIC data base. The annotated Bibliography in Appendix A lists the sources most useful for the entire manpower planning model study. The principal sources used in defining the current agency activity list were the following:

1. Rifkin, K. I. et al. (ASA). Task Analysis of State and Local Air Pollution Control Agencies and Development of Staffing Guidelines. Manpower Development Staff, Environmental Protection Agency, Research Triangle Park, North Carolina. Seven volumes and Technical Report. November 1972.

2. Eagles, John. Method for Estimating Manpower Resources for Air Pollution Control. Environmental Protection Agency, Research Triangle Park, North Carolina. July 1972. 14 pages.

3. Stein, Arnold. Guide to Engineering Permit Processing. Environmental Protection Agency, Research Triangle Park, North Carolina. APTD-1164. July 1972. 368 pages.

4. Jutze, George A. Guidelines for Technical Services of a State Air Pollution Control Agency. Office of Air Programs, Stationary Source Pollution Control Programs, Environmental Protection Agency, Research Triangle Park, North Carolina. APTD-1347. November 1972. 302 pages.

5. Several State Implementation Plans. Primarily those of New York (Transportation), North Carolina, Maryland, Colorado, and Connecticut.

The level of detail and the scope of the activities included in these references is typified by the list of agency activities given in Table 1. This list provided the initial delineation of current agency activities, with further subdivisions then being made where they seemed warranted for ultimate projection purposes. For comparison, the final list used in the model is in Table 2.

Table 1. TYPICAL EXISTING LIST OF AGENCY ACTIVITIES

Management:

- Policy and administration
- Training
- Liaison and community relations
- Clerical support

Engineering:

- Permit system operations
- Source testing and emissions estimates
- Engineering reports
- Miscellaneous
- Clerical support

Enforcement:

- Inspections and schedule monitoring
- Complaint handling and field patrol
- Training
- Clerical support

Technical Services:

- Laboratory operations
- Monitoring network operations
- Data processing
- Special projects
- Clerical support

Table 2. FINAL ACTIVITY LIST USED IN MODEL

MONITORING-ORIENTED ACTIVITIES	
Field operation	Network design and planning
Calibration and maintenance	Special monitoring studies
Sample preparation	Travel time for monitoring
Sample analysis	Laboratory quality control
Data handling	Air quality data analysis
SOURCE-ORIENTED ACTIVITIES	
Stationary source inspection	Compliance schedule monitoring
Stationary source testing	Formal legal action
Observe stack testing	Equipment plan review
Complaint investigation and small source enforcement	Mobile source inventory and TCP
	Motor vehicle inspection
Tax exemption certification	Oversee motor vehicle inspection
Review of development plans	Episode prevention
Travel time for enforcement	
MANAGEMENT AND SUPPORT ACTIVITIES	
Program management	Graduate school training
Strategy and regulation development	Professional activities
	Public information
Interstate liaison	Library and archives
Local APC agency liaison	Clerical
In-house training	Administrative management
EPA training	

Anticipated agency activities - The effort of defining those agency activities that are recommended or anticipated in the future was approached by first considering the broad areas of new responsibilities thrust upon or undertaken by the agencies, largely as these responsibilities are expressed in federal regulations relating to agency activities. Specifically, this approach was based on the uncodified Federal Register entries, which offer related amendments in a single source, and with the typical preamble, often offer a deeper insight into the intent of the regulations. Of the many promulgations and proposed rulemaking entries, those were selected that generally embody the new areas of agency responsibility with which we were concerned:

- Transportation Controls and Land Use Planning
- Stationary Source Review (direct, indirect emissions)
- Periodic Reports to Environmental Protection Agency
- Environmental and Economic Impact Statements
- Prevention of Significant Deterioration
- Supplementary (Intermittent) Control Systems

Air Quality Maintenance Planning was not considered as a separately identifiable set of SIP revisions because it is expected to consist of extensions of the normal planning responsibilities involved in the original SIP and the transportation planning and, as such, would not influence the delineation of the activities.

Each of these areas was surveyed to detail its FR entry listing, the general thrust of the policy, the inherent responsibilities, and the implications for control agency activities.

Organization of Activity List - In considering the various possible ways of grouping or organizing the agency activities into a small number of meaningful categories, the obvious options were to utilize the categories of Table 1 or to develop new ones specifically for the model. The traditional categories noted in Table 1 have developed historically, and are almost universally used, with perhaps slight variations in phrasing. They are fairly closely identified with organization units in many agencies, as they have followed the changing roles of the agencies over the years. The advantages of such a structure would be all the advantages usually associated with traditional patterns — recognition, familiarity, etc. Similarly, a disadvantage would be the lack of recognition of the emerging new areas of agency activities. Another disadvantage would be the unwieldly growth of the "Technical Services" category. This category has always included the newer activities, being

usefully vague, but to now further add the wide variety of anticipated activities would severely strain the logical arrangement.

The other option of completely revising the categories was the approach ultimately chosen. The decision was to organize the activities according to how they relate to the specific quantitative aspects of a control program, especially source control and ambient air monitoring. In such an organization, activities would be grouped to reflect the functions involved in each of these categories and further breakdown would be provided by considering the different elements involved in each of the categories, such as different types of monitoring equipment, in an array versus the related functional activities (e.g., sample preparation, etc.). The primary advantages of this approach are that new agency responsibilities can be interpreted in the light of the incremental additions they cause in the various functional areas (such as a certain number of additional monitoring sites), and that predictive relationships based on such tangible factors were considered more likely to be reliable than relationships based on indirect variables, such as population or economic activity. The primary disadvantage of this structure is that the data bases needed for such an approach, especially data on the numbers of stationary sources of various types, have not matured to the point that they permit good absolute estimates.

The structure that was finally chosen organizes the agency activities into three groups — a matrix of source-oriented activities versus source type, a matrix of monitoring-oriented activities versus sensor type, and a simple list of other activities. This approach kept the list of activities to a manageable size (72), and the use of matrices over monitor and source types also permits summaries by these categories, a useful way to consider hypothetical situations.

As anticipated, it did develop that the agencies visited were unable to provide information at the level of detail of the activity list

prepared, so that it was adjusted to provide the condensed list presented in Table 2; the overall structure of having three groups, two of them matrices, however, did prove appropriate and was preserved.

Activity Definitions - As is necessary with any delineation and categorization of functions, the activities were defined concurrent to the above tasks. Careful attention was paid to each definition to ensure that there would be no overlap or missing areas between activities or any misunderstanding as to exactly what particular items were under consideration.

The process of defining the activities included several iterations with much input and review by the EPA Project Officer and others in the Control Programs Development Division (CPDD) of the Office of Air Quality Planning and Standards (OAQPS). The result of this effort was that the definitions more accurately reflected the functional characteristics of the activities rather than the occupational ones, a format deemed more desirable as discussed above. Although previous delineations of activities were considered, the finer breakdown and functional direction of the study meant that the definitions were either prepared afresh or carefully reexamined and reconstructed to reflect the scope of the study.

The definitions were not meant to be exact explanations of all of the details which may be involved in the performance of each activity, as this would make them harder to accept due to the different approaches to problems by the various agencies. Instead, they were of a more exclusionary nature, outlining the activity under consideration by bordering it with other similar activities and specifically excluding those activities which may have been suggested by the activity heading but were, for the purpose of the study, to be considered separately. While this may not provide the best form of conveying the activity to the public, it helps a person engaged in a set of activities identify exactly what components are being discussed. As a part of the questionnaire, in which these definitions were to be incorporated, it has

the added advantage of requiring the reader to review all related activities, and their subsequent questions, before proceeding to answer any in the set.

Questionnaire Development

In order to apply the study methodology in the most systematic manner, an extensive questionnaire was developed for use in the study visits to the agencies. This questionnaire was formulated primarily to be used as a tool for the investigator to ensure that all relevant questions would be asked of each agency in the same fashion. In addition, several copies of the questionnaire were mailed to all agencies prior to the visit so that requested information not readily available could be compiled in time for the visit.

Objective of Questionnaire - The questionnaire was decided on as the best method of obtaining the maximum amount of detailed information in the shortest possible time, thereby producing less disruption of the normal activities of the APC agencies. This was used instead of long site visits, in which one or two GCA personnel would spend a week at each agency reviewing the actual activities, which was suggested in the course of the study. It was felt that the added time spent in careful questionnaire development would be much smaller than the manpower needed to conduct the more intensive visits.

As already mentioned, the questionnaire was meant to serve as a tool for the interviewer, especially useful for providing the complete gamut of questions that needed to be asked. Some thought was given to having the questionnaire developed to the stage of a public opinion poll whereby the questions could be asked strictly from the questionnaire with no interpretation or explanation; however, this option was not pursued as it was felt to be not pertinent to this type of survey, where a professional's opinion was being sought.

Questionnaire Structure - The type of questionnaire which was eventually decided upon was one which was aimed at exactly defining each activity under consideration through incorporation of the above definitions and then determining the manpower needed to perform such an activity through a slightly less structural format than would be necessary in a public opinion poll. The general format of the questions would then be to ask who or how many people were engaged in each activity, the percentage of each person's time involved, and the adequacy of the current effort. Questions regarding how the interviewee expected this effort to change over the next 5 years and the reasons for these changes were also to be included. These latter questions were to help primarily in the identification of predictor variables and the formulation of the manpower prediction relationships; the answers were also expected to provide an insight into how the model should be structured to be able to incorporate future developments.

Again, this was an iterative process with continuing review and input from the EPA Project Officer and other staff in the CPDD. The final result of these efforts was a highly developed questionnaire with questions relating directly to the specific details involved in each activity, asking not only about the manpower requirements but the procedures followed and tasks performed by the agencies. The structure was such that the information was requested at the highest degree of resolution, with provisions for collecting the data at a lower level of detail if necessary. The reader is referred to the questionnaire in Appendix B for further understanding of the format. The final step in the questionnaire development was a pilot application in one of the State air pollution control agencies. This involved a 2-day meeting between the GCA personnel and CPDD Project Officer who would be engaged in the study visits and the director and certain members of the agency. The project and the APC agency's activities were discussed at length and the questionnaire was used as it was expected to be in the following interviews.

While the trial application, especially through the general activity discussion, identified a few missing activities, which were subsequently incorporated, it did not suggest that any significant changes were needed in the structure of the questionnaire or the suggested format of the interviews.

AGENCY INTERVIEWS

Although much preliminary data had already been gathered in the course of the development of the study methodology, the empirical data base for utilization in the model formulation was to be obtained through interviews with specific non-federal air pollution control agencies. In compliance with the Office of Management and Budget (OMB) regulations and in consideration of the available time frame, the number of agencies to be interviewed was limited to nine. Since the resultant data projections can be no better than the aggregate empirical information used to produce them, the selection of the agencies and the actual conduct of the meetings were of paramount importance.

Agency Selection

The previous manpower planning models had been necessarily rooted in local, urban-area agencies, because they were the only source of accumulated experience available at the time. More recently, of course, responsibility under the Federal Clean Air Act has been placed clearly with the states, to be administered through the Air Quality Control Regions (AQCR's).

Consequently, it was determined that the focus of the new model should be on state agencies and their total responsibility within their geographic boundaries, regardless of whether the activities directed at meeting those responsibilities were conducted by state, regional, or local agencies. Accordingly, the list of agencies to be visited was to include seven state agencies and only two local agencies, with the

two locals being within the seven states and selected to reflect good state-local integration and cooperation.

The seven state and two local agencies visited were not selected via a randomized procedure, but were selected deliberately in full knowledge of their size, philosophy, their strong and weak points, and the nature of the area within which they have responsibility. The reason for this is because the intent of the study was not to project manpower utilization as it actually occurs, that is, to use a sample of agencies to estimate "national average manpower utilization" or some such parameter; rather, the intent was to project manpower utilization as it should be, that is, to estimate the manpower needed to operate an agency in an adequate fashion, meeting all its responsibilities in a satisfactory manner. Consequently, the agencies chosen were selected to provide an appropriate mixture from within a set of agencies that had been selected as meeting the adequacy criterion.

The impact that this selection criterion had on the total manpower levels projected as a result of the model cannot be estimated directly from this study. It would be necessary to conduct a second, similar study using agencies randomly selected in terms of adequacy. However, some idea of the total manpower impact may be derived from comparing the total manpower requirements on a national level with current air pollution control personnel staffing levels. The advantage of choosing agencies judged to be performing their activities adequately, as opposed to a random selection, is in avoiding those agencies which overemphasize or are overstaffed in particular areas and those which are not, for one reason or another, currently carrying on an appropriate level of effort. This further aids in the formulation of reasonable manpower projection relationships.

As the initial step in agency selection, the EPA Project Officer in CPDD at Research Triangle Park, North Carolina, requested from the

program advisors in each EPA Regional Office a list of agencies that were viewed as meeting the adequacy criterion. Additional criteria for selection of the agencies were to be the following:

1. The agency's program should be comprehensive, that is, it should incorporate a wide range of services and activities. Such comprehensive agencies would offer the most efficient data collection in that all of the activities of interest could be covered with the fewest agency visits.

2. Each of the activities of the agency should be performed thoroughly, that is, the tasks should be performed at an adequate level of detail.

3. The agency's activities and methods should be relatively effective in accomplishing the goals of air pollution control.

Roughly two dozen agencies were so suggested by the Regional Offices and from this list the CPDD Project Officer selected the agencies to be visited. This final selection was done with the intent of providing a cross sectional range of agencies. The following factors were considered in determining the best possible balance of agency characteristics:

- nature of pollution problem in jurisdiction
- geographical size of jurisdiction
- climate and geographic location
- age and structure of agency

The agencies eventually selected for interviews are coded A to I for identification herein; certain of the characteristics of their jurisdictions are listed in Table 3.

Table 3. AIR POLLUTION CONTROL AGENCIES VISITED

Agency	Pollution problem	Characteristics: Region	Characteristics: Agency	Characteristics: Local agencies
A	Motor vehicles - CO, Ox, NO_2 Oil - SO_2, TSP	Industrial/suburban, cold, ocean, 6070 dd,[a] 14 in.[b]	Separate environmental agency, new and fast growing	12 - screen permit applications
B	Oil and coal - SO_2, TSP Motor vehicles - CO, Ox, NO_2	Industrial, suburb, rural, cold, midwest 5690 dd,[a] 37 in.[b]	Separate environmental agency, new but with older city agency	11 - help in monitoring and enforcement
C	Oil - TSP, SO_2 Motor vehicles - CO, Ox, NO_2	Industrial/rural, shipping, cool - ocean 4790 dd,[a] 43 in.[b]	In health department, older but progressive, comprehensive program	10 - own programs, enforcement coordinate with state
D	Motor vehicles - CO, Ox Fugitive dust - TSP Gas, some coal	Tourist, agricultural, cold-warm, high altitude 6130 dd,[a] 14 in.[b]	In health department, older but progressive, commission	7 - help in monitoring
E	Coal - TSP, some SO_2	Mining, heavy industry, rural, cold, 4420 dd,[a]	Separate air pollution agency, older, traditional	1 - own program
F	Motor vehicles - CO, Ox, Fugitive dust - TSP gas, some coal	Tourist, warm, dry 4390 dd,[a] 9 in.[b]	Separate environmental agency, new	1 - own program, part of study
G	Particulates, some SO_2, NO_2	Agricultural, no big city or industry, cold, 6450 dd,[a] 31 in.[b]	Separate environmental agency, new, no older urban APC agencies	2 - some assistance in monitoring
H	Oil Combustion - TSP, SO_2	Suburban area, cool, light industry 4790 dd,[a] 43 in.[b]	In health department, new, growing	Not applicable
I	Motor vehicles - Ox, Fugitive dust - TSP	Metropolitan area, growth-oriented, warm, dry, 4390 dd,[a] 9 in.[b]	In health department, new, growing	Not applicable

[a] Degree days for major centrally located city.

[b] Inches of precipitation for major centrally located city.

Study Visits

Prior to the study visits, the air pollution control agencies were contacted regarding the proposed visit, explaining the purpose and scope of the study. Several copies of the questionnaire were provided with the request that, should time allow, the questionnaire be reviewed by the appropriate personnel so that data, relevant to the study though not readily available, be assimilated before the interviews were conducted. This was to serve to shorten the time needed for the study visits and thereby cause less disruption of the routine operation of the agency; unfortunately, in only a few instances was sufficient time provided to allow for more than a preliminary review of the questionnaire.

In addition, this initial contact by GCA requested that information on the structure of the agency and the positions and responsibilities of the pertinent APC agency personnel to be interviewed regarding the work in their particular division be provided prior to the site visit. This was to aid the GCA personnel in the understanding of the agency's organization and in preparing for the meetings and questions. Here again, the agencies were not always able to respond to the request before the visit though most of them had this information available when the interviewers arrived.

The study visits were generally conducted by two people from the staff of GCA and were completed within one normal working day. In addition, the CPDD Project Officer, and occasionally an EPA Regional Office contact, was present for the interviews. The GCA team consisted of those personnel actively engaged in the development of the manpower model and therefore they were thoroughly familiar with the goals and approaches of the program. The APC agency personnel interviewed were usually various division or departmental heads and the GCA interviewer was assigned the particular APC personnel based upon the team member's own area of expertise. To the extent possible, an attempt was made to have the same person conduct the interviews on the same activities throughout the study visits to help maintain consistency in data collection.

Visit Schedule - The study visits were generally begun with a short (about 1 hour) meeting to provide ample opportunity for the participants to get to know each other and the game plan for the day. The CPDD Project Officer and GCA presented the project, answered questions on it, and determined the general staffing and budget levels, functional responsibilities, planning and evaluation techniques, etc. of the whole agency. Any previously obtained information was confirmed at this meeting.

The appropriate GCA personnel then teamed up with the corresponding staff of the APC agency for in-depth consultations (1-2 hours) on the activities of interest. During this time, general and detailed questions relating to the various activities were posed as they appeared in the questionnaire although in many cases the flow of the discussion did not follow the structure outlined in the questionnaire. Thorough notes pertaining to the individual characteristics of the agency were taken for later reference and available supporting data and material that appeared to be helpful in the understanding of the manpower requirements and/or for use in the later model development were acquired.

Upon conclusion of these interviews, the GCA team reconvened privately to discuss the answers briefly and to try to determine if any major holes had been left unfilled. A meeting of the involved personnel was then reconvened, if possible, to present some summary of the day's activities and to try to fill in any of the holes left as a result of the varying agencies' structures.

Study Visit Data Review

After each study visit, each team member reviewed the data gathered on the questionnaire to determine the completeness and record any further impressions not recorded at the time of the interview. General comments and an evaluation of each data set was completed and attached to these raw data sheets. Detailed study visit summary sheets were completed for each agency listing the specific activity, the total manpower requirements

for each activity, and any comments that were made regarding the manpower level, especially its adequacy or any expected changes. In addition any holes or discrepancies in the data which were not resolved before the end of the study visir or which were discovered upon further review and analysis were noted.

These summary sheets and specific questions regarding the data collected were sent to each APC agency director, or principle study visit contact, with the request that the summary sheets be reviewed by the appropriate staff and the questions answered. In general, the response to this mailing was of little value and where it was deemed important for the model development, follow-up phone calls were made to ask the specific questions.

EMPIRICAL DATA BASE

The empirical data collected during the interviews with the air pollution control agencies provided the basis for the determination of the predictor relationships used in the manpower planning model. Although the interpretation of the data and the resulting relationships are discussed in detail for each of the activities in Section III of this report, several characteristics pertaining to the data and the interpretation thereof were found to be recurrent throughout the analysis process. A review of the characteristics is felt to be important to provide an understanding of how the data was handled and thereby set the framework for the discussions on the specific activities provided in the following section.

Data Completeness

There were two potential problem areas that were inherent in the data collected — the completeness of the data and the exactness of the manpower estimates — and both did in fact prove to be problems. The handling of both of these problem areas involves, to a large extent, the final interpretation given to the data and therefore the resulting relationships. In a real sense, the

completeness of the data can not be separated from the problem of the data quality; however, the exactness of the data collected was felt to more severely impact on the interpretation and, as such, is discussed later under the appropriate heading.

As already mentioned, an appreciable effort was made to ensure the maximum possible completeness of the data base through careful questionnaire development, interviews, and follow-up correspondence where some data appeared to be missing when the interview data was reviewed. Despite these efforts, it was not possible to obtain data on every activity from every agency; i.e., nine data points for each activity. The reasons for this lack of information were normally one of the following:

- The agency did not perform the activity and could not estimate the manpower requirements if it should perform it.
- The agency could not separate the activities to the level they were subdivided by the questionnaire and therefore the data was included in some agglomeration of activities.
- The agency did not respond directly or indirectly to the questions on the activity, especially true of the post-interview follow-up questions.

In cases where the particular activity was not performed by the APC agency and the interviewee could not estimate the total manpower needed if it was performed, there was little that could be done to establish a data point so the particular agency was dropped from consideration for that activity. When the activity was performed but the agency could not separate out its manpower requirements from some other activities, the manpower for the individual activities was estimated based upon the average percentage share given to each activity for the other agencies; however, where these percentage contributions were not similar among the other agencies, such a procedure could not be followed. This lack of comparableness was deemed to be a problem in the exactness of the data provided and was handled as discussed under the interpretation of data.

In a few instances, the data could not be gathered during the study visit either because the data was not immediately available or the person with the best knowledge of the manpower requirements was not at the APC agency during the visit. In the most common case that occurred, laboratory related services, the data was not available because it was performed by the state laboratory which was not at the site of the APC agency. These circumstances dictated follow-up correspondence, both written and by telephone, which was not always fruitful. The effort applied to gathering the data was proportional to the perceived need of the data points. For instance, in the case of laboratory services, the data gathered tended to indicate a high degree of agreement on the time per sample for the laboratory work and there was no reason to suspect that there would be any differences found in those states that did not report this data.

Interpretation of Data

The data collected was not, in most cases, in a format which allowed for the development of predictor relationships without some prior interpretation of the data. One indication of the need to interpret the data has already been given above in regards to those activities which could not be discussed separately from others by some agencies. The other major reason for interpretation of data was where one or more agencies presented data which was not consistent with the pattern established by other agencies or would tend to indicate a relationship contrary to logical expectations. Explanations of the general considerations involved in handling those incidents is provided here to provide an overview of the data handling process. More specific discussions relating to the individual activities are given in the following section as they are needed.

Combined Activities - Where the agency was not willing or could not separate one activity from another or from a related group for manpower

requirements, data was provided as a single manpower level for the combination of activities. In some cases, this single manpower level could be broken down into the component levels for each activity by reviewing the percentages attributed to each by other agencies. More often, however, it was found that, within groups of activities which were related and for which one or more agencies had difficulty in providing a manpower breakdown, the data provided for the individual activities were hard to correlate among the agencies. On the other hand, the combined manpower requirements for all agencies would usually establish a reasonable relationship.

Two reasons can be cited for this occurrence: (1) the definitions, though prepared carefully, still left some room for overlap and interpretation upon the part of the interviewee; and (2) the interviewee, while having a good idea of the total manpower expended on the general group of activities, could only guess at the manpower for each one. This was not felt to reflect any deficiency in the study methodology but rather these developments were expected to occur to help in the final formulation and definitions of the activities. Since this specific problem of combined activities typically arose in those types of activities which were closely related, it was felt that the resulting agglomeration of activities could be made without any loss of specificity in the final model.

As an example, the largest combinations of activities occurred within the program management related activities and also within the calibration and maintenance of monitoring equipment. In this latter case, the very fine breakdown as to which activities were performed at the site of the monitor or at the lab or APC agency and which tasks were considered maintenance as opposed to calibration was either handled or interpreted differently by different agencies. However, what was apparent was the total time spent on this general group of activities was fairly consistent for each monitor. Therefore, it was possible to relate the manpower

to perform the group of activities to the monitor type and the requirements of the model; i.e., to predict changes in manpower with changes in the monitoring network, were met.

Inconsistent Data - A more common problem in data interpretation was that there were often inconsistencies among the data collected from the different agencies. A strict use of the raw data would have either disallowed the possibility of any relationship being developed or provided relationships that were contrary to logical expectations. It was therefore necessary to analyze the data collected, its source, and any reasons for the variations.

The reasons for the inconsistencies were usually the same as those cited above; i.e., misinterpretation of definition or lack of knowledge as to the manpower breakdowns requested, with the latter reason being the most prevalent. Not only was this study requesting information that is not given much thought (the manpower for specific activities) but also the detail of the data required, due to the breakdown of activities, was much finer than ever considered before.

Therefore, the data review needed to have the following elements of consideration:

- Logicalness - Was each element of data within the range which could logically be expected?
- Comparability - How did the data compare with similar data collected from the other agencies?
- Reliability - Did the interviewee seem sure of the data he was providing; had such data been prepared and reviewed by the APC agency before?
- Activity Performance - Did the agency appear to do a more or less complete and thorough job for the activity; how did they rate their own adequacy of performance?

Such a review of the data implies that a direct quantitative analytical approach was not fully appropriate. The review needed to involve the

qualitative and judgmental consideration of the persons who collected and analyzed the data. More weighting was given toward those agencies who had done extensive, detailed analyses of their manpower requirements and toward those agencies who were determined to be doing a better job on an individual activity. Where data was illogical or not comparable with other data provided, the reasons behind these discrepancies were reviewed and, if no satisfactory explanation could be found, they were generally given less weight in the determination of the relationships.

Man-Year Equivalents - One of the more minor problems in the interpretation of data, which deserves mention, was the determination of equivalent units for discussing manpower. While the manpower requirements for an air pollution control agency are generally discussed in terms of man-years, the detail of the questions asked generally led to much smaller units which, when multiplied by the relevant parameters, end up as man-years in the model. The conversion of these other units to man-years needed to be based upon the assumptions of a certain number of hours, days, or man-months to a man-year.

Though some consideration was given to using each agency's interpretation of a man-year in terms of these other units, this was discarded as being not open to projection to other agencies and also beyond the accuracy of the study. With time off for holidays, vacations, and sick leave varying, it was decided to use a normal 40-hour working week for 50 weeks in the year so that a man-year was considered to be equivalent to 2000 man-hours, 250 man-days, or 50 man-weeks. In the cases where the agencies responded in terms of a man-month, the ratio of 12 man-months to one man-year was used.

Determination of Relationships

Not wholly separate from the interpretation of the data was the determination of the predictor relationships based upon the empirical data base. Obviously, the review of the data for comparability and logicalness

must take into account the relationships expected or being developed. This type of judgmental review continues into the determination of the relationships.

The types of relationships which are dealt with can be broken into the dichotomy of linear and nonlinear. A linear relationship in this type of study implies that, no matter how many times the tasks in an individual activity are performed, it will always take the same amount of time to do each task. Such an activity would be the field operation of monitoring instrument; it takes twice as long to change 50 hi-vol filters as it does to change 25 filters. A nonlinear relationship implies that the level at which the activity is performed determines the time to handle each task in the activity, normally due to efficiencies of scale. An example of a nonlinear relationship would be data handling where the more data one handles, the more efficiently one can handle it, especially as one goes from a manual to an automated handling system as the data volume grows.

Careful attention was directed toward which relationships are linear and which are nonlinear in the formulation of the relationships. The following were considered in determining how a relationship should be expressed.

- Data collected - whether the data indicated a linear or nonlinear relationship and whether this was logical.
- Range of the data collected - whether sufficient information was available to determine an expected nonlinear relationship and the impact of extrapolating a particular relationship beyond the range of data collected.
- Complexity of the relationship which would be needed - whether the data appeared to warrant a complicated relationship when a linear one adequately addressed the manpower within the accuracy of the data.
- Range of usage of the relationship - whether a complicated relationship was only pertinent at the end points of the expected range of usage (especially at the lower range above which all agencies were expected to be operating).

SECTION III

MODEL DEVELOPMENT

The predictive relationships which were developed from the empirical data base provided the final step before the formulation of the equations and the actual development of the manpower planning model. The formulation of the equations needs to account for the data inputs and the desired structure of the model. The predictive relationships have already taken into account, to some extent, the data inputs when they were being developed.

This Section of the report presents a complete review of each of the activities for which projection equations have been included in the model; included are the definitions of the activity, the empirical information from which the estimates were developed, and of course the projection equations themselves. In addition, the structure of the model is discussed to provide a general understanding of its data inputs and operations.

ACTIVITY PROJECTION RELATIONSHIP

The model which resulted from the data analysis consists of three major sets of predictive equations, corresponding to the three major groupings of agency activities. The first group, monitoring-related activities, includes five activities applied to 12 types of sensors, for a potential total of 60 manpower projections depending on the number of sensors of each type operated, and a few additional non-sensor related activities. The second group, the source-related activities, involves six activities

applied to 15 source types, for a potential total of 90 individual projections, each based on the number of sources. The third major group, administrative and support activities, is comprised of 17 specific activities grouped under the four categories: Management, Technical Planning and Support, Training, and Clerical Support. The projections for these activities are based on the manpower estimates made for the activities in the first two groups. There are also a few activities which do not fit into this structure because they need to be estimated from predictor variables other than the ones in the matrices (e.g., travel time, estimated in part from land area); these are estimated separately wherever appropriate in the model and discussed correspondingly in the text.

The structure of this presentation does not follow chronologically either the conduct of the project or the development of the model; rather, it is organized for increased ease of reference to information on specific activities.

Monitoring-Oriented Activities

The monitoring activities of an air pollution control agency are based on the requirement to provide information on the air quality within its area of jurisdiction. Such activities include the planning, design, and set-up of the surveillance network; the operation, calibration, and maintenance of various types of equipment pertinent to the pollutants of interest; the analysis of collected samples; and the data processing, summarization, analysis, and reporting. As some monitoring networks also gather meteorological information for use in modeling and forecasting of area quality, especially for emergency episodes, and the handling of such instruments is often done by those responsible for the air quality sensors, meteorological surveillance is similarly included under these activities.

The manpower requirements for these activities are primarily dependent upon the scope of the network; i.e., number and types of instruments and

the size of the region, the latter as it relates to travel time. The total manpower necessary to conduct an air quality monitoring program may be a significant portion of that of the control agency, depending upon the depth of the other activities which may be undertaken. If the pollution problem is not severe, so that there is little need for enforcement activities, monitoring-related activities may be a major portion of the total effort.

There are five principal agency activities for which projection relationships are developed under this heading. These are the monitoring and laboratory efforts that are generally proportional to the number of ambient sensors and the frequency at which they are operated, and they are projected in a matrix based on the numbers of the various sensor types utilized:

- Field Operation of Monitoring Equipment
- Calibration and Maintenance of Monitoring Equipment
- Sample Preparation
- Sample Analysis
- Data Handling

Other specific monitoring-oriented activities proved not to be predictable based upon sensor counts and were therefore estimated by other means. These include:

- Network Design and Planning
- Special Monitoring Studies
- Travel Time
- Laboratory Quality Control
- Air Quality Data Analysis

For each of the activities listed above, the following discussion defines the activity, outlines the data gathered for analyzing the individual manpower requirements, and gives the particular relationships developed.

Field Operation of Monitoring Equipment - This activity is defined as the various efforts required to conduct the day to day operation of automatic monitoring equipment, mechanized sampling equipment, and static sensors. The majority of the time spent on this activity is in the operation of automatic samplers, as they are inherently more complicated and require more careful attention. However, they are the only type of instrument that can give continuous, hourly readings, as is necessary for the enforcement of some of the National Ambient Air Quality Standards. They are actually the most efficient on a manpower per measurement basis and at the same time need no additional manpower for laboratory analysis; however, more highly trained personnel is necessary for the operation of automatic instruments. A field visit to an automatic instrument normally includes a zeroing and purge (in which an inert gas is fed into the sampling branch) and also, as necessary, the removal of recent strip chart data and the insertion of a new chart roll. In addition, depending upon the instrument type and procedures of the agency, a calibration at two or three check points may be made and the reagent and gas supplies checked and changed as needed.

