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Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-450/4-82-014
February 1982

Air

Cost Analysis of Proposed Changes to the Air Quality Modeling Guidlines

Errata

Cost Analysis of Proposed
Changes To The Air Quality
Modeling Guidelines

Page 11. Heading for fifth column of table should be, "Averaging Period(s)".

Page 12. 3rd Paragraph

Third bullet should be, "number of load conditions".

Page 29. Table 8

Total cost figure for Run number 1 should be 76,900, not 75,400.

Computer budget figure for Run number 3 should be 160, not 190.

Page 30. Table 9

Note b should refer to Appendix E, not Appendix C.

Page 32. Table 11

Figure in second column, first line should be 76,900, not 75,400.

Page A-18. Table A-6(e)

The column headed Materials should reference the footnote, i.e., change to read, "Materials[a]".

The total cost in the Materials column should be 13,600, not 53,500.

Page D-1. 3rd bullet, Second sentence

Change "single frequency distribution, etc." to read "a joint frequency distribution summary of wind speed, wind direction, and stability category."

Page E-5. Table E-1(b)

The total cost figure for the task, "Acquisition and Preparation of Meteorological Data" should be 63,920, not 63.920.

Change total cost figure to 76,920 and "Call" value to 76,900.

Page E-17. Table E-2(e)

Change total cost for Acquisition and Preparation of Emissions Data to 1,340.

Page E-19. Table E-2(g)

The hours and dollars under total cost for Analysis of Results and Report Preparation are erroneously offset. Strike out the figures given and insert 704 in the hours column and 19,890 in the dollars column. The same type of correction is needed on pages E-23 and E-32.

Page E-26. Table E-3(e)

Add a total cost for Model Execution of 1,260 and change the total cost for Analysis of Results, etc to 17,260.

Page E-28. Table E-3(g)

Change Total cost figures to 89,290.

Page E-32. Table E-4(b)

Change the title for the third Modeling analysis task to "Receptor Siting and Model Option Selection".

Page E-37. Table E-4(g)

Change Total Cost figure to 126,920.

Page E-41. Table E-5(b)

Change total cost for Acquisition and Preparation of Emission Data to 440.

Page E-44. Table E-5(e)

In the heading, for METEOROLOGICAL DATA: change to read, "1 year onsite hourly".

Page G-8. First bullet, First Sentence

Change "Inco." to "Inc."

EPA-450/4-82-014

Cost Analysis of Proposed Changes to the Air Quality Modeling Guidelines

by

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FOREWORD

EPA held a series of public meetings in October 1980 for the purpose of discussing proposed revisions to the Guideline on Air Quality Models, EPA 450/2-78-027. During those meetings there were many comments concerning the apparent disregard of costs as a factor in the EPA selection of recommended models and data bases.

This report is designed to provide a basis for response to the comments EPA received and will be used in the development of revisions to the guideline. Determining the representative cost of a modeling study is exceedingly difficult since there is no "typical" model application. The complexity and therefore the cost of an analysis varies with the complexity of the problem and with the availability of suitable modeling tools and model input requirements. No two groups will design or conduct a modeling study in precisely the same manner. Also, labor and computer rates vary considerably. To arrive at a figure that typifies the cost of a regulatory modeling analysis requires numerous assumptions. Therefore, great care should be exercised in the use of the information provided in this report. The cost figures should not be applied except in the context of the assumptions made in their development.

In addition, there is no information in this report on the potential benefits which might be realized from the use of more costly modeling options. Such benefits would accrue from a more adequate identification of emission limits or determination of increment consumption. These could involve cost savings either related to avoiding unnecessary environmental damage or avoiding unnecessarily expensive control equipment. The magnitude of these potential savings could easily far outweigh the additional modeling costs involved. While these potential savings cannot be quantified on a nationwide basis, their potential magnitude should receive substantial weight in specific decisions on the choice of models and data bases.

David H. Barrett
Project Officer

CONTENTS

CONTENTS (continued)

TABLES

TABLES (continued)

SECTION 1

INTRODUCTION

The Environmental Protection Agency (EPA) has developed a set of guidelines to be followed in any air quality modeling study performed for the EPA. The Guideline on Air Quality Models[1] (AQMG) was issued in 1978 as a part of the Office of Air Quality Planning and Standards (OAQPS) Guideline Series. Since the release of the 1978 AQMG, the EPA has had a chance to review its effectiveness and gather together recommendations on how the document could be improved. In 1980, a proposed revision to the 1978 AQMG was issued for review.[2] GCA has been contracted by OAQPS of EPA, to examine some of the costs associated with implementing certain features of the 1980 proposed revision.

An air quality modeling analysis consists of the following tasks:

- data acquisition,
- data processing,
- model execution, and
- analysis of results and report preparation.

In Section 2 of this report, the costs of performing each of the above tasks is determined based on the 1978 AQMG versus certain additional provisions of the proposed revisions. The cost analysis is performed for the following set of modeling situations:

- rural, single-source,
- rural, multi-source,
- urban, single-source,
- urban, multi-source,
- rural/urban, industrial source complex, and
- line source, roadway intersection.

Excluding the line source situation, all modeling situations are assumed to concern TSP and SO_2.

For each modeling situation, the cost of acquiring and processing the emission and meteorological data is assessed. Requirements under both the 1978 AQMG and the 1980 proposed revision to the AQMG are considered. In the case of the proposed revision document, where appropriate, the cost of the option of collecting meteorological data onsite is assessed.

The cost of model execution is analyzed for the modeling situations listed above. Models recommended in the 1978 AQMG and models recommended in the 1980 proposed revision to the AQMG were run by GCA. Complete model runs for 1 year of meteorological data were made whenever possible. If the cost of a complete run was too prohibitive, a sensitivity study was conducted to estimate computer costs.

The final task in an air quality modeling study is analyzing the results and preparing the report. The cost of the total direct labor to complete this task is estimated based on GCA experience. Modeling requirements, as stated in the 1978 AQMG and the proposed revision to the AQMG, determine the amount of labor (cost) required for this concluding task.

The cost estimates for the various components of the analysis were combined to provide an estimate of the total cost for performing an air quality modeling analysis. In addition to estimating the cost of compliance with the 1978 AQMG and the 1980 proposed AQMG, the cost of combinations of the two documents is analyzed. The intent here is to isolate the cost of each proposed change in modeling requirements.

Based upon the cost assessment of air quality modeling studies under 1978 AQMG requirements and 1980 proposed AQMG described in Section II, a set of related issues are addressed. They are:

- Section 3--Sensitivity of Modeling Costs to Level of Data Input and Model Cost Comparisons

  The sensitivity of modeling costs to differing levels of required data input is assessed. Also, the cost of an air quality modeling analysis under the same modeling situation but using different models is considered. A variety of modeling situations are considered.

- Section 4--Typical Cost of Applying Air Quality Models

  Costs of air quality modeling analyses are estimated for using models under consideration for recommendation by EPA, as well as for models already recommended. If appropriate, the cost of an analysis includes control strategy analysis.

- Section 5--Cost of Demonstration Study of Nonguideline Models

  Estimated costs are presented for conducting a demonstration study as outlined in the 1980 proposed AQMG. A detailed breakdown is provided for the cost of carrying out the three field study options, described in the revision document.

- Section 6--Nationwide Impact of Proposed Revisions on PSD and SIP Modeling

  Estimated costs of air quality analyses determined in Section 3 are applied to the estimated number of PSD permits and SIP revisions per year. This gives an indication of the overall impact of the requirements in the proposed revision.

- Section 7--The Comparative Cost of a Screening Study

  The cost of performing a screening analysis for a rural point source is estimated. This cost is compared to the cost of a refined study.

- Section 8--Cost Comparison of Determining SIP Emission Limits from Monitoring Data versus Modeling

  The monitoring requirements outlined in the 1980 proposed revision document are applied to a point source in a valley and the cost of the study is determined. The costs are compared to the costs of a modeling study.

- Section 9--Comparative Cost of Block Averaging and Running Averaging Calculations

  All of the short-term recommended models perform block averaging. The EPA has a modified version of CRSTER that calculates running averages. EPA's findings on the cost impact of utilizing CRSTER as a running average model are applied to judge the impact of similar changes in running other models.

- Section 10--Comments on Other Air Quality Modeling Issues of Concern

  Two additional issues of concern to the EPA are addressed. First, the cost information gathered by GCA is applied to determine the cost of model validation and evaluation of a point source in complex terrain. Next, the cost of a modeling study involving the photochemical grid model, Urban Airshed, is compared to the cost of a model applications involving Gaussian models.

SECTION 2

ESTIMATED COST DIFFERENCE BETWEEN CERTAIN 1978 GUIDELINE RECOMMENDATIONS AND 1980 PROPOSED REVISIONS

INTRODUCTION

The 1980 proposed guideline revisions place much more emphasis on: use of 5 years of National Weather Service (NWS) data (or a year of onsite data), rather than 1 year of NWS data; use of three load conditions rather than one in modeling point sources; and greater receptor resolution. The proposed revisions also recommend the use of population/land use data to characterize an area as rural or urban and make a number of changes in recommended models. Although a number of the items related to the level of data input (e.g., 5 years of NWS data) had been endorsed in the 1978 Guidelines, different agencies and jurisdictions have adopted differing requirements. Also, requirements have tended to be established on a case-by-case basis. A major purpose of the proposed revisions was to achieve consistency in both level of data input and model selection.

To estimate certain cost differences between the 1978 Guidelines and the proposed revisions, it is necessary to make some assumptions about what has been common practice under the 1978 Guideline and what would be common practice if the proposed revisions were adopted. For the purpose of this study the following assumptions are made:

	1978 guidelines	1980 proposed revisions
Meteorological Data	1 year NWS	5 years NWS or 1 year onsite
Number Load Conditions	1	3
Receptor Resolution	5 receptor rings or 5 km grid plus maximum impact receptors	10 receptor grids or 1 km grid plus maximum impact receptors
Use of land/use population data to classify areas as urban or rural	No	Yes

Also, cost comparisons have been made for certain changes in recommended models in the proposed guideline revision. For convenience, this common set of assumptions will be referred to as the 1978 guideline requirements and the 1980 proposed revisions, respectively.

The purpose of this section is to describe the methodology used in deriving cost estimates which provide a comparison of some of the 1978 Guideline recommendations and the corresponding recommendations in the 1980 proposed revisions.

The tasks that make up an air quality analysis are described briefly in Table 1. In this report, cost estimates are made for the labor, computer time, and material requirements necessary to satisfy the 1978 guideline requirements and the 1980 proposed revisions. A detailed cost analysis, including results of model runs performed by GCA, is made for the following models:

- CRSTER,
- MPTER,
- RAM,
- ISC,
- CDM,
- TEM8-A, and
- TCM

Computer Costs

All model executions were made on an IBM 3033N and all computer costs herein reflect this fact. It is important to note that these cost figures are the result of the costing algorithm in effect at the particular facility where the computer runs were made. They should not be interpreted as necessarily indicative of the cost on similar IBM hardware or that of other vendors. Depending upon the commercial facilities used, the costs could vary significantly from those given in this report. Appendix I gives the cost algorithm in effect at the facility used during the study. In addition, tables are given which provide rough approximations of the relative performance of most large scale computers as well as several smaller computers compared to the IBM 3033N. It is emphasized that these conversion factors are only rough approximations and should only be used as such.

Labor Cost Structure

In arriving at a dollar cost for the labor required under each task, GCA defined a labor grade and cost scale as follows:

TABLE 1. AIR QUALITY MODELING PROCEDURE

Task	Description
Data Acquisition	Emission, meteorological and source location maps must be acquired. If onsite meteorological data is being collected, there are additional equipment and maintenance costs.
Data Preparation	Preliminary calculations and data processing must be accomplished before modeling can proceed. In particular, the meteorological data must be translated into a model compatable format. This can be a major effort if onsite meteorological data is involved. In addition, receptor locations are determined with the aid of the PTPLU screening model.
Model Execution	Once emission, meteorological and receptor inputs have been prepared and all model options have been selected, the model run(s) are made.
Analysis of Results and Preparation of Report	Model results are analyzed and comparison with acceptable NAAQS, PSD increment and/or emission offset impacts is made. Entire study is documented and the report is presented to the appropriate federal, state, and local government agencies.

Labor grade	Definition	Cost per week (1980 dollars)
10	Group Scientist	2,000
9	Principal Scientist	1,680
8	Staff Scientist	1,380
7	Senior Scientist	1,180
6	Scientist	990
5	Junior Scientist	780
4	Technical Illustrator	720
3	Technical Typist	580

The costs per week reflect the following: direct labor (37.5 percent), salary related costs (12.2 percent), overhead (46.7 percent), and administrative expenses (3.6 percent). They should be representative of the fee a consulting firm would command of federal and state agencies for 1 week of a given labor grade's time. However, the labor cost figures quoted here are only estimates, which GCA hopes accurately portray the cost of the air quality analyses addressed in this report.

In the discussion of air quality modeling tasks that follows, the labor grade mixes and hour estimates are based upon GCA's experience over the last 3 years. The labor estimates are intended to represent typical requirements for a credible, professional performance of the required work.

COST ESTIMATES OF AIR QUALITY MODELING TASKS

The cost estimates for an air quality analysis were arrived at by breaking up an air quality analysis into the following procedure:

- acquisition and preparation of emission data,
- acquisition and preparation of meteorological data,
- labor and computer costs of siting receptors and selecting model options (including rural/urban option),
- computer cost of model execution,
- labor cost of model execution, and
- cost of analysis and report preparation.

Each step of the procedure was addressed separately and is discussed below. Cost estimates for some of the steps were independent of the model involved. The emission data task, for example, depends only upon the type of emission set. Other tasks, like computer cost of model execution, relate directly to the model used.

Acquisition and Preparation of Emission Data

A cost estimate was made for the following six emission data sets:

- Set 1--A three stack power plant, a single-source, point source situation representative of emissions from a moderate size power plant,
- Set 2--The multi-source, point source modeling situation, example 4 in the MPTER users manual,
- Set 3--The Hypothetical Potash Plant, representative of an industrial complex and used as an example in the ISC users manual,
- Set 4--A multipoint and multiarea source modeling situation from the RAM users manual,
- Set 5--A moderate sized urban area point and area source modeling situation, the Hartford urban area emission data base as compiled in the NEDS inventory and in the 1979 Connecticut SIP, and
- Set 6--A line source test data set used as example 3 in the CALINE 3 users manual.

Emission sets 1 through 5 are documented in Appendix A. The line source data set will be discussed later in this section.

Set 1, Table A-2a in Appendix A, is data for a hypothetical three stack power plant. It is representative of the type and amount of emission data required in a single-source, point source analysis. An examination of Table A-2a reveals the emission requirements for this modeling situation are minimal.

A multi-source, point source situation is exemplified by Table A-2b. The type of information required for each point source is the same as in the modeling situation represented by Table A-2a, but the number of point sources has increased significantly. This will be reflected in the amount of effort required in preparing the emission data sets. Also, the fact that all stacks are not collocated as in the previous situation will result in a greater effort being required to site receptors.

The hypothetical potash plant emission data set is presented in Table A-2c, in ISC style format. There are 16 sources in all at this hypothetical complex industrial site consisting of: 1 stack, 1 area source and 14 volume sources. All the sources are at one site as in emission set 1 but a significant amount of emissions come from nonpoint sources.

Set 4 is documented in Table A-2d. It consists of 12 point sources and 15 area sources over a 15 by 15 kilometer area. This emission data set will be used to estimate the cost of modeling a multisite situation in an urban area. This data set is not meant to be representative of an entire urban area. However, set 5, listed in Table A-2e is representative of a point and area source emission data set for a moderate sized urban area. There are 28 point sources and 119 five-kilometer-wide area sources.