The operation of hi-vol samplers and bubbler samplers involves the exchanging of sample collection media, making airflow measurements, and inspecting the equipment for wear and damage. The mechanics of the operation are fairly sample and require only a small amount of effort for each sample change. The field operation of static sensors involves only the periodic changes of sensors (dustfall buckets, sulfation candles and plates, corrosion panels, etc.). Chemical or gravimetric determination of samples and preparation of the sampling media are included under the laboratory operations.

Although this activity and the following one, Calibration and Maintenance of Monitoring Equipment, are both dependent upon the types of instruments being used, they were investigated separately to allow for the prediction of manpower needed if the frequency of visit is changed.

The total amount of time spent on field operations is directly proportional to the frequency of visits, while the need for calibration and maintenance can be expected to vary only slightly with the frequency of usage.

As expected, the experience of the various state and local agencies indicated that the amount of time spent on the field operation of the different instruments was dependent primarily upon the type of monitor being considered. While there are some differences in time that relate to the particular model of the sampler, greater differentiation was found in the type of sensor — automatic, mechanical, static — and the pollutant which was being measured. The latter results from the complexity of the instrument, which in turn is related to the type of pollutant.

The man-hours spent on the total number of samplers for each agency during each cycle (one visit to each instrument) are given in Table 4. A review of this table indicates that there appear to be many differences in the time spent by each agency during each visit and also that there are many holes in the data gathered. The problem of interpretation of this data can be understood from looking at the plot of hi-vol data in Figure 1 which indicates the type of data gathered and the equation that was chosen to represent the data. From the data points themselves it would have been possible to establish some form of a non-linear relationship indicating that the more hi-vols that were operated, the more manpower per hi-vol it would take for the routine field operation. This is contrary to any nonlinearity which might be expected to result due to efficiency of scale.

A more logical relationship, as shown, is a linear one which indicates that the time spent in the field operation of each instrument is constant regardless of the total number of instruments. The relationship drawn goes through agency B which was given more weighting in the review of data as it had conducted an extensive review of the time spent in this

Table 4. FIELD OPERATION OF MONITORING EQUIPMENT - MAN-HOURS PER CYCLE FOR EACH SAMPLER TYPE (NUMBER OF SAMPLERS IN PARENTHESES)

Agency	Sampler type											
	Hi-vol	SO_2 bubbler	NO_2 bubbler	Sequential tape	Continuous SO_2	Continuous NO_2	Continuous HC	Continuous CO	Continuous oxidant	Meteorological equipment	Dustfall bucket	Sulfation plate
A	18 (75)	2.7 (32)	2.7 (32)	2.9 (35)	6 (24)	3.5-7 (7)	0.5-1 (1)	2.3 (7)	2.7 (8)			
B	32.5 (65)	18.5 (24)	18.5 (24)	3.2 (16)	30.4 (13)	8.4 (4)	6.3 (3)	7.9 (5)	4.7 (3)	10.5 (40)		
C	7.8 (31)	7.5 (30)	7.5 (30)	8.4[a] (8)	24[a] (8)	39.5[a] (8)	30[a] (8)	12[a] (8)	6[a] (8)		2.5 (30)	1.1 (13)
D	27.6 (83)			1.6 (8)	0.2 (1)	1.0 (5)	1.0 (5)	1.0 (5)	0.8 (4)		(20)[b]	(80)[b]
E	8.1 (32)	3-4 (12)		1.7 (10)	0.5 (3)				(0.3) (1)	0.5 (3)	7.7 (46)	7.7 (46)
F	45 (60)	13.3 (40)	13.3 (40)	10 (10)	12 (12)	3 (3)	1.5 (1)	6 (6)	11.3 (9)	5.8 (10)		
G	2.0[c] (25)	1.1 (13)	0.2 (2)	2.3 (9)	1.5 (2)						4.7 (56)	
H	2.6 (9)	1.5 (6)	1.5 (6)	0.2 (1)	1.2 (3)		1.2 (3)	1.2 (3)		2.4 (6)	1.7 (13)	1.5 (11)
I	3.5 (11)			0.25 (3)				2.0 (4)	0.2 (2)	0.5 (2)		

[a] includes travel time

[b] used for special studies

[c] sampling done by paid volunteers

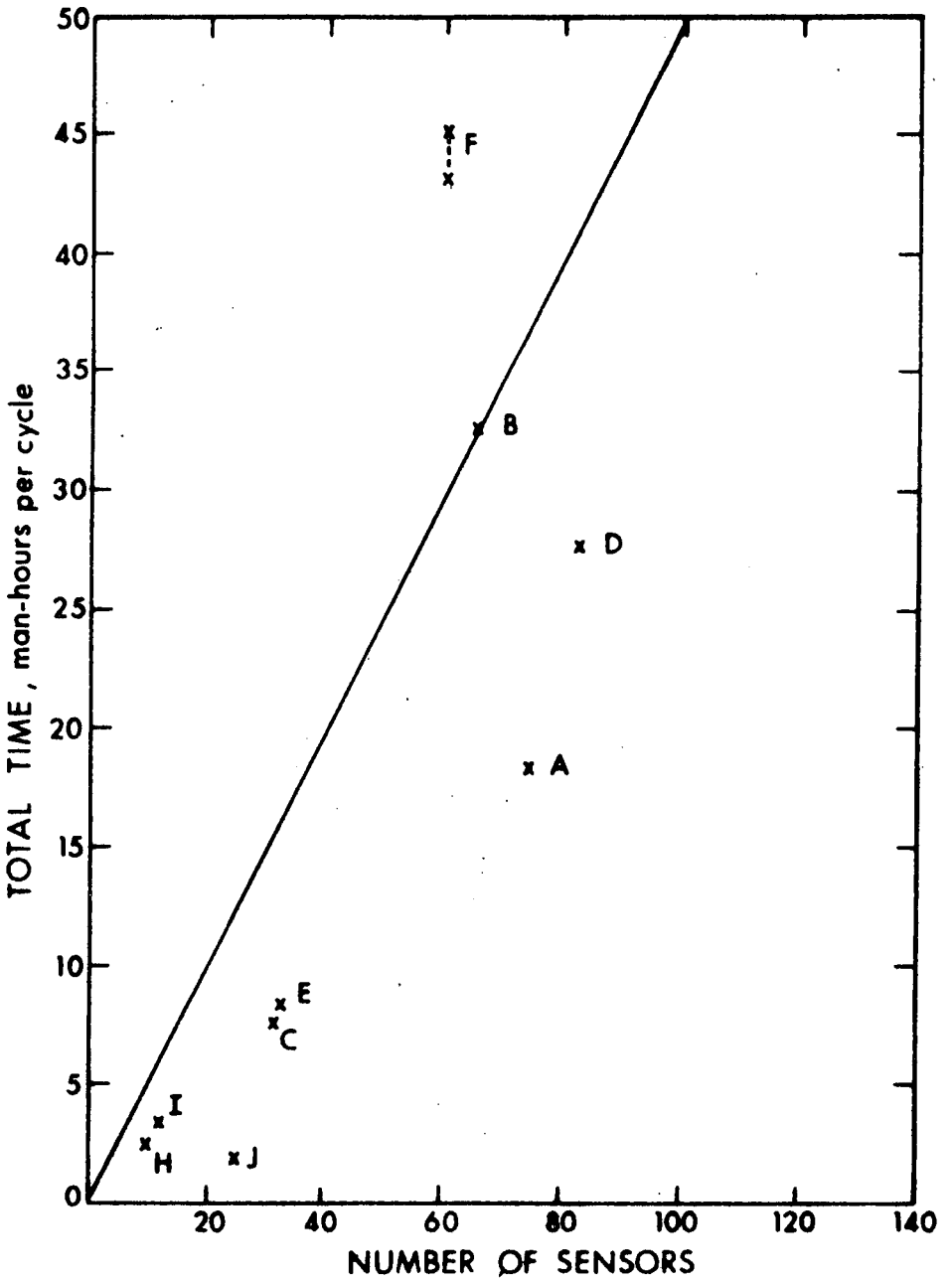

Figure 1. Field operation of monitoring equipment (hi-vols)

particular activity. Agency H had also kept a log of the time spent on its field operations and was in fairly close agreement with the line drawn. The dashed symbol for agency F indicates a range estimate.

The equation representing the linear relationship for the total manpower (in man-years) needed by an air pollution control agency for the field operation of its monitoring equipment (MY201 in the computer program) was determined to be given by the following relationship:

$$MY201 = \sum_{k=1}^{12} NSR(k) * M201(k)/F201(k)$$

where NSR(k) = the total number of sensors of category k

M201(k) = man-years to do the field operations for sensor k if done daily

F201(k) = the frequency of visits to sensor k given as the number of days between visits

The particular manpower requirements for each sensor type, as derived from the interviews, and the most common frequency of visits, for each of the sensor categories included in the study, are given below:

Sensor No.(k)	Sensor - category	M201(k)	F201(k)
1	Hi-vol	0.09	6
2	SO_2 Bubbler	0.12	6
3	NO_2 Bubbler	0.12	6
4	Sequential Tape Sampler	0.039	6
5	Continuous SO_2	0.26	2
6	Continuous NO_2	0.42	2
7	Continuous HC	0.30	2
8	Continuous CO	0.21	2
9	Continuous Ozone/Oxidant	0.22	2
10	Meteorological Equipment	0.10	6
11	Dustfall Bucket	0.015	30
12	Sulfation Plate	0.015	30

Calibration and Maintenance of Monitoring Equipment - The manpower included under this heading applies to the various activities which are normally required to ensure the continued proper calibration and operation of the monitoring equipment. These are activities that, though performed periodically as well as when necessary, are not generally performed during each visit to the sensor and, in some instances, may even require the return of the instrument to an operations base or lab affiliated with the air pollution control agency. The specific activities involved include:

1. Periodical on-site checking of the calibration of automatic sampling equipment.

2. Periodic on-site maintenance of mechanized and automatic sampling equipment.

3. Rebuilding or extensive repair of mechanized or automatic sampling equipment, in-house or by outside services (e.g., under guarantee or service contract), which requires down-time for the instrument.

4. Performing a dynamic calibration check, by running known samples through the instrument to ensure accurate measurements, especially on automatic samplers.

The four components cited above were originally investigated independently in the interviews with the agencies, though they were given the opportunity to combine the individual activities. There was considerable difficulty getting definitions of these four activities involved in upkeep and maintenance that the agencies could agree on. Therefore, the various components could not be predicted separately, and it was decided that these activities would be combined under the above title to provide only one measure of the relevant manpower levels. It is felt that this alteration of the earlier definition of activities did not seriously affect the goals of the project, as predictions are still possible on a per sensor basis.

The raw data collected for this activity is presented in Table 5 and plotted, for hi-vols only, in Figure 2. Again, it is necessary to have

Table 5. CALIBRATION AND MAINTENANCE OF MONITORING EQUIPMENT - MAN-YEARS PER YEAR FOR EACH SAMPLER TYPE (NUMBER OF SAMPLERS IN PARENTHESES)

Agency	Sampler type											
	Hi-vol	SO_2 bubbler	NO_2 bubbler	Sequential tape	Continuous SO_2	Continuous NO_2	Continuous HC	Continuous CO	Continuous oxidant	Meteorological equipment	Dustfall bucket	Sulfation plate
A					1.09 (24)							
B	0.39 (65)	0.41 (24)	0.41 (24)	0.73 (16)	0.74 (13)	0.26 (4)	0.22 (3)	0.32 (5)	0.18 (3)	1.07 (40)		
C	0.20 (31)	0.05 (30)	0.05 (30)									
D	0.75 (83)			0.06 (8)	0.12 (1)	0.52 (5)	0.17 (5)	0.17 (5)	0.03 (4)			
E	0.04 (32)	0.03 (12)		0.02 (10)	0.18 (3)				0.06 (1)		0.006 (46)	0.006 (46)
F	0.57 (60)	0.55 (40)	0.55 (40)	0.1 (10)	0.1 (12)	0.1 (3)	0.1 (1)	0.1 (6)	0.4 (9)	0.1 (10)		
G	0.05 (25)	0.04 (13)	0.04 (13)	0.26 (9)	0.05 (2)							
H	0.04 (9)				0.18-0.32 (3)		0.6 (3)	0.04 (3)		0.04 (6)		
I	0.01 (11)			0.08 (3)				0.03 (4)	0.004 (2)	0.02		

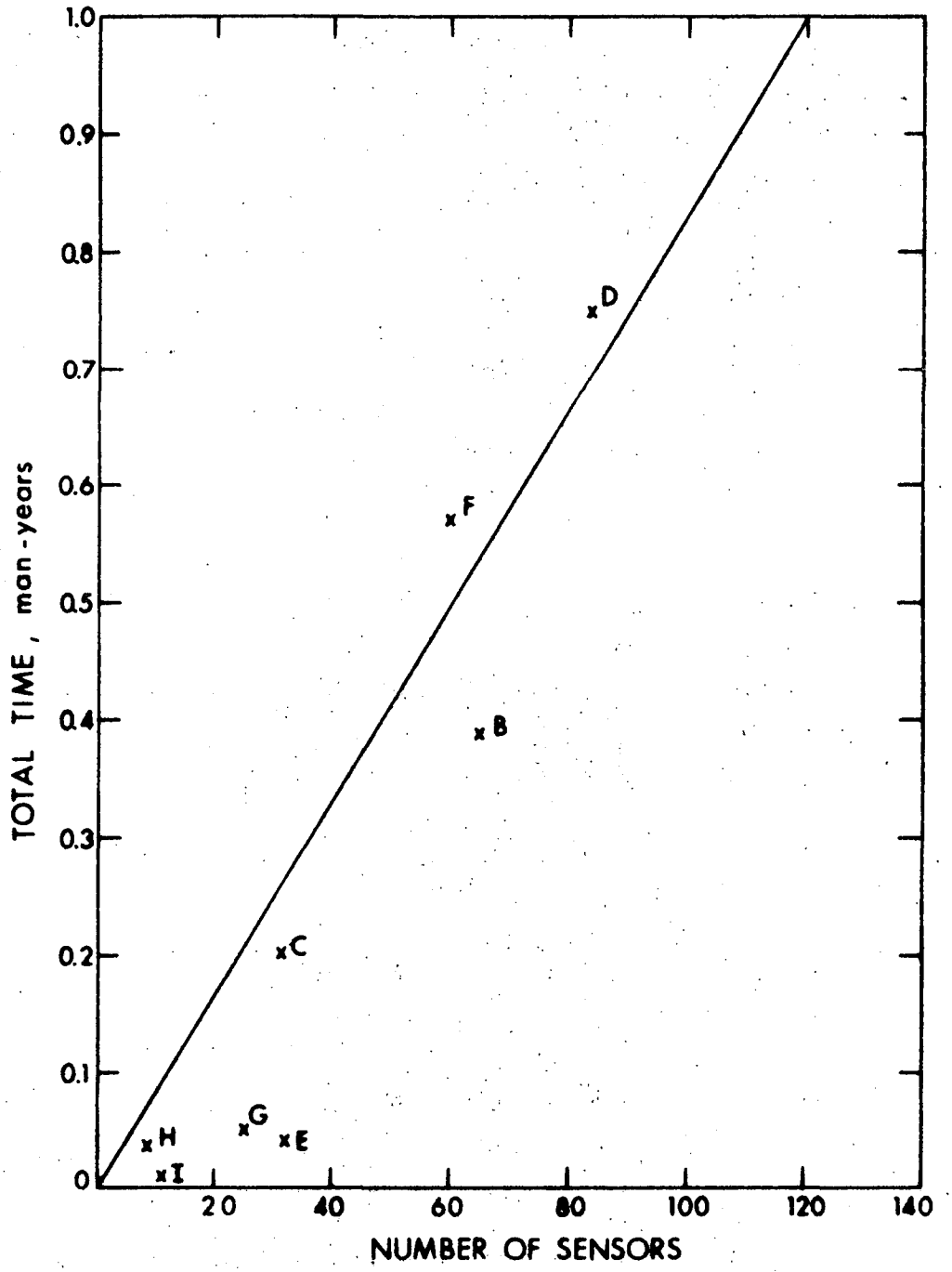

Figure 2. Calibration and maintenance of monitoring equipment (hi-vols)

an understanding of the data collected and also the expected relationship; i.e., it would not be plausible to have a line which intersects either axis at any point other than the origin. As already noted, the investigation of manpower requirements and resulting predictions for these efforts were found to be dependent upon the type of monitoring instrument and that, while differences in manpower requirements for calibration and maintenance by instrument model exist, the calculations could be adequately based on the type of sampler, including the pollutant for which it is designed. The major amount of time again is used for the automatic instruments, especially the hydrocarbon, ozone, and sulfur dioxide monitors; and only a minimal level of effort, about 1 hour per monitor per year, is applied to the maintenance of static sensors.

The equation which represents the sum of the family of lines that reflect the total manpower (in man-years) needed by an air pollution control agency for the calibration and maintenance of its monitoring equipment (MY202 in the computer program) was determined to be given by the following:

$$MY202 = \sum_{k=1}^{12} NSR(k) * M202(k)$$

where NSR(k) = the number of sensors of category k

M202(k) = manpower (in man-years) to calibrate and maintain each sensor k each year

Sensor No.(k)	Sensor Category	M202(k)
1	Hi-vol	0.012
2	SO_2 Bubbler	0.015
3	NO_2 Bubbler	0.015
4	Sequential Tape Sampler	0.03
5	Continuous SO_2	0.08
6	Continuous NO_2	0.05
7	Continuous HC	0.09
8	Continuous CO	0.04
9	Continuous Ozone/Oxidant	0.08
10	Meteorological Equipment	0.03
11	Dustfall Bucket	0.0005
12	Sulfation Plate	0.0005

Sample Preparation - This activity is defined as that effort necessary for the proper preparation of sampling media (static sensors, bubbler solutions, filter paper) before use in ambient samplers. The only types of static sensors which require any sample preparation are dustfall buckets, which need solutions prepared, as devices for measuring sulfation (sulfation plates, lead peroxide candles) are commercially available. The preparation of sampling media for wet chemical analysis is limited to the maintenance of the required reagents and solutions; particulate samplers require that the filter paper be dried and weighed prior to use. The level of effort for all of these efforts is directly related to the number of sensors and the sampling frequency.

Few of the agencies investigated were found to be conducting their lab work in-house; five out of the seven states had the labs do sample preparation (and analysis) for the state and local agencies. In one sense this tends to eliminate this manpower usage per se from the air pollution control agency, although the burden is usually reestablished through charges for the lab's services. For this reason, the model projections of total manpower requirements for lab activities are still

made for each agency but they are summarized as a separate total to allow for their proper assignment to the APC agency or state lab.

Table 6 presents the data gathered from the states who supplied information and the data (for hi-vol samplers) is presented graphically in Figure 3. As already noted, the data on this activity was not usually available during the visit and the follow-up correspondence did not prove to be fruitful; however, the correlation in the data received was high and it was decided not necessary to actively pursue further data. None of the agencies visited considered the use of continuous instruments to involve the preparation and standardization of reagents other than that included under calibration and maintenance so no time was allotted under this activity.

The relationship determined to predict the manpower (in man-years) needed by an air pollution control agency, or its associated lab, for the proper preparation of the sampling media (MY210 in the computer program) relates to the frequency of sample change and the number of sensors (i.e., the number of samples) and is given as follows:

$$MY210 = \sum_{k=1}^{12} NSR(k) * M210(k) * (365.0/F210(k))$$

where NSR(k) = the total number of sensors of category k

M210(k) = the manpower (in man-years) to prepare each sample for the sensor of category k

F210(k) = the frequency of sample change in number of days between changes.

The particular manpower requirements for each sensor type, as derived from the interviews, and the most common frequency of sample change, for each of the sensor categories included in the study, are as follows:

Table 6. SAMPLE PREPARATION - IN MAN-YEARS FOR EACH SAMPLER TYPE (NUMBER OF SAMPLES PER YEAR IN PARENTHESES)

Agency	Sampler type			
	Hi-vol	SO_2 bubbler	NO_2 bubbler	Dustfall bucket
C	0.20 (4780)	a (6817)	a (6817)	b
D	0.34 (6720)	b	b	b
E	0.14 (1940)	0.07 (730)	b	0.009 (552)
F	a (3650)	0.30 (5200)	0.23 (3900)	b
G	0.06 (1440)	0.03 (780)	0.005 (120)	0.005 (600)

[a]Manpower estimate not supplied by agency

[b]Sampler type not routinely used by agency

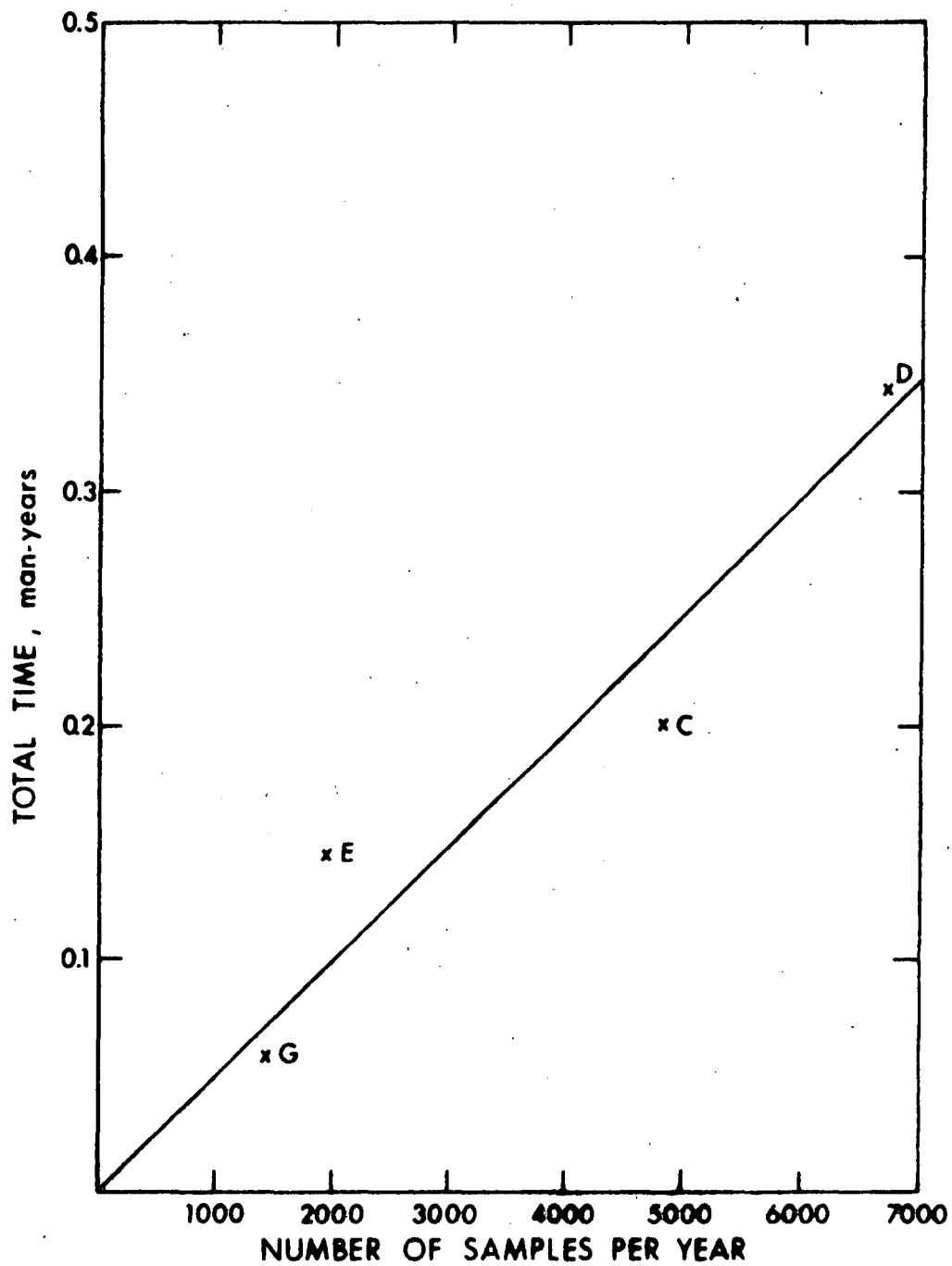

Figure 3. Sample preparation (hi-vol filters)

Sensor No.(k)	Sensor category	M210(k)	F210(k)
1	Hi-vol	$5x10^{-5}$	6
2	SO_2 Bubbler	$5.8x10^{-5}$	6
3	NO_2 Bubbler	$5.8x10^{-5}$	6
4	Sequential Tape Sampler	0	30
5	Continuous SO_2	0	1
6	Continuous NO_2	0	1
7	Continuous HC	0	1
8	Continuous CO	0	1
9	Continuous Ozone/Oxidants	0	1
10	Meteorological Equipment	0	1
11	Dustfall Buckets	$1x10^{-5}$	30
12	Sulfation Plates	$1x10^{-5}$	30

Sample Analysis - This activity involves the chemical analysis of the sampling media for the eventual determination of the ambient air quality. The particular operations involved depend upon the types of sampling utilized. The effort and considerations involved in this activity closely parallel those under sample preparation.

This activity was originally broken down into two separate activities to be able to discuss analysis by manual or automated means. This was determined to be neither necessary nor possible after the discussions with the agencies. This arises partly due to the small amount of time involved in routine analysis of ambient air concentrations and also because only a very few if any agencies use automatic analysis techniques; none of the agencies visited did.

Again there were problems in getting the data for the various APC agencies due to the fact that labs were not usually located at the APC agencies; however, the data from the state labs were comparable and these were given more weighting. The only type of analysis considered under this heading, where more than one may be performed on the sample, is that directly germane to the monitoring of the ambient air quality to

ensure compliance with the NAAQS. Therefore, the sample analysis for hi-vols refers only to the gravimetric determination of concentration and not any heavy metals, benzene solubles, or other analyses which could be performed on the hi-vol filter.

Table 7 provides the raw data that was assimilated from the study, in terms of the total effort spent (in man-years) by each agency to handle a year's supply of samples. In the case of a sequential tape sampler, one sample refers to a 1-month tape. Figure 4 provides a plot of the data and the relationship utilized for projecting the manpower requirements for handling hi-vol filters.

The relationship, which relates the total number of samples (number of sensors and frequency of sample change) to the total manpower (in man-years) needed by an air pollution control agency, or its lab, for sample analysis (MY211 in the computer program), was determined to be given by the following equation:

$$MY211 = \sum NSR(k) * M211(k) * (365.0/F210(k))$$

where M211(k) = the manpower (in man-years) to analyze each sample for the sensor of category k.

The frequency factor F210 (and the number of sensors) is the same as under Sample Preparation; the manpower per sample (M211) is as follows:

Sensor No.(k)	Sensor category	M211(k)
1	Hi-vol	13×10^{-5}
2	SO_2 Bubbler	16×10^{-5}
3	NO_2 Bubbler	16×10^{-5}
4	Sequential Tape Sampler	75×10^{-5}
5	Continuous SO_2	0

Table 7. SAMPLE ANALYSIS - IN MAN-YEARS FOR EACH SENSOR (NUMBER OF SAMPLES PER YEAR IN PARENTHESES)

Agency	Sampler type					
	Hi-vol	SO_2 bubbler	NO_2 bubbler	Sequential tape sampler	Dustfall bucket	Sulfation plate
C	0.80 (4780)	0.85 (6817)	0.85 (6817)	b	0.19 (893)	0.59 (548)
D	0.72 (6720)	b	b	a (5)	b	b
E	0.09 (1940)	0.19 (730)	b	0.005 (10)	0.24 (552)	0.24 (552)
F	0.15 (3650)	0.04 (5200)	0.03 (3900)	a (1)	b	b
G	0.06 (1440)	0.065 (780)	0.01 (120)	0.012 (12)	0.05 (600)	b

[a]Manpower estimate not supplied by agency

[b]Sampler type not routinely used by agency

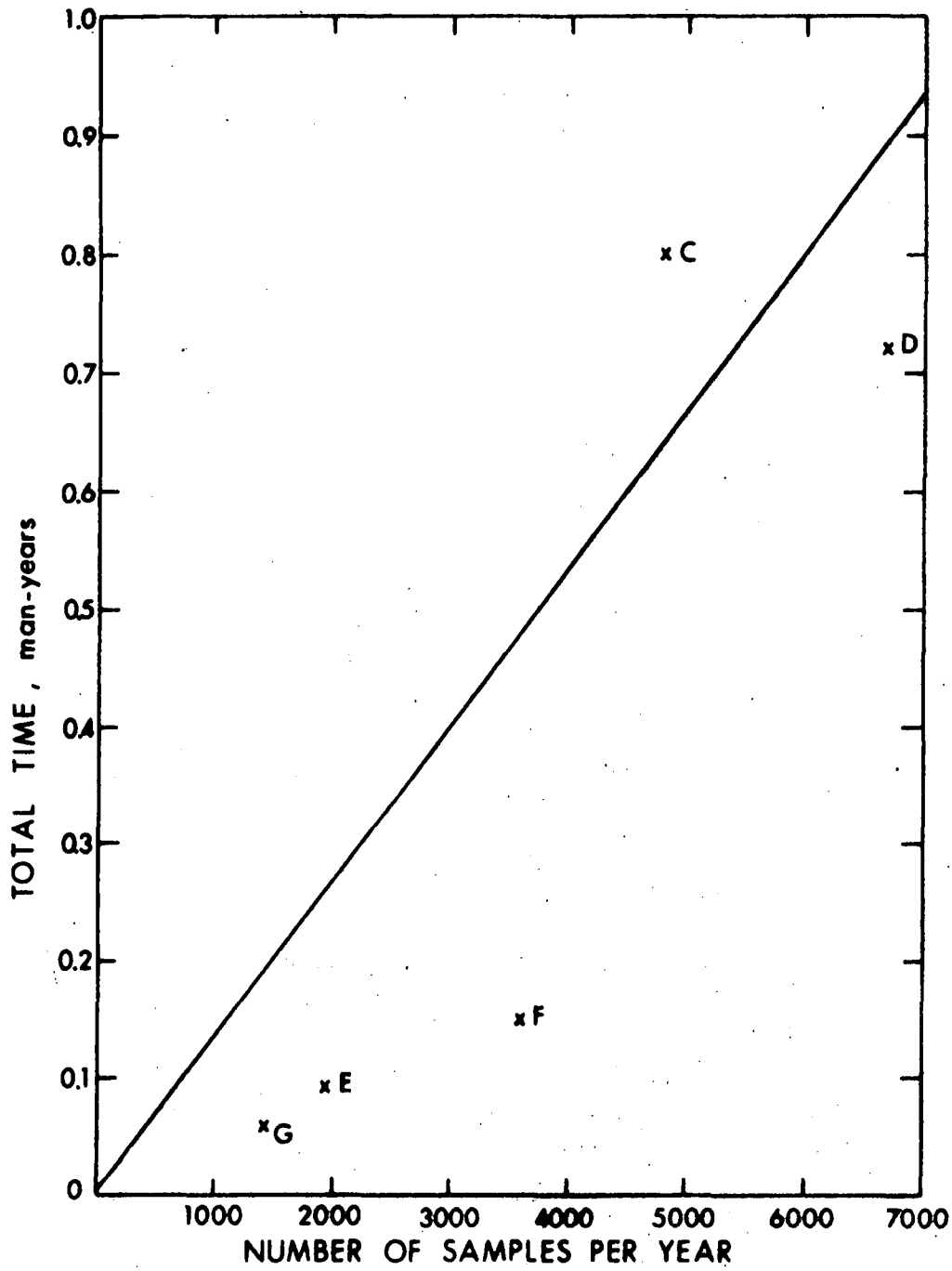

Figure 4. Sample analysis (hi-vol filters)

Sensor No.(k)	Sensor category	M211(k)
6	Continuous NO_2	0
7	Continuous HC	0
8	Continuous CO	0
9	Continuous Ozone/Oxidant	0
10	Meteorological Equipment	0
11	Dustfall Bucket	25×10^{-5}
12	Sulfation Plates	50×10^{-5}

Data Handling - This activity is defined as that effort required to process monitoring data from the sensor to the data storage system, including data validation, and to prepare routine summaries in one or more standard formats. Included under this heading is the effort expended in preparing, on appropriate SAROAD data forms or in other SAROAD-compatible format, the quarterly air quality data reports to EPA that are required by regulation. The total manpower engaged in handling data depends upon the total amount of data being handled and the degree of computerization of the data processing system; i.e., whether it is a totally manual system; semi-automatic, partially computerized; or totally automated, including telemetering.

The questionnaire was structured to pursue these three degrees of computerization so that, if possible, projections could be made with the knowledge of the type of data handling system each APC agency had. As it turned out, this was not necessary since, from the information gathered in the study, the more data that an agency handled, the more likely they were to handle it effectively. This implies an efficiency of scale, which is expected in this type of operation, with agencies going toward more efficient means of handling the data as the data volume increases.

The amount of data, or number of data bits, can be derived from knowing the number of monitors and their sampling frequency. Obviously, continuous monitors, producing hourly readings, will be consuming the

majority of effort in this area for any agency which has more than a few in operation. The average number of data bits per day (DB) produced by a monitoring netowrk can be determined from the following equation:

$$DB = \sum_{k=1}^{3} NSR(k)/F210(k) + 12 * NSR(4) + 24 * \sum_{k=5}^{10} NSR(k)$$

$$+ (NSR(11)/F210(11) + NSR(12)/F210(12))$$

where NSR(k) refers to the number of sensors of the appropriate type, and F210(k) refers to the number of days in the scheduled sampling cycle, as described previously. The equation also assumes that tape samplers produce 2-hour values and other continuous instruments 1-hour values.

A plot of the number of data bits handled by each agency versus the total manpower expended on data handling during the year is given in Figure 5. This plot is expressed in the number of data bits per 6-day period, rather than the average number per day, since the standard sampling cycle was every 6 days at the time of the agency visits, and the data was gathered in that form.

The data in Figure 5 reflect an efficiency of scale that results from the increase in the volume of data handled. It was decided to represent this relationship through the use of two straight lines which then produce two equations when expressed solely in terms of the total man-years to handle the data from an air monitoring network (MY220 in the computer program):

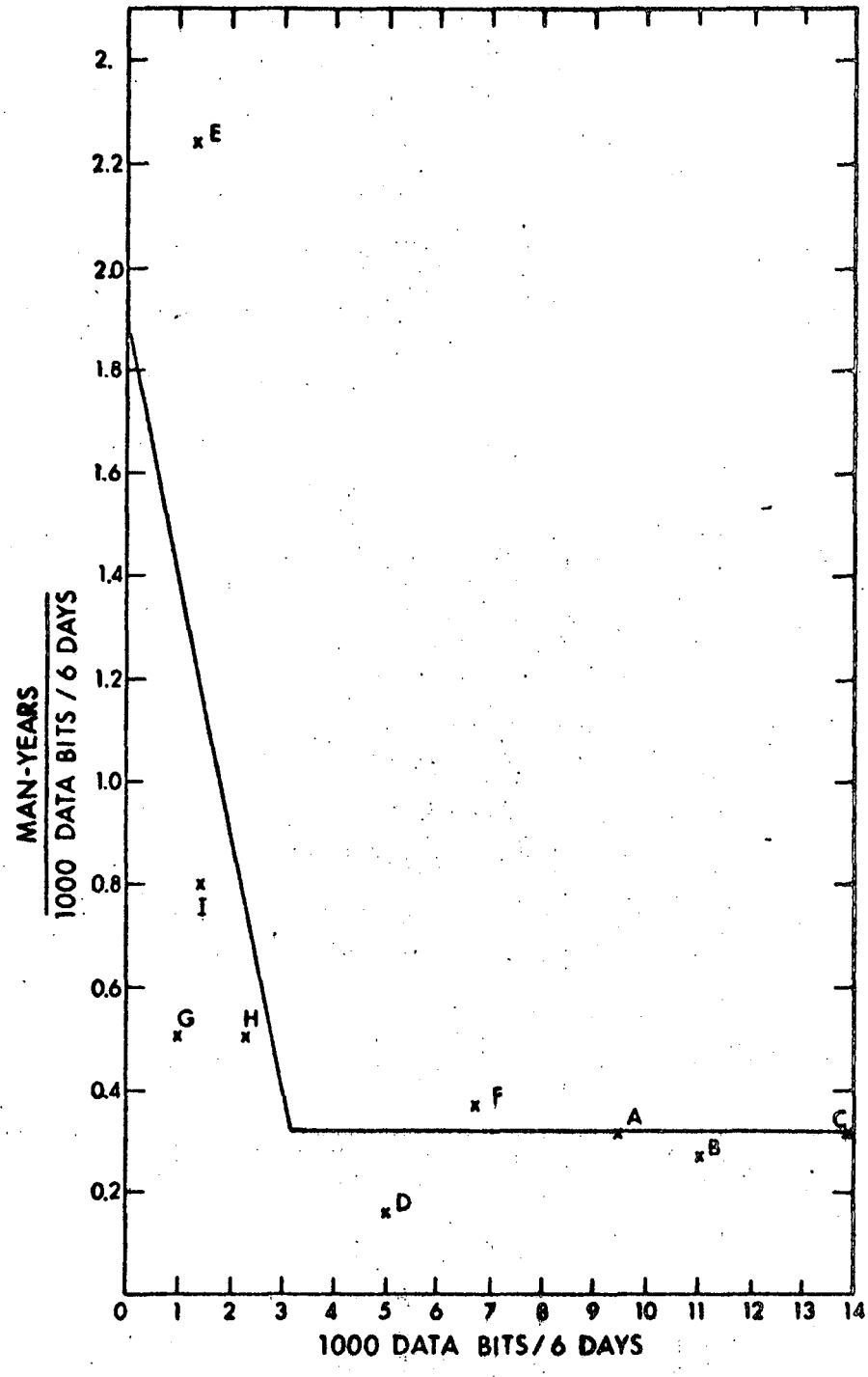

Figure 5. Data handling

$$\text{if } DB < 520$$
$$\text{then } MY220 = 0.0114 * DB - 1.8 \times 10^{-5} * DB^2$$

$$\text{if } DB \geq 520$$
$$\text{then } MY220 = 0.00186 * DB$$

The data also indicated that those agencies that had telemetered continuous monitors experienced some savings in total manpower because the telemetered monitors required only minimal data handling. It was found that subtracting 0.04 man-years for every telemetered monitor brought those agencies more closely in line with actual manpower usage projected. At the current time this is included in the model's predictive relationship, although the number of telemetered sensors (NTEL) is zero until data becomes available.

The manpower used for data processing is in most cases divided between the state agency and any local agencies in the AQCR in question, depending of course on the nature of the network and the data handling procedures utilized. This has been accommodated in the model by first estimating the manpower at the AQCR level, if any local agencies exist (if NLA $\neq$ 0), and thus estimating additional manpower on the state level. At the state level, the much larger accumulated value of DB serves to reduce the apparent overlap, because of the nonlinearity of the relationship, although estimating the manpower in this way still provides higher estimates than if it were assumed the state agencies did it all. This additional effort is not viewed as being unnecessary, but rather as contributing to the overall quality of the data, since the local personnel who operate the network have an intrinsically better opportunity for effective data validation.

Monitoring Network Design and Planning - Because ambient pollution levels and meteorological parameters are not the same throughout the region, it is necessary to carefully plan and periodically reconsider where the measurements should be made, how many should be taken, etc. Design of a

monitoring network is often assisted by dispersion modeling and a complete emission inventory. However, these aids are seldom available in initial phases of the network design and much design needs to be based on judgment, with subsequent reconsideration as more information becomes available. This activity includes the on-going effort involved in this designing and also includes such efforts as site selection and negotiation and operating schedule analysis.

This type of low-level, on-going activity is intrinsically difficult to estimate, and did prove to be so with the agencies visited (see Table 8). This was further complicated by the fact that two states (A and D) were involved in major equipment changes in their networks. There did seem to be good consensus on the fact that planning monitoring activities in currently undeveloped areas was the major effort, as opposed to modifying existing metworks in urban areas. Consequently, since it is only a small amount of the manpower, it was decided to estimate this activity as a function of the AQCR characteristics and to use the EPA-assigned priority rating as an indicator of the urban development characteristics of the AQCR. In the program, the priority classifications for SO_2 and TSP are summed (using 1A equal to 4) and if the total is 2 or 3 the AQCR is viewed as urban; otherwise, it is considered to be nonurban. Based on the average of estimates from all such AQCR's included in the study, urban AQCR's are estimated at 0.05 man-years for network planning. The nonurban AQCR's are estimated to require 0.15 man-years; this estimate is based primarily on the experience of two states that are actually developing network operations in such AQCR's. States that are not now monitoring such areas did recognize a need to do so, based to a large extent on the needs of air quality maintenance planning and analysis. The raw data and the manpower requirements for each state as derived from this relationship are given in Table 8.

Table 8. MONITORING NETWORK DESIGN AND PLANNING (TIME IN MAN-YEARS)

Agency	Stated manpower	Number of urban AQCR's	Number of nonurban AQCR's	Projected manpower
A	3	2	2	0.4
B	0.60	4	7	1.25
C	0.08	3	3	0.60
D	1.5	0	8	1.2
F	1.0	1	7	1.1
G	0.8	1	11	1.7

Special Monitoring Studies - From the discussions with the agencies, it was determined that an appreciable amount of time was spent on monitoring activities that were not part of the routine, on-going ambient monitoring. This activity, usually called special studies, was engaged in for determining ambient concentrations only during special times and/or at particular locations. Often such studies were performed as part of new indirect or direct source review procedures as a means of deriving ambient concentrations for use in emission models. Some studies were also carried out as a means of testing new equipment or in-use equipment; other reasons for special studies included episode monitoring, determining the impact on air quality of specific sources, and special requests.

It was not felt that these special studies should be regarded as extraneous activities and therefore left out of the model because they were not part of the EPA-required activities. The incorporation of this activity implied an additional manpower requirement for the air pollution control agencies, drawing upon the monitoring and laboratory personnel. These special studies were not immediately predictable due in part to the wide range of such studies which were engaged in, with different agencies placing emphasis in different areas, and the fact

that the questionnaire had not been structured to investigate this area. Therefore, the determination of a relationship was a much more qualitative judgment in this instance.

For those agencies for which data on special studies were broken out to some degree, the amount of effort involved in this activity ranged from 15 percent (agency B) to 40 percent (agencies C, D, I) of the manpower expanded in the other monitoring and laboratory activities. While it is felt that a more careful investigation would indicate that the additional burden on personnel engaged in monitoring activities would be more heavily weighted toward those performing laboratory activities, since more than one analysis can be performed on only one sample (e.g., benzene solubles, metals analyses, particle sizing, etc., on hi-vol filters), the data available indicated that the amount of manpower involved in special studies could be stated as an additional 30 percent burden on the total manpower engaged in Field Operations, Calibration and Maintenance, Sample Preparation, and Sample Analysis.

Travel Time for Monitoring - The amount of travel time needed for covering the monitoring network is directly related to the design and extent of the network. Such factors as average speed, total area covered, and the frequency of visits would be expected to be the determining factors. In regard to the area covered, it would have to be correlated with whoever is conducting the field operation; i.e., whether the field operation was handled by a local health board, a regional office of the state, or directly from the state APC agency's headquarters. Unfortunately, there is no immediately available data base for inputting this type of information.

The agencies visited reflected this mix in the conduct of their field operations, making it hard to arrive at a relationship that would be broadly applicable. A review of the data compiled from the visits with the agencies indicated a fairly good relationship based upon

only the square root of the area of the state, which could be interpreted to be proportional to the total miles traveled. The data gathered is plotted in Figure 6 along with the following relationship which was used in the model for projecting the manpower for this activity:

$$\text{Travel Time} = 0.0154 * (\text{area in miles})^{1/2}$$

In deriving this relationship, those agencies using local manpower (D and G) and those with regional offices (F and B) were discounted to varying degrees, depending upon the impact that they had. Agency E only visited the samplers half as often as the other agencies; agency C covered only the metropolitan area (the area plotted on the graph) with local health offices handling the rest of the state.

As the above relationship assumes a 6-day cycle for visiting the sampling stations and it may be desirable in the future to consider changing the sampling frequency, the equation in the model that represents the travel time needed for monitoring (MY404 in the computer program) contains the frequency of visit for hi-vols, which is usually the determining factor:

$$MY404 = 0.0924 * SQRT(AREA(ISTATE))/F201(1)$$

The application of this relationship in the actual computer program is not done on an AQCR basis but at the state level so that the travel time would not be disproportionately high for states with many smaller AQCR's. If more information on local agencies becomes available, their area of jurisdiction and who is responsible for the monitoring, these inputs could probably also be included and a new relationship determined.

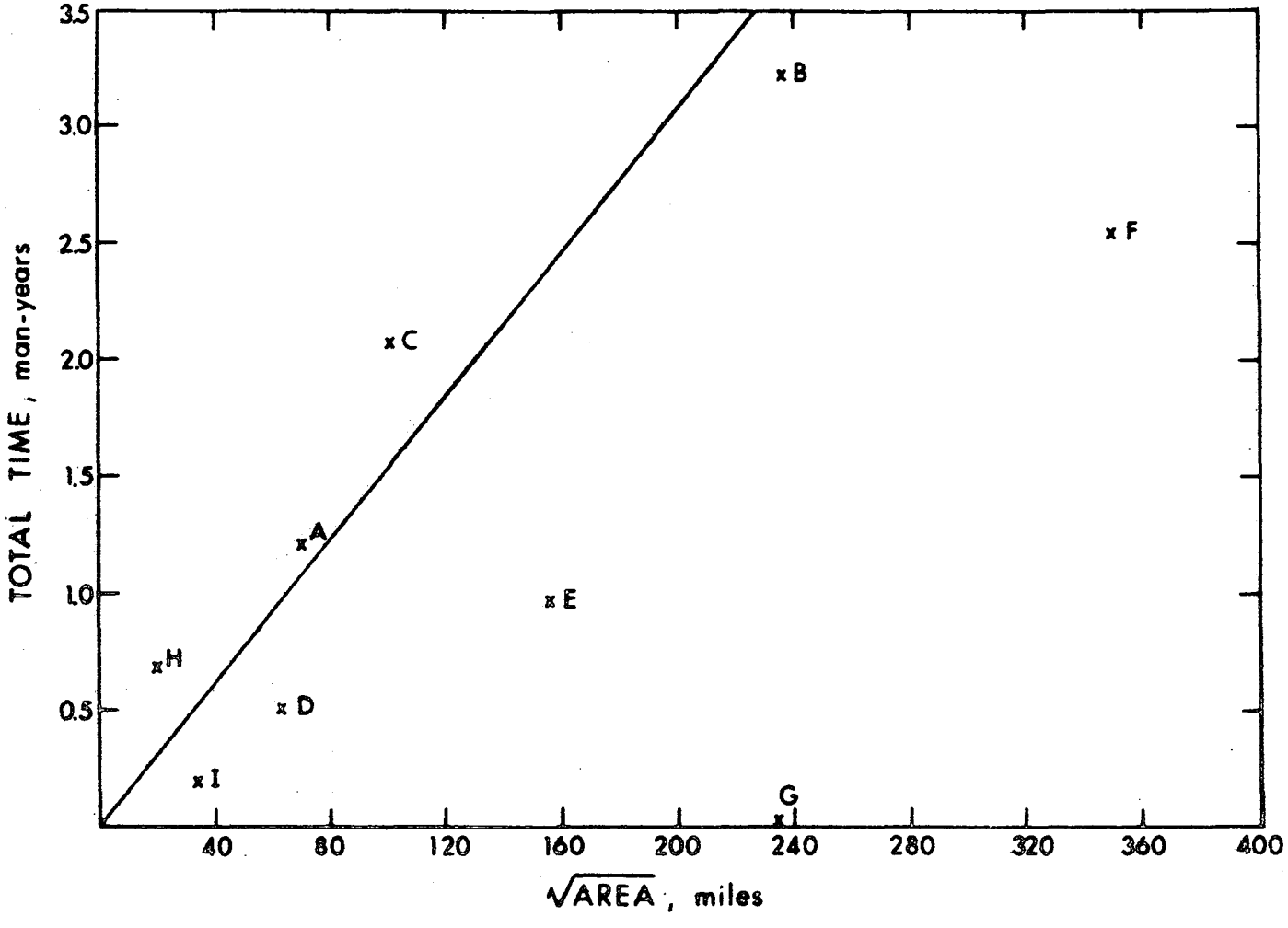

Figure 6. Travel time for monitoring

Laboratory Quality Control - This activity is defined as that effort to ensure the proper determination of pollutant samples and levels in the laboratory, such as systems of running known samples blindly through the wet chemical analysis techniques at periodic intervals. This activity does not include the calibration of ambient samplers or automatic analyzers, which is considered under "Calibration and Maintenance of Monitoring Equipment."

All agencies visited expressed the desire to have more time for the assurance of quality control for the laboratory activities. Since these were selected as some of the better agencies and they did engage in some quality control efforts, it was felt especially important that some additional time be provided in the model specifically for an expanded quality control effort. Discussions with the Quality Assurance and Environmental Monitoring Laboratory (QAEML) suggested that an effort equivalent to 10 percent of the activity in the laboratory would be required for adequate quality control operations. Therefore, the estimate of additional manpower for this activity was estimated as 10 percent of the total manpower estimated for Sample Preparation and Sample Analysis.

Air Quality Data Analysis - This activity is defined as the effort involved in analysis of the air quality data, including the necessary adjunct use of meteorological data, either from the agency's network or from other sources; e.g., study of the temporal and locational variations in pollutant levels in conjunction with meteorological data and knowledge of pollutant sources. Particular areas of data analysis include:

- AQ trends
- AQ patterns
- Source identification
- Monitoring of known sources
- Transportation planning
- Indirect source planning

The interviews with the agencies indicated that, naturally enough, those agencies that had more data to analyze spent more time in this activity. By relating the total manpower spent in this activity with that spent solely in the handling of the data, factors such as the total amount of data and the use of computers are automatically taken into consideration. Figure 7 provides a plot of these two manpower levels as determined from the study visits. The manpower for agency B was much higher than would be expected as it was still handling data analysis by hand, with plans for programming it in the near future. Agency C is low, probably due to the fact that much of its data analysis is done throughout the agency to help in their various planning activities and could not be very well estimated by one interviewee; agency G has done little analysis to date.

The line plotted on the graph reflects the relationship used in the computer program for projecting the manpower requirements for data analysis (MY322 in the computer program), a function of the manpower used in data handling (MY220):

$$MY322 = 0.5 * MY220$$

Source-Related Activities

The second major group of agency activities includes those that are quantitatively related to the number and type of pollutant sources in the area under consideration. These include the enforcement and source surveillance activities that are traditional, and also other compliance and planning activities that are relatively new. This group of activities has proved to be the one for which it was most difficult to obtain reliable empirical information and to develop satisfactory predictive relationships. There were a variety of causes for this difficulty. In the case of mobile sources, for instance, the difficulty was simply that actual transporation control activities were and still are only beginning, so there is little experience in even the most advanced agencies.

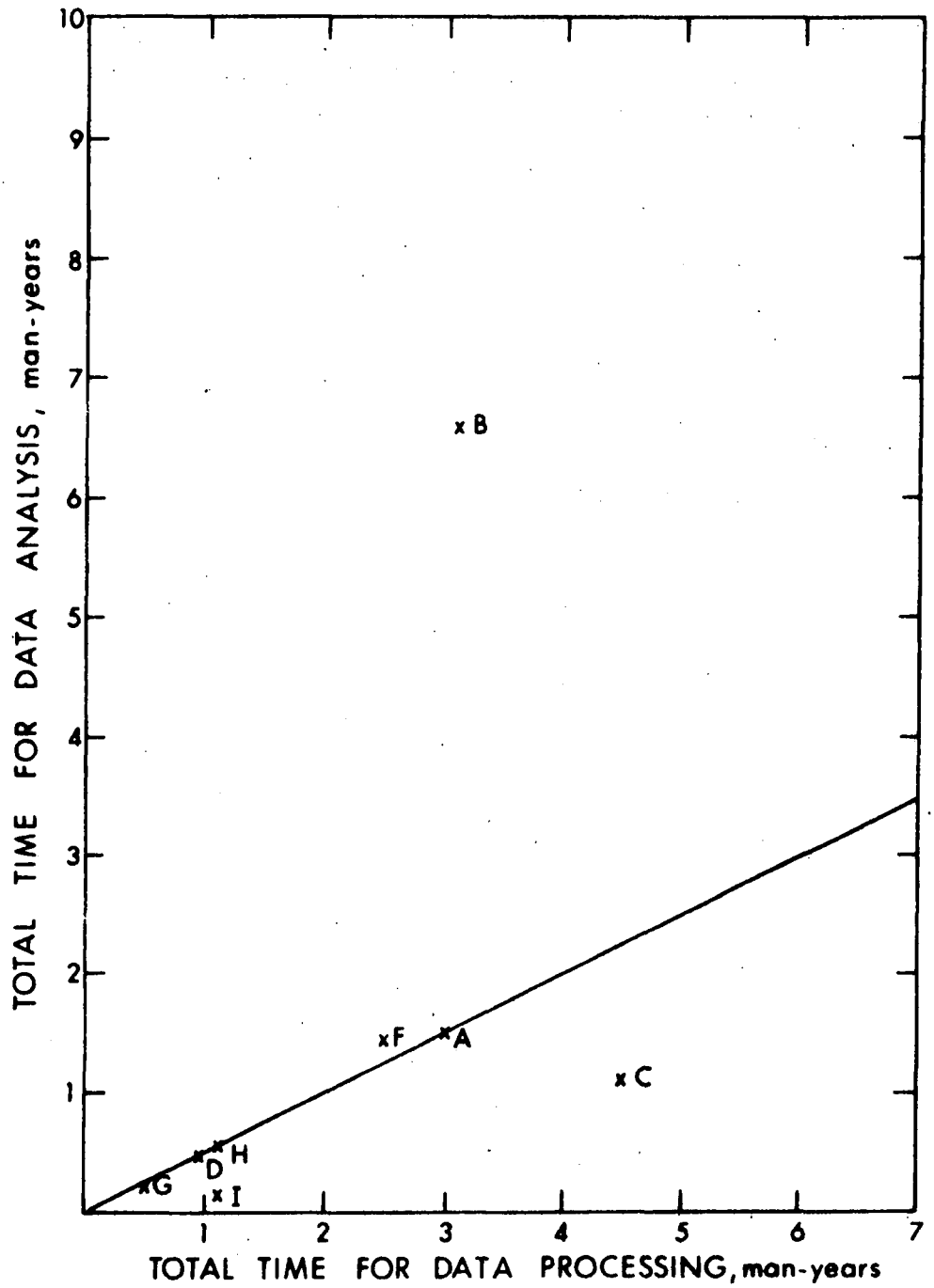

Figure 7. Data analysis

The primary difficulties in the case of stationary source activities, beyond those simply resulting from the lack of data, were the lack of homogeneity in the agencies' approach to stationary source enforcement and in the definition of some of the major activities. The first of these, nonhomogeneity of overall program thrust or control approach, is a problem fundamental to the entire concept of a planning model; it cannot be completely resolved, other than by homogenizing the agencies, and on an aggregate basis one can only hope to avoid any very severe effects and then temper model usage with judgment. (On a single-state basis, better estimates can be obtained by adjusting model parameters to values appropriate for the specific state.)

The second problem noted above, the varying definitions of the activities, would seem to be amenable to standardization in the model, and to a large extent is so. However, fundamental difficulties relating to the definitions used in the entire air pollution field make it more complex than just developing standard definitions for use in the manpower model development. An example is the idea of a compliance schedule, an agreement negotiated between a source and an agency relative to the timetable for installing control equipment on the source. Several agencies did not utilize such a concept and, although the ultimate purpose seemed to be served, discussing the idea and allocating manpower to it proved difficult.

With these general cautions in mind, the following text discusses the specific activities defined for the model, the data gathered, and the relationships utilized in the model.

Stationary Source Activity Matrix - Six activities that account for much of an agency's manpower in the area of stationary source control were defined in such a way as to be used in a matrix of activities versus source counts, much as was done with monitoring activities and sensor counts. These activities are:

- Stationary source inspection
- Conduct stationary source testing
- Observe conduct of stack test
- Overseeing of compliance schedules
- Formal legal action
- Technical review of equipment plans

Definitions of these activities follow immediately, and the predictive relationships are presented afterwards.

101. Stationary Source Inspection - These activities include the effort needed to conduct inspections, either routine or extensive, excluding any effort involved in associated stack testing or in travel time. Routine inspections are those that are typically performed in less than 1/2 man-day (exclusive of travel time), where visual inspection of equipment and operation, by a technician-level person, is adequate. This type of inspection might be performed for routine permit purposes, for on-going surveillance to help maintain the emissions inventory, or for other reasons. Extensive engineering inspections, in contrast, may involve one or more professional staff for perhaps several days, and will be much more thorough and detailed.

It was originally intended to utilize two activity definitions, one for routine inspections and one for engineering inspections. The information developed from the agency visits, however, indicated that the differences in these inspections were only differences in the complexity of the source being inspected. There were no cases, for instance, when a major source was inspected in a brief routine manner and no agency recommended such a practice. Consequently, a single category for all inspections is used, and the differences in manpower required are included in the different factors used for the various source types.

104. Conduct Stationary Source Tests - This activity includes the field and source-oriented effort involved in planning and conducting actual measurements of emissions. If the stack test is conducted in conjunction with an inspection, this activity includes only the effort needed to prepare and set-up the equipment, conduct the test, make necessary field calculations, and replace the equipment; access to sampling ports is presumed, and any subsequent calculations or data processing conducted in the office is also included.

103. Observe Conduct of Stack Test - To save manpower, agencies may require sources to conduct stack tests, using their own staff or an approved contractor, with the agency observing to the extent necessary to maintain the integrity of the process. This activity includes the effort to observe one such test.

107. Monitoring of Compliance Schedules - This activity includes the efforts involved in maintaining surveillance over and conducting negotiations about the definable increments of progress in the compliance schedules.

110. Formal Legal Action - This activity is defined as the time involved in actual court cases, hearings, etc., including assimilation and preparation of supporting documents, notification of the polluter of impending action, and actual time in court in prosecution. The time of both legal and engineering or other technical staff is included.

130. Technical Review of Equipment Plans - This activity is defined as the effort involved in reviewing equipment plans for proposed or existing sources to verify their compliance with established regulations pertaining to direct emissions prior to issuance of a permit. Review of the air quality impact of a proposed source is not included. Review of equipment plans for ta credit or adjustment purposes is considered as a separate activity; review of construction proposals relative to their indirect emissions, and advisory reviews, are also considered in subsequent activities.

Stationary Source Categories Used in Matrix - The stationary source categories used in the matrix are listed in Table 9. This list was condensed from a more extensive list in the questionnaire, based on the results of the agency visits and subsequent study of the source-count data base available for initial use with the model.

An initial list of 68 source types was developed for the questionnaire based on general knowledge of the nature of stationary sources and control activities, along with the list of source types for which New Source Performance Standards (NSPS) were either promulgated or being considered. (This initial list is included subsequently in Table 13.) One rather clear result of the agency visits was that such a list was too extensive - few of the agencies could provide much information at that detail, and most felt it not feasible. Accordingly, it was

Table 9. FINAL LIST OF SOURCE CATEGORIES USED IN STATIONARY SOURCE MATRIX

1.	Electric power plant boilers over 10 MMBtu/hour
2.	Coal- or residual oil-fired boilers over 100 MMBtu/hour
3.	Coal-fired industrial boilers 10-100 MMBtu/hour
4.	Coal-fired commercial/institutional boilers 10-100 MMBtu/hour
5.	Residual oil-fired boilers 10-100 MMBtu/hour
6.	Coal-fired boilers < 10 MMBtu/hour
7.	Small and miscellaneous boilers
8.	Chemical manufacture
9.	Food and agricultural
10.	Iron and steel industry
11.	Primary non-ferrous metallurgy
12.	Secondary metallurgy
13.	Portland cement manufacture
14.	Stone quarrying
15.	Other mineral products
16.	Petroleum processing
17.	Wood products
18.	Other industry
19.	Petroleum storage
20.	Other evaporative HC sources
21.	Open burning dumps
22.	Industrial incineration
23.	Other incineration

concluded that the list needed to be compressed, although this would necessarily require aggregating some relatively disparate source categories.

Subsequently, it was determined that the best available data base on the number of sources was in the form of Source Classification Codes (SCC), rather than emission points (e.g., stacks) or premises (e.g., an entire steel mill, refinery, etc.). This proved to be somewhat inconsistent with the way in which information was available from the agencies, but nonetheless it was necessary to use the source information in this form. Accordingly, the compressed list of source types (Table 9) was designed so that the various categories are aggregates of the SCC data available from the NEDS data system; Table 10 presents the aggregation scheme used, which necessarily makes use of the structure of the SCC coding scheme.

Empirical Information Sought During Agency Visits - The portion of the questionnaire devoted to stationary-source-related activities was intended to gather information in two forms - the per-unit time required for each activity applied to each particular source type; e.g., the effort needed to inspect that source type once, and the aggregate manpower applied to a particular activity, such as total time for inspections.

The first of these types of information, the data specific to source type, was sought for direct use in the activity versus source type matrix. It was decided in advance to attempt to develop a consistent, simple format of relationship between the number of sources and the manpower, so as to permit its ready adaptation to the differing philosophies adopted by various agencies. The general form of the predictive relationship, for source type k, which was in fact ultimately used, was to be:

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Empirical Information Sought During Agency Visits - The portion of the questionnaire devoted to stationary-source-related activities was intended to gather information in two forms - the per-unit time required for each activity applied to each particular source type; e.g., the effort needed to inspect that source type once, and the aggregate manpower applied to a particular activity, such as total time for inspections.

The first of these types of information, the data specific to source type, was sought for direct use in the activity versus source type matrix. It was decided in advance to attempt to develop a consistent, simple format of relationship between the number of sources and the manpower, so as to permit its ready adaptation to the differing philosophies adopted by various agencies. The general form of the predictive relationship, for source type k, which was in fact ultimately used, was to be:

Manpower = Mxxx(k) * Cxxx(k) * Fxxx(k) * NSRC(k) / Constant

where Mxxx(k) is a manpower factor for an activity, in time per single performance of that activity for source type k,

Cxxx(k) is a factor indicating the proportion of the sources in category k that is subject to the activity in question,

Fxxx(k) is a frequency factor providing an ability to specify the frequency of performance of each activity per year, and

NSRC(k) is the number of sources in category k;

The constant is for possible use to adjust the resultant manpower from man-days, man-hours, etc., into man-years.