GCA reviewed emission data sets 1 through 5 and based on GCA modeling experience estimated the amount of effort involved in acquiring and preparing the emission data sets. The labor cost estimates are presented in Appendix A, first assuming only one load condition, Table A-3a, and next assuming data was required for three load conditions, Table A-3b. In making the cost estimates GCA assumed that the emission data would be readily available through industry and government agencies. Examination of Tables A-3a and A-3b shows that, as might be expected, the time required to prepare a single-site point source data set is much less than the time required to prepare an emission data set for a metropolitan urban area. Part of the added cost is due to increased amount of time required to verify the emission data files.

Acquisition and Preparation of Meteorological Data

The cost of acquisition and preparation of meteorological data from two sources:

- National Weather Service (NWS) data from the National Climatic Center (NCC), and
- Onsite data, collected as part of the analysis, was determined.

The cost of purchasing hourly NWS meteorological data from NCC is documented in Table A-4. The cost of wind speed-wind direction stability category frequency distribution (STAR) data used by climatological models is presented in Table A-5. The cost of collecting the required data onsite is addressed in Appendix B. The acquisition and processing costs in Tables A-4, A-5 and Appendix B for meteorological data are combined in Table A-6. Five options are analyzed in Table A-6:

- NWS 1 year hourly data,
- NWS 5 years of hourly data,
- one NWS STAR data set 1
- five annual NWS STAR data sets, and
- onsite meteorological data.

As explained in Appendix B, the equipment costs for the onsite meteorological data option are amortized over the useful life of the equipment.

Labor and Computer Costs of Selection of Receptor Location and Model Options

The costs involved in locating receptors, determining urban/rural classification, and selecting model options is addressed in Table A-8. The labor and computer estimates are based on GCA experience. In Table A-8a to A-8c the cost of preparing receptor resolution-load condition for the modeling situations are determined for:

- 5 ring (5 km grid) resolution and 1 load condition,
- 10 rings (1 km grid) resolution and 1 load condition, and
- 10 rings (1 km grid) resolution and 3 load conditions (or control strategies).

A cost estimate applicable to emission sets 1, 2 and 3, which are all point source emission sets, and a cost estimate applicable to emission sets 4 and 5 are made on each table.

Cost of Model Execution

A detailed analysis was made of the following combinations of emission sets, models and meteorological data:

Run ID No.	Model	Urban/rural classification	Meteorology (surface/upper air)	Emission data set
1	CRSTER	Rural	1977 Cleveland/Buffalo	1
2	CRSTER[a]	Rural	1977 Cleveland/Buffalo	2
3	CRSTER[a]	Rural	1977 Cleveland/Buffalo	3
4	MPTER	Rural	1977 Cleveland/Buffalo	2
5	RAM	Urban	1977 Cleveland/Buffalo	1
6	RAM	Urban	1977 Columbus/Patterson	4
7	ISC	Rural	1977 Cleveland/Buffalo	3
8	CDM	Urban	1974 Hartford/Albany	5
9	TEM8-A	Rural	1977 Cleveland/Buffalo	1
10	TEM8-A	Rural	1977 Cleveland/Buffalo	2
11	TEM8-A	Urban	1977 Columbus/Patterson	4
12	TCM	Urban	1974 Hartford/Albany	5

[a]This was a run with CRSTER in an attempt to roughly approximate the source configuration. For Run ID No. 2, this consisted of considering the 30 point sources as 7 collocated clusters. In Run ID No. 3, the 16 sources were grouped into 4 collocated sources, with the volume and area sources given the same effective release heights used by ISC.

The input requirements and output option of each model are listed in Table 2.

TABLE 2. INPUT REQUIREMENTS AND CHARACTERISTICS OF MODELS ANALYZED BY GCA

	Input requirements				
Model	Meteorology	Emission	Receptor configuration	Averging period(s)	Number of pollutants
CRSTER	1 year of hourly data.	Up to 19 co-located point sources.	5 rings, 36 receptors per ring.	3 and 24 hour with option for 2 and 8 hour.	1
MPTER	1 year of hourly data.	Up to 250 point sources on user specified grid.	A maximum of 180 receptors. 1 to 5 rings, 36 receptors per ring and/or discrete receptors.	Five highest concentrations for 3, 8, 24 hour averages at all receptors with option for 4, 6, 12 hours.	1[a]
RAM	1 year of hourly data.	Up to 250 point sources and 100 area sources.	Same as MPTER.	Same as MPTER.	1[a]
ISCST	1 year of hourly data.	Up to 100 point, area, line sources.	A maximum of 400 receptors entered by polar or cartesian coordinate system. A combination of gridded and discrete receptors may be used.	Any combiantion of 1, 2, 3, 4, 6, 8, 12, 24 hour averaging.	1
CDM	STAR--wind direction, wind speed, stability frequency, of occurrence data.	Up to 2500 area and 200 point sources.	Any number of discrete receptors located on a user defined grid. (250)	Annual.	1 or 2[b]
TEM8-A	1 year hourly data.		Equally spaced grid.	24 hours only.	1 or 2[b]
TCM	STAR data.		Equally spaced grid.	Annual.	1 or 2[b]
HIWAY2	Worst case.	Any number of line sources.	Up to 50 located on a user specified coordinate system.	1 hour average.	1
CALINE3	Worst case.	Up to 20 line sources.	Up to 20 located on a user specified coordinate system.	User specified	1

[a]Although this model simulates only one pollutant per run, it was assumed that for the modeling situations involved results for the second pollutant can be obtained by scaling source contributions of the first pollutant.

[b]The user has the option of modelng one or two pollutants per run. In this study, it was assumed that two pollutants were modeled per run.

Complete runs were made, assuming 5 rings or 5 km resolution, cost permitting. If complete runs were not made, lengthy sensitivity studies were carried out. The details of GCA's analysis for runs number 1 through 12 are presented in Appendix C. The results are summarized in Table 3.

The computer costs of a single run as summarized in Table 3 for all 12 model runs were used to make computer budget estimates for each model run under various levels of input data requirements. Appendix C, Tables C-16a through C-16l, list the number of model runs and computer budget associated with a given level of data input requirement. The computer budget is equal to the number of model runs times the cost of CPU time of a run (listed in Table 3) times an "error" factor of 1.2. The error factor is designed to account for the cost of bad runs that are a part of any modeling exercise.

Labor Costs of Model Execution

The cost in man-hours of running the models was estimated for each model for six combinations of:

- meteorological data,
- receptor resolution, and
- number of local conditions.

The use of 1 year of meteorological data (NWS or onsite) and 5 years of NWS meteorological data was considered. The 5 km (or 5 ring) and 1 km (or 10 ring) receptor resolution options were examined. Labor costs assuming one load condition and three load conditions (or baseline plus two control strategies) were considered. Cost tables for the six options are presented in Table C-17a through C-17f.

Cost of Analysis of Results and Report Preparation

The cost of analyzing the results of a modeling study and writing a report is examined in Appendix D. Nine combinations of modeling requirements are considered for point source models (emission sets 1, 2 and 3) in Tables D-1a through D-1i. The first option meets the 1978 guideline requirements (1 year of NWS hourly data, 5 rings or 5 km receptor resolution and 1 load condition) and the eighth and ninth options would meet the requirements of the 1980 proposed revisions (5 years of NWS hourly data or 1 year of onsite hourly meteorological data, 10 rings or 1 km receptor resolution and three load conditions). Six options are considered for the urban area data sets (emission sets 4 and 5). The onsite meteorological data option is not appropriate for urban area analyses. This eliminates three of the options considered for emission sets 1, 2, and 3. Also, instead of estimating the cost of an analysis with three load conditions the cost of analyzing the results of a baseline plus two control strategy runs is considered. Tables D-1j through D-1o are used in cost estimates of analyses using emission set 4

TABLE 3. COMPUTER COSTS OF A 1 YEAR SIMULATION OF SO_2 AND TSP AIR QUALITY IMPACTS ASSUMING A 5 KILOMETER OR 5 RING RECEPTOR RESOLUTION. IN THE CASE OF GRID MODELS, COMPUTER COSTS ARE BASED ON THE USE OF A RECEPTOR ARRAY WITH EQUIVALENT COVERAGE AND THE SAME NUMBER OF RECEPTORS (180) AS CIRCULAR FORMAT MODELS.

Emission set	Run No.	Model	Computer cost[a] CPU (sec)	Computer cost[a] Cost (dollars)	Computer cost reference table
1	1	CRSTER	76.82	65.05	C-1
1	5	RAM[b]	565.65[c]	527.44[c]	C-4
1	9	TEM8-A[d,e]	93.28	105.55	C-10
2	2	CRSTER[f]	40.83	34.26	C-1
2	4	MPTER[b]	5,051.62[c]	5,314.79[c]	C-2
2	10	TEM8-A[d,e]	931.00[c]	1,053.00[c]	C-12
3	3	CRSTER	78.43	65.79	C-1
3	7	ISC	2,190.16[g]	2,956.09[g]	C-7
4	6	RAM[b]	1,859.70[c]	1,737.06[c]	C-5
4	11	TEM8-A[d,e]	471.00[c]	533.00[c]	C-13
5	8	CDM[d]	513.45[c]	418.42[c]	C-9
5	12	TCM[d]	10.00[c]	10.00[c]	C-14

[a]Computer costs are based on an IBM 3033N. The cost formula used, as well as a comparison of the IBM 3033N to other commonly used computers, is presented in Appendix I. Also, the computer costs are based on a single run. In some cases both pollutants can be modeled in a single run.

[b]Only one pollutant can be modeled per run but it was assumed that results for the other can be determined by scaling source contribution output tables.

[c]Estimated data, see Appendix C for method of estimation.

[d]Both pollutants can be simulated in one run.

[e]TEM8-A at present does not calculate 3-hour averages. In estimating the computer budget, GCA assumed that the cost of an additional averaging period would be minimal.

[f]This modeling situation would require 7 CRSTER runs per pollutant for a complete 1 year simulation.

[g]This is the average cost of a single run taking into account that a TSP run (one averaging period) will cost slightly less than an SO_2 run (two averaging periods).

Note: All costs are in 1980 dollars.

and Tables D-1p through D-1u are cost estimate tables for emission set 5 analyses. Emission set 5 is applied to studies involving the use of STAR data.

COST ESTIMATES OF AIR QUALITY MODELING ANALYSES

The total cost of an air quality modeling analysis of TSP and SO_2 is arrived at by combining cost estimates of the following:

- Acquisition and preparation of emission data, Tables A-3:
  - one load condition
  - three load conditions or baseline plus control strategies
- Analysis and preparation of meteorological data, Tables A-6:
  - 1 year NWS hourly data,
  - 5 years NWS hourly data,
  - 1 NWS STAR data set
  - 5 annual NWS STAR data sets, and
  - onsite hourly data.
- Labor and computer cost of selection of receptor locations and model options, Tables A-8:
  - assuming 5 rings (or 5 km) resolution, and
  - assuming 10 rings (or 1 km) resolution.
- Computer cost of model execution, Table C-16
  - for various levels of meteorological, emission and receptor resolution requirements
- Labor cost of model execution, Tables C-17:
  - 1 year NWS or 1 year onsite data, 5 rings or 5 km receptor resolution, and one load condition,
  - 5 years NWS data, 5 rings or 5 km receptor resolution, and 1 load condition,
  - 1 year NWS or 1 year onsite data, 10 rings or 1 km receptor resolution, and 1 load condition,
  - 5 years NWS data, 10 rings or 1 km receptor resolution, and 1 load condition,

- 1 year NWS or 1 year onsite data, 10 rings or 1 km receptor resolution, and 3 load conditions or baseline plus 2 control strategies, and

- 5 years NWS data, 10 rings or 1 km receptor resolution, and 3 load conditions or baseline plus 2 control strategies.

• Cost estimate for analysis of results and report preparation. There are three sets of cost tables:

  - Tables D-1a through D-1i, applicable to emission sets 1, 2, and 3 for 9 combinations of meteorological data, receptor resolution and load conditions.

  - Tables D-1j through D-1o, applicable to emission set 4, short-term averaging models, for 9 combinations of meteorological data, receptor resolution, and load conditions.

  - Tables D-1p through D-1u, applicable to emission set 5, long-term averaging models, for 6 combinations of meteorological data, receptor resolution and load conditions.

The cost estimates for air quality analyses arrived at by combining costs from the sets of Tables listed above are presented in Tables E-1 through E-12 as follows:

Table No.	Model	Emission set	No. of air quality modeling requirements combinations considered
E-1	CRSTER	1	9
E-2	CRSTER	2	9
E-3	CRSTER	3	9
E-4	MPTER	2	9
E-5	RAM	1	9
E-6	RAM	4	6
E-7	ISC	3	9
E-8	CDM	5	6
E-9	TEM8A	1	9
E-10	TEM8A	2	9
E-11	TEM8A	4	6
E-12	TCM	5	6

In addition to a total cost estimate, a "call" value (the total cost rounded to three significant figures) is presented in each of the Tables in Appendix E. The "call" values, which more accurately reflect the precision of the cost estimates, will be referred to in the following Sections.

COST ESTIMATES OF AIR QUALITY MODELING ANALYSES
USING HIWAY2 VERSUS CALINE3

The cost of modeling air quality impacts near roadways with HIWAY2 or CALINE3 was examined. The urban intersection example in the CALINE3 users manual, a 4-way intersection, was used by GCA as the basis for estimating air quality costs. The CALINE3 example was run using CALINE3 and HIWAY2. GCA found the model execution costs for the example run to be:

CALINE3		HIWAY2	
CPU (sec)	Cost (1980 $)	CPU (sec)	Cost (1980 $)
0.11	0.09	0.32	0.25

Based on the experience gained from running this example and past GCA experiences in line source modeling, cost tables for a complete modeling exercise were constructed. GCA assumed that 10 intersections were to be analyzed and impacts were presented for 1982 and 1987. The HIWAY2 and CALINE3 cost estimates are shown in Tables 4 and 5. A "Call" value (cost estimate rounded to three significant figures) is presented in both Tables. As can be seen, the cost for the modeling analysis is essentially the same for the two models.

TABLE 4. COST OF AIR QUALITY ANALYSIS OF CO IMPACT NEAR TEN INTERSECTIONS USING HIWAY2

RUN NUMBER: 13 MODEL: HIWAY2
NUMBER OF RECEPTORS: 10
NUMBER OF INTERSECTIONS MODELLED: 10

	Labor						Computer		
	Labor grade[c]								
	5		6		8				
Modeling analysis task	Hours	Dollars	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Total cost
Acquisition and Preparation of Traffic Data	8	160							160
Preparation of Emission Data	40	780					10[a]		790
Prepare Lane Configurations and Receptor Locations	80	1560	20	490					2050
Model Execution	40	780					20[b]	20[b]	800
Analysis of Results and Preparation of Report	40	780	40	990	20	690			2460
								Total	6260
								"Call" Value	6,300

[a]Computer requirements for running MOBILE2.

[b]Based on a cost of $0.25 and 0.32 CPU seconds per run on an IBM 3033N.

[c]Labor grades are defined in Section 2.

Note: All costs are in 1980 dollars.

TABLE 5. COST OF AIR QUALITY ANALYSIS OF CO IMPACT NEAR TEN INTERSECTIONS USING CALINE3

RUN NUMBER: 14 MODEL: CALINE3
NUMBER OF RECEPTORS: 10
NUMBER OF INTERSECTIONS MODELLED: 10

Modeling analysis task	Labor						Computer		Total cost
	Labor grade[c]								
	5		6		8				
	Hours	Dollars	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	
Acquisition and Preparation of Traffic Data	8	160							160
Preparation of Emission Data	40	780					10[a]	10[a]	790
Prepare Lane Configurations and Receptor Locations	80	1560	20	490					2050
Model Execution	40	780					10[b]	10[b]	790
Analysis of Results and Preparation of Report	40	780	40	990	20	690			2460
								Total	6250
								"Call" Value	6,300

[a]Computer requirements for running MOBILE2.

[b]Based on a cost of $0.09 and 0.11 CPU seconds per run on an IBM 3033N.

[c]Labor grades are defined in Section 2.

Note: All costs are in 1980 dollars.

SECTION 3

SENSITIVITY OF MODELING COSTS TO LEVEL OF DATA INPUT AND MODEL COST COMPARISONS

As discussed in Section 2, the cost of tasks involved in an SO_2 and TSP air quality modeling analysis under 12 modeling situations-model combinations were addressed in Appendices A through D and combined into cost estimates of a complete air quality analysis in Appendix E. The cost estimates were derived for various levels of data input, enabling a series of modeling study cost estimates to be made in Appendix E for each modeling situation-model combination. "Call" values (total cost estimate rounded to three significant figures) provided in each Table in Appendix E are used in this Section. The cost estimates in Appendix E will be used to assess the following:

- sensitivity of modeling costs to the level of data input, and
- comparative cost of air quality model analyses performed for the same modeling situation and with the same level of data input but using different models.

SENSITIVITY OF MODELING COST TO LEVEL OF DATA INPUT

There are six model situations-model combinations recommended in the 1980 proposed AQMG:

- single-source, rural--CRSTER,
- single-source, urban--RAM,
- multi-point source, rural--MPTER,
- industrial complex--ISC,
- point and area multi-source, urban, RAM, and
- point and area multi-source, urban area--CDM.

In Tables 6a through 6f, the cost of a TSP and SO_2 air quality modeling analysis is summarized for the six model situation-model combination assuming the following levels of data input:

TABLE 6a. THE SENSITIVITY OF TSP AND SO_2 AIR QUALITY MODELING COSTS TO THE LEVEL OF DATA INPUT. A BREAKDOWN OF THE COST FIGURES IN THIS TABLE IS PRESENTED IN APPENDIX E

Model: CRSTER
Modeling Situation: Single-source, rural

Level of data input	Modeling costs: Total (dollars)	Modeling costs: Relative
Base Case (1978 AQMG):		
1 year NWS met data 5 rings or 5 kilometer grid 1 load	11,600	1.0
Alternative 1:		
5 years NWS versus 1 year NWS met data	16,000	1.4
Alternative 2:		
5 years NWS versus 1 year NWS met data 10 rings/1 kilometer versus 5 rings/ 5 kilometers	23,300	2.0
Alternative 3 (1980 proposed AQMG):		
5 years NWS versus 1 year NWS met data 10 rings/1 kilometer versus 5 rings/ 5 kilometers 3 loads	27,100	2.3

Note: All costs are in 1980 dollars.

(continued)

TABLE 6b (continued)

Model: RAM
Modeling Situation: Single-source, urban

Level of data input	Modeling costs: Total (dollars)	Modeling costs: Relative
Base Case (1978 AQMG):		
1 year NWS met data 5 rings or 5 kilometer grid 1 load	12,200	1.0
Alternative 1:		
5 years NWS versus 1 year NWS met data	18,500	1.5
Alternative 2:		
5 years NWS versus 1 year NWS met data 10 rings/1 kilometer versus 5 rings/ 5 kilometers	28,200	2.3
Alternative 3 (1980 proposed AQMG):		
5 years NWS versus 1 year NWS met data 10 rings/1 kilometer versus 5 rings/ 5 kilometers 3 loads	34,000	2.8

Note: All costs are in 1980 dollars.

(continued)

TABLE 6c (continued)

Model: MPTER
Modeling Situation: Multi-point source, rural

Level of data input	Modeling costs: Total (dollars)	Modeling costs: Relative
Base Case (1978 AQMG):		
1 year NWS met data 5 rings or 5 kilometer grid 1 load	18,900	1.0
Alternative 1:		
5 years NWS versus 1 year NWS met data	48,200	2.6
Alternative 2:		
5 years NWS versus 1 year NWS met data 10 rings/1 kilometer versus 5 rings/ 5 kilometers	86,700	4.6
Alternative 3 (1980 proposed AQMG):		
5 years NWS versus 1 year NWS met data 10 rings/1 kilometer versus 5 rings/ 5 kilometers 3 loads	115,800	6.1

Note: All costs are in 1980 dollars.

(continued)

TABLE 6d (continued)

Model: ISC
Modeling Situation: Industrial complex

Level of data input	Modeling costs	
	Total (dollars)	Relative
Base Case (1978 AQMG):		
1 year NWS met data 5 rings or 5 kilometer grid 1 load	19,300	1.0
Alternative 1:		
5 years NWS versus 1 year NWS met data	51,500	2.7
Alternative 2:		
5 years NWS versus 1 year NWS met data 10 rings/1 kilometer versus 5 rings/ 5 kilometers	93,400	4.8
Alternative 3 (1980 proposed AQMG):		
5 years NWS versus 1 year NWS met data 10 rings/1 kilometer versus 5 rings/ 5 kilometers 3 loads	125,500	6.5

Note: All costs are in 1980 dollars.

(continued)

TABLE 6e (continued)

Model: RAM
Modeling Situation: Point and area multi-source

Level of data input	Modeling costs: Total (dollars)	Modeling costs: Relative
Base Case (1978 AQMG):		
1 year NWS met data 5 rings or 5 kilometer grid 1 load	19,600	1.0
Alternative 1:		
5 years NWS versus 1 year NWS met data	31,500	1.6
Alternative 2:		
5 years NWS versus 1 year NWS met data 10 rings/1 kilometer versus 5 rings/ 5 kilometers	50,100	2.6
Alternative 3 (1980 proposed AQMG):		
5 years NWS versus 1 year NWS met data 10 rings/1 kilometer versus 5 rings/ 5 kilometers 1 baseline plus two control strategies	68,000	3.5

Note: All costs are in 1980 dollars.

(continued)

TABLE 6f (continued)

Model: CDM
Modeling Situation: Point and area multi-source

Level of data input	Modeling costs Total (dollars)	Relative
Base Case (1978 AQMG):		
1 NWS STAR met data set 5 rings or 5 kilometer grid 1 load	14,200	1.0
Alternative 1:		
5 annual NWS STAR versus 1 NWS STAR met data set	21,900	1.5
Alternative 2:		
5 annual NWS STAR versus 1 NWS STAR met data set 10 rings/1 kilometer versus 5 rings/ 5 kilometers	27,200	1.9
Alternative 3 (1980 proposed AQMG):		
5 annual NWS STAR versus 1 NWS STAR met data set 10 rings/1 kilometer versus 5 rings/ 5 kilometers 1 baseline plus two control strategies	33,200	2.3

Note: All costs are in 1980 dollars.

- a base case (1978 AQMG) with 1 year of NWS meteorological hourly data (or 1 NWS STAR data set), 5 rings (or 5 kilometer grid resolution), and 1 load condition,

- alternative 1 with 5 years of NWS hourly data (or 5 annual NWS STAR data sets) and with all other input requirements the same as in the base case,

- alternative 2 with 5 years of NWS hourly data (or 5 annual NWS STAR data sets), 10 rings (or 1 kilometer grid resolution) and 1 load condition, and

- alternative 3 (1980 proposed AQMG) with 5 years of NWS hourly data (or 5 annual NWS STAR data sets), 10 rings (or 1 kilometer grid resolution) and three load conditions or a baseline plus 2 control strategies.

The base case data input assumptions would satisfy the 1978 AQMG. Each alternative requires greater amounts of data input with the last alternative's level of data input satisfying the 1980 proposed AQMG. By showing the modeling analysis costs and relative cost with respect to the base case, Table 6 shows the incremental costs associated with the several requirements for increased data input.

Examination of Table 6 shows the following:

Modeling situation-model	Relative increase in cost of base case (1978 AQMG) versus alternative 3 (1980 proposed AQMG)
Single-source, rural--CRSTER	2.3
Single-source, urban--RAM	2.8
Multi-point source, rural--MPTER	6.1
Industrial complex--ISC	6.5
Point and area multi-source, urban--RAM	3.5
Point and area multi-source, urban area--CDM	2.3

As will become clearer in the next section, the principal reason for the much higher relative increase in costs for MPTER and ISC compared to CRSTER is that these two models have a much higher base case computer budget. Thus, a similar proportional increase in computer budgets has a much greater inpact on relative total costs for these models.

MODEL COST COMPARISONS

Costs were assessed in the following situations for two or more air quality models:

Modeling situation	Air quality model
Single-source, rural	CRSTER and TEM8-A
Multi-point source, rural	MPTER, CRSTER and TEM8-A
Single-source, urban	RAM and CRSTER
Industrial complex	ISC and CRSTER
Point and area multi-source, urban	RAM and TEM8-A
Point and area multi-source, urban area	CDM and TCM
Line source, roadway intersection	CALINE3 and HIWAY2

Based on Appendix E and Section 2, the cost of an air quality analysis under the 1978 AQMG and the 1980 proposed AQMG (see discussion on page 4) are presented in Tables 7 through 10 as follows:

- Table 7, the 1978 AQMG is followed and NWS meteorological data is used,

- Table 8, the 1978 AQMG is followed and onsite meteorological data is used,

- Table 9, the 1980 proposed AQMG is followed and NWS meteorological data is used, and

- Table 10, the 1980 proposed AQMG is followed and onsite meteorological data is used.

The costs of model analysis presented in Tables 7 through 10 are regrouped by modeling situation in Table 11. Examination of Table 11 reveals the following:

- When the cost of data acquisition is included, the use of 1 year of onsite meteorological data increases the cost under the 1978 AQMG's by a factor of 4 to 7 depending on the model application. For the most part, the increased costs are directly related to the data collection effort. Under the 1980 proposed revisions, which require 5 years of NWS data, there is an offsetting savings in computer costs when 1 year of onsite meteorological data is used instead. (See Tables 9 and 10).

TABLE 7. COST OF AN SO_2 AND TSP AIR QUALITY ANALYSIS PERFORMED FOLLOWING THE 1978 AQMG AND USING 1 YEAR OF NWS METEOROLOGICAL DATA. A 5 RING OR 5 KILOMETER GRID RECEPTOR RESOLUTION AND 1 LOAD CONDITION ARE ASSUMED.

			Air quality analysis costs (dollars)	
Model	Run number	Modeling situation	Computer budget[a]	Total cost of study[b]
CRSTER	1	Rural/urban, single source	160	11,600
CRSTER	2	Rural, multi-source	580	13,800
CRSTER	3	Rural, industrial complex	160	12,400
MPTER[c]	4	Rural, multi-source	6,380	18,900
RAM[c]	5	Urban, single source	630	12,200
RAM[c]	6	Urban area multi-source	2,080	19,600
ISC	7	Rural, industrial complex	7,090	19,300
CDM	8	Urban area multi-source	500	14,200
TEM8-A	9	Rural, single source	130	11,600
TEM8-A	10	Rural, multi-source	1,260	13,800
TEM8-A	11	Urban area multi-source	640	18,100
TCM	12	Urban area multi-source	10	13,700
HIWAY2[d]	13	Line source, roadway intersection	20	6,300
CALINE3[d]	14	Line source, roadway intersection	10	6,300

[a]See Table C-16 in Appendix C for details.
[b]See Appendix E for detailed cost breakdown by task.
[c]It is assumed that only one pollutant is modeled and results for the other are obtained by scaling the source contribution tables.
[d]These are CO line source models.
Note: All costs are in 1980 dollars.

TABLE 8. COST OF AN SO_2 AND TSP AIR QUALITY ANALYSIS PERFORMED FOLLOWING THE 1978 AQMG AND USING 1 YEAR OF ONSITE METEOROLOGICAL DATA. A 5 RING OR 5 KILOMETER GRID RECEPTOR RESOLUTION AND 1 LOAD CONDITION ARE ASSUMED.

Model[a]	Run number	Modeling situation	Air quality analysis costs (dollars)	
			Computer budget[b]	Total cost of study[c]
CRSTER	1	Rural/urban, single source	160	75,400
CRSTER	2	Rural, multi-source	580	79,100
CRSTER	3	Rural, industrial complex	190	77,700
MPTER[d]	4	Rural, multi-source	6,380	84,200
RAM[d]	5	Urban, single source	630	77,500
ISC	7	Rural, industrial complex	7,090	84,600
TEM8-A	9	Rural, single source	130	76,900
TEM8-A	10	Rural, multi-source	1,260	79,100

[a]It is not appropriate to use onsite data for the multi-source urban modeling situations considered by RAM, TEM8-A, CDM and TCM.

[b]See Table C-16 in Appendix C for details.

[c]See Appendix E for a detailed cost breakdown by task. These figures include the cost of data acquisition for the onsite meteorological data.

[d]It is assumed that only one pollutant is modeled and results for the other are obtained by scaling the source contribution tables.

Note: All costs are in 1980 dollars.

TABLE 9. COST OF AN SO_2 AND TSP AIR QUALITY ANALYSIS PERFORMED FOLLOWING THE 1980 PROPOSED AQMG AND USING 5 YEARS OF NWS METEOROLOGICAL DATA. A 10 RING OR 1 KILOMETER GRID RECEPTOR RESOLUTION and 3 LOAD CONDITIONS ARE ASSUMED, EXCEPT WHERE NOTED.

Model	Run number	Modeling situation	Air quality analysis costs (dollars)	
			Computer budget[a]	Total cost of study[b]
CRSTER	1	Rural/urban, single source	2,190	27,100
CRSTER	2	Rural, multi-source	2,140	29,800
CRSTER	3	Rural, industrial complex	2,210	28,400
MPTER	4	Rural, multi-source	89,290	115,800
RAM	5	Urban, single source	8,860	34,000
RAM[c]	6	Urban area multi-source	20,840	50,100
ISC	7	Rural, industrial complex	99,320	125,500
CDM[c,d]	8	Urban area multi-source	5,020	27,200
TEM8-A	9	Rural, single source	1,770	26,700
TEM8-A	10	Rural, multi-source	17,690	44,200
TEM8-A[c]	11	Urban area multi-source	6,400	35,700
TCM[c,d]	12	Urban area multi-source	110	22,300

[a]See Appendix C, Table C-16, for details.

[b]See Appendix C for cost breakdown by Task.

[c]One load condition assumed; all other modeling cost estimates assume three load conditions.

[d]Meteorological data consists of 5 annual NWS STAR data sets.

Note: All costs are in 1980 dollars.

TABLE 10. COST OF AN SO_2 AND TSP AIR QUALITY ANALYSIS PERFORMED FOLLOWING THE 1980 PROPOSED AQMG AND USING 1 YEAR OF ONSITE METEOROLOGICAL DATA. A 10 RING OR 1 KILOMETER GRID RESOLUTION AND THREE LOAD CONDITIONS ARE ASSUMED EXCEPT WHERE NOTED.

			Air quality analysis costs (dollars)	
Model[a]	Run number	Modeling situation	Computer budget[b]	Total cost of study[c]
CRSTER	1	Rural/Urban, single source	1,080	88,100
CRSTER	2	Rural, multisource	1,480	91,000
CRSTER	3	Rural, industrial complex	950	89,300
MPTER	4	Rural, multisource	38,270	126,900
RAM	5	Urban, single source	3,800	91,100
ISC	7	Rural, industrial complex	42,570	131,100
TEM8A	9	Rural, single source	760	87,900
TEM8A	10	Rural, multisource	7,580	96,200

[a]It is not appropriate to use onsite meteorological data for the multisource modeling situations considered by RAM, TEM8-A, CDM, and TCM.