Table 10. AGGREGATION OF SCC's INTO 23 SOURCE TYPE CATEGORIES FOR MODEL

Source type category	NEDS source classification code (SCC) I	II	III	IV
1. Electric Power Plant Boilers over 10 MM Btu/hr	1	01	ELECTRIC POWER GENERATION	
		01	001	Anthracite Coal
			001	01-02 > 100 MM Btu/hr
			001	03-04 10 - 100 MM Btu/hr
		01	002	Bituminous Coal
			002	01-05 > 100 MM Btu/hr
			002	06-09 10 - 100 MM Btu/hr
		01	003	Lignite
			003	01-06 > 100 MM Btu/hr
			003	07-11 10 - 100 MM Btu/hr
		01	004	Residual Oil
			004	01 > 100 MM Btu/hr
			004	02 10 - 100 MM Btu/hr
		01	005	Distillate Oil
			005	01 > 100 MM Btu/hr
			005	02 10 - 100 MM Btu/hr
2. Coal- or Residual Oil-Fired Boilers over 100 MM Btu/hr	1	02	INDUSTRIAL	
		02	001	Anthracite Coal
			001	01-02 > 100 MM Btu/hr
		02	002	Bituminous Coal
			002	01-04 > 100 MM Btu/hr
		02	003	Lignite
			003	01-06 > 100 MM Btu/hr
		02	004	Residual Oil
			004	01 > 100 MM Btu/hr
		02	005	Distillate Oil
			005	01 > 100 MM Btu/hr
	1	03	COMMERCIAL - INSTITUTIONAL	
		03	004	Residual Oil
			004	01 > 100 MM Btu/hr
		03	005	Distillate Oil
			005	01 > 100 MM Btu/hr
3. Coal-Fired Industrial Boilers 10 - 100 MM Btu/hr	1	02	INDUSTRIAL	
		02	001	Anthracite Coal
			001	03-04 10 - 100 MM Btu/hr
		02	002	Bituminous Coal
			002	05-09 10 - 100 MM Btu/hr
		02	003	Lignite
			003	07-11 10 - 100 MM Btu/hr
		02	009	XX Wood/Bark Waste
		02	011	XX Bagasse
		02	012	XX Solid Waste
4. Coal-Fired Commercial/Institutional Boilers 10 - 100 MM Btu/hr	1	03	COMMERCIAL/INSTITUTIONAL	
		03	001	Anthracite Coal
			001	05-07 10 - 100 MM Btu/hr
		03	002	Bituminous Coal
			002	05-10 10 - 100 MM Btu/hr
		03	003	Lignite
			003	05-09 10 - 100 MM Btu/hr
		03	009	XX Wood/Bark Waste
		03	012	XX Solid Waste
	2	01	ELECTRIC POWER GENERATION	
		01	003	XX Diesel Fuel
		01	004	XX Residual Oil
		01	006	XX Crude Oil
	2	02	INDUSTRIAL	
		02	004	XX Diesel Fuel
		02	005	XX Residual Oil
		02	007	XX Crude Oil
5. Residual Oil-Fired Boilers 10 - 100 MM Btu/hr	1	02	INDUSTRIAL BOILERS	
		02	004	Residual Oil
			004	02 10 - 100 MM Btu/hr
		02	005	Distillate Oil
			005	02 10 - 100 MM Btu/hr
	1	03	COMMERCIAL/INSTITUTIONAL BOILERS	
		03	004	Residual Oil
			004	02 10 - 100 MM Btu/hr
		03	005	Distillate Oil
			005	02 10 - 100 MM Btu/hr

Table 10 (continued). AGGREGATION OF SCC's INTO 23 SOURCE TYPE CATEGORIES FOR MODEL

Source type category	NEDS source classification code (SCC) I	II	III	IV
6. Coal-Fired Boilers less than 10 MM Btu/hr	1	01	ELECTRIC POWER GENERATION	
		01	001	Anthracite Coal
			001	05-06 < 10 MM Btu/hr
		01	002	Bituminous Coal
			002	10-12 < 10 MM Btu/hr
		01	003	Lignite
			003	07-11 < 10 MM Btu/hr
	1	02	INDUSTRIAL BOILERS	
		02	001	Anthracite Coal
			001	05-07 < 10 MM Btu/hr
		02	002	Bituminous Coal
			002	10-14 < 10 MM Btu/hr
		02	003	Lignite
			003	12-16 < 10 MM Btu/hr
	1	03	COMMERCIAL/INSTITUTIONAL BOILERS	
		03	001	Anthracite Coal
			001	08-10 < 10 MM Btu/hr
		03	002	Bituminous Coal
			002	11-14 < 10 MM Btu/hr
		03	003	Lignite
			003	10-14 < 10 MM Btu/hr
7. Small and Miscellaneous Boilers	1	01	ELECTRIC POWER GENERATION	
		01	001	Anthracite Coal
			001	99 Unclassified
		01	001	Bituminous Coal
			001	99 Unclassified
		01	004	Residual Oil
			004	03 < 10 MM Btu/hr
		01	005	Distillate Oil
			005	03 < 10 MM Btu/hr
		01	006	XX Natural Gas
		01	007	XX Process Gas
		01	008	XX Coke
		01	009	XX Wood/Bark Waste
		01	011	XX Bagasse
		01	012	XX Solid Waste
		01	013	XX Liquid Waste
		01	999	XX Unclassified
	2	01	ELECTRIC POWER GENERATION	
		01	001	XX Distillate Oil
		01	002	XX Natural Gas
		01	005	XX Jet Fuel
		01	007	XX Process Gas
		01	999	XX Unclassified
	1	02	INDUSTRIAL	
		02	001	Anthracite Coal
			001	99 Unclassified
		02	002	Bituminous Coal
			002	99 Unclassified
		02	004	Residual Oil
			004	03 < 10 MM Btu/hr
		02	005	Distillate Oil
			005	03 < 10 MM Btu/hr
		02	006	XX Natural Gas
		02	007	XX Process Gas
		02	008	XX Coke
		02	010	XX Liquid Petroleum Gas
		02	013	XX Liquid Waste
		02	999	XX Unclassified
	1	03	COMMERCIAL/INSTITUTIONAL	
		03	001	Anthracite Coal
			001	99 Unclassified
		03	002	Bituminous Coal
			002	99 Unclassified
		03	004	Residual Oil
			004	03 < 10 MM Btu/hr
		03	005	Distillate Oil
			005	03 < 10 MM Btu/hr
		03	006	XX Natural Gas
		03	007	XX Process Gas
		03	010	XX Liquid Petroleum Gas
		03	013	XX Liquid Waste
		03	999	XX Unclassified

(Continued)

Table 10 (continued). AGGREGATION OF SCC's INTO 23 SOURCE TYPE CATEGORIES FOR MODEL

Source type category	NEDS source classification code (SCC) I	II	III	IV	
7. (Continued)	2	02	INDUSTRIAL		
		02	001	XX	Distillate Oil
		02	002	XX	Natural Gas
		02	003	XX	Gasoline
		02	006	XX	Jet Fuel
		02	008	XX	Process Gas
		02	999	XX	Unclassified
8. Chemical Manufacture	3	01	XXX	XX	All Processes
9. Food and Agricultural	3	02	XXX	XX	All Sources
10. Iron and Steel Industry	3	03	PRIMARY METALS		
		03	003	XX	Coke - Byproduct ovens
		03	004	XX	Coke - Beehive ovens
		03	006	XX	Ferroalloy - Open Furnace
		03	007	XX	Ferroalloy - Semi-covered
		03	008	XX	Iron Production
		03	009	XX	Steel Production
11. Primary Non-Ferrous Metallurgy	3	03	PRIMARY METALS		
		03	000	XX	Aluminum Ore - Bauxite
		03	001	XX	Aluminum Ore - Electroreduction
		03	002	XX	Aluminum Ore - Calcium Aluminum Hydrate
		03	005	XX	Copper Smelter
		03	010	XX	Lead Smelter
		03	011	XX	Molybdenum
		03	012	XX	Titanium
		03	013	XX	Gold
		03	014	XX	Barium
		03	015	XX	Beryllium Ore
		03	025	XX	Mercury Mining
		03	026	XX	Mercury Ore Processing
		03	030	XX	Zinc Smelter
		03	999	XX	Unclassified

Source type category	NEDS source classification code (SCC) I	II	III	IV	
12. Secondary Metallurgy	3	04	XXX	XX	All Sources
13. Portland Cement Manufacture	3	05	006	XX	Cement Manufacture - Dry
		05	007	XX	Cement Manufacture - Wet
14. Stone Quarrying	3	05	020	XX	All Sources
15. Other Mineral Products	3	05	MINERAL PRODUCTS		
		05	001	XX	Asphalt Roofing
		05	002	XX	Asphaltic Concrete
		05	003	XX	Brick Manufacture
		05	004	XX	Calcium Carbide
		05	005	XX	Castable Refractory
		05	008	XX	Ceramic/Clay
		05	009	XX	Clay/Fly Ash
		05	010	XX	Coal Cleaning
		05	011	XX	Concrete Batching
		05	012	XX	Fiberglass
		05	013	XX	Frit Manufacturing
		05	014	XX	Glass Manufacturing
		05	015	XX	Gypsum Manufacturing
		05	016	XX	Lime Manufacturing
		05	017	XX	Mineral Wool
		05	018	XX	Perlite Manufacturing
		05	019	XX	Phosphate Rock
		05	021	XX	Salt Mining
		05	022	XX	Potash Production
		05	023	XX	Calcium Borate
		05	024	XX	Magnesium Carbonate
		05	025	XX	Sand - Gravel
		05	026	XX	Diatomaceous Earth
		05	030	XX	Ceramic Electric Pts
		05	031	XX	Asbestos Mining
		05	032	XX	Asbestos Milling
		05	040	XX	Unspecified Mining
		05	999	XX	Unclassified

Table 10 (continued). AGGREGATION OF SCC's INTO 23 SOURCE TYPE CATEGORIES FOR MODEL

Source type category	NEDS source classification code (SCC) I	II	III	IV	
16. Petroleum Processing	3	06	XXX	XX	All Sources
17. Wood Products	3	07	XXX	XX	All Sources
18. Other Industry	3	09	METAL FABRICATION		
		09	XXX	XX	All Sources
	3	20	LEATHER PRODUCTS		
		20	XXX	XX	All Sources
	3	30	TEXTILE MANUFACTURING		
		30	XXX	XX	All Sources
	3	90	IN-PROCESS FUEL		
		90	XXX	XX	All Sources
	3	99	UNCLASSIFIED		
		99	XXX	XX	All Sources
19. Petroleum Storage	4	03	XXX	XX	All Sources
20. Other Evaporative HC Sources	4	01	CLEANING SOLVENT		
		01	XXX	XX	All Sources
	4	02	SURFACE COATING		
		02	XXX	XX	All Sources
	4	04	MISCELLANEOUS ORGANIC STORAGE		
		04	XXX	XX	All Sources
	4	05	PRINTING PRESS		
		05	XXX	XX	All Sources
21. Open-Burning Dumps	5	01	002	XX	All Sources
22. Industrial Incineration	5	03	XXX	XX	All Sources
23. Other Incineration	5	01	GOVERNMENT		
		01	001	XX	Municipal Incinerator
		01	005	XX	Other Government Incinerator
		01	900	XX	Auxiliary Fuel
	5	02	COMMERCIAL/INSTITUTIONAL		
		02	XXX	XX	All Sources

The second type of information sought, the aggregate manpower used by the agency in conducting each activity for all sources, was intended as a supplement to the source-type-specific data and as a means of checking the completeness with which all the agency's manpower was accounted for.

As it developed, relatively little reliable source-type-specific information was obtainable from the agencies, and it was necessary to also make use of a variety of the aggregated information, as well as general knowledge and judgment, in order to develop the required coefficients. Consequently, this is likely the portion of the model that will most need additional effort in the future. On an aggregated level, either for activities or source types, the manpower estimates are expected to be quite adequate, but the individual source-type activity coefficients are probably not supportable in isolation from the rest of the matrix.

Given these difficulties, consideration was given to abandoning the use of a matrix in favor of some simpler option. However, the original option had two advantages: the reasonableness of the idea that agency effort should be proportional to the magnitude of the problem, and the ability to represent changes in enforcement policies with simple coefficient changes, both features of the matrix structure. These were judged too valuable to give up in exchange for some additional simplicity, so the final decision was to retain the original concept. It was further judged that no indirect predictor variable, such as population or dollar volume of industrial output, was likely to be any more precise than the matrix relationships, even with imprecise coefficients, and it was also recognized that future improvement in the empirical coefficients could be readily accommodated in the matrix structure.

Data Obtained During Agency Visits - The empirical information obtained from the agency visits will be summarized here in some detail before turning to discussion and tabulation of the coefficients ultimately utilized in the model.

The aggregate manpower allocated by the agencies to the six activities in the stationary source matrix is summarized in Table 11. It should be noted that the activity numbers used in the table are from the final computer program, and differ slightly from the numbers originally used in the questionnaire: activity 101 (inspections) includes both 101 and 102 from the questionnaire, while 103 (observing stack tests) is an addition to the activity 104 (conducting stack tests) as defined prior to the visits. It will also be noted that there is no information in Table 11 on the predictor variables (i.e., numbers of sources), such as was presented in the previous discussions of the monitoring activities. Detailed information on numbers of sources was not strenuously sought during the agency visits because it was expected it would not be available in a format consistent with the list of source types being used. This judgment was confirmed during the visits; in fact, most agencies had relatively little ready data on numbers of sources, as opposed to emissions, etc. The numbers of sources (SCCs) from the NEDS data base are summarized in Table 12, along with the abbreviated category identifiers used in the computer program.

The source-type-specific data was sought by means of a list of 68 source types included with the questionnaire sections on inspections (activities 101 and 102) and equipment plan review (130), and by open-ended questions whenever relevant. Responses that utilized the bulk of the extensive source-type list were received from two agencies concerning their plan review-permit systems. Some of this data, along with the list of 68 source types, is presented in Table 13. The responses concerning source inspections, while not utilizing the full range of the source-type list, did include some reliable estimates of manpower required for certain specific types; these responses are summarized in Table 14.

Agency B was also able to provide data on the breakdown by activity of their regional field enforcement/source surveillance staff; these percentage breakdowns, tabulated in Table 15, were also utilized in developing the matrix coefficients.

Table 11. AGGREGATE MANPOWER BY ACTIVITY FROM AGENCY VISITS

Activity[a]	Agency								
	A	B	C	D	E	F	G	H	I
101. Inspections	18.0	9.36	13.5+	3.0	2.0	0.37	0.40	1.52	0.69
103. Observe stack test	5.0	b	b	c	c	c	0.50	c	c
104. Conduct stack test	c	1.57	2.33	0.25	c	5.5	2.6	0.1	0.03
107. Compliance schedules	1.0[d]	9.33	2.0	b	0.5	b	0.08	c	b
110. Legal action	3.9	16.9	1.0	b	0.2	0.75	0.8	0.005	0.25
130. Equipment plans	5.6	32.0	4.0	2.88	1.5	1.32	1.03	0.03	0.01

[a]See pages 64-65 for definitions.

[b]Not definable separately.

[c]Activity not performed by agency.

[d]Anomalous — computer system development.

Table 12. NUMBER OF SCC's IN NEDS DATA BASE BY 23 SOURCE TYPE CATEGORIES

Source type	Number of entries national total
1. ELEC PP BOILERS >10	3,312
2. COAL, RESID OIL >100	1,994
3. COAL INDSTRL 10-100	1,182
4. COAL C/I 10-100	1,828
5. OIL-FIRED 10-100	4,159
6. COAL-FIRED <10	518
7. SMALL, GAS, MISC.	13,525
8. CHEMICAL MANUFACTURE	4,921
9. FOOD AND AGRICULTURE	13,952
10. IRON/STEEL INDUSTRY	1,367
11. NON-FE PRIM METLURGY	800
12. SECONDARY METALLURGY	3,144
13. PORTLAND CEMENT MFR	782
14. STONE QUARRYING	3,130
15. OTHER MINERAL PROD	7,311
16. PETROLEUM PROCESSING	4,224
17. WOOD PRODUCTS	3,132
18. OTHER INDUSTRY	8,559
19. PETROLEUM STORAGE	4,789
20. OTHER EVAPORATIVE HC	4,200
21. OPEN BURNING DUMPS	987
22. INDUSTRL INCINERATOR	2,566
23. OTHER INCINERATION	1,189
TOTAL	91,571

Table 13. EMPIRICAL DATA FROM AGENCY B ON MANPOWER BY SOURCE TYPE FOR PLAN REVIEW AND PERMIT SYSTEMS

Source type	Unit manpower estimated (man-days per review)
	Agency B
1. Power plant boiler, coal-lignite, > 100 MMBtu/hr	0.5
2. , 10-100	0.1
3. , <10	0.05
4. , oil, > 100 MMBtu/hr	na[a]
5. , 10-100	0.1
6. , <10	0.05
7. , gas-coke	0.05
8. , misc.	0.01
9. Industrial boiler, coal-lignite, > 100 MMBtu/hr	0.5
10. , 10-100	0.1
11. , <10	0.05
12. , oil, > 100 MMBtu/hr	0.05
13. , 10-100	0.01
14. , <10	0.05
15. , gas-coke	0.01
16. , misc.	0.01
17. Commercial-Institutional boiler, coal-lignite, > 100 MMBtu/hr	na
18. , 10 - 100	0.8
19. , < 10	0.05
20. , oil, >100 MMBtu/hr	0.05
21. , 10 - 100	0.01
22. , < 10	0.01
23. , gas-coke	0.01
24. , misc.	0.02
25. Internal Combustion (Stat. sources)	0.01
26. Nitric acid mfg.	2.0

Table 13 (continued). EMPIRICAL DATA FROM AGENCY B ON MANPOWER BY SOURCE TYPE FOR PLAN REVIEW AND PERMIT SYSTEMS

Source type	Unit manpower estimated (man-days per review)
	Agency B
27. Paint & varnish mfg.	0.05
28. Sulfuric acid mfg.	1.0
29. Phosphate fertilizer mfg.	1.0
30. Other chemical mfg.	1.0
31. Feed grain handling	0.3
32. Other food & agriculture	0.3
33. Aluminum reduction	0.5
34. Copper smelters	na
35. Ferroalloy	1.0
36. Electric arc steel furnace	1.0
37. Other iron and steel	1.0
38. Lead smelters	0.5
39. Zinc smelters	0.5
40. Other primary metals	0.5
41. Secondary aluminum	0.3
42. Gray iron foundry	1.0
43. Other secondary metals	0.5
44. Portland cement mfg.	2.0
45. Coal cleaning	0.5
46. Other mineral products	0.3
47. Petroleum processing	2.0
48. Kraft (sulfate) pulp processing	2.0
49. Other wood products	0.5
50. Metal fabrication	0.2
51. Leather products	0.1
52. Textile mfg.	0.1
53. In-process coal use	na
54. In-process oil use	na

Table 13 (continued). EMPIRICAL DATA FROM AGENCY B ON MANPOWER BY SOURCE TYPE FOR PLAN REVIEW AND PERMIT SYSTEMS

Source type	Unit manpower estimated (man-days per review)
	Agency B
55. In-process gas use	2.0
56. Other in-process fuel use	na
57. Dry cleaning	0.1
58. Other solvent usage	0.3
59. Surface coatings	0.3
60. Petroleum storage	0.1
61. Other evaporative losses	0.2
62. Municipal incinerator	1.0
63. Open burning dumps	0.1
64. Other gov't. incineration	1.0
65. General commercial-institutional incineration	0.1
66. Flue-fed apartment incineration	na
67. Other commercial-institutional incineration	0.05
68. Industrial incineration	0.1

[a]na indicates not applicable - no estimate possible.

Table 14. SUMMARY OF DATA IN RESPONSE TO QUESTIONS ON INSPECTIONS

Agency A

No categorization into routine/extensive; most less than 1/2 man-day, some up to 3 to four man-days; frequency/extent matter of judgment. Not able to provide estimates by source type; effort determined primarily by familiarity of staff with process involved and by number of emission points on premise; following types significantly above average effort:

27 - paint and varnish
30 - chemical mfg.
33 - Al reduction
34 - Cu smelters
35 - ferroalloy
36 - electric arc furnace
42 - gray iron foundry

Agency B

Bulk of inspections handled by regional field staff who also handle all other contact with sources; hence, not thoroughly separate from other activities and not estimable by source type. Following exceptions are handled on statewide basis by source type:

0.61 man-year for 58 metallurgical facilities (inadequate)
0.28 man-year for 34 power plant facilities
0.42 man-year for 43 petrochemical facilities

Agency C

Inspections generally divided by source size into two groups routinely handled by the state or by the local agencies, with flexibility in unusual circumstances. Possible to estimate by source type only for following types handled on statewide basis by same individuals (time generally includes most time with source, not merely inspections).

0.33 man-year for 16 gasoline distribution facilities
0.4 man-year for 84 asphalt batching plants
0.5 man-year for 12 organic solvent facilities
0.25 man-year for 15 to 20 rendering plants
1.0 man-year for 12 major, 8 smaller, power plants
1.0 man-year for one major, two other, steel mills

Table 14 (continued). SUMMARY OF DATA IN RESPONSE TO QUESTIONS ON INSPECTIONS

Agency D

Relatively few major sources; routine structured inspection program in process of being implemented; routine inspections by local agencies; long driving time complicates time estimation, no reliable estimate possible by source type.

Agency E

Few major sources; inspections made by regional field staff, largely on field patrol/complaint basis; no reliable estimates by source type possible.

Agency F

Inspections made on informal, ad hoc basis; no reliable manpower estimate possible.

Agency G

Relatively new agency with few major sources; inspection time not significantly affected by source type within set of source types included in jurisdiction; estimates, including travel time, follow:

2 man-days for: 2, 3, 10, 11, 18, 19 - coal boilers < 100 MMBtu

3 man-days for: 1 - coal-fired power plant > 100 MMBtu
9 - coal-fired industrial boiler >100 MMBTU
31 - feed grain handling
42 - gray iron foundry
44 - portland cement mfg.
68 - industrial incineration

Agency H

Local agency; handles only routine inspections and small sources; hence, little difference by source type.

Agency I

Local agency; handles all types of inspections, but relatively few different source types within jurisdiction; specific estimates:

3 man-days - portland cement mfg.
2 man-days - asphalt batching plant

Table 15. SOURCE SURVEILLANCE MANPOWER BREAKDOWN BY ACTIVITY FROM AGENCY B

Source	Percentage	
	As reported	Distributed[a]
Variances	15	23
Citizen complaints	10	15
Annual inspections	10	18
Ad hoc inspections	2	3
Requested inspections	3	4
Eng. report preparation	23	–
Litigation	19	19
Emission inventory	6	6
Permit workshop	2	2
Add. permit workshop	9	9
Other activities	1	1

[a]23 percent in report preparation distributed to other activities.

Development of Manpower Coefficients - From the information tabulated in Tables 11 through 15, it was necessary to develop the manpower factors (Mxxx) for the various cells in the source type versus activity matrix. As has been suggested above, this was necessarily a fairly judgmental operation; this is not as serious, however, as it might at first seem. While there was relatively little data to use, in comparison to other activities, and what data there was is relatively inconsistent, the very existence of the structure which the matrix form provides made it possible to develop a consistent set of factors that appear to be adequate for the purpose. As an example, the percentage breakdown in Table 15 could be used roughly to proportion the coefficients among activities, with the magnitude of the factors being provided from other data. The matrix structure also permitted the utilization of the qualitative, "greater-than-average," type data in adjusting the relative values of factors for various source types.

The largest difficulty with the factor development, and one with which the matrix features above cannot assist, is the necessity to develop factors appropriate for the SCC-level data that is available, rather than for premises. The use of premises as the unit for prediction would be much more consistent with actual agency practice, and hence would make it much easier to estimate accurately. This difficulty was isolated by first developing a matrix of factors applicable to premises, and then converting this to a matrix of factors applicable to SCC counts by means of estimates of the typical number of SCCs per premise. Tables 16 and 17 present these two sets of manpower factors; for convenience, the abbreviations used for the source types are the same as are used for the computer printout.

Development of Other Matrix Factors - Beyond the factors expressing manpower per unit performance of an activity, the matrix form prediction relationship involves an applicability factor (Cxxx) and a frequency factor (Fxxx). The Cxxx factors represent the percentage of the total number of sources of a certain type to which activity xxx is applied. While this factor will in many cases be 100, indicating the activity is applicable to all sources, having such a factor in the relationship provides the ability to adjust the relationship to suit specific policies. Table 18 presents the factors initially provided in the program. This table illustrates two different situations involving the use of non-unity values for this factor. The factor for legal action represents the obvious fact that all sources do not go to court every year; the 1 percent figure was estimated from the agency visits. The non-unity factors for conducting and observing stack tests reflect two different aspects of stack testing - the fact that the observation and the conduct of such tests are in a sense mutually exclusive activities, and the fact that such testing is not likely to be universal for smaller sources. All the factors in Table 18 represent more matters of policy decision than matters of empirical knowledge; the values provided represent an amalgamation of EPA policy and the technical judgment and opinion

Table 16. PREMISE-BASED MANPOWER FACTORS FOR STATIONARY SOURCE ACTIVITIES - TIME (hours) PER UNIT PERFORMANCE PER PREMISE

Source type	Source insp.	Stack test	Observe test	Compl. sched.	Legal action	Plan review
1. ELEC PP BOILERS >10	24	128	32			
2. COAL, RESID OIL >100	10	80	16			
3. COAL INDSTRL 10-100	10	64	16			
4. COAL C/I 10-100	10	64	16	Not applicable to premises		
5. OIL-FIRED 10-100	8	48	8			
6. COAL-FIRED <10	3	32	8			
7. SMALL, GAS, MISC.	2	32	8			
8. CHEMICAL MANUFACTURE	24	160	32			
9. FOOD AND AGRICULTURE	10	32	8			
10. IRON/STEEL INDUSTRY	20	64	16			
11. NON-FE PRIM METLURGY	20	64	8			
12. SECONDARY METALLURGY	6	32	8			
13. PORTLAND CEMENT MFR	16	64	16			
14. STONE QUARRYING	10	16	8			
15. OTHER MINERAL PROD	16	32	8			
16. PETROLEUM PROCESSING	20	96	16			
17. WOOD PRODUCTS	6	32	8			
18. OTHER INDUSTRY	10	32	8			
19. PETROLEUM STORAGE	10	16	8			
20. OTHER EVAPORATIVE HC	16	16	8			
21. OPEN BURNING DUMPS	2	16	8			
22. INDUSTRL INCINERATOR	4	16	8			
23. OTHER INCINERATION	2	16	8			

Table 17. SCC-BASED MANPOWER FACTORS FOR STATIONARY SOURCE ACTIVITIES - TIME (hours) PER UNIT PERFORMANCE PER SCC

Source type	Source insp.	Stack test	Observe test	Compl. sched.	Legal action	Plan review
1. ELEC PP BOILERS >10	12	64	16	8	120	4
2. COAL, RESID OIL >100	5	40	16	8	120	4
3. COAL INDSTRL 10-100	5	32	8	8	120	8
4. COAL C/I 10-100	5	32	8	8	120	4
5. OIL-FIRED 10-100	4	24	8	6	120	2
6. COAL-FIRED <10	3	32	8	6	120	2
7. SMALL, GAS, MISC.	2	32	8	2	120	1
8. CHEMICAL MANUFACTURE	5	32	8	2	120	8
9. FOOD AND AGRICULTURE	3	8	2	2	120	2
10. IRON/STEEL INDUSTRY	4	16	3	3	120	8
11. NON-FE PRIM METLURGY	5	16	2	4	120	8
12. SECONDARY METALLURGY	6	32	8	3	120	8
13. PORTLAND CEMENT MFR	4	16	4	3	120	8
14. STONE QUARRYING	3	8	4	2	120	2
15. OTHER MINERAL PROD	4	8	2	3	120	8
16. PETROLEUM PROCESSING	3	16	1	2	120	2
17. WOOD PRODUCTS	2	8	4	2	120	2
18. OTHER INDUSTRY	4	16	4	2	120	6
19. PETROLEUM STORAGE	2	3	1	1	120	1
20. OTHER EVAPORATIVE HC	3	3	1	1	120	2
21. OPEN BURNING DUMPS	2	16	8	2	120	1
22. INDUSTRL INCINERATOR	4	16	8	2	120	4
23. OTHER INCINERATION	2	16	8	2	120	4

Table 18. PROPORTIONAL APPLICABILITY FACTORS FOR STATIONARY SOURCE ACTIVITIES - PERCENTAGE OF SOURCES (SCCs) SUBJECT TO ACTIVITY

Source type	Source insp.	Stack test	Observe test	Compl. sched.	Legal action	Plan review
1. ELEC PP BOILERS >10	100	50	50	100	1	100
2. COAL, RESID OIL >100	100	50	50	100	1	100
3. COAL INDSTRL 10-100	100	50	50	100	1	100
4. COAL C/I 10-100	100	50	20	100	1	100
5. OIL-FIRED 10-100	100	50	20	100	1	100
6. COAL-FIRED <10	100	20	10	100	1	100
7. SMALL, GAS, MISC.	10	10	0	100	1	100
8. CHEMICAL MANUFACTURE	100	30	20	100	1	100
9. FOOD AND AGRICULTURE	30	40	10	100	1	100
10. IRON/STEEL INDUSTRY	100	30	20	100	1	100
11. NON-FE PRIM METLURGY	100	30	20	100	1	100
12. SECONDARY METALLURGY	100	40	10	100	1	100
13. PORTLAND CEMENT MFR	100	40	10	100	1	100
14. STONE QUARRYING	50	10	0	100	1	100
15. OTHER MINERAL PROD	80	20	10	100	1	100
16. PETROLEUM PROCESSING	100	10	10	100	1	100
17. WOOD PRODUCTS	80	10	0	100	1	100
18. OTHER INDUSTRY	50	30	30	100	1	100
19. PETROLEUM STORAGE	100	10	10	100	1	100
20. OTHER EVAPORATIVE HC	100	10	10	100	1	100
21. OPEN BURNING DUMPS	100	0	0	100	1	100
22. INDUSTRL INCINERATOR	100	10	0	100	1	100
23. OTHER INCINERATION	100	30	10	100	1	100

of EPA, GCA, and the agencies visited. In particular, the factors for stack testing are a matter of EPA judgment, as none of the agencies actually had a full-fledged, routine stack test program implemented.

The frequency per year factors (Fxxx), presented in Table 19, are likewise largely a matter of policy rather than empirical fact. It would be possible to combine these frequency factors along with the manpower factors into a single annual manpower factor for each activity and source type. This was not done because the separation of the information into two factors was felt to provide a useful increase in flexibility, improving the model's ability to evaluate the effect of hypothetical policy changes.

Other Stationary Source Activities - In addition to the six major activities that are incorporated into the source-type matrix, there are several other stationary-source-oriented activities that are projected on the basis of simpler predictor variables. These include complaint investigation and small source enforcement, tax exemption certification, the review of development plans, and the travel time involved in enforcement.

Complaint Investigation and Small-Source Enforcement - Beyond the manpower identified for specific inspections, compliance negotiations, etc., all of the agencies identified some manpower as being expended on miscellaneous enforcement activity directed at small or intermittent sources. These efforts include such things as the investigation of complaints, supervision of open-burning permits, field patrol and general surveillance, etc. The data obtained are tabulated in Table 20, along with population data. It is clear that the agencies in "clean-air" states (D, F, and I) expend much greater proportional effort in these activities; this is apparently because they have fewer or no large sources within their jurisdiction, so that the smaller sources are a larger share of the problem. Accordingly, the variable FTE, developed for the public information activity, was utilized as an indicator of the states with such a

Table 19. FREQUENCY FACTORS FOR STATIONARY SOURCE ACTIVITIES — NUMBER OF PERFORMANCES PER YEAR

Source type	Source insp.	Stack test	Observe test	Compl. sched.	Legal action	Plan review
1. ELEC PP BOILERS >10	1	1	1	Not	1	1
2. COAL, RESID OIL >100	1	1	1	appli-	1	1
3. COAL INDSTRL 10-100	1	1	1	cable	1	1
4. COAL C/I 10-100	1	1	1		1	1
5. OIL-FIRED 10-100	0.5	1	1		1	0.5
6. COAL-FIRED <10	0.5	1	1		1	0.5
7. SMALL, GAS, MISC.	0.3	1	1		1	0.3
8. CHEMICAL MANUFACTURE	1	1	1		1	1
9. FOOD AND AGRICULTURE	1	1	1		1	1
10. IRON/STEEL INDUSTRY	1	1	1		1	1
11. NON-FE PRIM METLURGY	1	1	1		1	1
12. SECONDARY METALLURGY	1	1	1		1	1
13. PORTLAND CEMENT MFR	1	1	1		1	1
14. STONE QUARRYING	1	1	1		1	1
15. OTHER MINERAL PROD	1	1	1		1	1
16. PETROLEUM PROCESSING	0.5	1	1		1	0.5
17. WOOD PRODUCTS	0.3	1	1		1	0.3
18. OTHER INDUSTRY	0.5	1	1		1	0.5
19. PETROLEUM STORAGE	0.3	1	1		1	0.3
20. OTHER EVAPORATIVE HC	1	1	1		1	1
21. OPEN BURNING DUMPS	1	1	1		1	1
22. INDUSTRL INCINERATOR	1	1	1		1	1
23. OTHER INCINERATION	0.5	1	1		1	0.5

Table 20. DATA RELATIVE TO COMPLAINT INVESTIGATION AND SMALL-SOURCE ENFORCEMENT

Agency	Manpower	Population (millions)	Ratio
A	3 +	3.032	1.0 +
B	4.7	11.114	0.42
C	5[a]	3.922	1.28
D	8[a]	2.207	3.63
E	1.6	1.744	0.92
F	5.6	1.016	5.5
G	3.8	2.825	1.35
H	0.52	0.298	1.75
I	2.6	0.316	8.2

[a]Including estimated contributions from local agencies.

situation. The variable FTE serves to double the estimate for agencies in states with a "clean-air", tourist image. The predictor relationship used is MY105 = 0.0015*POP*FTE(ISTATE), that is, an estimate of 1.5 per million population.

Tax Exemption Certification - This activity includes the effort required to evaluate and process applications for tax exemption or other adjustment on pollution control hardware purchases. Three of the seven state agencies visited had enough of such effort to make a meaningful estimate of the time required. Agency A spent 1.0 manyears in an extensive review of such applications, including followup site visits. Agency B reported 0.9 manyears, and agency G only 6 mandays, in less extensive efforts. Since it was not possible to project the number of applications, due to variations in the laws, it was decided to use a simple estimate based on the total number of sources (SCC's). The relationship used was 0.0003 manyears per source, which is about midway in the range of responses.

Review of Development Plans - This activity was originally posed as four separate activities, derived in the questionnaire as follows:

131-134. As a group, these next few activities are meant to include the efforts to review proposals for new sources, both direct and indirect, to assure their being consistent with the achievement and maintenance of the NAAQS.

131. Review of Development Plans - This activity is defined as the review of specific development plans with respect to their direct and indirect emissions, the emissions from associated development, and the generation of displaced emissions, including the selection of sites for stationary sources. This activity includes the receipt and processing of a permit application, the examination and evaluation of the projected air quality impact for consistency with on-going plans for achieving and maintaining the NAAQS, and the ultimate decision. The quantitative analysis required for the projections are included separately as activities 132-134. The compliance of stationary source equipment with emission standards, as opposed to siting, is covered in activity 130.

132. Microscale Modeling and AQ Estimation - This activity includes the microscale modeling or other procedure used for estimating the AQ impact of a proposed source of either direct or indirect emissions. If the source is very large, regional-scale modeling may be more appropriate, and in such cases, is also included in this activity.

133. Review of Source-Conducted AQ Estimation - This activity involves the review by the APC Agency of modeling, monitoring, or other estimation procedures conducted by an applicant for a permit to construct a proposed source.

134. Technical Land Use Planning - This activity includes the effort needed to provide technical planning support to the agency management in guiding the land use planning functions. It also provides technical support for the analysis of the developmental implications of various alternate policies, their other ramifications, likely obstacles to their implication, and so on, as well as the technical planning expertise necessary to support the review of development proposals.

No agency was able to provide a good, reliable breakdown of their efforts into this structure, in large measure because their plans were not yet complete and operational. Consequently, the activities were aggregated into one, called in the computer program MY131 - Review of Development Plans. The combined manpower reported for these activities is tabulated in Table 21.

Table 21. DATA RELATIVE TO THE REVIEW OF DEVELOPMENT PLANS

Agency	Manpower	Population (millions)	Ratios
A	7.16	3.032	2.36
B	4.2	11.114	0.38
C	0.83	3.922	0.21
D	2.0	2.207	0.91
E	0	1.744	0.0
F	0.31	1.016	0.31
G	0.36	2.825	0.13
H	[a]	0.298	[a]
I	0.06	0.316	0.19

[a]Not performed.

The value of the ratios in Table 21 are relatively consistent with the exception of that from Agency A. This is because only Agency A had any kind of a functioning program to review development plans on a reasonably on-going basis; the other agencies were all still in one stage or another of developing their plans to undertake this responsibility. The agency visits were conducted during a period when EPA regulations impacting on these efforts were not available, with several divergent possibilities under active consideration. A common response from interviewees was that the final definition of their plans was contingent on EPA policy.

The manpower spent by these other agencies (Table 21) consisted primarily of planning efforts and of irregular situations where some effort on these tasks was expended. Most of the agencies felt that regular performance of these reviews would require greatly increased efforts on the part of one agency or another, depending on the ultimate decisions to be made. Consequently, the manpower factor was chosen to be essentially that experienced by agency A; the relationship used is MY131 = 0.00235*POP, or 2.35 per million population.

Travel Time for Enforcement - Information was sought during the agency visits that would relate the travel time involved in enforcement activities in some empirical way to the parameters of the agency or its jurisdiction. No satisfactory empirical information could be developed, however, for a variety of reasons. Accordingly, the projection is made on the basis of the square root of the area, as a rough measure of the typical trip lengths, and the number of trips, estimated from the stationary source matrix activities. In order to adjust as accurately as possible to the differences between areas with and without local agencies, this estimation is done in two ways: If there are local agencies in an AQCR, half the number of trips are used, with the area of the AQCR, to estimate part of the time spent in travel. The other half of the number of trips, plus those originating in AQCR's with no local agencies, are used with the area of the state to estimate the balance.

Mobile Source Control Activities - Because the serious undertaking of mobile source control has only begun very recently, and only in the more urban states, the final structuring of the activities and projections in this area was done only following the visits to the agencies and the evaluation of their responses. It was then concluded that the activities separately identified should be the on-going development and refinement of the transportation control plan (a set of revisions to the SIP to provide for automobile pollutants), including the required extensive traffic study/emission inventory, and the actual control activities themselves, although most of them are not yet implemented.

Transportation Control Plan and Emission Inventory - An estimated manpower requirement of 0.30 manyears has been provided in AQCRs that are priority I for either CO or photochemical oxidants. This amount of manpower is not adequate to develop a transportation control plan (TCP); additional manpower would need to be estimated in any urban area that might be required to prepare a plan in the future. Rather, the manpower estimated is for the efforts involved in on-going concern with revisions, appeals, updates,

and so on. The effort that is required was estimated from discussions with Agency C and experience with TCPs in other areas.

Mobile Source Control - The current status of the actual control of mobile sources is such that no sizable amount of experience is available on which to draw. Estimates have been included in the model for only the one most common control measure - a periodic motor vehicle inspection system with required maintenance. There are three general types of inspection programs - visual inspection, idle emissions testing, and loaded or dynamometer testing. The model contains, for each state, a code (INSTYP) identifying the type of inspection system, if any, adopted by that state, and associated manpower factors (FMVINS) per vehicle. The codes and the manpower factors are tabulated in Table 22.

Table 22. FACTORS FOR ESTIMATING MANPOWER NEEDED FOR INSPECTION PROGRAM

INSTYP(ISTATE)	Type of inspection	Factor (manyears per 1000 vehicles)
1	None	0.000
2	Annual visual	0.008
3	Annual idle-mode	0.016
4	Annual dynamometer	0.024
5	Semi-annual visual	0.016
6	Semi-annual idle-mode	0.032
7	Semi-annual dynamometer	0.048

Episode Prevention

The final source-oriented activity is one that is not classifiable as either entirely stationary - or mobile-source oriented. The episode prevention activity is defined to include any effort involved in maintaining surveillance for periods of unusually-adverse dispersion, plus the effort required to conduct episode avoidance activities when required.

The relationship used depends on the priority classification of each AQCR, the total number of sources involved (NTSRC), and the number of days per year (NODAYS) of adverse dispersion forecast by the APPF program. If the AQCR is priority I for oxidants only, the manpower is estimated as MY160 = 0.03 + 0.002*NODAYS. If the AQCR is priority I for SO_2, TSP, or both, the estimate is MY160 = 0.03 + 0.002*NODAYS + 0.0005*NTSRC. If both situations apply, the estimates are added together.

Management and Support Activities

The functions included under this heading are those that do not relate directly to either the air quality monitoring activities or the source surveillance and enforcement activities of an agency. They include the overall administrative and technical management of a control program, training activities, professional support efforts, and clerical support activities. In most cases, they are estimated with empirical relationships based on the size of the technical staff they support, referred to as total technical personnel, or TTP in the computer program.

Program Management - This activity includes the various efforts required for overall program management, including the development of agency policies, the planning of activities and resource allocations, and the determination of the general direction and thrust of the agency's pollution control program. The efforts of an Air Pollution Control Board or Commission, originally asked about separately, were combined into this activity. Activities relating to liaison with other state agencies, also originally considered separately, were included to the extent they could not be assigned elsewhere for specific tasks (e.g. liaison re transportation controls). Those activities, generally staff activities, that are specifically directed at developing new or revised regulations or overall control strategies or "implementation plans" are not included but rather are considered separately under Strategy and Regulation Development.

Reliable estimates were obtained from eight agencies. As indicated in Figure 8, the results proved, not unexpectedly, to be very closely related to the size of the technical staff of the agency. The curve is, however, highly nonlinear, with very dramatic reductions in the management/staff ratio with increasing agency size. This is quite a reasonable phenomenon, and the points define the curve quite precisely (even the slight departure of agency C is interpretable in terms of their organizational structure). Consequently, the relationship as plotted in Figure 8 was used for the projection relationship, even though it is mathematically more complex than most of the others. The relationship is:

$$\text{Management} = 1.433 \times (\text{technical staff})^{0.175}$$

or, as expressed in the computer program,

MY301 = 1.433 * TTP ** 0.175.

Because of the striking non-linearity of this relationship, it makes a significant difference at what geographic scale the projections are made. In contrast to the linear relationships, this projection cannot be made on an AQCR scale and accumulated to provide a total for a state agency. Neither, however, can a single projection based on total state requirements adequately account for the management required if there are a significant number of local agencies. In the model, this conflict is resolved, albeit probably imperfectly, in the following manner. At the AQCR level, a projection of manpower for local agency management is made if there is at least one local agency in the AQCR (i.e. if variable NLA $\neq$ 0); the technical staff (TTP) used in the projection is noted. When the state totals are being summarized and projected, the estimate of state agency management manpower is made based on the total technical staff required for the state, less one-half of the accumulated technical staff (if any) that was used as a basis for local agency management estimates. The factor of one-half simply embodies the concept that the existence of local agencies does not preclude the requirement for a substantial state involvement in the AQCR; the quantitative value of the factor would need

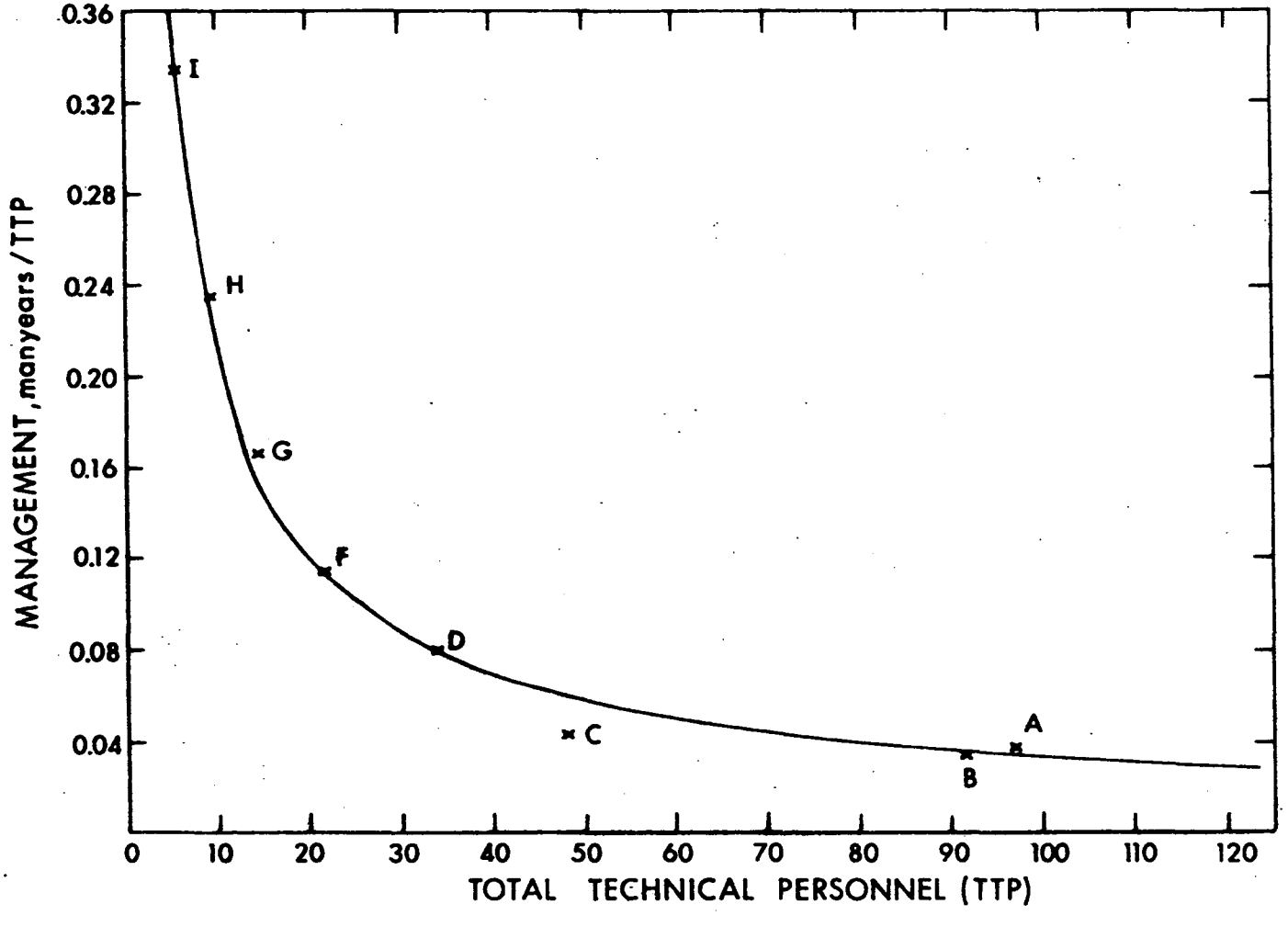

Figure 8. Program management

to be refined if the specific issue of state versus local management were of primary concern.

Strategy and Regulation Development - This activity includes the effort required to develop and evaluate possible alternative approaches or strategies for the control of pollutant sources, such as effort in operating a diffusion model and in conducting economic and sociological impact analysis of alternative strategies. It also includes the effort involved in developing the detailed technical and legal form of proposed regulations and any required supporting documentation. In the questionnaire and interviews, these activities were pursued as six separate functions.

The following are the specific definitions of these activities (310 through 315), as extracted from the questionnaire:

310. Development of New or Modified Control Strategies - This activity is defined to be the effort required to develop possible policies or control strategies for consideration by the agency management; it is expected that this effort will be conducted by staff members working very closely under the direction of the agency director, although the ultimate policy decisions are considered separately in activity 301 (program management). The quantitative analysis of such control strategies is also considered separately in activities 310-313. If manpower was separated into these activities, this (314) includes the balance; if not, it includes the total.

311. Climatological Dispersion Modeling
312. Economic Impact Analysis
313. Community Interaction and Social Impact Analysis
314. Quantitative Evaluation of Alternate Strategies - These activities provide for the quantitative assessment of the effectiveness and other impacts of proposed alternate control strategies, for purposes of assistance in decision-making, attempting to anticipate public reaction and avoiding difficulties, etc. Activities 311-313 represent specific major tools or capabilities that are a part of an overall assessment; activity 314 includes primarily the assessment of the strategy effectiveness in conjunction with the emission inventory. The development of the alternate strategies is considered in Activity 310; activity 310 can be used to include the entire manpower in 310-314 if quantitative subdivision is not possible.

Activity 311 is defined as the effort needed to maintain and use a climatological-scale dispersion model for purposes of control strategy

planning, etc., including the gradual adaption of existing standard computerized models to the topographic and other idiosyncrasies of the area(s) in question.

Activity 312 involves the preparation of economic analysis to provide reasonable estimates of the impact of regulations on impacted industries and the economic viability of the region as a whole.

Activity 313 is limited to the programmed interaction with survey panels of "unorganized" citizens as well as citizen interest groups and the analysis of the impact of proposed APC agency actions on the lifestyles of the community. Public hearings are included separately under activity 315.

315. Development and Adoption of New or Modified Control Regulations - This activity is defined as the efforts involved in developing the detailed technical and legal form of proposed regulations to implement the policies selected in activity 314, preparing the required supporting documentation, and seeing the regulations through the adoption procedure, including legislative liaison. It includes the manpower involved in preparing and conducting public hearings, except for the small effort in publicizing them, which is in activity 370 (public information).

The majority of respondents in the agencies felt that the breakdown of activity 310 into items 311-314 was too detailed to permit separate estimation (although the extra items did help bring into focus the overall concept of control strategy development, which had not been seen by most of the agencies as an identifiable function). Of the nine agencies, one could provide a breakdown into the several functions, and two others were able to isolate at least one activity; all nine, however, could provide an aggregate estimate for all six combined, including one estimate of 0. Consequently, the six have been aggregated into one for projection.

The information on the combined activity (called MY310 in the computer program) is plotted in Figure 9 as a function of total technical staff. The relationship is similar to that for program management, although less precisely defined. The general opinion of the agencies visited was that these functions were essentially state responsibilities, although one local agency did invest nearly 1 man-year in this type of activity. Consequently, the manpower expended by the one local agency (the other reported none) was included with its state agency, and the relationship is

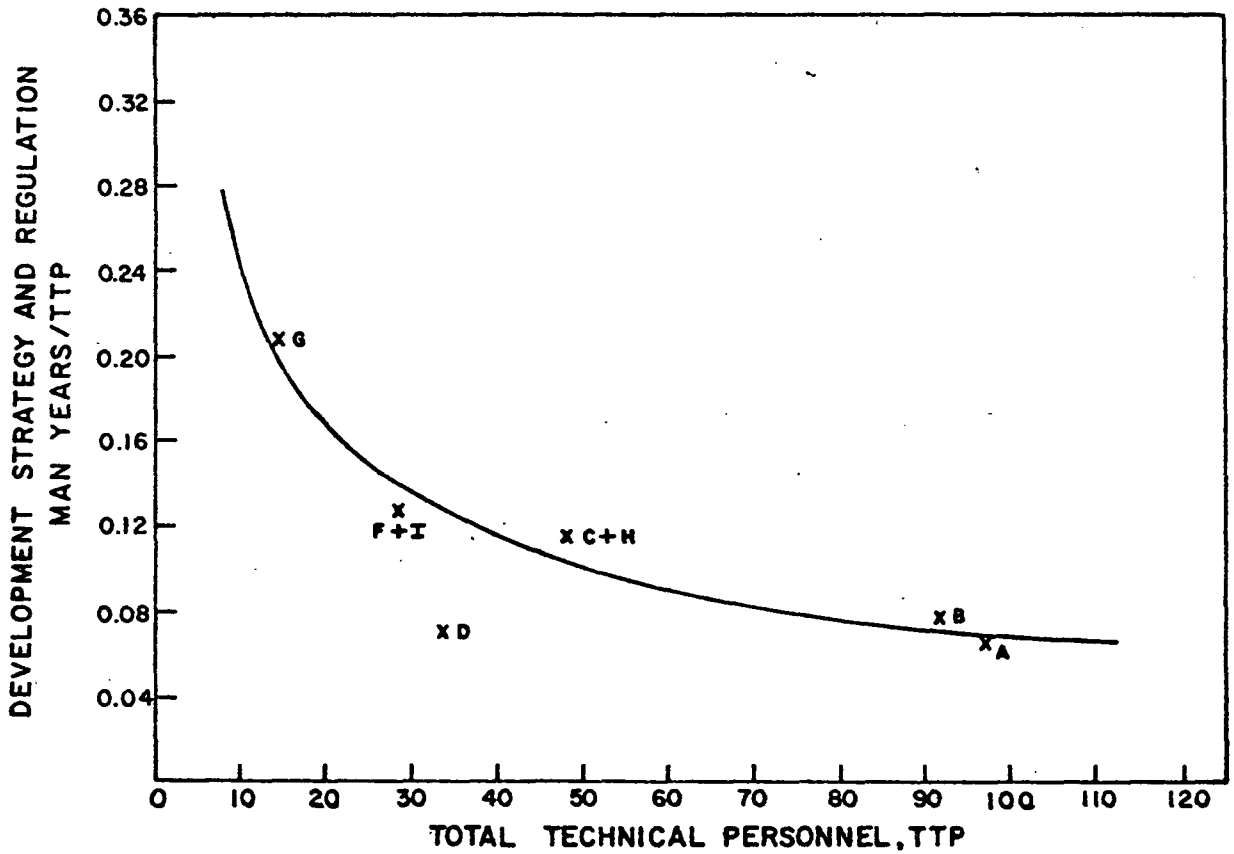

Figure 9. Control strategy and regulation development

used in the model for state-level projections. The expression for the relationship is:

$$\text{Strategy development} = 0.871 \times (\text{technical staff})^{0.45}$$

or, as expressed in the computer program,

MY310 = 0.871 * STTP ** 0.45

Liaison Activities - Anticipating that a significant share of the time of various agency staff members might be spent in the communication and coordination among various agencies that necessarily characterize complex governmental programs, a number of types of liaison were identified as specific activities in the questionnaire and during the agency visits. While agreeing that such activities could consume a measurable amount of time, most of the agency staff interviewed felt it was not possible or useful to try to estimate separately the time spent. Consequently, any effort along these lines was implicitly included with other activities, with the two exceptions of liaison with other states concerning policies, episodes, etc. in interstate AQCR's, and the liaison with local agencies.

Interstate Liaison - Agencies were asked about time spent in coordinating with EPA and other air pollution control agencies. Aside from communication with local agencies within their jurisdiction, the state agencies identified two areas where time was spent - contact with EPA and contact with other states over interstate AQCR's.

The estimates of time spent in contact with EPA were very erratic, ranging from zero to half the agency director's time. The variation seemed to be caused mainly by highly individualistic differences in the people involved and the current status of agency activity relative to important EPA policy matters, such as transportation control planning. After considering various ways of handling this information, it was ultimately concluded that it should be included within the agency management activity, since that appropriately covered the substance of the EPA contacts and the precision of the resultant relationship lent credence to the decision.

In contrast, the time spent in liaison with the other states involved in interstate AQCR's is separately incorporated in the computer model at the AQCR level. The relationship used is:

$$MY340 = 0.025 * INTERS,$$

where INTERS is an input indicator variable that is set to one if the AQCR is interstate, and to zero otherwise. Thus the relationship simply serves to add 0.025 man-year (50 hours) for each interstate AQCR involved in the State's jurisdiction. This estimate is based on estimates from two state agencies, one of which spent the time in monthly planning committee meetings, the other of which spent much of the time in interstate consultation during potential emergency episodes.

Local Agency Liaison and Assistance - The other category of liaison activity specifically included in the model is the liaison with, and provision of assistance to, local agencies within the state agency's jurisdiction. This effort is estimated, at the AQCR level, as 0.10 man-year for each local agency in the AQCR. The data on which this estimate is based is tabulated in Table 23. The highest ratio, from agency C, reflects the fact that the local and state agencies in that state are operating a coordinated, well-integrated control plan in which each has a significant defined role. The low ratio from agency D reflects the fact that the local agencies there do very little except operate monitoring sites. Similarly, the fact that two states felt unable to estimate any manpower reflects the small effort prompted by the small number of local agencies in those states.

Training Activities - Information was solicited during the agency visits on three types of training activity: in-house training, training at EPA courses, and graduate school training, with the former divided initially into time spent by trainees and time spent by teachers. Table 24 summarizes the data gathered.

Table 23. DATA RELATIVE TO ESTIMATING STATE-LOCAL LIAISON MANPOWER

State	Manpower (man-years)	No. of local agencies	Ratio
A	1.0	12	0.083
B	1.0	11	0.090
C	1.89	10	0.189
D	0.20	7	0.029
E	a	1	a
F	a	1	a
G	0.19	2	0.095
		Average	0.097

[a]Not separately definable.

In-house training - The separate information on trainees and teachers presented several inconsistencies, as is apparent in the table. In some cases (e.g., agencies A and C) this was because training was offered by state agencies to local agency staff personnel or others outside the agency, while in other cases (e.g., agencies B and I) the informal or seminar approach utilized precluded a clear delineation of teacher and trainee. Consequently, the data were totaled and used in this combined form. As such, the resulting relationship is an amalgamation of formal training (primarily for new employees) and informal sessions; several agencies also emphasized that much training necessarily takes place in a passing manner and is thus not accountable. The ratio of manpower spent on in-house training to total technical staff ranged from 0.16 percent (agency A) to 7.5 percent (agency I), and averaged 2.67 percent. Since there was no evident economy with respect to size of staff, it was determined to use a simple relationship with an average ratio. However, there were only four estimates that were believed to be complete, with both trainee and teacher time included fully, and also to represent a stable, adequate level of training. These four (B, F, G, and I) averaged

Table 24. DATA RELATIVE TO TRAINING ACTIVITIES

Agency	In-house training			EPA training courses	Graduate school training	Total technical staff
	Teachers	Trainees	Total			
A	0.16	a	0.16	1.80	0.75	97
B	a	a	4.49	0.12	b	91.8
C	0.30	a	0.30	0.05	1.25	47.95
D	a	a	a	0.46	b	32.75
E	a	0.25	0.25	b	b	40.94
F	0.05	0.42	0.47	0.40	1.00	21.48
G	0.24	0.38	0.62	0.38	0.30	14.3
H	a	0.06	0.06	b	b	9.62
I	0.48	0.24	0.72	0.20	b	5.75

[a]Not separately definable.

[b]Activity not performed.

3.2 percent and this figure was used for the projection relationship; i.e., MY360 = 0.032*TTP.

EPA Training Courses - The manpower expended in sending staff to EPA training courses was solicited, and figures were provided by all agencies, including two that had not sent anyone recently. The apparent relationship found was a nonlinear one, with a higher proportion of manpower spent by the smaller agencies. This appears to reflect the fact that the smaller agencies tend both to be the newest and to have the least in-house resources for training of new staff.

The relationship used is:

MY362 = (0.04 - 0.001 * TTP) * TTP for TTP < 30;
for TTP of 30 or more, MY 362 is estimated at 0.01 * TTP.

The difficulty arising in applying such a nonlinear relationship to state and local agencies of greatly varying size is handled in much the same manner as for activity 301, Program Management. The calculation is made at the AQCR level if there are local agencies, and at the state level otherwise.

Graduate School Training - Four of the nine agencies released employees for a significant share of time, up to full-time for 1 year, to undertake graduate training programs. The other agencies all supported this activity, but had not done so themselves either because there were regulations preventing it, or more commonly because adequate part-time, after-hours training was available locally. The relationship utilized is a nonlinear one similar to the one for EPA training:

MY363 = (0.04 - 0.0003*TTP)*TTP for TTP < 100;
for TTP of 100 or more, MY 362 is estimated as 0.01 * TTP.

The interaction between the nonlinearity and the scale of area for which the estimates are made is again handled in the dual manner described under Program Management.

Professional Activities - Under the heading of professional activities, the questionnaire inquired about time involved in conferences, professional meetings, etc., including time for travel and preparatory activities. The data elicited is tabulated in Table 25; the predictor relationship used is MY364 = 0.005 * (TTP + MY301 + MY310). Since the time involved was very frequently the time of the most senior members of the staff, the predictor relationship is based not solely on the number of technical staff members, but on that number (TTP) plus the manpower involved in program management and regulation development (MY301 and MY310). As such, it is also calculated on a dual AQCR - state basis, contingent on the existence of local agencies in an AQCR, although the relationship itself is linear.

Table 25. DATA RELATIVE TO ESTIMATING MANPOWER SPENT IN PROFESSIONAL ACTIVIIES

Agency	Manpower	Staff[a]	Ratio (%)
A	0.20	100.7	0.20
B	0.76	95.0	0.80
C	0.06	50.0	0.12
D	0.34	34.4	0.99
E	0.06	41.5	0.14
F	b	23.9	b
G	0.08	16.7	0.48
H	b	11.9	b
I	0.14	7.7	1.83

[a]Includes program management.

[b]Not separately definable.

Public Information - The activity labeled public information is defined as

> "the active, organized dissemination of information on the APC agency, the air pollution problem, and proposed agency actions. Press releases, prepared articles, school and community groups presentations would be included in this activity. The conduct of public hearings is not included, although dissemination of public notices is."

The data obtained is tabulated in Table 26, along with the values of three supplementary variables utilized in the projection relationship. The public information manpower, when studied in light of what was actually done with the time, proved to be more related to the nature of the state and their pollution problem than to agency size. Consequently, the projection relationship was designed to include these factors, represented by various other variables. The relationship as determined for states is:

$$MY370 = 0.20 * FTE(*ISTATE) * NPRI1 + 0.2 * IORG(ISTATE)$$

The FTE variable is used as a carrier of information on the clean air/tourist image of a state. It was clear from the discussions with the agencies that this was an important factor; "clean-air" states spent a much greater effort in proportion to their pollution problem than did other states. The variable FTE in the program is given a value of 1 or 2 for each of the states, thus effectively doubling the estimate for those states that make clean air an important part of their tourist image. The variable NPRI1 is simply a count of the number of AQCR's with TSP priority 1 within the state; it is used as a rough measure of the severity of the state's pollution problem. The IORG variable is an indication of how the air pollution agency fits into the state organizational structure; it is set to 0 if the agency is part of a much larger Health or Environmental Protection Department, and to 1 if it is an independent commission or agency. The inclusion of the IORG variable reflects the fact that there are efficiencies in utilizing a large, departmental, public information operation for such things as press releases and newsletters; that portion of the relationship has the effect of adding 0.2 man-years for those agencies that do not have access to such a departmental operation.

Table 26. DATA RELATIVE TO ESTIMATING MANPOWER SPENT IN PUBLIC INFORMATION ACTIVITIES

Agency	Manpower	Supplementary variables		
		FTE	MPRI1	IORG
A	0.43	1	2	0
B	1.18	1	7	0
C	0.50	1	3	0
D	0.80	2	3	0
E	1.20	1	6	1
F	1.00	2	2	0
G	0.75	1	6	0
H	0.01 (+)	1	[a]	0
I	0.90	1	[a]	0

[a]Not applicable to local agencies.