[b]See Appendix C, Table C-16 for details. These figures include the cost of data acquisition for the onsite meteorological data.

[c]See Appendix E for cost breakdown by task.

Note: All costs are in 1980 dollars.

TABLE 11. COST OF A TSP AND SO_2 AIR QUALITY ANALYSIS UNDER 1978 AQMG REQUIREMENTS AND REQUIREMENTS IN THE 1980 PROPOSED AQMG

Modeling situation: Model used	Cost of SO_2 and TSP air quality analysis (dollars)			
	1978 AQMG with NWS met. data	1978 AQMG with onsite met. data	Proposed revisions to AQMG with NWS met. data	Proposed revisions to AQMG with onsite met. data
Rural, single source:				
CRSTER	11,600	75,400	27,100	88,100
TEM8-A	11,600	76,900	26,700	87,900
Rural, multisource:				
CRSTER	13,800	79,100	29,800	91,000
MPTER	18,900	84,200	115,800	126,900
TEM8-A	13,800	79,100	44,200	96,200
Urban, single source:				
CRSTER	11,600	75,400	27,100	88,100
RAM	12,200	77,500	34,000	91,100
Rural, industrial complex:				
CRSTER	12,400	77,700	28,400	89,300
ISC	19,300	84,600	125,500	131,100
Urban area point and area multisource:				
TEM8-A	18,100	-	35,700	-
RAM	19,600	-	50,100	-
TCM	13,700	-	22,300	-
CDM	14,200	-	27,200	-
Line source:				
HIWAY2	6,300	-	Unchanged	-
CALINE3	6,300	-	Unchanged	-

Note: All costs are in 1980 dollars.

- Single source studies using CRSTER and TEM8-A are generally about the same in cost.

- Cost of the air quality study using MPTER increases by a factor of 6 under the proposed revisions to the AQMG. The principal component of the cost increase is an increase in computer costs. (See Tables 7 and 9).

- Under the proposed revisions to the AQMG, the cost of a rural multi-source air quality modeling analysis using TEM8-A is about 38 percent of the cost of the same analysis with MPTER. Virtually all the cost savings are in computer costs.

- An urban single-source analysis under the 1980 proposed AQMG (see Table 9) is 25 percent more expensive if RAM is used instead of CRSTER. Virtually all the difference is in computer costs.

- An industrial complex air quality analysis performed under the 1980 proposed AQMG is more than 4.4 times as expensive if ISC is used instead of CRSTER. However, the CRSTER analysis involves simplifying assumptions which will not always be appropriate.

- An urban area multi-source analysis under the 1980 proposed AQMG is 29 percent less if TEM8-A is used rather than RAM. All the savings are in computer costs.

- Under the 1980 proposed revisions, an urban area modeling analysis using TCM costs almost 20 percent less than the same analysis using CDM.

- The most dramatic increases in costs for the 1980 proposed revisions occur for MPTER and ISC. In both cases, the increase in computer costs account for over 85 percent of the total cost increase.

- The cost of a urban area analysis using RAM is most probably underestimated since a relatively small emission data set (12 point sources and 15 area sources) was assumed.

SECTION 4

TYPICAL COST OF APPLYING AIR QUALITY MODELS

The following models are either recommended for use in the 1980 proposed revision to the AQMG or under consideration for recommendation:

- CRSTER,
- MPTER,
- RAM,
- ISC,
- CDM,
- HIWAY2,
- CALINE3,
- BLP,
- SHORT Z,
- LONG Z,
- MESOPUFF, and
- MESOGRID.

In Section 2, GCA derived detailed air quality analysis cost estimates for CRSTER, MPTER, RAM, ISC, HIWAY2, and CALINE3. The cost of using the remaining models was assessed based on information provided by the model developers and users. The results of the study are presented in Appendix F, along with the cost of typical applications.

Briefly, costs for the new models are based on the following assumptions:

- in the case of BLP, a source configuration of 6 line sources and 20 point sources with 360 receptors and 1 year of onsite data are assumed,
- in the case of SHORT Z, a site in complex terrain with 20 sources is assumed, 10 worst case days selected by screening 1 year of onsite data will be simulated and there would be approximately 360 receptors,
- for LONG Z, the source configuration would be the same as for SHORT Z, an NWS STAR data set would be used, and there would be approximately 360 receptors,
- for MESOPUFF, a representative modeling situation consists of 10 point sources over a region, four 4-day simulations would be run and there would be a 26 by 26 receptor array, and
- for MESOPUFF, a regional emission data set of 40 point sources are assumed, four 4-day simulations would be performed and there would be a 51 by 51 receptor grid.

Table 12 presents a listing of modeling situations and recommended (or proposed recommended) models. Next to each recommended model, the modeling requirements, based on the 1980 proposed revisions, are listed. Making use of the cost estimates in Appendices E and F, the computer costs and total cost of an air quality modeling analysis were determined and are listed in Table 12. The "call" values (total cost estimate rounded to three significant figures) provided in each total cost estimate Table in Appendices E and F are used in Table 12.

TABLE 12. TYPICAL COST OF APPLYING AIR QUALITY MODELS

Modeling situation	Model	Number of load conditions or control strategies	Meteorological data	Receptor resolution	Pollutant(s)	Computer cost model exec. (dollars)	Total cost of analysis (dollars)
Rural, single source	CRSTER	3	5 years NWS	10 rings	SO_2, TSP	2,190	27,100
		3	1 year onsite	10 rings	SO_2, TSP	960	88,100
Urban, single source	RAM	3	5 years NWS	10 rings/1 km	SO_2, TSP	8,860	34,000
		3	1 year onsite	10 rings/1 km	SO_2, TSP	5,800	91,100
Rural, multisource	MPTER	3	5 years NWS	10 rings/1 km	SO_2, TSP	89,290	115,800
		3	1 year onsite	10 rings/1 km	SO_2, TSP	38,270	126,900
Rural/Urban industrial complex	ISC	3	5 years NWS	10 rings/1 km	SO_2, TSP	99,320	125,500
		3	1 year onsite	10 rings/1 km	SO_2, TSP	42,570	131,100
Urban area multisource	RAM	Baseline plus 2 control strategies	5 years NWS	10 rings/1 km	SO_2, TSP	29,180	68,000
Urban area multisource	CDM	Baseline plus 2 control strategies	5 Annual NWS STAR	1 km	SO_2, TSP	7,030	55,200

(continued)

TABLE 12 (continued)

Modeling situation	Model	Number of load conditions or control strategies	Meteorological data	Receptor resolution	Pollutant(s)	Computer cost model exec. (dollars)	Total cost of analysis (dollars)
Roadway intersections	HIWAY2	10 intersections with control strategies	2 worst-case scenarios	Fine resolution (100m) near roadways	CO	20	6,300
Roadway intersections	CALINE3	10 intersections with control strategies	2 worst-case scenarios	Fine resolution (100m) near roadways	CO	10	6,300
Rural/Urban industrial complex	BLP	3	1 year onsite	1 km	SO_2, TSP	13,320	91,900
Urban areas or industrialized valleys	SHORT Z	3	10 1-day scenarios of worst-case conditions from 1 year onsite data	1 km	SO_2, TSP	6,260	84,600
Urban areas or industrialized valleys	LONG Z	3	NWS STAR	1 km	SO_2, TSP	2,650	16,000
Long-range transport of SO_2 and $SO_4^=$	MESOPUFF	1	4 worst-case scenarios, 4 days long	10 km	SO_2, SO	750	15,600
Long-range transport of SO_2 and $SO_4^=$	MESOGRID	1	4 worst-case scenarios, 4 days long	10 km	SO_2, SO	13,200	39,000

Note: All costs are in 1980 dollars.

SECTION 5

COST OF A DEMONSTRATION STUDY OF NONGUIDELINE MODELS

In order for the use of a nonguideline model to be approved, the 1980 proposed AQMG revisions would require that some comparative study of the model be performed. Such a study would consist of the following:

- presentation of model theory,
- collection of air quality data in a field study (or use of an existing data base),
- model execution,
- comparison of model results to field study data, and
- analysis of results and preparation of a report.

The cost of three field study options was considered for an isolated source in a shallow valley. The following assumptions were made for each option:

- Onsite Field Study--It was assumed that a 4-month data collecting effort was undertaken. Meteorological data (wind speed, wind direction, temperature and vertical wind fluctuations) were recorded continuously at one site. SO_2 and TSP were measured at 15 key locations within 15 kilometers of the facility.
- Tracer Study--It was assumed that tracer studies were conducted during each season of the year. There was one test period per season consisting of three releases. Three meteorological stations were required and there were 25 ground receptors. During test periods, the concentrations across the tracer plume were measured with an aircraft.
- Offsite Study--It was assumed that the field study data had already been collected at a different location and were available on tape. This option requires the modeler to demonstrate that the different location and the actual location are similar.

The details of the cost analysis are presented in Appendix G. The major cost components and the total cost of the three options are listed below.

COST OF A DEMONSTRATION STUDY (1980 Dollars)

Major activities	Onsite field study	Tracer study	Offsite field study
Collecting meteorological data	34,550	99,190	
Collecting air quality data	210,670		4,390[a]
Performing tracer study		550,000	
Computer costs - model execution	2,750	2,750	2,750
Total cost[b]	285,600	689,600	46,300

[a]This includes cost of acquiring offsite meteorological and air quality data.

[b]The total cost refers to the "call" values (total cost rounded to three significant figures) in Appendix G.

As expected, collection of onsite data adds greatly to the cost of an analysis. Collecting air quality data at 15 sites increases the study cost by about $200,000. A tracer study, which requires three meteorological stations operating for 1 year, as well as four 2-week tracer tests, costs on the order of $700,000.

SECTION 6

NATIONWIDE IMPACT OF PROPOSED AQMG REVISIONS ON PSD AND SIP MODELING

In Section 3 the cost of a TSP and SO_2 air quality analysis for a wide range of modeling situations was derived. Cost estimates of an analysis were made for studies using NWS meteorological data first assuming the 1978 AQMG was followed, and next assuming the 1980 proposed revisions were followed. The cost estimates were presented in Tables 7 and 9. In this section the cost figures in Tables 7 and 9 will be used to estimate the nationwide impact of the proposed AQMG revisions. The intent of this exercise is to gain a general indication of the magnitude of the potential cost impacts associated with imposing the 1980 proposed AQMG.

NATIONWIDE IMPACT OF PROPOSED AQMG REVISIONS ON SIP MODELING

The number of SO_2 and TSP SIP revisions in an average year are broken down by modeling situation in Tables 13 and 14. The data in these tables were used to estimate the number and type of model applications in an average year. In Table 15, the SIP revisions presented in Tables 13 and 14 are grouped by the model that would probably be used for each situation based on the 1980 proposed revision to the AQMG.

The cost estimates in Tables 7 and 9 were applied to the model distribution in Table 15 to determine the cost impact of the proposed revision. The cost estimates derived in Section 3 were made assuming both SO_2 and TSP were being modeled. Since TSP and SO_2 are addressed separately in Table 15, the values in Tables 7 and 9 were not applied directly. First, in order to get a better estimate for a single pollutant analysis, the computer costs were cut in half for the CRSTER and ISC modeling studies (CRSTER and ISC model TSP and SO_2 separately). Modeling a single pollutant would also reduce the technical effort. Therefore, based on GCA experience, labor costs were reduced by 20 percent. The resulting nationwide cost estimate for TSP and SO_2 SIP revision modeling is presented in Table 16 for data input levels that satisfy the 1978 AQMG and the 1980 proposed revisions.

NATIONWIDE IMPACT OF PROPOSED AQMG REVISIONS ON PSD MODELING

There are, as documented in Table 17, approximately 450 PSD permit applications per year. A distribution by model used was arrived at in Table 17 based on the model distribution in a 51 permit data base prepared by TRW. GCA assumed that an SO_2 and TSP analysis was performed in all cases. The cost associated with the permit data in Table 17 is presented in Table 18 for data input levels that satisfy the 1978 AQMG and the 1980 proposed revisions.

TABLE 13. NUMBER AND TYPE OF SO_2 SIP REVISIONS NATIONWIDE IN A NORMAL YEAR[a]

Areawide SIP revisions			Site specific SIP revisions		
Number	Modeling situation	Recommended model	Number	Modeling situation	Recommended model
16	Multicounty	CDM	18	Power plants	RAM/CRSTER and CDM
6	Urban area	CDM	9	Industrial boilers	RAM/CRSTER and CDM
			6	Miscellaneous	RAM/CRSTER and CDM
6	Countywide changes on limits for power plants, addressed individually	CDM	2	Paper mills	ISC, CDM
			2	Coke ovens	RAM/CRSTER and CDM
			2	Refinery operations	RAM/CRSTER and CDM
			2	Smelters	RAM/CRSTER and CDM
			2	Chemical plants	RAM/CRSTER and CDM
			2	Steel mills	ISC and CDM

[a]Data is based on a conversation with Lanny Deal of OAQPS, EPA. 100 percent of the areawide SIP revisions were based on long-term analyses. Nearly the opposite was true of site specific analyses, where 90 percent were based on short-term modeling.

TABLE 14. NUMBER AND TYPES OF TSP SIP REVISIONS NATIONWIDE IN A NORMAL YEAR[a]

Areawide SIP revisions			Site specific SIP revisions		
Number	Modeling situation	Recommended model	Number	Modeling situation	Recommended model
15	4-5 power plants plus 5-8 industrial boilers	MPTER, CDM	5	Power plants	CRSTER/RAM and CDM
3	Statewide agricultural burning[b]		4	Industrial boilers	CRSTER/RAM and CDM
			3	Paper mills	ISC and CDM
2-3	Countrywide open burning[b]		3	Municipal	CRSTER/RAM and CDM
			3	Glass factories	CRSTER/RAM and CDM
7	Urban areas (space heating boilers, etc.)	RAM, CDM	2	Pulp mills	ISC and CDM
			2	Cement plants	CRSTER/RAM and CDM
			2	Asphalt batch	CRSTER/RAM and CDM
			6	Miscellaneous	CRSTER/RAM and CDM

[a]Data is based on a conversation with Lanny Deal of OAQPS, EPA. 70 percent of the areawide SIP revisions were based on short-term analyses and 90 percent of the site specific SIP revisions required short-term modeling.

[b]None of the recommended air quality models are really appropriate for analyzing the impacts of these activities. Therefore, emission limits are normally set by other means, such as linear rollback.

TABLE 15. BREAKDOWN OF NUMBER OF TSP AND SO_2 SIP RELATED MODELING STUDIES AND THE MODEL RECOMMENDED UNDER THE 1980 PROPOSED REVISION TO THE AQMG

TSP model applications			SO_2 model applications		
Number	Model	Modeling situation	Number	Model	Modeling situation
10	CDM	Power plants and industrial boilers, urban areas, and site-specific revisions	33	CDM	Multicounty point sources, urban areas, countywide changes, and site-specific revisions
10	MPTER	Power plants and industrial boilers	18	RAM	Site-specific SIP revisions
17	RAM	Urban areas and site-specific SIP revisions			
11	CRSTER	Site-specific SIP revision	19	CRSTER	Site-specific SIP revisions
4	ISC	Site-specific SIP revision	4	ISC	Site-specific SIP revisions

[a]Model distribution based on Tables 13 and 14 and conversations with Lanny Deal of OAQPS, EPA.

TABLE 16. NATIONWIDE COST OF TSP AND SO_2 SIP RELATED MODELING STUDIES

Number of studies	Model used	Pollutant	1978 AQMG (thousand dollars)	1980 proposed AQMG (thousand dollars)	Difference in cost (thousand dollars)
10	CDM	TSP	100	190	90
17	RAM[a]	TSP	190	550	360
10	MPTER	TSP	160	1,090	930
11	CRSTER	TSP	100	220	120
4	ISC	TSP	50	280	230
33	CDM	SO_2	350	630	280
18	RAM	SO_2	170	500	330
19	CRSTER	SO_2	160	380	220
4	ISC	SO_2	50	280	230
126			1,330	4,120	2,790

[a]RAM analyses consists of 5 urban areas and 12 urban point sources.