Library and Archives - The latter portion of this activity was included in the questionnaire as a possible activity that may be emerging as states become more involved with the public hearings required under the Clean Air Act. None of the agencies visited had made any particular arrangements for maitaining documents for public inspection, though several felt it a good idea; consequently, the manpower reported (see Table 27) was essentially only library service. Actually, the effort involves only the semi-clerical maintenance of a library, the filing, purchasing, etc., rather than any technical library work, such as literature searching; such effort was left to the technical staff and to such outside assistance such as EPA's APTIC searches. The people actually involved are generally clerical or administrative staff, rather than professional librarians. The manpower required is estimated at 0.3 percent of the total technical staff, including program management.

Clerical Support - This activity involves the manpower required for general secretarial support; any routine clerical activity involved in such things as data processing or permit handling is included with those activities. The information was sought for separate groups of professional staff, in the belief that the ratios would be different, and they did in fact prove to be so. The clerical support ratios are tabulated in Table 28, along with the ratios used in the program. The ratios selected are based primarily on the data from the state agencies.

Table 27. DATA RELATIVE TO ESTIMATING LIBRARY MANPOWER

Agency	Manpower	Staff	Ratio (%)
A	a	100.7	a
B	0.3	95.0	0.32
C	0.1	50.0	0.20
D	0.2	34.4	0.58
E	0.04	41.5	0.10
F	0.10	23.9	0.44
G	0.75[b]	16.7	4.5[b]
H	0.037	11.9	0.31
I	a	7.7	a

[a]None separately defined.

[b]Abnormally high for special one-time reason.

Table 28. RATIOS OF CLERICAL SUPPORT TO PROFESSIONAL STAFF

Agency	Management	SS enforcement	Other technical
A	0.67	0.24	0.100
B	1.00	0.20	0.123
C	0.67	0.33	0.127
D	0.80	0.22	0.148
E	0.75	a	0.183
F	1.00	a	0.125
G	0.43	a	0.133
H	0.50	a	0.083
I	0.50	a	0.091
Model	0.80	0.24	0.125

[a]Not separately definable-included in other technical.

SECTION IV

INITIAL MODEL APPLICATION

As part of the model development effort, an initial version of the data base used by the model was prepared and used in testing the computer program. The model in its final form was then exercised on this data, both to provide an initial set of manpower estimates for EPA and to permit an overall rough check of model performance. This section describes the data and data sources that were utilized for this initial application, and discusses the rough check of the manpower estimates obtained.

DATA BASE UTILIZED

The data required to operate the model can be conveniently classified into four groups - three types of AQCR-level data and one group consisting of State-level information. The three types of AQCR-level data are associated with three different card inputs to the computerized model, while the State-level data are provided to the program via data initialization instructions (DATA statements) within the program source deck itself.

AQCR Monitoring Data

The model requires, for each AQCR or State portion thereof, the number of sensors of various types operated within the area in question. The list of the 12 sensor types used can be seen in the array of monitoring-based activities in Table 4.

Data on the numbers of hi-vols, bubblers, and continuous instruments (except hydrocarbons) were provided by EPA from tabulations that were originally based on the various State Implementation Plans. Data was available in computerized format by state portion of AQCR for both the minimum required numbers of sensors and the number proposed in the SIP's; the initial application used the latter, which are generally larger and closer to the numbers being actually operated in the field.

Data on numbers of tape samplers, continuous hydrocarbon analyzers, and dustfall collectors were obtained from an inventory of the National Aerometric Data Bank (NADB). An inventory of all stored data on the relevant pollutants was provided by NADB, and from this was determined the number of sites that appeared to be operated in a routine, on-going manner. Because the data bank is known to be incomplete with respect to noncriteria pollutants, these numbers are presumably low.

The input format also calls for the number of the continuous sensors that are telemetered, for use in estimating data processing efforts. This variable (NSRT) is currently set at 0 for every AQCR, lacking any complete data base. This information, along with some other data, will need to be supplied by the EPA Regional Offices, as is discussed in the next section.

AQCR Source Data

The source data required for the operation of the model consists of counts, in 23 categories, of the number of SCC-coded emission-producing processes in the AQCR. These data were summarized from an SCC Report by County, one of the routine NEDS retrieval formats, which was provided as a computer tape by NADB. The NEDS summary format was primarily directed at summarizing emissions of the criteria pollutants by county, but it also included a count by SCC of the sources in each county. A series of

computerized routines was developed to summarize the counties by state portion of AQCR and the SCC's by the 23 categories utilized in the manpower model program.

It should be emphasized that the source data input format was developed to fit this particular NEDS summary, as being the only way to obtain the counts of sources that the NEDS data base should provide. Using SCCs in 23 categories is not necesszrily the way in which to make maximum use of the empirical data on manpower usage available from agencies. As is discussed further elsewhere, this interface with the NEDS system is the area of the greatest need for further systems development to support the manpower program. In particular, the use of the number of premises, possibly categorized by the number of SCC's or emission points contained, rather than just the number of SCC's, should be incorporated into the manpower model if and when an adequate data base can be provided by NEDS.

Quite beyond the manner in which the nature of the system is dictated by the availability of NEDS information, the degree of completeness of the data base in the NEDS system also has a direct bearing on the reliability of the manpower estimates made with the manpower model. While no thorough survey of the completeness of NEDS was made (or indeed is even possible) within this effort, occasional comparisons that occurred in the process of handling the tape files suggested that the data base is seriously incomplete. This of course merely confirms what is generally recognized by the NADB staff and others involved with the NEDS system.

As a consequence of this incompleteness, the aggregate manpower estimates must be viewed with some caution; the national projections are most likely low to some unknown degree. The subtotals for any given

State or EPA Region, however, can be interpreted in the light of knowledge of the status of the emission source data base for that State or Region. If the NEDS data base is up-to-date and complete, the estimates for that State or Region will be quite adequate.

AQCR Background Information

The third set of AQCR-level input data, contained on the third input card format, consists of background information; the third card also provides the alphabetic name of the AQCR to the computer. Sources for the data used for these variables for the initial model application are as follows.

Number of Local Agencies - Determined from the APCA Directory of Air Pollution Agencies, 1973-1974 Edition.

Priority Classification - Used as reported in August 1973 Air Quality and Emissions Trends Report, except for nitrogen oxides priority, for which subsequent Federal Register promulgation was used.

Stagnation Days - The average number of days with APPF was read, to the nearest whole day, from Holzworth (AP-101).

Area and Population - The land area and population for each AQCR was taken from the August 1973 Air Quality and Emissions Trends Report, which utilized information stored in the NADB data system; population data was from the 1970 census.

State-level Input Information

The final set of variables in the data base are those providing information at the State level. These are provided to the program with data initialization statements included in the manpower program itself.

Beyond the alphabetic name of the states and their land areas and populations, these variables provide the motor vehicle registration figures and coded information on the agencies' organizational place in the state government and the type of motor vehicle inspection program, if any, they operate.

Vehicle Registration Data - The number of light-duty and heavy-duty vehicles registered in each state was taken from the Census Bureau's Statistical Abstracts, 1973 Edition. The data (in Table 902) represent 1972 registrations. The heavy-duty vehicle data is not currently utilized by the model.

Type of Motor Vehicle Inspection - The type of motor vehicle inspection utilized in each state is entered as the array INSTYP, with coded values representing the case of no inspection or one of three types (visual, idle, dynamometer) either annually or semi-annually. The list of states proposing inspection programs was determined from tabulations in the semi-annual SIP progress reports. Lacking adequate information on the type of programs being proposed, all were presumed for the interim to be code 4 - annual dynamometer systems.

Organizational Position - The location of the State APC agency, either in a major department or as a separate agency, is used in a small way, providing additional administrative management manpower for agencies without the support of a large department. The variable IORG is set to 0 if the agency is in a department, to 1 if isolated. The structure is each state was identified from the APCA Agency directory booklet, 1973-4 Edition.

FTE Variable - Another variable used only in a minor fashion involves the significance of tourism and related industries in a state. It was found that those states where environmental considerations were part

of a dominant tourist or retirement climate expended a significantly greater effort in public information than other states. The variable FTE is set to 1.0 except for states with such a tourist, retirement, or "clean-air" image. In the initial data base, values greater than 1.0 were assigned to: Arizona, Colorado, Florida, Hawaii, Maine, New Hampshire, New Mexico, and Vermont.

MODEL OUTPUT

Because the agency visits have provided manpower utilization information similar to the output from the model, it seemed obviously useful to compare that data with the results of the trial application, as a rough check on how well the model predicts aggregate manpower requirements. Detailed comparisons of individual activities are of course not meaningful, as they merely reflect the differences among agencies that have already been illustrated in the discussions of the development of the individual relationships. However, some rough checks involving aggregates of a number of activities will serve to provide a feel for the extent to which the fluctuations among activities and agencies will "average out" at the various scales of aggregation, and also as a check against programming idiosyncracies.

The most obvious check on the output of the model, a comparison with the data from the states visited, is considered in greater detail in the balance of this section. There are two major groups of activities that are both distinct enough from each other and coherent enough from agency to agency that it is judged they provide a meaningful comparison of the data from the visits with the output of the initial model application. These are the large groups of monitoring-oriented activities and source-oriented activities.

Monitoring-Oriented Activities

The projections of manpower levels for these activities are based upon the number of the various types of monitors, along with other variables such as frequency of sample change or site visit. For the purposes of the model, the information on the number of sensors was obtained from a summary of the SIP's as explained earlier. Since this data is a major determinant of the projected manpower, it is useful to first review this data to try to understand how it affects the manpower comparisons.

Table 29 gives the number of samplers of each type, both as used in the trial application of the model and as determined from the visit to the agency. Obvious from this table is the fact that there are numerous discrepancies between the two sets of data, ranging from those agencies (A and F) that, according to the visit, had many more samplers than listed in the data bank, and those agencies (B, C, and G) that had fewer samplers than listed. In addition, the discrepancies are not usually consistent within any one agency; e.g., agency D had 17 more hi-vols than were projected in the SIP's, but none of the seven SO_2 bubblers.

These differences have not been fully investigated to determine the reasons for their existence; however, several may be suggested. Probably the major reason for these differences is that the SIP data base represents not the actual number of monitors in the state, but rather the number they were planning to have in operation by this time. Changing needs and budgets could easily account for the difference between the expected and the actual number of monitors. This effect could be minimized in the future by utilizing counts of monitors obtained from the SAROAD data bank; this, however, will require an improved flow of data from the agencies into the data bank. In a similar vein, the monitoring data base used in the model trial relates to the total number of monitors in the state, regardless of whether they are operated by the state agency or other local health or APC agencies.

Table 29. NUMBER OF SAMPLERS FOR EACH STATE AGENCY, FROM THE VISIT AND IN THE MODEL

Agency	Data base	Sampler type											
		Hi-vol	SO_2 bubbler	NO_2 bubbler	Sequential tape	Continuous SO_2	Continuous NO_2	Continuous HC	Continuous CO	Continuous O_3/oxidant	Meteorological equipment	Dustfall bucket	Sulfation plate
A	Model[a]	67	11	22	39	24	2	0	6	7	0	0	0
	Visit	75	32	32	35	24	7	1	7	8	0	0	0
B	Model	125	50	16	19	32	11	1	16	12	0	0	0
	Visit	65	24	24	16	13	4	5	3	40	0	0	0
C	Model	74	38	34	14	26	4	21	20	19	0	0	0
	Visit	31	30	30	8	8	8	8	8	8	0	30	13
D	Model	66	7	0	5	7	6	5	6	6	0	0	0
	Visit	83	0	0	8	5	5	5	5	4	5	20	124
E	Model	37	21	0	0	2	0	0	1	3	0	0	0
	Visit	32	12	0	10	3	0	1	1	0	3	46	46
F	Model	52	22	18	1	5	0	0	3	3	0	0	0
	Visit	60	40	40	10	12	3	1	6	9	10	0	0
G	Model	44	13	4	12	3	0	0	1	2	0	0	0
	Visit	25	13	2	9	2	0	0	0	0	0	56	0

[a]"Model" data are the counts used in the initial trial application of the model.

The model is designed to project the total manpower needed in a state for the handling of the monitoring.

Table 30 gives the projected manpower requirements for seven of the monitoring-oriented activities for the state agencies as currently specified in the model. The three rows of manpower levels give those manpower requirements projected from the trial application of the model with the corresponding monitoring inputs, the manpower levels from the study visits, and the projected manpower requirements if the relationships in the model were applied to the number of sensors determined from the study visits (called "adjusted model" in the table). The last column in the table, Comparison Subtotal, gives the sum of man-years expended on those activities for which the agencies provided data, which is the significant number for comparing the two results.

Except for agencies A and F, this table indicates that the manpower levels projected from the adjusted model are closer to those determined from the study visits than those projected from the data base in trial application. This change from the trial application model to the adjusted model meant a change of as much as 50 percent in the manpower levels at the subtotal level, indicating that these data base differences can have a substantial impact on the manpower projected from these activities. While there are still some differences in the visit versus the adjusted totals, they can be explained by going back to the raw data discussed in Section III of this report and reviewing how each agency's data compared to the derived relationship. As an example, it is worthwhile to review the circumstances which tend to make agencies A and F further off than the rest of the agencies. Both agencies A and F are relatively new agencies undergoing rapid expansion and, at the time of the study visit, they were performing extensive reviews of and increases in their monitoring systems. This tended toward an underestimation bias when discussing

Table 30. COMPARISON OF DIFFERENT PROJECTED MANPOWER REQUIREMENTS FOR MONITORING ORIENTED ACTIVITIES (IN MAN-YEARS)

		Field operation	Calibration and maintenance	Sample preparation	Sample analysis	Data processing	Lab qual control	Special studies	Comparison Subtotal
A	Model	6.86	5.29	0.32	1.21	2.69	0.15	4.10	14.84
	Visit	2.43	2.5	--		3.0			7.93
	Adjusted model	8.98	6.32	0.46	1.59	2.79	0.21	5.21	18.09
B	Model	12.94	7.86	0.61	1.81	3.70	0.24	6.96	24.50
	Visit	4.29	4.79			2.00			11.08
	Adjusted model	6.64	5.13	0.38	1.11	3.43	0.15	3.98	15.20
C	Model	14.20	8.88	0.48	1.41	4.38	0.19	7.49	29.35
	Visit	1.97	0.30	0.20	3.28	4.53			10.28
	Adjusted model	7.38	4.26	0.32	1.06	2.00	0.14	3.91	15.02
D	Model	5.37	3.08	0.23	0.64	1.47	0.09	2.79	10.79
	Visit	4.39[b]	1.90	0.34	0.72	0.8			8.15
	Adjusted model	4.89	3.11	0.25	1.55	1.54	0.18	2.94	9.80
E	Model	1.67	1.20	0.19	0.50	1.33	0.07	1.07	4.89
	Visit	0.48[c]	0.34	0.22	0.73	3.05			4.82
	Adjusted model	1.40	1.38	0.13	0.88	1.79	0.10	1.14	3.79
F	Model	2.88	2.01	0.30	0.81	1.79	0.11	1.80	7.79
	Visit	2.38	2.67	0.53	0.22	2.55			8.35
	Adjusted model	6.72	4.68	0.48	1.33	1.83	0.18	3.96	15.04
G	Model	1.79	1.58	0.19	0.62	1.80	0.08	1.26	5.98
	Visit	[d]	0.44	0.10	0.47	0.52			1.53
	Adjusted model	1.03	0.96	0.11	1.41	1.39	0.15	1.05	4.90

[a]Model relationships applied to number of sensors from study visits.

[b]Includes estimate of 3 m-y local help.

[c]Visit sites half as often.

[d]Performed solely by local manpower.

their monitoring activities, because the number of monitors referred to was often the number immediately current or expected to be operational shortly, while the manpower levels related to the time that had been spent in the past on these activities.

Source-Oriented Activities

The varying manner in which the several agencies conduct their source surveillance and enforcement activities precludes any useful comparison with the model's hypothetical approach on a task-by-task basis. However, since the overall goal of each agency is the same, there is some reason to expect that the projected aggregate manpower applied to these activities should agree roughly with the totals determined during the visits. Table 31 presents a summary of this comparison for the seven states visited. None of the data include mobile source figures, since no actual mobile source effort was underway. A comparison of the first pair of columns, for total stationary source manpower, indicates that the model does not agree closely with the levels determined from the visits, generally over-predicting rather than under-predicting, with an aggregate over-prediction of 39 percent. One obvious difference between the model's hypothetical control approach and the actual approach of the agencies is in stack testing; none of the agencies was actually conducting a stack test program of the magnitude envisioned in the model. Consequently, a second comparison was made with stack test manpower excluded; in this case, there is an under-estimation of the aggregate manpower by about 2 percent.

Table 31. COMPARISON OF PROJECTED MANPOWER REQUIREMENTS FOR STATIONARY SOURCE-ORIENTED ACTIVITIES

State agency	Manpower (man-years)			
	Total stationary source activities		Stationary source activities less stack testing	
	Visit	Model	Visit	Model
A	46.0	19.6	41.0	16.6
B	88.3	83.8	86.7	71.8
C	25.6	41.0	23.3	33.4
D	32.2	20.1	31.9	18.3
E	a	0.0[b]	a	0.0[b]
F	11.4	19.6	5.9	17.3
G	11.8	47.2	8.7	37.1
Total	215.3	231.3	197.5	194.5

[a]No estimate provided by Agency E.

[b]Results are not obtained because NEDS data base is absent.

SECTION V

CONCLUSIONS AND RECOMMENDATIONS

The previous sections of this report have presented the Manpower Planning Model, as developed to date by GCA/Technology Division for EPA, by providing an extensive review of the procedures for the empirical information development, the considerations involved in the formulation of the manpower projection relationships, and the actual structure of the model. In addition, a discussion of a trial application of the model has been given. By way of conclusion, this Section summarizes briefly the ways in which the model can be put to use, and offers a brief assessment of the model development effort. Then a few recommendations are presented with respect to what different or further investigations would be required to allow for the development of the model when experience and improved input data bases warrant.

POSSIBLE APPLICATIONS OF THE CURRENT MODEL

The purpose of developing the model was primarily to provide a <u>means of estimating current manpower requirements</u>. In addition, it was planned to have a model which was usable for some time so that it could project manpower requirements for future years. To provide this latter component, it was necessary to provide a model which could project changes in manpower with changes in the duties performed by an agency due perhaps to new regulatory requirements.

Current Manpower Requirements

While there are still areas of improvement which should be made in the model, as discussed later, it does allow for reasonably good projections of the manpower levels needed in a state air pollution control agency for a wide range of activities. The model provides some selection in whether the activity is being conducted by each agency, usually by reviewing the pollutant priority classifications of the AQCR, and as to the degree of performance of the activity; for instance, by including the number of monitors.

The data inputs for the projection of current manpower requirements are the pertinent data inputs as they are presently known. Often, as noted several times earlier, these are not entirely accurate or up-to-date and may lead to some inaccuracies for individual activities. However, as no pattern for these differences has yet been established, it is assumed that these are approximately random, so that they will come close to averaging out on a state level, with increased accuracy as totals are accumulated at the regional and national levels. Where particular concern is warranted is the situation where a state does not maintain up-to-date NEDS or SAROAD files. As the model bases the bulk of the manpower estimates on the fundamental counts of sources and monitors, the accuracy of projections can be no better than the reliability with which the States and Regional Offices submit such information.

As the model is presently structured, the manpower levels projected for each state are primarily those which are necessary for one central agency to handle all the air pollution activities within the state. Therefore, the manpower requirements projected for each state from the model must be reviewed in light of the actual character of the air pollution control activities of the state. While some additional manpower is allocated in the area of management and support activities for additional agencies within a state, there was no way of thoroughly addressing the increased manpower requirements or the savings that may

result from having either local agencies or regional offices of the State agency.

In summary, the use of this model for projecting current manpower requirements can be expected to provide reasonably accurate projections of the total manpower needed by a central state agency if data input for the state is current. The resolution for the manpower levels for each individual activity cannot be expected to be as accurate as the aggregate for the state. Care must also be taken in applying these projections to noncentral APC agencies and regional offices, or the States themselves would have to be consulted in reviewing and allocating the projections to the various agencies within the state.

Projecting Impact of Policy or Regulatory Changes

A key factor considered in the development of the model was to make it flexible in the context of the scope of activities and relationships used. The model would have application not only for projecting current or immediate future manpower requirements, but also for projecting what may be expected in the more distant future as the role of the agencies changes, and for considering the manpower impact of possible or hypothetical changes. The role of an APC agency may change as new regulations are passed, as sources come into compliance, or as areas reach the NAAQS. Other changes may result from external events, such as changes in EPA regulatory policy, and so on.

It would be far too lengthy to try to identify all the possible changes which could occur in the future and, even then, more would surely arise. Instead, the following discussion indicates how the model may adjust to such changes in the three main sections of the model.

Monitoring Oriented Activities - Two types of changes can be reasonably expected for these activities: 1) changes in the number of sensors to be operated, and 2) changes in the frequency of sample collection. The

former of these is fairly straightforward, since the model allows any number of monitors to be input and these will be changing over time anyway. The only problem that might arise is in the travel time, which would need to be modified if the overall density of the network were changed dramatically. Changing the frequency of the sample collection for one or more sensor types is also fairly easy, as the sample-change frequencies are present as separate, explicit variables, readily changeable in the program.

It must be remembered with both of these changes, as with most others, that the numerous interactions between activities in the model require that the total model be rerun if the aggregate manpower required of the agency is to be considered. While doubling the sample collection frequency for a hi-vol obviously doubles the field operation, sample preparation, and sample analysis time, it affects such things as the time needed for handling and analysis of the data in a different way; and the increased manpower for hi-vols in turn also impacts on those management level activities which are estimated as a function of the size of the technical staff.

Source-oriented Activities - Changes which may be expected in the source-oriented activities cover a wide range from the inclusion of new sources to the requirement for more motor vehicle inspection programs. Again, all of the considerations mentioned above must be given in projecting changes in these areas. Because the source-oriented activities are subject to much greater variation in structure among agencies than are the monitoring activities, it is probably less likely that clear policy changes, like the frequency of inspection, will be meaningful; but because of the matrix structure, the changes could be easily made.

Management and Support Activities - The management and support activities are ones which, if they relate at all to the other sets of activities, are dependent on the other activities and will not impact on them.

Therefore, changes which affect them can be applied directly to this level only. However, much more thought and information may have to be involved in the changes, since beyond just changing the number of monitors or sources, the relationships themselves will likely have to be altered.

These changes can actually be very easy, as in expressing a policy of encouraging graduate studies by simply increasing the pertinent coefficient. A more policy-level change would be to decide to discourage all local APC agencies or, conversely, to require local or regional offices. While the model as it is could make estimates of the impact on manpower of these changes, and careful analysis of data and re-interpretation of relationships could perhaps provide better estimates, in general, as mentioned earlier, the model is not really adaptable, as presently formulated, to consider such a change accurately. To do so would require either a data base on the precise sharing of responsibilities in each state, or a homogenized definition of the state/local roles that could apply to all states; neither is in the model as it currently exists.

ASSESSMENT OF THE MODEL DEVELOPMENT

As with any project, there are some possible improvements that can be suggested from the benefits of hindsight; in the case of the development of the manpower planning model, the agency visits and the data base used are the only areas where the conduct of the effort might be different, although there are a number of areas where additional development effort is warranted, with the goal of a more complete and accurate model than has been provided under this work, or a more generally applicable, more subtle, sophisticated model. These development efforts are discussed in the next sub-section.

Data Gathering Process

One of the areas that requires some assessment is the manner in which the empirical data was gathered. Following the collection of the data from the agencies during the study visits, and during the subsequent analyses, it was concluded that, although most of the shortcomings of the data were unavoidable, some of the difficulties in the data base were related to the manner in which the data was gathered (i.e., a 1-day visit using a detailed questionnaire). Sometimes the interviewee was placed in a position of providing an immediate estimate of manpower expended in minor areas which had not been given serious consideration previously. In addition, the interviewer was required to make an assessment of the adequacy of the level of performance of each activity for use in formulating the relationships, but the short time generally precluded any more than a qualitative judgment.

It is therefore urged that when the model is revised, the visits to agencies be made more flexible, and probably for a longer duration, perhaps a minimum of 3 days. It probably would also be efficient to consult with the agencies more extensively in advance of the format design, or to leave the visit and data formats open.

Input Data Base

The other area which requires some assessment is of course the input data base used. The model is, of course, highly dependent upon the number of monitors and sources as given in the SIP's and NEDS, respectively. The former of these would seem to be as good as would be possible to obtain. As discussed earlier, however, the NEDS-based source data inputs used are often not as complete as would be desired, nor do they contain precisely the type of information needed for the best

development of the model. In addition, the NEDS system apparently does not always contain consistent data (e.g., some states have only 100 tons/year or larger sources, while other states may have much smaller sources).

It is not likely that either the format or the content of the data bases will be improved for the primary purpose of the manpower projection model, since this would take an inordinate amount of effort. However, the needs of the model should be taken into account in any future decisions on updating and refining these data bases. In particular, some consideration should be given to writing a NEDS retrieval routine that would provide the summaries specifically for the manpower model.

Aside from the major data inputs, there are several less detailed inputs that would be desired for a more sophisticated application of the model (e.g., information on whether the agency has regional offices). The model, as presently structured, cannot account for all of the variations found in the study visits which are due to specific characteristics of an agency because there was no data base on which to apply the pertinent relationships. It is likely that this information could be readily obtained from the EPA Regional Offices.

FUTURE STRUCTURAL DEVELOPMENT OF THE MODEL

There are several areas where it is expected that increased flexibility, sophistication, or accuracy could be built into the model by making further structural developments that were not possible in the current effort. Several of the most important of these are reviewed briefly below.

Data Base Development

The desirability of revising the way in which the model interfaces with the NEDS system has been mentioned several times. This is a high priority, in our judgment.

Compliance Status

The model as it now exists does not distinguish between sources in varying compliance status. The anticipated interfacing with the compliance data system (CDS) was ultimately rejected, based on the unavailability of CDS in many Regions.

State-Local Agency Interactions

Because of the limitations in the data base, and the lack of definition on which agencies perform what functions, the model operates on a state-by-state basis, rather than on an agency-by-agency basis, and the ability to make good projections for local agencies or to explore subtle state-local interactions is minimal.

Flexibility Among Agencies

The computer system, as opposed to the model as a conceptual entity, could be modified to permit deliberate variation of such factors as inspection or stack test frequency from state to state, to provide for variations in policy.

APPENDIX A

ANNOTATED BIBLIOGRAPHY

1. Blair, Roger, and Gatewood, William B., Automation of Emissions Surveillance through Computer Applications, Air Pollution Control Association, Pittsburgh, Pa., 18p., 1972. APTIC # 44482.

General discussion on how a computer could be used to schedule necessary activities. Data for Kentucky.

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Overview of agencies in Germany.

3. Colorado, State of, The State of Colorado Air Pollution Control Transportation and Land Use Plan; Colorado Department of Health, Air Pollution Control Commission, Denver, Colorado, 198p., May 1973.

Chapter 7, Control Strategy Implementation, contains much information pertaining to present and anticipated manpower requirements. In particular, Section 7.1.1, Agency Staff and Budget Requirements, pp.7-1, 7-10, was the basis for the input from this Plan to the matrix shown in the Appendix to the present report.

4. Connecticut, State of, Air Quality Implementation Plan, Department of Environmental Protection, Hartford, Connecticut, 320 pp., undated (early 1972).

This plan contains an excellent summary and listing of State and local agency functions and associated manpower requirements. Tables 11-2 through 11-6, pp. 240-244, are reproduced in part in the Appendix to this report, along with the lists from the other plans reviewed for this project.

5. Cooper, J.S., Dunfee, N.L., and Townsend, R., State and Local Air Pollution Control Agency Salary Levels, 1971, Air Pollution Control Association, Pittsburgh, Pennsylvania, 22p., 1972. APTIC # 44810.

More up-to-date information is provided on salary levels than in other reports reviewed. The report shows that salaries have risen and are more competitive. Much salary data is included.

6. Doyle, Kathleen F., "Manpower for Pollution Control," Environment Reporter, Monograph No. 7, 17 pp., 8 January 1971.

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7. Dunfee, Norman L., Career Opportunities in the Public Sector for Environmental Managers, Institute for Management Sciences, Pleasantville, New York, 8p., 1971. APTIC # 43549.

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10. Gartner, Irvin, Air Pollution Control Salaries in Today's Competitive Labor Market, Pennsylvania State University, Center for Air Environment Studies, 349p., 1968. APTIC # 10648.

Provides a comprehensive compilation and comparison of annual salaries of government employees in air pollution and those salaries offered by industries. Emphasis is on what is being offered to recent college graduates. The need to make government salaries more competitive is concluded.

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Covers the requirments for support to an APC agency by a Technical Service Group. This document stresses laboratory operations. The information presented therein is based on existing agencies - state, regional, and local. The vertical links between successive strata of agencies as well as the horizontal relationships among other agencies at the same level as the APC agency are enumerated. It is emphasized that "the State is in the middle." Major areas of agency activity discussed here include: 1. organization, 2. management, 3. program element definition, 4. legal considerations, 5. technical functions, 6. quality control.

14. Keitz, E.L., and Mongan, T.R., Analysis of Requirements for Air Quality Monitoring Networks, Air Pollution Control Association, Pittsburgh, Pa., 25p., 1970. APTIC # 28191.

Interview of local and national agencies indicated a justification for local data gathering on a delayed and immediate response basis, but a national scale data gathering on a delayed response basis only.

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16. Maryland, State of., Plan for Implementation of the Ambient Air Quality Standards of the Metropolitan Baltimore Intrastate Air Quality Control Region (State Air Quality Control Area III), Maryland State Department of Health & Mental Hygiene, Environmental Health Administration, Bureau of Air Quality Control, Baltimore, Maryland, 375p., May 1972.

A very comprehensive plan that includes sections on manpower resource requirements and transportation/land use planning as well as a wealth of information on some of the more important input parameters needed to quantify the manning requirements. Among these are the material in Chapter 1, "Description of the Region", Appendix H, "Functional Statement-Bureau of Air Quality Control," and Appendix K, "Air Pollution Episode Plan, State of Maryland." Examples of some of the more highly technical activities for which trained manpower support is needed are contained in Appendices C, "Data Base for Computer Simulation Exercise," and D, "Diffusion Model Verification." The list of agency functions and the corresponding manpower requirements derived from the Plan are included in the appendix to this report.

17. State of New York, New York City Metropolitan Area Air Quality Implementation Plan - Transportation Controls. New York State Department of Environmental Conservation, 344p., April 1973.

Because this plan is so forward-looking, the entire document contains a great deal of useful information that is suggestive of new or expanded activities to be undertaken by state and local APC agencies. Chapter 9 - Maintaining Air Quality Standards Beyond 1975, is especially fruitful in this area.

18. North Carolina, State of, Implementation Plans for the State of North Carolina (in two volumes): Vol. I, The North Carolina Plan for Implementing National Air Quality Standards, and Vol. II, Report on Public Hearings on Adoption of Proposed Plan for Implementing National Air Quality Standards. The Michie Company, Charlottesville, Virginia, 91 p., January 1972.