Note: All costs are in 1980 dollars.

TABLE 17. ESTIMATE OF THE NUMBER OF TSP AND SO_2 PSD MODELING ANALYSES BY MODEL USED[a]

SO_2 and TSP PSD applications	
Number	Model
180	CRSTER
25	RAM
25	ISC
25	CDM
195	SCREENING STUDY

[a]There are an average of 450 PSD applications per year (based on conversations with Jim Weigold, OAQPS, EPA). The distributions by model are based on 51 permits from the Clean Air Act Analysis Data base where relevant modeling data was available.

TABLE 18. NATIONWIDE COST OF TSP AND SO_2 PSD RELATED MODELING STUDIES

Number of studies	Model used	Pollutant	1978 AQMG (thousand dollars)	1980 proposed AQMG (thousand dollars)	Difference in cost (thousand dollars)
180	CRSTER	TSP and SO_2	2,090	4,890	2,800
25	RAM	TSP and SO_2	310	850	540
25	ISC	TSP and SO_2	480	3,140	2,660
25	CDM	TSP and SO_2	350	680	330
195	SCREENING STUDY[a]	TSP and SO_2	820	820	-
450			4,050	10,380	6,330

[a]Based on estimates in Table 19.

Note: All costs are in 1980 dollars.

SECTION 7

THE COMPARATIVE COST OF A SCREENING STUDY

There is a set of easy-to-use Gaussian air quality models designed by EPA to be used in a screening analysis. The screening models:

- PTPLU,
- PTDIS, and
- PTMTP

predict 1-hour average concentrations for hypothetical meteorological conditions. If the modeling guidelines for a screening analysis are followed, conservative estimates of SO_2 and TSP air quality impacts are arrived at cheaply and quickly. Sources that obviously will not exceed NAAQS and maximum allowable PSD increments are spared the costs of a refined modeling study.

The steps involved in a point source screening analysis are as follows:

- Acquisition and preparation of emission data for three load conditions.
- Acquisition of emission data from nearby significant sources.
- PTPLU is run for three load conditions; it determines maximum concentration and its downwind distance for a wide range of wind speed and atmospheric stability combinations.
- If there are areas where incremental impacts from sources are being limited to less than the maximum allowable PSD increment, PTDIS is run for worst case meteorological conditions to determine the impact at that location.
- If there are significant sources nearby, PTMTP is run for a set of worst case meteorological conditions to determine maximum concentrations, including background sources.
- The results of the screening study are tabulated and a brief report is written.

The model execution time of the screening models is minimal. The cost of typical runs follows:

	Computer costs	
Model	CPU (sec)	1980 Dollars
PTPLU	0.49	0.40
PTDIS	0.15	0.12
PTMAX	0.20	0.16

The labor and computer cost estimates, based on GCA experience, for each of the steps of a screening analysis listed above, are presented in Table 19.

The total cost of an SO_2, TSP screening analysis compares to the cost of a refined analysis as follows (all costs are in 1980 dollars):

CRSTER	1 year NWS data 5 rings 1 load	$11,600
CRSTER	5 years NWS data 10 rings 3 loads	$27,100
SCREENING ANALYSIS		$ 4,200

TABLE 19. COST OF A TSP AND SO_2 SCREENING STUDY

Task	Labor costs[a]										Computer costs			
	3		4		5		6		8					
	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and preparation of emission data					16	310			4	140			20	450
Acquisition of emission data for nearby sources					16	310							16	310
Run PTPLU for 3 load conditions					8	160			2	70	10	10	10	240
Run PTDIS for areas of concern					8	160	2	50			10	10	10	220
Run PTMTP to *determine* background contribution					8	160	2	50			10	10	10	220
Tabulate screening analysis results					32	620	8	200	4	140			44	960
Prepare Report	16	250	8		40	780	8	200	24	830			96	1,810
Total cost														4,210
													"Call" Value	4,200[b]

[a]Labor grades are defined in Section 2.
[b]This is the value referred to in the text.
Note: *All costs are in 1980 dollars.*

SECTION 8

COST COMPARISON OF DETERMINING SIP EMISSION LIMITS FROM MONITORING DATA VERSUS MODELING

Where recommended models are shown to be inapplicable such as in complex terrain, the 1980 proposed AQMG provides guidelines for determining SIP emission limits from monitoring data. The following requirements must be met if a monitoring analysis is undertaken:

- One year of ambient data must be collected by the monitoring network,
- it must be demonstrated that the design concentration for each averaging time is representative of the maximum for the whole area, and
- the meteorological conditions must be reviewed to determine whether the year had normal weather.

In Appendix H, the cost of a 1-year monitoring study for determining SO_2 and TSP SIP emission limits for a point source was estimated. It was assumed that a 15-receptor TSP and SO_2 network would be required. The end product of the analysis would be a report that presented design values for TSP and SO_2, based on the monitoring data.

The cost of performing an air quality modeling analysis in complex terrain using SHORTZ was estimated in Appendix F. Since the surrounding terrain makes use of NWS meteorological data questionable, the cost estimate was made assuming the SHORTZ analysis would be performed with onsite data. It is also assumed that a preprocessor program is used to screen the 1-year of hourly data to select 10 1-day worst case meteorological conditions for simulation by SHORTZ.

The cost (in 1980 dollars) of a monitoring study and a modeling study compare as follows:

Cost of TSP and SO_2 monitoring analysis	Cost of TSP and SO_2 complex terrain modeling analysis
\$430 K	\$80 K

SECTION 9

COMPARATIVE COST OF BLOCK AVERAGING AND RUNNING AVERAGING CALCULATIONS

All the EPA recommended short-term averaging models use a block averaging method; that is, concentrations for each averaging time are computed for discrete, nonoverlapping time periods for each day. The more conservative way to compute average concentrations is to calculate running averages; i.e., for each averaging period the average concentration would be calculated for each possible continuous averaging time segment over the course of the year. Averaging periods would overlap each other and the averaging time segments would not be grouped by day.

There are many more computational steps involved in calculating running averages, and consequently more computer time would be required per model run. A running average subroutine was developed by EPA for CRSTER and its use is an option available to model users. Some testing of its impact on CPU time was made by EPA; the results of that study were documented in "Supplemental Information to the User's Manual for Single Source (CRSTER) Model." Use of the running averaging subroutine was found to increase computer time as follows:

RATIO INCREASE IN COMPUTER TIME REQUIRED FOR A CRSTER RUN IF RUNNING AVERAGES ARE COMPUTED

Three-Averaging Periods (3, 8, 24 hours)	Two-Averaging Periods (3, 24 hours)	One-Averaging Period (24 hours)
13:1	9:1	4:1

The increased computer costs due to computing running averages were added to the air quality analysis cost estimates previously given in Tables 9 and 10 For this purpose it was assumed that the computer budget would increase by a factor of 9. In Table 20 the cost of an air quality analysis computing running averages, is compared to air quality modeling analysis costs if block averages were computed. Examination of the cost estimates in Table 20 shows that running average calculations increases the cost of using MPTER, ISC, and RAM dramatically. The reason for this is that for these model applications the computer budget for block averages comprised a significant portion of the total cost.

TABLE 20. COMPARATIVE COST OF TSP AND SO_2 ANALYSES PERFORMED WITH MODELS MAKING BLOCK AVERAGING AND RUNNING AVERAGING CALCULATIONS FOR TWO AVERAGING PERIODS

		1980 proposed AQMG with NWS met. data		1980 proposed AQMG with onsite data	
Modeling situation	Model	Block avg. (thousand dollars)	Running avg. (thousand dollars)	Block avg. (thousand dollars)	Running avg. (thousand dollars)
Rural, single-source	CRSTER	27	45	88	94
Rural multisource	MPTER	116	830	127	360
Urban single-source	RAM	34	105	91	112
Industrial complex	ISC	125	920	131	392
Urban area	RAM[a]	50	217	-	-

[a]One load condition assumed to be modeled; all other modeling analyses are performed with three load conditions.

Note: All costs are in 1980 dollars.

SECTION 10

COMMENTS ON OTHER AIR QUALITY MODELING ISSUES OF CONCERN

COST OF MODEL VALIDATION AND EVALUATION STUDY IN COMPLEX TERRAIN

A detailed model validation and evaluation study in complex terrain would consist of the following:

- setting up and maintaining a meteorological station,
- setting up and maintaining an air quality monitoring network
- processing the meteorological data into model input format,
- reviewing air quality and monitoring data and selecting a range of meteorological conditions for model comparison,
- running model for comparison days,
- evaluating model performance,
- preparing report.

GCA estimated the cost of performing such a modeling studying assuming that meteorological station and 15 TSP and SO_2 monitors were operating near the facility for 1 year. The air quality and meteorological data would then be reviewed, and 50 days covering the five highest measured TSP and SO_2 values, plus a wide range of wind speed-wind direction atmospheric stability categories would be selected of model comparison. The 50 days would then be simulated with the air quality model. The model results would be validated with the monitoring data and a report would be prepared.

The costs of setting up and operating a meteorological network are documented in Tables B-2 and B-3. The cost of processing the data into the proper format was addressed in Table B-4. Similarly, the cost for setting up and maintaining a 15-monitor air quality network has already been discussed and the cost is documented in Tables G-5 and H-1. The cost of the analysis and report tasks are documented in Table 21. The total cost for the analysis is as follows:

TABLE 21. COST OF ANALYSIS AND REPORT TASKS OF A MODEL VALIDATION AND EVALUATION STUDY

Task	Labor costs[a]												Computer costs			
	3		4		5		6		8		10					
	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Review A.Q. and Met. data and select 50 days for study					320	6,240			40	1,380	8	400	1,500	1,000	368	9,020
Run model for 50 comparison days					120	2,340			8	280			1,500	1,000	128	3,620
Evaluate model					120	2,340	120	2,960	40	1,380	8	400	750	500	288	7,580
Prepare report	120	1,840	56	1,010	120	2,340	40	990	200	6,920	16	800			552	13,900
Total															1336	34,120

[a]Labor grades are defined in Section 2.

Note: All costs are in 1980 dollars.

Activity	Cost (1980 dollars)
Meteorological Station Material Costs	12,420
Labor Costs of Operating and Maintaining Met. Station	41,990
Process Meteorological Data Into Model Format	7,000
Fifteen TSP and SO_2 Air Quality Monitors	66,520
Labor Cost of Operating and Maintaining Monitors	344,790
Cost of Analysis and Report Tasks	34,120
Total Cost	506,840

COST OF APPLYING PHOTOCHEMICAL GRID MODELS

Analysis of ozone impacts in an urban area, because of the nature of the pollutant sources and the complex photochemistry involved, cannot be modeled with the Gaussian models used for modeling TSP and SO_2. Photochemical grid models, which have been specifically designed to treat the transport of ozone and its precursors and their chemical interaction, are often used instead. One of the more commonly used photochemical grid models is the SAI Urban Airshed Model.

In order to obtain a description of a typical Urban Airshed analysis and its cost, GCA contacted SAI. An application of the photochemical grid model in order to determine the effectiveness of proposed control strategies on ozone impacts would consist of the following:

- Acquisition and reformatting of already existing emission data base for NO_x and Volatile Organic Compounds.
- Review of air quality monitoring data to identify a 2- to 3-day ozone episode for study.
- Acquisition of meteorological data for nearby NWS upper air station(s).
- Acquisition of all available surface meteorological data.
- Preparation of meteorological wind fields for all vertical layers, initial conditions and boundary conditions for concentration fields, and all other model input data fields.
- A sensitivity study (approximately 12 model runs).
- A validation study (approximately 6 model runs).
- A control strategy analysis (approximately 12 model runs).
- Preparation of a report.

Each model run would cost approximately $1,000. Therefore, a computer budget on the order of $30,000 to $35,000 dollars would be needed. The total cost of the analysis would be:

Consulting Firm With Previous Urban Airshed Experience	Consulting Firm With No Previous Urban Airshed Experience
\$80,000-\$125,000	\$160,000-\$250,000

In comparison, an urban area modeling analysis of TSP and SO_2 with RAM, for a small urban area, was estimated to cost \$50,000 (see Table 9) under the 1980 proposed AQMG.

REFERENCES

1. Environmental Protection Agency. "OAQPS Guideline Series Guideline on Air Quality Models", EPA-450/2-78-027, Research Triangle Park, NC. April 1978.

2. Environmental Protection Agency. "OAQPS Guideline Series Guideline on Air Quality Models Proposed Revisions", Research Triangle Park, NC. October 1980.

3. Environmental Protection Agency. "Summaries and Proposed Recommendations Concerning Air Quality Models Submitted to Environmental Protection Agency", Research Triangle Park, NC. October 1980.

APPENDIX A

COST ESTIMATES FOR DATA ACQUISITION AND DATA PROCESSING

In this appendix, the cost of data acquisition and data processing is addressed. A definition of labor grades is listed in Table A-1.

TABLE A-1. DEFINITION OF LABOR GRADES

10	Group Scientist
9	Principal Scientist
8	Staff Scientist
7	Senior Scientist
6	Scientist
5	Junior Scientist
4	Technical Illustrator
3	Technical Typist

The labor cost associated with 40 hours of each labor grade has been provided in Section 2. Emission sets 1 through 5 are listed in Tables A-2(a) through A-2(e). Next, the costs involved in the preparation tasks of an air quality modeling study are presented as follows:

Tasks	Tables
Acquisition and Preparation of Emission Data	A-3(a) through A-3(b)
Meteorological Data Acquisition Cost	A-4 through A-5
Labor, Materials and Computer Costs for Preparing Meteorological Data	A-6(a) through A-6(e)
Cost of Acquiring UNAMAP Tape	A-7
Labor and Computer Cost of Receptor Siting	A-8(a) through A-8(c)

The onsite meteorological data costs listed in Table A-6(e) come directly from Appendix B. The costs presented in Tables A-3, A-6, and A-8 are included in the total cost of an air quality analysis estimates in Appendix E, the Appendix from which the cost figures used in the main text originate.

TABLE A-2. DOCUMENTATION OF EMISSION DATA SETS

(a) Emission Set 1--3 Stack Power Plant

Source	Point source listing							
	East Coord. (User Units) Km	North Coord. (User Units) Km	SO_2 (g/sec) Emissions	Part. (g/sec) Emissions	Stack HT (m)	Stack Temp. (°K)	Stack Diameter (m)	Stack Velocity (m/sec)
Plant 1	2.00	2.00	2671.41	0.0	91.44	401.00	4.88	11.67
Plant 2	2.00	2.00	1551.40	0.0	91.44	386.00	5.49	12.31
Plant 3	2.00	2.00	4086.00	0.0	182.88	414.00	7.23	21.12

(continued)

TABLE A-2 (continued)

(b) Emission Set 2--Multipoint Source, Example 4 in MPTER Manual

	Point source information							
	East Coord. (User Units) Km	North Coord.	SO_2 (g/sec) Emissions	Part. (g/sec) Emissions	Stack HT (m)	Stack Temp. (°K)	Stack Diameter (m)	Stack Velocity (m/sec)
1	0.50	0.70	0.0	600.00	200.0	430.0	5.8	21.0
2	0.40	1.85	0.0	225.00	150.0	425.0	5.2	19.0
3	0.50	1.80	0.0	250.00	150.0	425.0	5.2	19.0
4	1.75	0.85	0.0	70.00	80.0	430.0	3.6	16.0
5	1.75	0.75	0.0	70.00	80.0	430.0	3.6	16.0
6	1.75	0.65	0.0	70.00	80.0	430.0	3.6	16.0
7	2.40	1.50	0.0	100.00	120.0	415.0	5.0	23.0
8	2.50	1.60	0.0	120.00	120.0	415.0	5.0	23.0
9	2.50	1.50	0.0	100.00	120.0	415.0	5.0	23.0
10	1.80	1.85	0.0	85.00	90.0	420.0	4.6	17.0
11	1.95	1.90	0.0	85.00	90.0	420.0	4.6	17.0
12	2.10	1.85	0.0	85.00	90.0	420.0	4.6	17.0
13	2.00	1.75	0.0	60.00	50.0	440.0	3.0	15.0
14	1.90	1.75	0.0	60.00	50.0	440.0	3.0	15.0
15	2.35	1.10	0.0	5.00	30.0	450.0	2.3	12.0
16	2.40	1.10	0.0	5.00	30.0	450.0	2.3	12.0
17	2.45	1.10	0.0	5.00	30.0	450.0	2.3	12.0
18	2.50	1.10	0.0	5.00	30.0	450.0	2.3	12.0
19	2.35	1.00	0.0	5.00	30.0	450.0	2.3	12.0
20	2.40	1.00	0.0	5.00	30.0	450.0	2.3	12.0
21	2.45	1.00	0.0	5.00	30.0	450.0	2.3	12.0
22	2.50	1.00	0.0	5.00	30.0	450.0	2.3	12.0
23	0.85	1.05	0.0	80.00	120.0	420.0	4.8	18.0
24	0.90	1.05	0.0	80.00	120.0	420.0	4.8	18.0
25	0.95	1.05	0.0	80.00	120.0	420.0	4.8	18.0
26	1.00	1.05	0.0	80.00	120.0	420.0	4.8	18.0
27	0.70	2.65	0.0	60.00	100.0	460.0	4.0	20.0
28	0.70	2.60	0.0	60.00	100.0	460.0	4.0	20.0
29	0.70	2.55	0.0	60.00	100.0	460.0	4.0	20.0
30	0.70	2.50	0.0	60.00	100.0	460.0	4.0	20.0

(continued)

TABLE A-2 (continued)

(c) Emission Set 3--Hypothetical Potash Plant

Source number	Type	Wake	Number part. cats.	Emission rate type = 0,1 (g/sec) type = 2 (g/sec per meter**2)	X (m)	Y (m)	Base elev. (m)	Height (m)	Temp. type = 0 (°K); vert. dim type = 1 (m)	Exit vel. (m/sec) horz. dim type = 1,2 (m)	Diameter type = 0 (m)	Bldg. height type = 0 (m)	Bldg. length type = 0 (m)	Bldg. width type = 0 (m)
				Source data										
1	2	0	6	0.10000E+00	-13.3	-13.3	0.0	10.00	0.0	26.60	0.0	0.0	0.0	0.0
2	1	0	6	0.13000E+00	20.0	0.0	0.0	0.90	1.00	4.70	0.0	0.0	0.0	0.0
3	1	0	6	0.13000E+00	30.0	0.0	0.0	2.60	1.00	4.70	0.0	0.0	0.0	0.0
4	1	0	6	0.13000E+00	40.0	0.0	0.0	4.30	1.00	4.70	0.0	0.0	0.0	0.0
5	1	0	6	0.13000E+00	49.0	0.0	0.0	6.10	1.00	4.70	0.0	0.0	0.0	0.0
6	1	0	6	0.13000E+00	59.0	0.0	0.0	7.80	1.00	4.70	0.0	0.0	0.0	0.0
7	1	0	6	0.13000E+00	69.0	0.0	0.0	9.60	1.00	4.70	0.0	0.0	0.0	0.0
8	1	0	6	0.13000E+00	79.0	0.0	0.0	11.30	1.00	4.70	0.0	0.0	0.0	0.0
9	1	0	6	0.13000E+00	89.0	0.0	0.0	13.00	1.00	4.70	0.0	0.0	0.0	0.0
10	1	0	6	0.13000E+00	99.0	0.0	0.0	14.80	1.00	4.70	0.0	0.0	0.0	0.0
11	1	0	6	0.13000E+00	109.0	0.0	0.0	16.50	1.00	4.70	0.0	0.0	0.0	0.0
12	1	0	0	0.26300E+01	121.0	0.0	0.0	22.50	11.60	10.80	0.0	0.0	0.0	0.0
13	1	0	0	0.26300E+01	144.0	0.0	0.0	22.50	11.60	10.80	0.0	0.0	0.0	0.0
14	1	0	0	0.26300E+01	167.0	0.0	0.0	22.50	11.60	10.80	0.0	0.0	0.0	0.0
15	1	0	0	0.26300E+01	190.0	0.0	0.0	22.50	11.60	10.80	0.0	0.0	0.0	0.0
16	0	0	0	0.50000E+01	201.0	0.0	0.0	50.00	340.00	8.00	1.00	25.0	90.00	50.00

(continued)

TABLE A-2 (continued)

(d) Emission Set 4--Test Case in RAM

Source	East Coord. (User Units) Km	North Coord. (User Units) Km	SO_2 (g/sec) Emissions	Part. (g/sec) Emissions	Stack HT (m)	Stack Temp. (°K)	Stack Diameter (m)	Stack Velocity (m/sec)
	Point source listing							
Plant 1	579.50	4406.75	232.37	13.34	82.90	513.10	3.50	13.70
Plant 2	575.25	4405.25	150.46	57.01	76.20	464.30	3.20	12.50
Plant 3	571.25	4407.00	19.01	3.26	25.90	477.60	1.00	15.80
Plant 4	571.75	4402.25	81.06	28.35	40.80	499.80	2.80	17.60
Plant 5	579.50	4403.25	26.15	5.15	18.30	533.20	0.60	14.70
Plant 6	567.14	4400.89	2.56	0.0	26.50	505.00	1.04	3.81
Plant 7	564.70	4407.50	36.43	0.0	48.80	464.00	3.05	18.60
Plant 8	577.45	4401.35	33.64	0.0	26.50	428.00	1.68	5.02
Plant 9	576.75	4400.70	38.80	0.0	6.00	654.00	0.79	24.89
Plant 10	580.10	4412.00	299.50	0.0	93.00	405.00	4.88	12.59
Plant 11	583.00	4400.90	16.74	0.0	18.10	506.00	1.37	4.23
Plant 12	574.00	4398.00	226.20	0.0	93.60	483.00	4.88	12.59

Source	East Coord. (User Units) Km	North Coord. (User Units) Km	SO_2 (g/sec-M**2) Emissions	Part. (g/sec-M**2) Emissions	Side Length (User units)	Effective Height (m)
	Area source listing					
1	570.0	4400.0	3.0164E-08	0.0	4.0	10.0
2	574.0	4400.0	2.9440E-07	0.0	2.0	10.0
3	576.0	4400.0	6.0328E-07	0.0	2.0	12.0
4	578.0	4400.0	8.5425E-07	0.0	2.0	15.0
5	578.0	4402.0	3.0406E-07	0.0	2.0	10.0
6	574.0	4402.0	0.0	0.0	4.0	0.0
7	570.0	4404.0	1.0256E-07	0.0	4.0	15.0
8	574.0	4406.0	2.5097E-07	0.0	2.0	10.0
9	578.0	4406.0	2.9923E-07	0.0	2.0	12.0
10	580.0	4406.0	2.6641E-07	0.0	2.0	20.0
11	582.0	4406.0	8.0116E-08	0.0	2.0	20.0
12	580.0	4404.0	1.6023E-07	0.0	2.0	20.0
13	582.0	4404.0	1.8340E-07	0.0	2.0	20.0
14	580.0	4402.0	4.9228E-08	0.0	2.0	20.0
15	582.0	4402.0	1.4286E-07	0.0	2.0	20.0

(continued)

TABLE A-2 (continued)

(e) Emission Set 5 - Hartford Urban Area

X (Km)	Y (Km)	Width (Km)	SO_2 Emission (g/sec)	Part. Emission (g/sec)	Effective height (m)
690.0	4590.0	5000.0	1.38	1.56	25.6
695.0	4590.0	5000.0	1.38	1.56	25.6
690.0	4595.0	5000.0	1.38	1.56	25.6
695.0	4595.0	5000.0	1.38	1.56	25.6
700.0	4590.0	5000.0	0.71	0.92	20.9
705.0	4590.0	5000.0	0.71	0.92	20.9
700.0	4595.0	5000.0	0.71	0.92	20.9
705.0	4595.0	5000.0	0.71	0.92	20.9
710.0	4590.0	5000.0	0.32	0.16	15.9
715.0	4590.0	5000.0	0.32	0.16	15.9
710.0	4595.0	5000.0	0.32	0.16	15.9
715.0	4595.0	5000.0	0.32	0.16	15.9
720.0	4590.0	5000.0	0.18	0.09	14.8
720.0	4595.0	5000.0	0.18	0.09	14.8
670.0	4600.0	5000.0	2.12	3.01	35.3
675.0	4600.0	5000.0	2.12	3.01	35.3
670.0	4605.0	5000.0	2.12	3.01	35.3
675.0	4605.0	5000.0	2.12	3.01	35.3
680.0	4600.0	5000.0	3.04	3.51	30.0
685.0	4600.0	5000.0	3.04	3.51	30.0
680.0	4605.0	5000.0	3.04	3.51	30.0
685.0	4605.0	5000.0	3.04	3.51	30.0
690.0	4600.0	5000.0	2.21	3.15	31.0
695.0	4600.0	5000.0	2.21	3.15	31.0
690.0	4605.0	5000.0	2.21	3.15	31.0
700.0	4630.0	5000.0	1.78	2.04	22.4
705.0	4630.0	5000.0	1.78	2.04	22.4
700.0	4635.0	5000.0	1.78	2.04	22.4
705.0	4635.0	5000.0	1.78	2.04	22.4
710.0	4630.0	5000.0	5.75	6.85	31.5
710.0	4635.0	5000.0	0.28	0.20	20.5
715.0	4635.0	5000.0	1.31	3.53	22.8
720.0	4635.0	5000.0	0.44	1.18	20.5
675.0	4640.0	5000.0	0.96	0.64	20.5
675.0	4645.0	5000.0	0.21	0.15	20.5
680.0	4640.0	5000.0	0.53	0.92	22.4
685.0	4640.0	5000.0	0.53	0.92	22.4
680.0	4645.0	5000.0	0.53	0.92	22.4
685.0	4645.0	5000.0	0.53	0.92	22.4
690.0	4640.0	5000.0	1.95	2.03	31.0
695.0	4645.0	5000.0	1.95	2.03	31.0

(continued)

TABLE A-2 (continued)

(e) Continued

X (Km)	Y (Km)	Width (Km)	SO_2 Emission (g/sec)	Part. Emission (g/sec)	Effective height (m)
690.0	4645.0	5000.0	1.95	2.03	31.0
695.0	4645.0	5000.0	1.95	2.03	31.0
700.0	4640.0	5000.0	1.48	1.52	22.4
705.0	4640.0	5000.0	1.48	1.52	22.4
700.0	4645.0	5000.0	1.48	1.52	22.4
705.0	4645.0	5000.0	1.48	1.52	22.4
710.0	4640.0	5000.0	1.05	1.19	20.5
710.0	4645.0	5000.0	0.44	0.40	20.5
715.0	4640.0	5000.0	0.65	1.76	20.5
675.0	4650.0	5000.0	0.21	0.15	12.7
685.0	4650.0	5000.0	0.60	0.61	14.8
690.0	4650.0	5000.0	0.60	0.61	21.3
695.0	4650.0	5000.0	0.60	0.61	21.3
700.0	4650.0	5000.0	2.03	2.11	22.4
705.0	4650.0	5000.0	1.42	1.35	21.3
710.0	4650.0	5000.0	0.61	0.44	20.5
695.0	4605.0	5000.0	2.21	3.15	31.0
700.0	4600.0	5000.0	1.08	0.95	22.4
705.0	4600.0	5000.0	1.08	0.95	22.4
700.0	4605.0	5000.0	1.08	0.95	22.4
705.0	4605.0	5000.0	1.08	0.95	22.4
660.0	4610.0	5000.0	2.01	1.21	35.3
665.0	4610.0	5000.0	2.01	1.21	35.3
660.0	4615.0	5000.0	2.01	1.21	35.3
665.0	4615.0	5000.0	2.01	1.21	35.3
670.0	4610.0	5000.0	3.55	3.87	43.9
675.0	4610.0	5000.0	3.55	3.87	43.9
670.0	4615.0	5000.0	3.55	3.87	43.9
675.0	4615.0	5000.0	3.55	3.87	43.9
680.0	4610.0	5000.0	6.75	4.95	43.9
685.0	4610.0	5000.0	6.75	4.95	43.9
680.0	4615.0	5000.0	6.75	4.95	43.9
685.0	4615.0	5000.0	6.75	4.95	43.9
690.0	4610.0	5000.0	3.24	5.28	43.9
695.0	4610.0	5000.0	3.24	5.28	43.9
690.0	4615.0	5000.0	3.24	5.28	43.9
695.0	4615.0	5000.0	3.24	5.28	43.9
700.0	4610.0	5000.0	1.30	1.70	31.0
705.0	4610.0	5000.0	1.30	1.70	31.0
700.0	4615.0	5000.0	1.30	1.70	31.0
705.0	4615.0	5000.0	1.30	1.70	31.0
710.0	4610.0	5000.0	0.35	0.44	20.2

(continued)

TABLE A-2 (continued)

(e) Continued

X (Km)	Y (Km)	Width (Km)	SO_2 Emission (g/sec)	Part. Emission (g/sec)	Effective height (m)
715.0	4610.0	5000.0	0.35	0.44	20.2
710.0	4615.0	5000.0	0.35	0.44	20.2
715.0	4615.0	5000.0	0.35	0.44	20.2
665.0	4620.0	5000.0	0.34	0.23	18.1
665.0	4625.0	5000.0	0.34	0.23	18.1
670.0	4620.0	5000.0	1.12	1.78	37.5
675.0	4620.0	5000.0	1.12	1.78	37.5
670.0	4625.0	5000.0	1.12	1.78	37.5
675.0	4625.0	5000.0	1.12	1.78	37.5
680.0	4620.0	5000.0	4.49	5.30	43.9
685.0	4620.0	5000.0	4.49	5.30	43.9
680.0	4625.0	5000.0	4.49	5.30	43.9
685.0	4625.0	5000.0	4.49	5.30	43.9
690.0	4620.0	5000.0	12.13	11.85	43.9
695.0	4620.0	5000.0	12.13	11.85	43.9
690.0	4625.0	5000.0	12.13	11.85	43.9
695.0	4625.0	5000.0	12.13	11.85	43.9
700.0	4620.0	5000.0	3.85	4.95	37.5
705.0	4620.0	5000.0	3.85	4.95	37.5
700.0	4625.0	5000.0	3.85	4.95	37.5
705.0	4625.0	5000.0	3.85	4.95	37.5
710.0	4620.0	5000.0	0.61	0.75	20.2
715.0	4620.0	5000.0	0.71	0.82	18.1
710.0	4625.0	5000.0	0.61	0.75	20.2
670.0	4630.0	5000.0	1.17	0.73	22.4
675.0	4630.0	5000.0	1.17	0.73	22.4
670.0	4635.0	5000.0	1.17	0.73	22.4
675.0	4635.0	5000.0	1.17	0.73	22.4
680.0	4630.0	5000.0	1.72	1.62	24.8
685.0	4630.0	5000.0	1.72	1.62	24.8
680.0	4635.0	5000.0	1.72	1.62	24.8
685.0	4635.0	5000.0	1.72	1.62	24.8
690.0	4630.0	5000.0	1.88	3.22	24.8
695.0	4630.0	5000.0	1.88	3.22	24.8
690.0	4635.0	5000.0	1.88	3.22	24.8
695.0	4635.0	5000.0	1.88	3.22	24.8