In Volume I, the sections on actions to be taken in air pollution episodes, and those dealing with resources and intergovernmental cooperation (Sections V, IX, and X, respectively) were found to contain much useful

information as to the implications for skills and numbers of staff required to discharge properly the responsibilities of the state and local air pollution control agencies. The descriptive material on the physical, geographical, and meteorological characteristics of the region contained data needed as basic input to a manpower planning model. Several parts of Appendix C, "Regulations Governing the Control of Air Pollution," implied manpower requirements, both qualitative and quantitative.

19. Plotkin, Steven E., Proposed Permit System for Sources of Air Pollution in the State of Alabama, Resources Research, Inc., McLean, Virginia, 111p., November, 1971. APTIC # 39457.

Good sample of state-wide permit system. Includes a small section on staffing for the permit system.

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Volume A - Guidance and Supporting Information for Staffing and Training Decisions in an Air Pollution Control Agency - Introduction and Directions for Using These Guidelines

Volume B - Guidance and Supporting Information for Staffing and Training Decisions in an Air Pollution Control Agency - Engineering

Volume C - Guidance and Supporting Information for Staffing and Training Decisions in an Air Pollution Control Agency - Field Enforcement

Volume D - Guidance and Supporting Information for Staffing and Training Decisions in an Air Pollution Control Agency - Laboratory Support

Volume E - Guidance and Supporting Information for Staffing and Training Decisions in an Air Pollution Control Agency - Air Monitoring and Meteorological Support

Volume F - Guidance and Supporting Information for Staffing and Training Decisions in an Air Pollution Control Agency - Source Testing

Volume G - Detailed Task Data, and Staffing Guidance - Agency Management, Program Development, and Public Information Support

23. Schueneman, Jean J., "Organizational and Operational Techniques for Relieving Manpower Shortages in Air Pollution Control Agencies", J. Air Pollution Control Assoc., 17 (10):670-672, October 1967. APTIC # 05559.

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Chapter 1 provides a concise introduction to the major components of air pollution control. The organizational configurations of an agency, as separation of state and local control, are discussed, as are staffing

needs. Emphasis is on the field enforcement officer's duties and background.

Chapter 1 provides a concise introduction to the major components of air pollution control. The organizational configurations of an agency, as separation of state and local control, are discussed, as are staffing needs. Emphasis is on the field enforcement officer's duties and background.

Chapter 2 gives more detailed enforcement procedure. What an inspection should entail and what is of primary consideration in different industries is delineated. Sample forms for activities ranging from inspection to court appearances are filled out. Systematic filing of reports is discussed.

Chapter 3 deals further with prosecuting violations. Court procedures and the need for training enforcement officers as witnesses are mentioned.

Chapter 4 provides information on inspection of emissions. Perhaps too much emphasis is based on the actual visibility of the emission. The need to record all times and conditions is noted. Complaint investigation and mediation is suggested. Field equipment is reviewed.

A very good glossary of technical and industrial terminology is provided.

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APPENDIX B

AGENCY VISIT QUESTIONNAIRE

Activities Projected from Source Information

101. Routine Inspection of Stationary Source
102. Engineering Inspection of Stationary Source
103. Inspection of Hazardous Pollutant Source
104. Stationary Source Testing
105. Complaint Investigation and Field Patrol
106. Development of Compliance Schedules
107. Monitoring of Compliance Schedules
108. Oversee Required Source Record-Keeping
109. Oversee Conduct of Supplementary Control Strategy
110. Formal Legal Action
111. Enforcement Reports to EPA
112. Semi-Annual Reports to EPA on Progress in Plan Enforcement
113. Semi-Annual Emissions Reports to EPA

120. Review of Application for Tax Exemption

130. Technical Review of Equipment Plans
131. Review of Development Plans
132. Microscale Modelling and AQ Estimation
133. Review of Source-Conducted AQ Estimation
134. Technical Land Use Planning
135. Environmental Impact Statement Review

150. Establishment of Mobile Source Emissions Inventory
151. Performance of Dynamometer Emissions Testing Program
152. Performance of Idle-Modes Emissions Testing Program
153. Performance of Emission Equipment Inspection Program
154. Oversee Motor Vehicle Emissions Testing Program
155. On-going Surveillance of Mobile Source Emissions
156. Mobile Source Enforcement

160. Episode Control Plan

Activities Projected from Monitoring System Information

201. Field Operation
202. Routine Calibration
203. Equipment Maintenance
204. Equipment Repair
205. Dynamic Calibration

210. Sample Preparation
211. Sample Analysis: Manual
212. Sample Analysis: Automated

220. Data Processing and Summarization: Manual
221. Data Processing and Summarization: Semi-Automatic
222. Data Processing and Summarization: Automated

230. Preparation of Quarterly AQ Data Reports to EPA: Manual
231. Preparation of Quarterly AQ Data Reports to EPA: Computerized

Activities Projected from Other Staffing Levels

301. Air Pollution Control Board
302. Overall Program Management

310. Development of New or Modified Control Strategies
311. Climatological Dispersion Modelling
312. Economic Impact Analysis
313. Community Interaction and Social Impact Analysis
314. Quantitative Evaluation of Alternate Strategies
315. Development and Adoption of New or Modified Control Regulations

320. Network Design and Planning
321. Laboratory Quality Control
322. Statistical and Engineering Analysis of Air Quality Data

340. Liaison with EPA and Other APC Agencies
341. Liaison With Transportation Agencies
342. Liaison With Land-Use Planning Agencies
343. Provide Technical Assistance to Local APC Programs

350. Liaison With Other Non-APC Governmental Agencies
351. Staffing

360-361. In-house Training
362. Training at EPA
363. Graduate School Training
364. Professional Activities

370. Public Information
371. Library and Archives
372. Editing and Graphic Services
373. Effects Surveillance
374. Photographic Services

390. Clerical Support for Administrative Staff
391. Clerical Support for Laboratory Staff
392. Clerical Support for Stationary Source Inspectors
393. Clerical Support for Legal Staff
394. Clerical Support for Other Technical Staff

101. Routine Inspection of Stationary Source

102. Engineering Inspection of Stationary Source

These activities include the effort needed to conduct inspections, excluding, any effort involved in associated stack testing. Routine inspections, activity 101, are those that are typically performed in less than 1/2 man-day (exclusive of travel time), where visual inspection of equipment and operation, by a technician-level person, is adequate. This type of inspection might be performed for routine permit purposes, for on-going surveillance to help maintain the emissions inventory, or for other reasons. Engineering inspections, activity 102, are, in contrast, those that may involve one or more professional staff for perhaps several days, and will likely be much more thorough and detailed. These inspections are aimed at the major pollutants only; hazardous pollutants are covered in activity 103.

1. Does such a division into two types of inspection seem consistent with your usual procedures? ____yes ____no, only one type
   ____no, we have several types

   Explain:

2. Do the types or frequency of inspections vary with the size or type of industry? ____ no; ____ yes, by size only; ____ yes, by type. (Explain)

3. Under what circumstances do you conduct inspections of each type?

Routine	Eng'g.	
_____	_____	Operating permit (frequency _____)
_____	_____	Begin compliance schedule
_____	_____	Complete compliance schedule
_____	_____	When complaint received
_____	_____	On request
_____	_____	Informal
_____	_____	Other (explain)

101
102 (2)

4. Are there any significant differences in time spent on routine inspections by type of source? ____ no, ____ yes (explain)

5. We'd also like to consider differences in inspection requirements for various type sources. Here is an extensive list of source types; (see array 100). For the source types you're familiar with, could you estimate the typical manpower requirement for engineering inspections? Give number of inspections, man-days each, and/or total manyears.

6. In total, could you summarize the manpower spent on inspections?

Manpower levels: total man-years _____

by type:	No. Inspection	man-days each	man-years
routine (or_____)	_____	_____	_____(101)
engineering (or ___)	_____	_____	_____(102)

7. Instead of (or in addition to) source type, what factors affect the time required?

Emission volume _____, Other (explain) _____

8. Do the above estimates reflect travel time? ____ Yes, ____No

Average travel time _____hours/week

Average distance _____miles/week

101
102 (3)

9. How much extra time do you spend if the source being inspected for the criteria pollutants is at the same time inspected for hazardous pollutants? _____manhours or _____% extra.

Number of such sources: _____

101 ____my 102 ____my	

LIST OF SOURCES

FOR SOURCE-ORIENTED ACTIVITY ARRAY (100)

1. Power plant, coal-lignite, > 100 MMBTU/Hr. _____
2. , 10-100 _____
3. , <10 _____
4. , oil, > 100 MMBTU/Hr. _____
5. , 10-100 _____
6. , <10 _____
7. , gas-coke _____
8. , misc. _____
9. Industrial boiler, coal-lignite, >100 MMBTU/Hr. _____
10. , 10-100 _____
11. , <10 _____
12. , oil, > 100 MMBTU/Hr. _____
13. , 10-100 _____
14. , < 10 _____
15. , gas-coke _____
16. , misc. _____
17. Comm.-Institutional boiler, coal-lignite, _____
18. > 10 MMBTU/Hr. _____
19. , <10 _____
20. , oil, >100 MMBTU/Hr. _____
21. , 10-100 MMBTU/Hr. _____
22. , <10 _____
23. , gas-coke _____
24. , misc. _____
25. Internal Combustion (Stat. sources) _____

26. Nitric acid mfg. _____
27. Paint & varnish mfg. _____
28. Sulfuric acid mfg. _____
29. Phosphate fertilizer mfg. _____
30. Other chemical mfg. _____
31. Feed grain handling _____
32. Other food & agriculture _____
33. Aluminum reduction _____
34. Copper smelters _____
35. Ferroalloy _____
36. Electric arc steel furnace _____
37. Other iron and steel _____
38. Lead smelters _____
39. Zinc smelters _____
40. Other primary metals _____
41. Secondary aluminum _____
42. Gray iron foundry _____
43. Other secondary metals _____
44. Portland cement mfg. _____
45. Coal cleaning _____
46. Other mineral products _____
47. Petroleum processing _____
48. Kraft (sulfate) pulp processing _____
49. Other wood products _____
50. Metal fabrication _____
51. Leather products _____
52. Textile mfg. _____
53. In-process coal use _____
54. In-process oil use _____
55. In-process gas use _____
56. Other in-process fuel use _____
57. Drycleaning _____
58. Other solvent usage _____
59. Surface coatings _____

60. Petroleum storage _____

61. Other evaporative losses _____

62. Municipal incinerator _____

63. Open burning dumps _____

64. Other gov't incineration _____

65. General comm.-institutional incineration _____

66. Flue-fed apartment incineration _____

67. Other comm.-inst. incinerator _____

68. Industrial incineration _____

103. Inspection of Hazardous Pollutant Source

This activity is the effort to inspect a source of a hazardous pollutant which would not be inspected for criteria pollutant emissions. Those sources which emit both criteria and hazardous pollutants are covered under activities 101 and 102.

1. Do you (or do you expect to) conduct inspections of sources of hazardous pollutants - Be, Hg, Asbestos?

   ____No, none here

   ____No, not inspected

   ____No, ____agency does it

   ____Yes, we plan to

   ____Yes, we do now

2. Under what circumstances do you conduct such inspections?

Routine	Eng'g.	
_____	_____	Operating permit (frequency _____)
_____	_____	Begin compliance schedule
_____	_____	Complete compliance schedule
_____	_____	When complaint received
_____	_____	On request
_____	_____	Other (explain)

3. Would you estimate the typical manpower requirements for this effort?

	No. of insp.	Man-days each	Man-years
Asbestos	_____	_____	_____
Beryllium	_____	_____	_____
Mercury	_____	_____	_____

4. Do these estimates reflect travel time? ____Yes, ____No.

   Average travel time _____hours/week

   distance _____miles/week

103 ____my	

104. Stationary Source Testing

This activity includes the field and source-oriented effort involved in planning and conducting actual measurements of emissions. The chemical analysis efforts are included in activity 211. If the stack test is conducted in conjunction with an inspection, this activity includes only the effort needed to prepare and set up the equipment, conduct the test, make necessary field calculations, and replace the equipment; access to the sampling ports is presumed, and any subsequent calculations or data processing conducted in the office in considered separately. Any time spent observing others' stack tests is included in this activity.

1. Does your agency conduct/observe source tests?
   - ____ Yes, both
   - ____ Yes, conduct only
   - ____ Yes, observe only
   - ____ No, _____agency does
   - ____ No, contract for Testing
   - ____ Other, (specify)

2. Does our definition seem to agree with your operating procedures for conducting source tests?
   - ____Yes
   - ____No, can't separate from inspection
   - ____No, all calc's should be included
   - ____No, other

3. In what circumstances do you conduct/observe tests?

conduct	observe	
_____	_____	verify compliance-agency regulation
_____	_____	verify compliance - NSPS
_____	_____	part of inspection (frequency: _____)

conduct	observe	
_____	_____	evidence for enforcement action
_____	_____	on request
_____	_____	other (specify)

4. What test procedure do you use? Please estimate time required.

SO_2	Particulate		No. tests/year	Time per test
___	___	EPA train	___	_____
___	___	ASTM train	___	_____
___	___	Bag sampling	___	_____
___	___	Other _____	___	_____

5. In the aggregate, what is your overall manpower usage for conducting/observing stack testing?

Conduct _____man-years; _____ tests

Observe _____man-years; _____ tests

6. What factors influence the time required?

7. Do these figures include travel time? ____Yes, ____No

Average travel time _____hours/week

Average distance _____miles/week

104 ____my	

105. Complaint Investigation and Field Patrol

Complaint investigation includes the effort expended to conduct field investigations of citizen complaints, including preparation of reports, letters, or other material serving to terminate the investigation phase. The effort required to receive the complaint, by telephone or by mail, is included in activity 392. The appropriate agency action in response to the complaint may be legal enforcement, more careful engineering investigation, etc; in these cases the effort to conduct the follow-on activity is considered separately. It is presumed that the staff occassionally note apparent violations on their own initiative; this is also included here, whether conducted as an incidental activity or by a separate staff.

1. To what extent does your agency conduct such activities?

   ___ None-done by _____ agency

   ___ Complaint investigation only

   ___ Complaint investigation and occassional patrol

   ___ Complaints and field patrol separately

2. Aggregate manpower usage _____ man-years.

   Complaints _____ man-years or _____%

   Patrol _____ man-years or _____%

3. How many complaints handled? _____last year

   Rough distribution: _____% visible

   _____% odors

   _____% fugitive dust

   _____% other _____

105 ____my	

106. Development of Compliance Schedules

Activity 106 includes those efforts involved in the development of legally enforceable compliance schedules to meet the requirements of the State Implementation Plans as undertaken by negotiations between designated sources and the staff of the appropriate APC agency.

1. Will all of the compliance schedules be developed by the end of FY 1974 (June 1974)? ____Yes, ____No, # completed _____, # remaining _____

2. What manpower was required to develop these schedules? _____man-months

106 ____ mm	

107. Monitoring of Compliance Schedules

This activity includes those administration efforts involved in maintaining surveillance over the accomplishment of definable increments of progress in the compliance schedule.

1. Do you maintain this surveillance by making use of EPA's computerized Compliance Data System? ____Yes, ____No

2. If yes, what manpower is utilized? _____man-months

3. If no, what procedure do you use?

4. What manpower is required for these procedures? _____man-months

5. Of the manpower utilized for inspections (activities 101-103) and source testing (104), how much is directly attributable to monitoring compliance schedules?

   _____% of routine inspections

   _____% of engineering

   _____% of source tests

6. Do any of the manpower requirements change dependent upon source type?

   ____Yes - HOW? ____No

107 ____ mm	

108. Oversee Required Source Record-Keeping

This activity consists of the effort expended in maintaining surveillance over the record keeping required of major sources. Such record keeping, when federally required for sources making use of supplementary control strategy, is included in activity 109; this activity covers cases where it is under the APC agency, and is an on-going process.

1. *Do you attempt to oversee the production of these records?*

	No	Yes	No. Sources	Man-months
Process data	____	____	_____	_____
Emission data	____	____	_____	_____
Air quality data	____	____	_____	_____
No. sensors per source			_____	

108 ____ irm

109. Oversee Conduct of Supplementary Control Strategy

This activity is defined as the effort required to oversee the record-keeping, monitoring, modelling and forecasting required of a source permitted to operate a supplementary control strategy, and to insure emission reduction.

1. Are any of the sources in the region planning to operate a supplementary control strategy?

___No - none eligible

___No - agency policy

___Maybe - some eligible (____eligible)

___Yes - permission requested (____sources)

2. What manpower do you anticipate being required to oversee such efforts?

___man-months more than otherwise

___same as otherwise needed for source

___man-months less than otherwise

109 ____my	

110. Formal Legal Action

This activity is defined as the actual court cases, hearings, etc., including assimilation and preparation of supporting documents, notification of the polluter of impending action, and actual time in court in prosecution.

1. Is this performed by: Local APC agency _____, State APC agency _____, other governmental (e.g., D.A.) office (specify):_____

2. Number cases per year _____current year

_____expected next year

_____expected in 2 years

_____expected in 5 years

3. Manpower usage (in man-years)

	APC Agency	Other Legal Staff
preparation	_____	_____
briefing	_____	_____
in court	_____	_____

4. Estimate percentage of sources likely to require legal action _____ .

5. Are any industry types more likely to require legal action? ____Yes, (which ones, explain), ____No.

111. Enforcement Reports to EPA

This activity provides for the effort expended in preparing and submitting the required semi-annual enforcement reports to EPA on the legal enforcement actions taken that result in civil and criminal penalties.

1. How will these reports be prepared? _____ manually

   _____ computerized ____existing program

   ____new program

   _____combination (what)_____

2. Time required to prepare one semi-annual report in (man-days) _____

3. Number of enforcement actions reported _____

111 ____md	

112. Semi-Annual Reports to EPA on Progress in Plan Enforcement

This activity provides for the effort expended in preparing and submitting the required semi-annual reports to EPA on the status of source control.

1. How will these reports be prepared? ____ manually
   ____ computerized ____ existing program
   ____ new program
   ____ combination (what) _____

2. Time required to prepare one semi-annual report in (man-days) _____

3. Number of sources _____

112 ____md	

113. Semi-Annual Emissions Reports to EPA

This activity provides for the effort expended to update the emissions inventory and submit the semi-annual emissions report to EPA, based on the information in the reports prepared under activity 112.

1. Man-days required for report preparation _____

2. Number of sources reported on _____

113 ____ md	

120. Review of Application for Tax Exemption

This activity is primarily one of checking the tax exemption application for accuracy and completeness, and determining percentage eligible for write-off. The technical evaluation of the control equipment has usually been done prior to construction (see 130).

1. Is such an activity done with the help of your APC agency?

   _____Yes _____No

2. How many per year?

3. Average review time per application _____ man-days

120 ____md	

As a group, these next few activities are meant to include the efforts to review proposals for new sources, both direct and indirect, to assure their being consistent with the achievement and maintenance of the NAAQS.

Do you have a specific portion of your staff assigned to this overall purpose?

___ Yes ___ No No. of staff____

130. Technical Review of Equipment Plans

This activity is defined as the effort involved in reviewing plans for proposed sources to verify their compliance with established regulations pertaining to direct emissions prior to issuance of a construction permit. Review of such plans for tax credit or adjustment purposes is considered separately as activity 120; review of construction proposals relative to their indirect emissions, and advisory reviews, are considered in subsequent activities in this group.

1. Performed by: APC agency _____ Other _____

2. Is the technical review best described as:

   a cursory review of sufficient supporting specifications provided by applicant _____

   an extensive review, including calculation checking of the above _____

   a study undertaken by the agency to completely estimate emissions from equipment specifications _____.

3. Total number of reviews per year _____ average
   _____ current year
   _____ expected next year
   _____ expected in 2 years
   _____ expected in 5 years

4. We'd also like to consider differences in review requirements for various type sources. For the source types you're familiar with, could you estimate the typical manpower re-requirements for technical reviews? (See Array 100) Give man-days per review and number of each expected.

5. In total, could you summarize the manpower spent on technical reviews.

   Manpower levels: total man-years_____

6. Does manpower required vary with size, type of emissions, etc.?

_____ No _____ Yes (Explain)

7. Do you foresee that a "best available control technology" requirement would change manpower requirements?

_____ No _____ Yes How?

130 ____md	

LIST OF SOURCES
FOR SOURCE-ORIENTED ACTIVITY ARRAY (100)

1. Power plant, coal-lignite, > 100 MMBTU/Hr. _____
2. , 10-100 _____
3. , <10 _____
4. , oil, > 100 MMBTU/Hr. _____
5. , 10-100 _____
6. , <10 _____
7. , gas-coke _____
8. , misc. _____
9. Industrial boiler, coal-lignite, >100 MMBTU/Hr. _____
10. , 10-100 _____
11. , <10 _____
12. , oil, > 100 MMBTU/Hr. _____
13. , 10-100 _____
14. , < 10 _____
15. , gas-coke _____
16. , misc. _____
17. Comm.-Institutional boiler, coal-lignite, _____
18. > 10 MMBTU/Hr. _____
19. , <10 _____
20. , oil, >100 MMBTU/Hr. _____
21. , 10-100 MMBTU/Hr. _____
22. , <10 _____
23. , gas-coke _____
24. , misc. _____
25. Internal Combustion (Stat. sources) _____

26. Nitric acid mfg. _____
27. Paint & varnish mfg. _____
28. Sulfuric acid mfg. _____
29. Phosphate fertilizer mfg. _____
30. Other chemical mfg. _____
31. Feed grain handling _____
32. Other food & agriculture _____
33. Aluminum reduction _____
34. Copper smelters _____
35. Ferroalloy _____
36. Electric arc steel furnace _____
37. Other iron and steel _____
38. Lead smelters _____
39. Zinc smelters _____
40. Other primary metals _____
41. Secondary aluminum _____
42. Gray iron foundry _____
43. Other secondary metals _____
44. Portland cement mfg. _____
45. Coal cleaning _____
46. Other mineral products _____
47. Petroleum processing _____
48. Kraft (sulfate) pulp processing _____
49. Other wood products _____
50. Metal fabrication _____
51. Leather products _____
52. Textile mfg. _____
53. In-process coal use _____
54. In-process oil use _____
55. In-process gas use _____
56. Other in-process fuel use _____
57. Drycleaning _____
58. Other solvent usage _____
59. Surface coatings _____

60. Petroleum storage _____

61. Other evaporative losses _____

62. Municipal incinerator _____

63. Open burning dumps _____

64. Other gov't incineration _____

65. General comm.-institutional incineration _____

66. Flue-fed apartment incineration _____

67. Other comm.-inst. incinerator _____

68. Industrial incineration _____

131. Review of Development Plans

This activity is defined as the review of specific development plans with respect to their direct and indirect emissions, the emissions from associated development, and the generation of displaced emissions, including the selection of sites for stationary sources. This activity includes the receipt and processing of a permit application, the examination and evaluation of the projected air quality impact for consistency with on-going plans for achieving and maintaining the NAAQS, and the ultimate decision. The quantitative analysis required for the projections are included separately as activities 132-134. The compliance of stationary source equipment with emission standards, as opposed to siting, is covered in activity 130.

1. How do you expect this activity will be performed, or how is it now performed?

   _____ APC agency program

   _____ APC veto in planning agency

   _____ APC input to planning agency

   _____ No APC agency involvement

   _____ Other _____

2. Status of plans:

   _____ presently in force, adopted:_____

   _____ being adopted, expected by:_____

   _____ anticipated only, expected by:_____

3. Is (will) the authority cover one or more of the following types of emissions? _____ Unknown

   _____ direct

   _____ indirect (vehicular)

   _____ associated development

   _____ displaced emissions

   _____ other

4. What criteria is (will be) used to define the magnitude of project required to apply for a permit? _____ Unknown

   _____ (describe)

5. How many applications do you expect this will generate?

   _____ Unknown _____ per year

6. Estimated manpower per application_____man-days

7. Is the time required for the review related to anything, such as the type or size of source, location, etc.?

   No_____ Unknown _____

   Yes_____ (describe)_____

131 ____md	

132-134. These activities are quantitative support efforts, conducted in support of activities 130 and 131 and, more generally, in support of overall policy and control strategy development.

132. Microscale Modelling and AQ Estimation

This activity includes the microscale modelling or other procedure used for estimating the AQ impact of a proposed source of either direct or indirect emissions. If the source is very large, regional-scale modelling may be more appropriate, and in such cases, is also included in this activity.

1. Number of proposed source applications requiring this activity: ____

2. Manpower per application_____ man-days

3. Proportion of effort conducted by:

   _____% APC agency

   _____% Planning agency

   _____% Other (specify)_____

4. How is (will be) modelling conducted? _____Unknown

   _____ In-house

   what model(s)_____

   _____ EPA facility

   what model(s)_____

   _____ other (specify)_____

   what model_____

132 ____md	

133. Review of Source-Conducted AQ Estimation

This activity involves the review of the APC Agency of modelling, monitoring, or other estimation procedures conducted by an applicant for a permit to construct a proposed source.

1. Do you now, or will you in the future, require proposed sources to conduct modelling prior to construction?
   ____ No ____ Yes (Which ones? On what basis?)

2. Do you now, or will you in the future, require proposed sources to operate monitoring systems before construction?
   ____ No. ____ Yes (Which ones? On what basis?)

3. Are they, or will they, be required to operate monitoring systems after construction? ____ No ____ Yes (Which ones? On what basis? For how long?)

4. Agency manpower usage:

	No. Sources/ Year	Man-days/ Source	or	Man-years
Review of modelling	_____	_____		_____
Review of monitoring before	_____	_____		_____
Review of monitoring after	_____	_____		_____
Other review _____	_____	_____		_____

133 ____my	

134. Technical Land Use Planning

This activity includes the effort needed to provide technical planning support to the agency management in guiding the land use planning functions. It also provides technical support for the analysis of the developmental implications of various alternate policies, their other ramifications, likely obstacles to their implementation, and so on, as well as the technical planning expertise necessary to support the review of development proposals.

1. Manpower _____ man-years

2. Proportion of effort conducted by:

   _____ % APC Agency

   _____ % Planning Agency

   _____ % Other (specify) _____

3. How is (will be) technical land use planning conducted?

   Unknown _____ APC staff professional planners _____

   Non-APC staff professional planners _____

   APC staff (familiar with land use planning) _____

   Other (specify) _____

134 ____my	

135. Environmental Impact Statement Review

This activity involves the effort spent in reviewing and providing comments on EIS's prepared by other groups. In contrast to activity 131, this would involve projects or actions over which the APC agency has no direct review authority; otherwise, the analysis required may be quite similar to other activities in this group.

1. Manpower usage in man-days (per EIS) and number of EIS's per year:

	Man-days	EIS's	Total man-years
Indirect source review	____	____	____
New source review	____	____	____
Transportation review	____	____	____
Other _____	____	____	____

135 ____my	

150. Establishment of Mobile Source Emissions Inventory

This activity is meant to include the effort required to initially develop a mobile source emissions inventory based on vehicle use and speed estimates, vehicle age, and per-mile emission factors; on-going surveillance and updating of such estimates is included in activity 155. This activity includes the effort required to develop the required data (primarily vehicle-use data) in conjunction with the appropriate transportation planning agencies; coordination with such agencies for other purposes, such as the development of control measures, is included in activity 341.

1. Is this activity currently completed _____, being performed _____, under consideration _____, or not considered _____?

2. Is it (will it be) based on VMT _____ or fuel usage _____?
3. Computer _____; manual _____
4. The VMT or fuel usage data, available: good _____, poor _____, none _____.
   How and where obtained? _____

5. Which of the following motor vehicle types were included?
   _____ light-duty gas vehicles (< 6000 lb)
   _____ medium-duty gas vehicles (< 10,000 lb)
   _____ heavy-duty gas trucks
   _____ light-duty diesel vehicles (< 6000 lb)
   _____ heavy-duty diesel vehicles (> 6000 lb)
   _____ gaseous fuel vehicles
   _____ motorcycles
   _____ buses

6. Which fuels
   _____ gasoline
   _____ diesel
   _____ other (specify LNG, etc.) _____

7. Manpower usage (estimate or actual)

	Man-years
Computer staff	_____
Transportation engineers	_____

150 ____my	

151
152
153
154

151. Performance of Dynamometer Emissions Testing Program
152. Performance of Idle-Modes Emissions Testing Program
153. Performance of Emission Equipment Inspection Program
154. Oversee Motor Vehicle Emissions Testing Program

These activities involve the actual conducting by the APC agency of a vehicle inspection and testing program (151-3), or the effort required to oversee such a program conducted by another agency. When the testing program is conducted in conjunction with a vehicle safety inspection program, the manpower included is only that required for the emission testing portion.

1. Is this activity on-going _____ project (give date expected)_____, or not expected _____?

2. Is this conducted on a local or statewide basis? (Which one and why?)

3. Nature of APC agency involvement:
   _____ no role
   _____ advise transportation agency
   _____ supervise, oversee
   _____ collaborate
   _____ perform tests

4. What type(s) of inspection is (are) carried out?
   Dynamometer _____, idle _____, emission equipment inspection _____

5. Are these tests performed at local service stations _____ or public inspection stations _____?

6. Pollutants of interest - CO, HC, other _____?

7. Vehicles of interest:
   _____ light-duty vehicles (< 6000 lb)
   _____ medium-duty gas vehicles (< 10,000 lb)
   _____ heavy-duty gas trucks
   _____ light-duty diesel vehicles (< 6000 lb)

151
152 (2)
153
154

_____ heavy-duty diesel trucks (> 6000 lb)

_____ gaseous fuel vehicles

_____ motorcycles

_____ buses

8. Age range

9. Fuel of interest

_____ gasoline

_____ diesel

_____ other

10. Frequency & Timing of inspections?

_____ annual _____ staggered

_____ semi-annual _____ confined period

_____ quarterly

_____ other

11. Who pays for cost of inspection?

	Percentage
APC Agency	_____
Transportation agency	_____
Vehicle Owner	_____
Other	_____

12. Manpower for each type of inspection?

	Per Vehicle	Per Year
Dynamometer	_____	_____ (151)
Idle	_____	_____ (152)
Equipment inspection	_____	_____ (153)

Supervision of inspections, manpower requirements; APC Agency _____(154)

(Other)_____agency

151 _____my	
152 _____my	
153 _____my	
154 _____my	

155. On-going Surveillance of Mobile Source Emissions

This activity includes the efforts involved in maintaining surveillance over the various inputs to the mobile source emission calculations; these include primarily the efforts involved in analyzing the data from the emission testing program (151-3) and any effort required in maintaining surveillance over trends in vehicle usage (e.g., VMT).

1. Does your agency have a program to maintain on-going surveillance of mobile source emissions? _____ Yes _____ No

2. Is (will) the activity associated with this surveillance primarily (be) undertaken by the APC agency _____, transportation agency (specify)_____, or other (specify) _____?

3. If a surveillance program is operational, what is the primary data utilized?
   (a) VMT trends _____
   (b) Age distribution of mobile sources _____
   (c) Gasoline sales _____
   (d) other (specify) _____

4. Is the analysis of emission testing data a computer _____ or manual _____ operation?

5. What is the purpose of the emission testing analysis:
   _____ failure rate analysis
   _____ mobile source emission factors
   _____ other _____
   _____ other _____

6. Manpower usage:
   Computer staff _____
   Engineering analyist _____
   Other _____

155 ____my	

156. Mobile Source Enforcement

This activity includes any mobile source enforcement efforts conducted by the APC agency, as well as liaison and coordination efforts in conjunction with other agencies' enforcement efforts.

1. Which of the following activities are performed for enforcement of mobile source regulations, and by whom? Give man-hour estimates

	APC Agency State or local	Transportation Agency Specify_____	Enforcement Agency Specify_____	Other Specify _____
Spot testing	_____	_____	_____	_____
Field patrol	_____	_____	_____	_____
Sticker Inspections	_____	_____	_____	_____
Complaint Investigation	_____	_____	_____	_____
Other (specify)				
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

156 ____my	

160. Episode Control Plan

This activity includes all effort used to maintain surveillance for periods of unusually adverse dispersion and to exercise the episode avoidance plan when required.