(continued)

TABLE A-2 (continued)

(e) Continued

X (Km)	Y (Km)	Width (Km)	SO_2 Emission (g/sec)	Part. Emission (g/sec)	Stack Parameters Height (m)	Diameter (m)	Velocity (m/sec)	Temp (°K)
690.9	4636.6	0.0	1.09	0.12	15.2	0.6	9.2	463.7
687.5	4645.2	0.0	0.00	1.24	3.0	0.6	1.6	286.1
696.4	4624.4	0.0	4.35	0.78	43.3	1.6	9.0	488.7
696.4	4624.4	0.0	3.54	0.63	42.7	1.6	10.4	477.6
696.4	4624.4	0.0	1.76	0.35	43.3	1.6	12.4	505.4
696.3	4623.4	0.0	1.18	0.12	29.3	2.0	14.7	577.6
696.3	4623.4	0.0	1.24	0.12	29.3	2.0	14.7	577.6
696.3	4623.4	0.0	1.96	0.20	29.3	2.0	14.7	577.6
696.3	4623.4	0.0	1.12	0.12	29.3	2.0	14.7	577.6
696.3	4623.4	0.0	2.07	0.20	29.3	2.3	18.0	644.3
696.3	4623.4	0.0	2.27	0.23	29.3	2.3	18.0	644.3
683.0	4614.5	0.0	0.00	0.86	3.0	1.7	0.1	294.3
678.2	4615.5	0.0	2.10	0.20	9.1	0.9	9.0	449.8
689.5	4623.2	0.0	0.72	0.06	53.6	2.3	20.1	449.8
689.5	4623.2	0.0	0.72	0.06	53.6	2.3	20.1	449.8
689.5	4623.2	0.0	0.72	0.06	53.6	2.3	20.1	449.8
689.5	4623.2	0.0	0.72	0.06	53.6	2.3	20.1	449.8
689.6	4622.6	0.0	3.86	18.48	54.9	3.5	5.1	477.6
689.6	4639.5	0.0	5.53	1.15	42.7	0.6	80.8	588.7
691.7	4645.9	0.0	1.61	0.17	17.4	1.7	3.4	505.4
691.7	4645.9	0.0	1.61	0.17	17.4	1.7	3.4	505.4
691.7	4645.9	0.0	1.61	0.17	17.4	1.7	3.4	505.4
691.7	4645.9	0.0	0.92	0.09	12.5	1.2	6.7	533.1
711.8	4637.7	0.0	0.81	0.09	36.6	1.7	4.3	519.3
711.8	4637.7	0.0	1.21	0.12	36.6	1.7	4.3	519.3
696.0	4608.0	0.0	1.53	0.14	12.8	1.8	4.9	588.7
703.6	4601.3	0.0	1.24	0.12	13.7	8.4	19.5	422.0
701.9	4603.1	0.0	46.41	4.66	152.4	5.5	29.9	588.7

TABLE A-3. LABOR COSTS FOR ACQUISITION AND PREPARATION OF EMISSION DATA

(a) Cost Estimates Assuming Compliance with 1978 AQMG

Emission Data Set		Acquisition and preparation cost															
		Labor grade															
		4		5		6		7		8		9		10		Total Cost	
Set No.	Description	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars
1	Large point source					12	300			4	140					16	440
2	Multi-point source			16	310	36	890			4	140					56	1340
3	Industrial source complex			16	310	24	590			4	140					44	1040
4	Point and area sources in an urban area			24	470	60	1490			16	550					100	2510
5	Metropolitan area point and area sources			32	620	80	1970			16	550					128	3140
6	Line source	16	310													16	310

Note: All costs are in 1980 dollars.

(continued)

TABLE A-3 (continued)

(b) *Cost Estimates Assuming Compliance with 1980 Proposed AQMG, Three Load Conditions are Prepared*

Emission Data Set		Acquisition and preparation cost															
		Labor grade															
		4		5		6		7		8		9		10		Total Cost	
Set No.	Description	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars
1	Large point source					16	390			4	140					20	530
2	Multi-point source			16	310	52	1300			8	280					76	1890
3	Industrial source complex			16	310	40	990			8	280					64	1580
4*	Point and area sources in an urban area			[illegible]	470	[illegible]	2270			24	830					140	570
5*	Metropolitan area point and area source			32	620	112	2760			24	830					168	4210
6*	Line source			24	470			-								24	470

*The cost estimates are not for preparing multi-load emission data sets, but for preparing two additional control strategy emission data sets

Note: All costs are in 1980 dollars.

TABLE A-4. COST OF ACQUIRING HOURLY METEOROLOGICAL DATA FROM THE NATIONAL CLIMATIC CENTER FOR USE IN AIR QUALITY MODELS

Type of meteorological data	Readily available data Cost (dollars)		Unprepared data Cost (dollars)	
	1 Year	5 Years	1 Year	5 Years
Surface	185	185	990	4470
Upper air	185	185	315	630
Total Cost	370[a]	370[a]	1305	5100

[a]Data acquisition costs used in the study.

Note: All costs are in 1980 dollars.

TABLE A-5. COST OF ACQUIRING STATISTICAL TABULATION OF WIND DIRECTION AND WIND SPEED (STAR) DATA FROM NATIONAL CLIMATIC CENTER FOR USE IN AIR QUALITY MODELS

(a) Already Prepared and Readily Available Data

Type of STAR summary tables	Form of delivered data: Tabulated data sheets, 5 stability categories	Tabulated data sheets, 6 stability categories	Punched cards, 5 stability categories	Punched cards, 6 stability categories	Magnetic tape, 5 stability categories	Magnetic tape, 6 stability categories
	Cost (dollars)		Cost (dollars)		Cost (dollars)	
Annual	8	10	70[a]	70[a]	120	120
Annual and seasonal	18	21	75	75	120	120
Annual and monthly	45	50	75	75	120	120

(b) Cost of STAR data that NCC is compiling for the first time

Type of STAR summary tables	Form of delivered data: Tabulated data sheets and punched cards, Averaging period 1 Year	Tabulated data sheets and punched cards, 5 Years	Tabulated data sheets and punched cards, 10 Years	Tabulated data sheets, punched cards, and magnetic tape, Averaging period 1 Year	Tabulated data sheets, punched cards, and magnetic tape, 5 Years	Tabulated data sheets, punched cards, and magnetic tape, 10 Years
	Cost (dollars)			Cost (dollars)		
Annual	315	350	440	380	440	575
Annual and seasonal	350	420	500	415	530	645
Annual and monthly	420	525	630	485	735	975

[a]Data acquisition cost used in the study. If five annual STAR data sets are required, the acquisition cost would be $350.

Note: all costs are in 1980 dollars.

TABLE A-6. LABOR, MATERIALS AND COMPUTER COSTS FOR ACQUISITION AND PREPARATION OF METEOROLOGICAL DATA

(a) Hourly Meteorological Data Set for 1-Year Period

	Acquisition and preparation costs										
	Labor grade										
	5		6		7			Computer		Total Cost	
Procedure	Hours	Dollars	Hours	Dollars	Hours	Dollars	Materials dollars	CPU (sec)	Dollars	hours	dollars
1. Acquisition of surface/ upper air data from NCC	4	80			1	30	370	-	-	5	480
2. Compilation of CRSTER preprocessor					4	120	-	10	10	4	130
3. Prepare meteorological file with CRSTER preprocessor			4	100				10	10	4	110
Total	4	80	4	100	5	150	370	20	20	13	720

(continued)

Note: All costs are in 1980 dollars.

TABLE A-6 (continued)

(b) Hourly Meteorological Data Set for 5-Year Period

	Acquisition and preparation costs										
	Labor grade										
	5		6		7			Computer		Total Cost	
Procedure	Hours	Dollars	Hours	Dollars	Hours	Dollars	Materials dollars	CPU (sec)	Dollars	hours	dollars
1. Acquisition of surface/ upper air data from NCC	4	80			1	30	370	-	-	5	480
2. Compilation of CRSTER preprocessor					4	120		10	10	4	130
3. Prepare meteorological file with CRSTER preprocessor			8	200				80	70	8	270
Total	4	80	8	200	5	150	370	90	80	17	880

Note: All costs are in 1980 dollars.

(continued)

TABLE A-6 (continued)

(c) STAR Meteorological Data Set assuming a 5-Year Average, Already Prepared.

	Acquisition and preparation costs										
	Labor grade										
	5		6		7			Computer		Total Cost	
Procedure	Hours	Dollars	Hours	Dollars	Hours	Dollars	Materials dollars	CPU (sec)	Dollars	hours	dollars
1. Acquisition of STAR data	2	40			1	30	70	--	-	3	140
2. Prepare meteorological file for model use	4	80						10	10	4	90
Total	6	120			1	30	70	10	10	7	230

Note: All costs are in 1980 dollars.

(continued)

TABLE A-6 (continued)

(d) STAR Meteorological Data Set assuming 5 Annual Averages, Already Prepared

	Acquisition and preparation costs										
	Labor grade										
	5		6		7			Computer		Total Cost	
Procedure	Hours	Dollars	Hours	Dollars	Hours	Dollars	Materials dollars	CPU (sec)	Dollars	hours	dollars
1. Acquisition of STAR data	2	40			1	30	350	--	-	3	420
2. Prepare meteorological file for model use	8	150						10	10	8	160
Total	10	190			1	30	350	10	10	11	580

Note: All costs are in 1980 dollars.

(continued)

TABLE A-6 (continued)

(e) Onsite Meteorological Data for 1-Year Period

Procedure	Labor grade 3 Hours	3 Dollars	5 Hours	5 Dollars	6 Hours	6 Dollars	8 Hours	8 Dollars	10 Hours	10 Dollars	Materials Dollars	Computer CPU (sec)	Computer Dollars	Total Cost hours	Total Cost dollars
1. Collection and processing of onsite data (see Appendix B for detail)	48	730	904	17,620	948	23,410	128	4,430	56	2,800	13,410	1,000	1,000	2084	63,400
2. Acquisition of NWS upper air data	4	80					1	30			190			5	300
3. Compilation of CRSTER preprocessor					4	100						10	10	4	110
4. Prepare meteorological file with CRSTER preprocessor					4	100						10	10	4	110
Total Cost	52	810	904	17,620	956	23,610	129	4,460	56	2,800	53,500	1,020	1,020	2097	63,920

[a]Material costs consist of meteorological equipment costs amortized over useful life of equipment (See Appendix B) and the cost of NWS hourly meteorological data tape (see Table B-5).

Note: All costs are in 1980 dollars.

TABLE A-7. COST INFORMATION ON ACQUISITION OF UNAMAP MODELS

TAPE NAME:	UNAMAP (VERSION 4)
ACCESSION NUMBER:	PB 81 164 600
PRICE	$840
AVAILABLE FROM:	COMPUTER PRODUCTS 703/487-4763 NATIONAL TECHNICAL INFORMATION SERVICE U.S. DEPARTMENT OF COMMERCE SPRINGFIELD, VA 22161

Note: All costs are in 1980 dollars.

TABLE A-8. LABOR AND COMPUTER COST OF SELECTION OF RECEPTOR LOCATIONS AND MODEL OPTIONS

(a) 5-Rings or 5-Kilometer Grid Resolution

Procedure	Labor grade 5		6		7		8		Computer		Total Cost	
	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	hours	dollars
1. Run EPA screening model, PTPLU			8	200					10	10	8	210
2. Select location of worst case receptors			12	300			4	140			16	440
3. Prepare model input runstream: emission parameters, receptor locations, meteorological data, and model options.												
a. Emission Sets 1, 2 and 3	16	390			2	70					18	460
b. Emission Sets 4 and 5	32	790			4	140					36	930
Total												
a. Emission Sets 1, 2 and 3	36	890			6	210			10	10	42	1,110
b. Emission Sets 4 and 5	52	1,280			8	280			10	10	60	1,570

Note: All costs are in 1980 dollars.

(continued)

TABLE A-8 (continued)

(b) 10-Rings or 1 Kilometer Grid Resolution

Procedure	Labor grade 5 Hours	5 Dollars	6 Hours	6 Dollars	7 Hours	7 Dollars	8 Hours	8 Dollars	Computer CPU (sec)	Computer Dollars	Total Cost hours	Total Cost dollars
1. Run EPA screening model, PTPLU			8	200					10	10	8	210
2. Select location of worst case receptors			12	300			4	140			16	440
3. Prepare model input runstream: emission parameters, receptor locations, meteorological data, urban rural classification, and model options.												
a. Emission Sets 1, 2 and 3	8	160	24	590			4	140			36	890
b. Emission Sets 4 and 5			64	1,580			8	280			72	1,860
Total												
a. Emission Sets 1, 2 and 3	8	160	44	1,090			8	280	10	10	60	1,540
b. Emission Sets 4 and 5			84	2,080			12	420	10	10	96	2,510

Note: All costs are in 1980 dollars.

(continued)

TABLE A-8 (continued)

(c) 10-Rings or 1 Kilometer Grid Resolution, 3 Load Conditions

Procedure	Labor grade 5 Hours	5 Dollars	6 Hours	6 Dollars	7 Hours	7 Dollars	8 Hours	8 Dollars	Computer CPU (sec)	Computer Dollars	Total Cost hours	Total Cost dollars
1. Run EPA screening model, PTPLU			8	200					10	10	8	210
2. Select location of worst case receptors			16	390			4	140			20	530
3. Prepare model input runstream: emission parameters, receptor locations, meteorological data, urban rural classification, and model options.												
a. Emission Sets 1, 2 and 3			40	990			8	280			48	1,270
b. Emission Sets 4 and 5			100	2,470			16	550			116	3,020
Total												
a. Emission Sets 1, 2 and 3			64	1,580			12	420	10	10	76	2,010
b. Emission Sets 4 and 5			124	3,060			20	690	10	10	144	3,760

Note: All costs are in 1980 dollars.

(continued)

APPENDIX B

COST ESTIMATE FOR COLLECTING AND PROCESSING 1-YEAR OF ONSITE METEOROLOGICAL DATA

In this Appendix, a detailed breakdown of the costs involved in running and processing data from an onsite meteorological station is presented. GCA assumed that a 10 meter permanent meteorological tower would be constructed and that continuous measurements of horizontal and vertical wind speed, wind direction, precipitation and temperature would be made for 1 year. The instruments would be connected to an onsite data processor. The measurements would be averaged over one hour intervals (the vertical wind speed fluctuations would be converted to Pasquill-Gifford stability category) and recorded on magnetic tape by the data processor.

GCA contacted Weathermeasure Division of Systron Donner in Sacramento, California to get an estimate on the cost of materials for a 10 meter meteorological station with the capability of measuring and recording on magnetic tape the following:

- one hour averaged transport wind speed and direction,
- one hour averaged temperature, and
- hourly Pasquill-Gifford Stability category (based on the standard deviation of vertical wind speed fluctuations over a one hour period).

The cost of the meteorological tower and instruments, data processor, cable and services are itemized in Table B-1.

The equipment costs listed in Table B-1 are combined with the cost of all additional required materials in Table B-2 to arrive at a total equipment cost for a 10 meter high meteorological station. If a 100 meter tower was desired instead, GCA and Weathermeasure estimate that there would be an added expense of 55,000 dollars for materials and installation.