1. What is the total number of people involved in episode type activities? _____

2. Do you maintain on-going Met surveillance?
   _____ No, weather service only; _____ Yes, _____% of man-year

3. During an episode, how much additional effort (per day of alert) is placed on monitoring? _____ man-days, _____ % increase in sampling
   On compliance checking? _____ man-days
   On data processing? _____ man-days
   On forecasting & modeling? _____ man-days
   On other (specify)? _____ _____ man-days

4. How many alerts last year? _____alerts, _____ days

   How were episodes handled?
   _____ people from other jobs
   _____ overtime
   _____ permanently assigned
   _____ other in-house (specify) _____
   _____ highway patrol
   _____ other outside agency (specify) _____

160 ____md	

201-205
210-212

These activities cover monitoring and laboratory efforts that are generally proportional to the number of source tests conducted or ambient samplers operated, etc.

The quantitative information has been arranged into two arrays for convenience, and the definitions are presented separately.

201
202
203
204
205

201. Field Operation

This activity is defined as the various efforts required to conduct the day-to-day operation of automatic monitoring equipment, mechanized sampling equipment, and static sensors. As automatic equipment needs less field time, this activity is aimed more at the operation of hi-vol samplers and bubbler samplers, including exchanging sample collection media, making airflow measurements, and inspecting the equipment for wear and damage. The field operation of static sensors basically involves the periodic changes of sensors (dustfall jars, sulfation candles and plates, corrosion panels, etc.) and chemical or gravimetric determinations or sensor preparation are included in activities 210-212.

202. Routine Calibration

This activity is defined as the effort required to periodically check the calibration of mechanized and automatic sampling equipment and is performed on-site, usually during the routine field operation.

1. Is it possible to separate out this activity from 201 - Field Operations? ____yes, ____no (why not?)

203. Equipment Maintenance

This activity is defined as that effort to check and provide periodic maintenance of mechanized and automatic sampling equipment on-site.

1. Is it possible to separate out this activity from 201 - Field Operations? ____yes, ____no (why not?)

204. Equipment Repair

This activity is defined as that effort necessary to rebuild or extensively repair mechanized or automatic sampling equipment which cannot be performed on-site.

1. Is this done in-house or by outside services? _____ Explain

201
202
203 (2)
204
205

2. Is it reasonable, given your procedures, to separate this from activity 203 - Maintenance? _____Yes, _____ No

205. Dynamic Calibration

This activity is defined as that effort required to insure the proper measurement of samples, especially on automatic samplers. This is usually performed by running known samples through the sampling equipment.

1. Consider the 11 types of samplers as given in Array 200, is it possible to estimate separately the time to perform Activies 201-205 as defined? ____yes, ____station vs. separately only, ____ not at all (why not?)

2. What other samplers are used and are they in stations or employed separately? (Enter in blanks of Array 200)

3. Complete Array 200 to the fullest extent possible.

4. What is the travel time spent and mileage travelled each week visiting the monitors?

time _____, miles _____

ARRAY 200

	Station (manned)	Station (unmanned)	Dustfall	Sulfation Rate	Hi-Vols	SO_2 bubblers	NO_2 bubblers	Sequential tape samplers	Continuous SO_2	Continuous $NO_2/NO/NO_x$	Continuous non-CH_4, H_xC_x	Continuous CO	Meteorological		
# of each															
201 Field Operation															
Frequency of Visit															
Frequency of Sample Change (stations only)															
202 Routine Calibration															
Frequency of 202															
203 Equipment Maintenance															
Frequency of 203															
204 Equipment Repair															
Frequency Of 204															
205 Dynamic Calibration															
Frequency of 205															

201 ____my
202 ____my
203 ____my
204 ____my
205 ____my

210. Sample Preparation

This activity is defined as that effort necessary for the proper preparation of sampling media (static sensors, bubbler solutions, filter paper) before use in ambient samplers and source test trains.

211. Sample Analysis: Manual

This activity is defined as that effort necessary for the manual analysis of samples from both ambient samplers and source test trains.

212. Sample Analysis: Automated

This activity is defined as that effort necessary for the automated analysis of samples from wet chemical bubblers.

1. Consider the 8 sample types as given in Array 210, is it possible to estimate separately the time needed to perform activities 210-212 as defined. _____Yes, _____by dry or wet only, _____by ambient or stack only, _____not at all (why not)

2. What other types of samples are used?

3. Complete Array 210 to the fullest extent possible.

4. Give the method of analysis of each sample - only if it differs from standard EPA procedures. (This can be subscripted in and recorded beneath Array 210)

ARRAY 210

	Dustfall	Sulfation Rate	Ambient SO_2 bubblers	Ambient NO_2 bubblers	Sequential tape samplers	Hi-Vols	Stack particulate	Stack SO_2				
210 Sample Preparation												
# of 210 per day												
# of 210 per year												
Method of 210												
211 Sample Analysis; manual												
# of 211 per day												
# of 211 per year												
Method of 211												
212 Sample Analysis; automated												
# of 212 per day												
# of 212 per year												
Method of 212												

210 ____ my
211 ____ my
212 ____ my

220
221
222

220. Data Processing and Summarization: Manual

221. Data Processing and Summarization: Semi-Automatic

222. Data Processing and Summarization: Automated

These activities are defined as the effort required to process monitoring data from the sensor to the data storage system, including validation, and to prepare routine summaries in one or more standard formats. The subdivisions are according to the degree of computerization of the data processing system:

220. total manual system
221. semi-automatic, partially computerized
222. totally automated, including telemetering

As different types of data processing and summarization may be used for different types of data, more than one of the above activities may be practiced by any one agency.

1. Do you engage in more than one of the above activities for data processing and summarization? Yes, No

if yes, describe which types of data are handled by which system.

manual:

semi-automatic:

automatic:

2. What is the manpower usage on each of these activities (in manyears)?

Manual _____manyears (220)

Semi-automatic_____manyears (221)

Automatic_____manyears (222)

220 ____my	
221 ____my	
222 ____my	

230. Preparation of Quarterly AQ Data Reports to EPA: Manual

231. Preparation of Quarterly AQ Data Reports to EPA: Computerized

This activity involves the effort required to prepare, on appropriate SAROAD data forms or in other SAROAD-compatible format, the quarterly air quality data reports to EPA that are required by regulation. These can be recorded manually (230) or through use of a computer (231).

1. Which of the above two activities describes your method of preparation of AQ data reports for submission to EPA? _____ manual (230), _____computer (231)

2. Are SAROAD data forms employed? Yes, No
   if no, what type of form?

3. What is the manpower required to prepare and submit each quarterly report? _____mandays/quarter.

230 ____md 231 ____md	

301. <u>Air pollution control board</u>

This activity is meant to incorporate the efforts of any air pollution control board, commission, etc. which may be part of the legal framework of the air pollution control activities in the jurisdiction of the agency.

1. Does your jurisdiction have an Air Pollution Control Board, Commission, etc.

_____ No

_____ Yes, advisory only (part-time) man-hours/mo._____

_____ Yes, regulatory (part-time) man-hours/mo._____

_____ Yes, regulatory (full-time) man-hours/mo._____

2. Briefly describe the duties of the board and its interactions with the APC agency.

302. Overall Program Management

This activity includes the various efforts required for overall program management, including the development of agency policies, the planning of activities and resource allocations, and the determination of the general direction and thrust of the agency's pollution control program. Those activities, probably staff activities, that are specifically directed at developing new or revised overall control strategies or "implementation plans" are considered separately in activity 310.

1. Are these functions carried out by anyone besides the director?

Director	_____ man-weeks or	_____ % of time
Other	_____ man-weeks or	_____ % of time
Other	_____ man-weeks or	_____ % of time

302 ____ mw	

310. Development of New or Modified Control Strategies

This activity is defined to be the effort required to develop possible policies or control strategies for consideration by the agency management; it is expected that this effort will be conducted by staff members working very closely under the direction of the agency director, although the ultimate policy decisions are considered separately in activity 301. The quantitative analysis of such control strategies is also considered separately in activities 310-313. If manpower was separated into those activities, this (314) includes the balance; if not, it includes the total.

1. Given your organization, is it reasonable to separate the activities 302 and 310

   ____No; ____Yes: man years in 310 _____

2. Could you describe briefly the way in which you conduct these efforts?

310 ____my	

311
312
313
314

311. Climatological Dispersion Modelling

312. Economic Impact Analysis

313. Community Interaction and Social Impact Analysis

314. Quantitative Evaluation of Alternate Strategies

These activities provide for the quantitative assessment of the effectiveness and other impacts of proposed alternate control strategies, for purposes of assisting in decision-making, attempting to anticipate public reaction and avoiding difficulties, etc. Activities 311-313 represent specific major tools or capabilities that are a part of an overall assessment; activity 314 includes primarily the assessment of the strategy effectiveness in conjunction with the emission inventory. The development of the alternate strategies is considered in Activity 310; activity 310 can be used to include the entire manpower in 310-314 if quantitative subdivision is not possible.

Activity 311 is defined as the effort needed to maintain and use a climatological-scale dispersion model for purposes of control strategy planning, etc., including the gradual adaptation of existing standard computerized models to the topographic and other idiosyncrasies of the area(s) in question.

Activity 312 involves the preparation of economic analyses to provide reasonable estimates of the impact of regulations on impacted industries and the economic viability of the region as a whole.

Activity 313 is limited to the programmed interaction with survey panels of "unorganized" citizens as well as citizen interest groups and the analysis of the impact of proposed APC agency actions on the lifestyles of the community. Public hearings are included separately under activity 315.

1. Is it possible to separate all of these activities out from activity 310? ____yes, ____no, only activities _____, _____not at all.

2. Is a climatological-scale dispersion model used for purposes of control strategy planning? ____ extensively, ____seldom, ____never.

3. To what extent is it adapted to the topographic and other factors of the region? ____adapted, ____in progress, ____planned, ____do not plan to.

4. Discuss briefly how you undertake the quantitative evaluation of alternate control strategies? (314)

311
312 (2)
313
314

5. For each of the activities which can be predicted separately, indicate whether it is done by the APC agency or another (specify) group and what the manpower usage is:

Activity	APC agency	Other	# people	% time	manhours	
Climatological Dispersion Modelling	_____	____	_____	____	_____	(311)
Economic Impact Analysis	_____	____	_____	____	_____	(312)
Community Interraction Social Impact Analysis	_____	____	_____	____	_____	(313)
Quantitative Evaluation of Alternative Control Strategies	_____	____	_____	____	_____	(314)

311 ____mh	
312 ____mh	
313 ____mh	
314 ____mh	

315. Development and Adoption of New or Modified Control Regulations

This activity is defined as the efforts involved in developing the detailed technical and legal form of proposed regulations to implement the policies selected in activity 314, preparing the required supporting documentation, and seeing the regulations through the adoption procedure, including legislative liaison. It includes the manpower involved in preparing and conducting public hearings, except for the small effort in publicizing them, which is in activity 370.

Stationary Source Regulations

1. How is this activity conducted in your agency?

_____ by specifically-defined group of people

_____ on ad hoc basis, with contributions from:

_____% management

_____% engineers

_____% legal staff (____ in-house or _____)

2. What effort goes into developing and adopting regulations for stationary source control?

_____ new regulations/year; _____ man-weeks total

distribution: ____% mgmt., _____% engineers, _____% legal

Transportation Source Regulations

3. Status of transportation regulations?

_____ none required

_____ transportation control plan developed, regulations not yet adopted

_____ transportation regulations adopted

4. What effort goes into developing and adopting regulations for transportation source control?

_____ new regulations/year; _____ man-weeks total

distribution: _____% mgmt., _____% engineers, _____% legal

315 ____mw	

320. Network Design and Planning

In urban regions, where agencies already have an air quality/meteorological network in existance, this activity includes the effort to make the required decisions on rearranging and extending the network, including site selection, negotiation, and operating schedule analysis. In rural or outlying regions, the development of new networks is also included. Short-term source-oriented monitoring effort are not included.

1. How is (if at all) the re-evaluation of the AQ/meteorological network conducted? _____ none; _____ routine, systematic; _____ periodically as needed.

2. Briefly describe how and why the re-evaluation system is done: (include stimulant for re-evaluation - AQ, Met, SS, MS, IS, land use planning, political considerations - and any method used - modeling, emission inventory, etc.)

3. Manpower usage: _____ man-years per year

4. Are you now, or do you envision, developing a network for presently uncovered area; e.g., in response to requirements to prevent deterioration of air quality in unpolluted areas? _____No _____ Yes
Nature of plan _____.

5. Would you estimate the manpower needed for this effort?
_____ man-weeks per year.

320 ____my	

321. Laboratory Quality Control

This activity is defined as that effort to ensure the proper determination of pollutant samples and levels in the laboratory, such as systems of running known samples blindly through the wet chemical analysis techniques at periodic intervals. This activity does not include the calibration of samplers or automatic analyzers.

1. Considering the above definition, does your agency engage in this already? _____ yes; _____ no, _____ agency does it for us _____ no, not done at all.

2. Are there other activities which you conduct that you would consider "Laboratory Quality Control"? Briefly describe: (If any of these are included under other activities, pull them out of consideration before manpower questions.)

3. Number of known samples run _____
(If not run periodically, find out how frequently the checking occurs.)

4. Manpower usage

Task	Man-years
Checking wet chemical	_____
Other _____	_____
_____	_____

321 ____my	

322. Statistical and Engineering Analysis of Air Quality Data

This activity is defined as the effort involved in analysis of the air quality data, including the necessary adjunct use of meteorological data, either from the agency's network or from other sources; e.g., study of the temporal and directional variations in pollutant levels in conjunction with meteorological data and knowledge of pollutant sources. This activity does not include the preparation of routine data summaries (activity 220).

1. Which (if any) of the following is done by your agency?

AQ trends and non-deterioration	_____
AQ patterns	_____
Source identification	_____
Monitoring of known sources	_____
Transportation planning	_____
Indirect source planning	_____
Other: _____	_____
_____	_____

2. How much of this analysis is done by computer?

____ all, ____ most, ____ half, ____ little, ____ none

3. What overall level of manpower is used in this activity?

_____ man-weeks

322 ____mw	

340. Liaison with EPA and Other APC Agencies

This activity is defined as that intercommunication necessary for establishing and maintaining mutual understanding, unity of action, and prompt and effective mutual support, particularly among agencies sharing a single AQCR. It includes any meetings or extensive communications with EPA or other APC agencies, including STAPPA and ALAPCO meeting, etc.

1. Do you find that a defineable amount of time is spent on the activity as defined above? _____ yes, _____ no.

2. If yes, manpower usage:

	Man-days
Problem - specific meetings	_____
General policy meetings	_____
Other	_____
or Total	_____

340 ____md	

341. Liaison With Transportation Agencies

(From comments made on activities at the 130 level, you should know whether or not the review of mobile sources is (or will be) at the transportation planning agency _____, joint review _____, or APC agency _____ level. If there appears to be no significant liaison with other agencies, omit the following activity.)

This activity is specifically directed at the various meetings, communications, and joint-decision making processes necessary to coordinate the air quality reviews of proposed transportation projects and develop transportation control measures. This latter aspect would include the time needed for obtaining data from transportation agency records or jointly developing the needed data base.

1. Transportation control plan? _____ no, _____ complete, _____ in process.

2. Given the above definition, estimate man-months spent with the different agencies concerned with mobile sources.

Agency	Man-months
_____	_____
_____	_____

341 ____ mm	

342. Liaison with Land-Use Planning Agencies

(From comments made on activities at the 130 level, you should know whether or not the review of development proposals is (or will be) done by the planning agency _____, joint review _____, or APC agency _____. If there appears to be no significant liaison with land use planning agencies, omit the following activity.)

This activity is specifically directed at the various meetings, communications, and joint-decision making processes necessary to coordinate the air quality review of proposed construction and development projects with other review procedures.

1. Are regulations yet in effect concerning review of indirect sources, etc.? _____ yes, _____ no.

2. Given the above definition, estimate man-months spent with each of the different agencies concerned with land use planning.

Agency	Present Man-months	Anticipated Man-months
_____	_____	_____
_____	_____	_____

342 ____ mm

343. Provide Technical Assistance to Local APC Programs

This activity is restricted to state or possibly large regional agencies and includes the manpower required to provide support to, and oversight of, local or regional control programs that operate in a fashion subsidiary to the larger program. The technical assistance may include things such as direct laboratory support, computer data processing, and modeling.

1. Does your agency conduct any such activities? _____ yes (see below)
   _____ no:

2. If yes, which ones: Lab support _____, computer data processing _____, modeling _____, other (specify) _____.

3. Describe briefly the extent of each:

4. Manpower usage:

	At state	At local	Man-years	travel days/year
Lab support	_____	_____	_____	_____
Computer data processing	_____	_____	_____	_____
Modeling	_____	_____	_____	_____
Other _____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

5. Is the travel time a responsibility of the state_____ or local _____ agency?

6. In general, do you feel that the state or local agencies increase or decrease your total work load? _____increase, _____decrease Explain, especially in which areas the other agencies make a difference.

343 ____my	

350. Liaison With Other Non-APC Governmental Agencies

This activity is specifically directed at the various meetings and communications with other public agencies in the area of the agency's jurisdiction, such as Governors' or Mayors' offices, legislative bodies, administrative (e.g., purchasing) offices, Attorney Generals, and other enforcement bodies.

1. Is it possible to divide out the amount of time in this activity from the others (e.g., legislative liaison office or administrative assistant)? _____ yes, _____ no: (if no, omit balance).

2. Is it possible to separate out the amount of time spent on liaison with each of the above agencies? _____ yes, _____no:

3. Manpower usage:

Agency or Office	Man-months
Governor or Mayor	_____
Legislature	_____
Purchasing and other administrative	_____
Attorney General or other enforcement	_____
Other_____	_____
Total	_____

350 ____mm	

351. Staffing

This activity includes the identification of personnel requirements and selection criteria, and recruitment and hiring, as well as the review of current job specifications. It also includes the time spent in moderating employee disputes, supervising employee benefit programs and the administration of a personnel performance evaluation system.

1. Is there a defined individual or group with responsibility for staffing and personnel matters? _____ no, _____ yes (who), _____ man-years

2. Who is usually responsible for each of the above decisions and how much time is spent on each.

	Person	% of time	Man-months
Identification of personnel requirements	_____	_____	_____
Recruitment and Hiring	_____	_____	_____
Employee benefits, et al.	_____	_____	_____
Evaluation of personnel	_____	_____	_____

351 ____mm	

360-361. In-house Training

These activities involve the development, administration, and evaluation of a training effort administered within each individual APC agency. Activity 360 includes the identification of the training requirements and objectives (e.g., smoke school, engineering assistance), the preparation of required materials (e.g., ASA study, EPA training course manuals), and the administration of the program (e.g., formal class instruction, on the job training.) Activity 361 includes the manpower spent by the trainee.

1. Is a formal training or orientation program (as suggested above) carried out? _____no, _____yes; how long_____? mwk./yr._____
   Are short courses carried out? _____ wks./yr_____.

2. Is training conducted "on the job" _____yes, _____no
   How long before one is working at full steam? _____weeks

3. Is measurable time contributed by supervisors and co-workers?
   _____No; _____Yes, how much?_____(360) mwk/yr.

4. Manpower in training (Activity 361)

	No. of people/ year	x	Length of Course	or	Man-years
Administrative	_____		_____		_____
Lab support	_____		_____		_____
Stationary source	_____		_____		_____
Legal	_____		_____		_____
Other _____	_____		_____		_____
_____	_____		_____		_____

360 ____mw 361 ____my	

362. Training at EPA

This activity is defined as the release of personnel to take part in EPA training and refresher courses offered at Research Triangle Park and around the country.

1. Do any of your personnel take courses from EPA? _____yes, _____ no.

2. Are there any major differences by type of staff? _____ yes, _____ no. Explain.

3. Manpower usage

	No. of People	Weeks/Year	Man-weeks
Administrative	_____	_____	_____
Lab support	_____	_____	_____
Stationary source	_____	_____	_____
Legal staff	_____	_____	_____
Other _____	_____	_____	_____
_____	_____	_____	_____

362 ____mw	

363. Graduate School Training

This activity is defined as the release of personnel, either new or existing, to undertake relevant graduate school programs. These may range from a limited number of evening courses up to a full load of courses taken for an advanced degree.

1. Do any of your personnel take part-time courses at graduate schools? _____no, _____ yes. Describe.

2. Are there any differences by type of staff? _____no, _____ yes. Explain.

3. Manpower usage:

	Day or Evening Courses	For semester
Administrative	_____	_____
Lab support	_____	_____
Stationary source	_____	_____
Legal staff	_____	_____
Other_____	_____	_____
_____	_____	_____

4. How much of this is time lost from work? _____ man-hours/year

5. Do you now, or do you anticipate, releasing staff for full-time study? _____ no, _____ yes. Describe

363 ____mh	

364. Professional Activities

This activity is defined as the time allotted for the release of personnel to attend conferences and exchange ideas with other professionals.

1. Are personnel ever released for professional activities (as defined above)? _____ no, _____ yes: _____ APCA meetings
_____ Other national meetings
_____ Local meetings
_____ Other _____

2. Time in travel and meetings, etc.

	No. of People	x	Weeks/Year	or	Man-years
Management	_____		_____		_____
Laboratory staff	_____		_____		_____
Engineers	_____		_____		_____
Legal staff	_____		_____		_____
Other technical:					
_____	_____		_____		_____
Non-technical:					
_____	_____		_____		_____

3. How much time is expended in preparatory activities, such as writing papers, planning programs, etc. _____ man-years.

364 ____my	

370. Public Information

This activity is defined as the active, organized dissemination of information on the APC agency, the air pollution problem, and proposed agency actions. Press releases, prepared articles, school and community group presentations would be included in this activity. The conduct of public hearings is not included, although dissemination of public notices is.

1. Do you currently have anyone on your staff specifically engaged in this type of activity? _____yes, _____no
   If no, how is this handled? Not at all _____ or by other _____

2. Would you consider this an accurate definition of the way the activity is undertaken? _____ yes, _____ no. How different?

3. Is it possible to break up the time spent on each of the various forms of public information dissemination -- press releases, prepared articles, school presentations, community group presentations? _____ yes, _____ no. How or why not?

4. Is it possible to break up the time spent on each of the various topics -- APC agency, general information, proposed agency actions? _____ yes, _____ no. How or why not?

5. Manpower usage (in manhours):

Press releases	_____
Prepared articles	_____
School presentations	_____
Community group presentations	_____
Other_____	_____
or Total _____	

370 ____mh	

371. Library and Archives

This activity is defined as the maintenance of a library of references, current publications, and in-house documents, including required maintenance of plans and documents for public use. It also includes any technical service of reviewing periodicals and alerting others to appropriate material.

1. Do you currently have anyone on staff engaged in this type of activity? _____ yes, _____ no.
   If no, how is this handled? not at all _____, by other _____

2. Would you consider this an accurate definition of the way the service is provided? _____ yes, _____ no. How different?

3. Manpower usage:

	No. of people	x	% time	or	Man-weeks
APC Agency	_____		_____		_____
Other_____	_____		_____		_____

371 ____mw

372. Editing and Graphic Services

This activity is defined as the editorial and graphic arts assistance in technical report production and the preparation of public information materials.

1. Do you currently have anyone on staff engaged in this activity? Yes No

   If no, how is this activity handled?

2. Manpower usage

	# people	x	% time	or manyears
APC Agency	_____		_____	_____
Other	_____		_____	_____

372 ____my	

373. Effects Surveillance

This activity is defined as that effort aimed at surveying the effects of pollution on humans, vegetation, livestock, soiling of buildings, corrosion, etc. Time spent in cooperation with national effects surveillance efforts are included, as are local efforts, aimed either at unique local pollution problems or at simply providing local estimates for planning and public information purposes. Static sensor field monitoring of materials effects is included elsewhere.

1. Do you conduct, or expect to conduct, any activities of this type?

_____ None

_____ Would cooperate, if asked

Which activities

_____ Summarize local health statistics

_____ Compile local economic statistics

_____ Other (specify) _____

_____ _____

2. Manpower usage: _____ man-weeks per year

373 ____mw	

374. Photographic Services

This acitivty is defined as that effort expended in pictorally documenting violations, hearings, conferences, etc. or in other public relations activities involving use of photographic services. It would include any time spent in taking and processing pictures.

1. Do you currently have anyone on your staff engaged in this type of activity? _____ yes, full time

   _____ yes, ____man-hour

   _____ no, professional outside help

   _____ no, not done at all

2. Does the time given above include processing of pictures?

   _____ no, done by regular services

   _____ yes, ____% of total time spent

3. For what purpose are photographic services performed?

   _____ violation documentation _____% of time

   _____ public relations _____% of time

   _____ other _____ _____% of time

374 ____mh	

390. Clerical Support for Administrative Staff

1. How many secretaries (clerks) are responsible to your administrative and management staff? _____ Number of staff _____

2. Is all their time spent on support for this category?
_____ yes, _____ no, only _____%

390 ____my	

391. Clerical Support for Laboratory Staff

1. How many secretaries (clerks) are responsible to your laboratory staff? _____ Number of staff? _____

2. Is all their time spent on support for this category?
_____ yes, _____ no, only _____ %

391 ____my | ____

392. Clerical Support for Stationary Source Inspectors

1. How many secretaries (clerks) are responsible to your stationary Source Inspectors staff? _____ Number of staff? _____

2. Is all their time spent on support for this category?
_____ yes, _____ no, only _____%

392 ____my	

393. Clerical Support for Legal Staff

1. How many secretaries (clerks) are responsible to your legal staff?

_____ Number of staff? _____

2. Is all their time spent on support for this category?

_____ yes, _____ no, only _____ %

393 ____my	

394. Clerical Support for Other Technical Staff

1. How many secretaries (clerks) are responsible to other technical staff? _____ Number of staff? _____

2. Is all their time spent on support for this category?
_____ yes, _____ no, only _____ %

394 ____my	

Activity #_____

Are there any anomalous instances or events (particular source, episode, etc.) which accounts for more than a normal share of the manpower requirements. Yes No

State instance, % of time, and reasons:

Ideal manyears for this task

At present: _____my's or _____% change

Reasons for difference from actual usage:

In two years: _____my's or _____% change

In five years:_____my's or _____% change

Reasons for changes (increased development, compliance achievement, control equipment requirements, current new Federal Requirements, etc.). State reasons and how and why you expect them to affect manpower.

Are there any other factors not previously mentioned which you feel have a direct or indirect relationship to the amount of manpower needed for the proper completion of this task? State factors and give any known (or felt) relationships.

Are there any anomalous factors concerning your agency or area of jurisdiction which may make the manpower requirements strikingly difficult from other APC agencies? Yes No

State the factor (s), reasons, and effect on manpower:

Activity #_____

Rate this activity's importance on a scale of 1 to 10 (1 least important) for each of the following categories.

attainment of air quality standards _____

maintenance of air quality standards_____

prevention of significant deterioration _____

public PR value _____

political PR value _____

industrial PR value _____

Man-years	Man-months	Man-weeks	Man-days	Man-hours
101 ____	106 ____	301 ____	111 ____	310 ____
102 ____	107 ____	315 ____	112 ____	311 ____
103 ____	108 ____	322 ____	113 ____	312 ____
104 ____	341 ____	360 ____	120 ____	313 ____
105 ____	350 ____	362 ____	130 ____	363 ____
109 ____	351 ____	371 ____	131 ____	370 ____
110 ____	____	373 ____	132 ____	374 ____
133 ____	____	____	160 ____	____
134 ____	____	____	230 ____	____
135 ____	____	____	231 ____	____
150 ____	Total ____ mm	Total ____ mw	340 ____	Total ____ mh
151 ____			____	
152 ____			____	
153 ____			____	
154 ____			Total ____ md	
155 ____				
156 ____				
201 ____				
202 ____				
203 ____				
204 ____				
205 ____				
210 ____				
211 ____				
212 ____	364 ____	____	my ____	
220 ____	372 ____	Total ____ my	$\frac{mm}{12}$ ____	
221 ____	390 ____			
222 ____	391 ____		$\frac{mw}{50}$ ____	
314 ____	392 ____			
320 ____	393 ____			
321 ____	394 ____		$\frac{md}{250}$ ____	
343 ____	____			
361 ____	____		$\frac{mh}{2000}$ ____	
			Total ____ my	

Personnel - 100

Personnel Categories / Activities	101 Routine Insp.	102 Eng. Insp.	103 Hazardous Insp.	104 Stat. Source Test.	105 Complaint Patrol	106 Devel. Compliance	107 Monitor Compliance	108 Source Record-Keeping	109 Supp. Control Strat.	110 Formal Legal Act.	111 Enforce. Reports	112 Progress Reports	113 Emission Reports	120 Tax Exemption	130 Tech Review Devel.	131 Devel. Plan Review	132 Micro Model & A.Q.	133 Rev. Source A.Q.	134 Land Use Plan	135 EIS Rev.	150 MS. Emissions	151 Dynamometer	152 Idle-modes	153 Equipment Insp.	154 Oversee M.V. Test	155 Surv. M.S. Emission	156 M.S. Enforcement	160 Episode Control				

Personnel - 200

Personnel Categories / Activities	201 Field Operation	202 Routine Calib.	203 Equip. Maint.	204 Equip. Repair	205 Dynamic Calib.	210 Sample Prep.	211 Analysis: Manual	212 Analysis: Auto	220 Data: Manual	221 Data: Semi-Auto.	222 Data: Auto.	230 AQ Reports: Manual	231 AQ Reports: Comp.

Personnel - 300

Personnel Categories / Activities	301 APC Board	302 Program Management	310 Develop Strat.	311 Dispersion Model	312 Econ. Analysis	313 Social Analysis	314 Evaluate Strat.	315 Devel. & Adopt. Res.	320 Network Planning	321 Lab Quality Cont.	322 A.Q. Data Analysis	340 Liaison: EPA, APC	341 Liaison: Transp.	342 Liaison: Land-Use	343 Local APC Assist.	350 Liaison: Non-APC	351 Staffing	360-1 In-house Training	362 EPA Training	363 Grad. School Trng.	364 Prof. Activities	370 Public Info.	371 Lib. & Archives	372 Edit & Graph	373 Effect Surv.	374 Photo. Services	390 Support: Admin.	391 Support: Lab.	392 Support: Inspect.	393 Support: Legal	394 Support: Other	

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(Please read Instructions on the reverse before completing)

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

This report presents a computerized manpower planning model designed to estimate the manpower requirements of nonfederal control agencies and to project the effects on manpower levels of various policy options and other decisions. In contrast to the model in current use, the new model is based on data primarily from states rather than urban areas, utilizes about 40 functional activities compared to 17, and is based as much as possible on direct air pollution characteristics of the geographic region within which the agency has responsibility, such as number of sources and level of monitoring activity, rather than economic and demographic characteristics.

The predictive relationships formulated for the model are based on empirical information obtained from nine existing agencies — seven state agencies and two local agencies within two of the seven states. The agencies to be studied were not selected via a randomized procedure, but were selected in full knowledge of their size, philosophy, strong and weak points, and the nature of the area within which they have responsibility. This was because the intent of the model is not to project manpower utilization as it actually occurs, but rather to project manpower utilization as it should be, that is, to estimate the manpower needed to operate an agency in an adequate fashion, meeting all its responsibilities in a satisfactory manner.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Control Programs Manpower Computer Model	Air Pollution Control Control Agencies Manpower Resources	

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