To arrive at an equipment cost estimate for a 1-year onsite study, the equipment costs were amortized over the useful life of the equipment. The annual equipment cost is equal to the cost of the equipment times the capital recovery factor (CRF). CRF is defined as follows:

$$CRF = \frac{i\ (1 + i)^n}{(1 + i)^n - 1}$$

TABLE B-1. COST OF METEOROLOGICAL STATION INSTRUMENTS, DATA PROCESSOR AND ACCESSORIES*

Description	Cost (dollars)
AQM 1 Station A standard 10 meter permanent meteorological tower. Features include cup anemometer and wind vane (W2034 series), thermistor (WMLTX-T), steel frame (WMT1/03), and base plate (667151)	16,900
Sensor Accessories	
W173-A Propeller Anemometer	300
W173-MA Mast Adapter	40
P511-E Rain/Snow Gauge, Electrically Heated (Substituted for P501-I)	530
MD173-LC Wind Speed Module	250
Data Acquisition	
M10-I/O Parallel Input/Output Port (M-10 Tape Recorder)	300
M-10 Magnetic Tape Recorder (Kennedy 9832)	11,500
RC19 Cabinet	1,000
RCP/14-EW Recorder Panel	260
REW12V-6 Recorder (Six Point)	2,780
REW2P-12V/12V (Two Pen)	4,950
Cable and Accessories	
Sensor Cable, 4 Conductor, 18 AWG	20
Power Cable, Vinyl, Shielded, 3 Conductor, 18 AWG	20
Miscellaneous Extra Cable to Rack From M733	100
WM/TM Cable Terminations	50
Engineering Services	
Systems Integration Calibration, Burn-in Special and/or Standard Documentation, One Complete Set	2,000
TOTAL COST	41,000

*Cost estimates based on information from Weathermeasure Division, Systron Donner, Sacramento, CA.

Note: All costs are in 1980 dollars.

TABLE B-2. COST OF EQUIPMENT REQUIRED TO RUN A METEOROLOGICAL STATION FOR 1 YEAR

	Cost (dollars)
Shelter 8 ft x 14 ft	6,580
Ladder and railing	680
Shipping	500
Power company electrical lines	200
Electrician, 1 day	280
Fence surrounding site	1,300
Tool kit	180
Environ. data 10% strip chart data reduction for quality assurance	850
Concrete slab	750
Meteorological instruments, computer, 10 meter tower	41,000
Total Cost	52,320[b]
Annual Equipment Cost[a]	12,420

[a]This value is used in all onsite meteorological equipment cost estimates in this study. The procedure for calculating the annual equipment cost is defined in the Appendix B text.

[b]If a 100 meter tower were constructed instead of a 10 meter tower, material and installation costs would add 55,000 dollars to the total equipment costs.

Note: All costs are in 1980 dollars.

TABLE B-3. LABOR COSTS FOR ESTABLISHING AND RUNNING A METEOROLOGICAL STATION FOR 1 YEAR

	Labor grade											
	3		5		6		8		10		Total cost	
Task description	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars
Management:												
Client Support							40	1,380	40	2,000	80	3,380
Presurvey of Site					8	200	8	280			16	480
Project Planning					8	200	8	280	4	200	20	680
Test Plan Preparation	8	120			8	200	24	830	4	200	44	1,350
Pretest Meeting							8	280	8	400	16	680
Labor:												
Equipment Calibration			120	2,340	120	2,960					240	5,300
Quarterly Calibrations			72	1,400	72	1,780					144	3,180
Routine Site Visits			312	6,080	312	7,700					624	13,780
Maintenance			72	1,400	72	1,780					144	3,180
Breakdown Time			40	780	40	990					80	1,770
Data Reduction					80	1,970					80	1,970
Quality Assurance					60	1,480					60	1,480
Report Writing	40	610			168	4,150					208	4,760
Total Cost	48	730	616	12,000	948	23,410	88	3,050	56	2,800	1756	41,990

Note: All costs are in 1980 dollars.

where: i = interest rate corrected for inflation
and n = useful life of equipment.

GCA calculated the annual equipment cost, assuming a 6 percent inflation corrected interest rate and a 5 year useful instrument life. The 5 year instrument life is based upon GCA experience. The annual equipment cost is presented in Table B-2. This value is used in all onsite meteorological data collection estimates.

The labor costs involved in running a meteorological station for 1 year are presented in Table B-3. In arriving at this labor estimate, GCA assumed the following:

- there would be an initial series of meeting and site visits required to select equipment and arrange for its installation and testing,
- it would require two people three weeks to set up and calibrate the meteorological data collecting system,
- there would be three quarterly calibrations by two engineers taking three days,
- there would be a 4-hour routine site visit by one engineer three times a week,
- there would be 12 hours per month of unscheduled maintenance, and
- it would take two people one week to shutdown and pack-up the system.

After the onsite surface data has been collected and documented in a report, the resulting data tape is used to create an hourly surface meteorological data tape in CRSTER preprocessor format. The tasks involved and their labor requirements are listed in Table B-4. The material costs involved in this assignment are presented in Table B-5.

The total cost of collecting and processing one year of onsite meteorological data is equal to the sum of the costs listed in Tables B-2, B-3, B-4, and B-5. It equals:

	Cost (1980 $)	Labor (hrs)
Amortized cost of equipment required to run a meteorological station for 1 year (See Table B-2 and accompanying text)	12,420	
Labor cost for establishing and running a meteorological station for 1 year	41,990	1,756
Labor cost for processing onsite data into CRSTER preprocessor format	7,000	328

	Cost (1980 $)	Labor (hrs)
Material and computer cost for processing onsite data into CRSTER preprocessor format	1,990	———
Cost of collecting and processing one year of onsite meteorological data	63,400	2,084

These costs are added to the costs of combining the surface and upper air data in Appendix A. In Table A-6(e), the total cost of collecting onsite data and preparing a CRSTER useable meteorological data file is presented. When costs of one year of onsite meteorological data are used in the main text or Appendix E, they originate from Table A-6(e).

TABLE B-4. LABOR COSTS FOR PROCESSING ONSITE DATA INTO CRSTER PREPROCESSOR FORMAT

	Labor grade											
	3		5		6		8		10		Total cost	
Task description	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars
Read onsite data tape and check for data gaps			80	1,560							80	1,560
Acquire coincident NWS surface data for filling data gaps			8	160							8	160
Process data and produce a data tape with proper format to be used as input to CRSTER preprocessor			200	3,900			40	1,380			240	5,280
Total Cost			288	5,620			40	1,380			328	7,000

Note: All costs are in 1980 dollars.

TABLE B-5. MATERIAL COST FOR PROCESSING ONSITE METEOROLOGICAL DATA INTO CRSTER PREPROCESSOR FORMAT

Material	Cost (1980 dollars)
NWS Hourly Meteorological Data Tape*	990
Computer Time	1,000
	1,990

*Hourly surface meteorological data from nearest NWS site is needed to fill data gaps in onsite data tape.

APPENDIX C

COST ESTIMATES FOR MODEL RUNS

This Appendix provides a detailed breakdown of the sensitivity study of air quality models CPU time to key input parameters. The models are addressed in the following order:

Model	Figures	Tables	Run number
CRSTER	-	C-1	1 through 3
MPTER	C-1 to C-2	C-2 to C-3	4
RAM	C-3 to C-4	C-4	5
RAM	C-5 to C-6	C-5 to C-6	6
ISCST	C-7 to C-8	C-7 to C-8	7
CDM	C-9	C-9	8
TEM8A	C-10	C-10 to C-11	9
TEM8A	C-11 to C-13	C-12	10
TEM8A	C-14 to C-15	C-13	11
TCM	C-16 to C-17	C-14 to C-15	12

The data presented in the above figures and tables were used to construct the computer cost table, Table 3, in the main text. In Table C-16(a) to C-16(1), the cost of a single run presented in Table 3 was used to determine the computer budget for each run ID, assuming various levels of data requirements. The computer budgets in Table C-16 were used in the total cost of a modeling anlysis Tables in Appendix E, as well as, in computer budgets quoted in the main text. All costs are in 1980 dollars.

Labor projections for running the models were made in Tables C-17(a) to C-17(f) based on GCA experience. The costs in these tables were used in the total cost of a modeling analysis Tables in Appendix E, and subsequently in the main text.

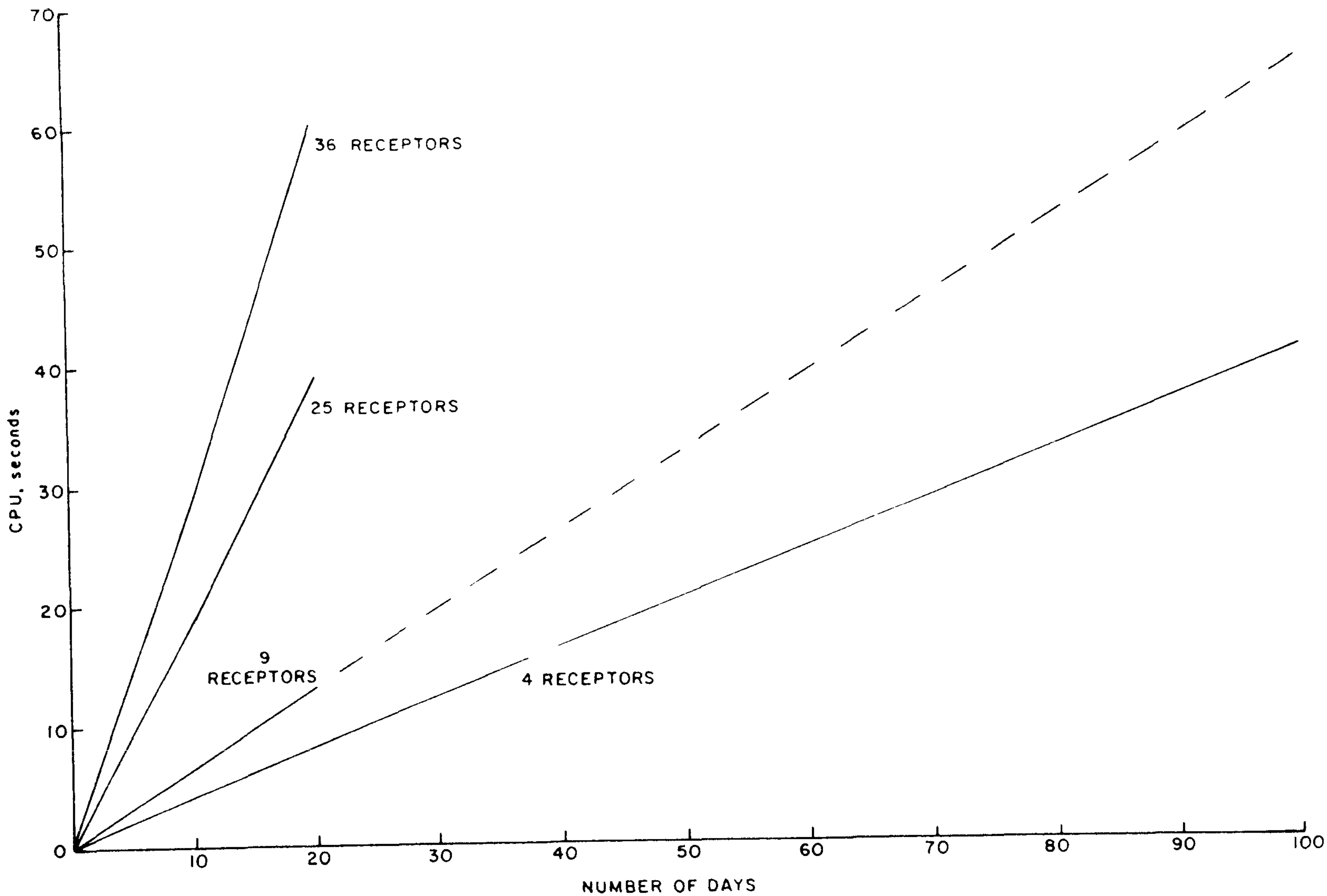

Figure C-1. Results of cost sensitivity study of MPTER performed for run number 4.

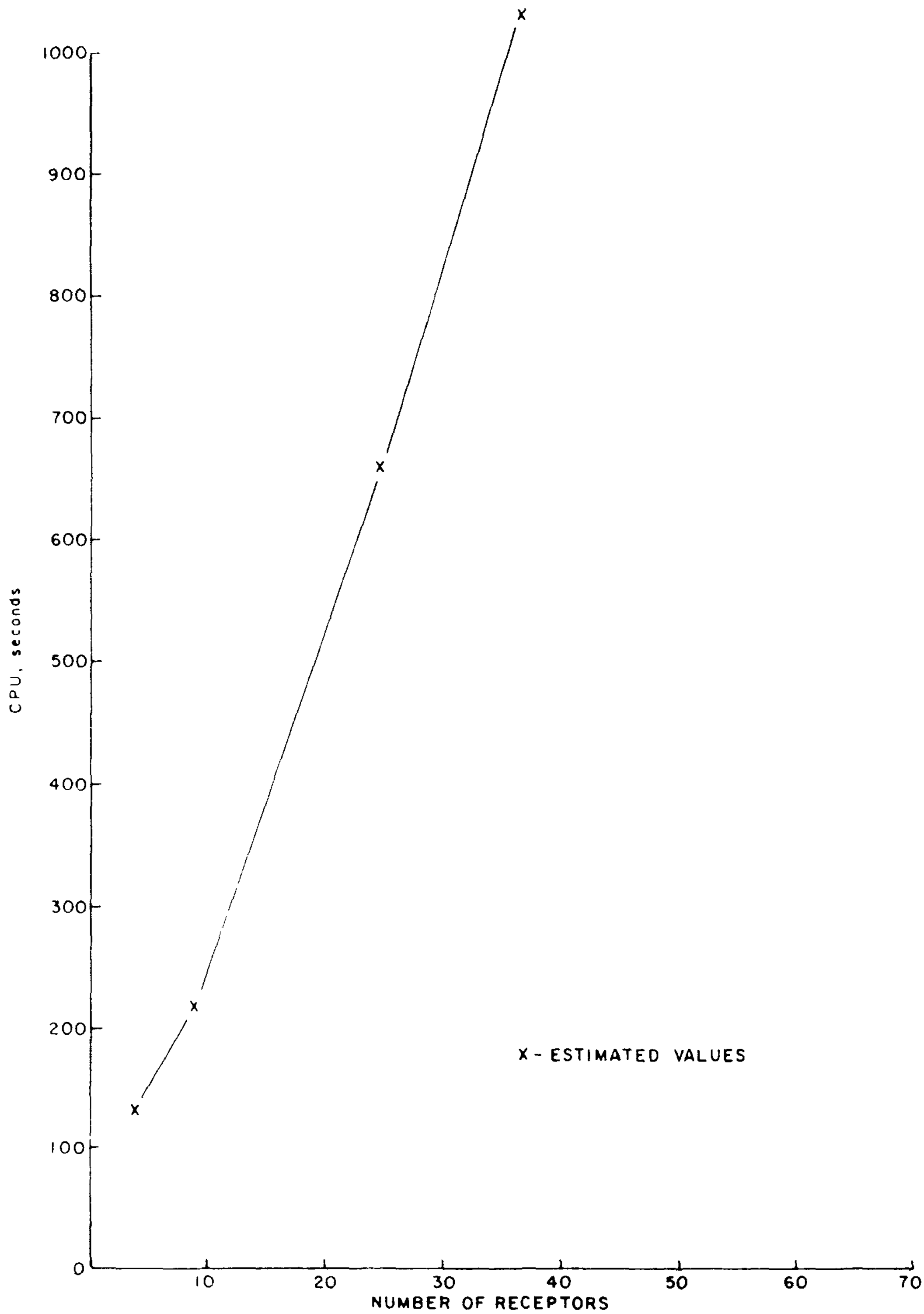

Figure C-2. Computer cost projections of a 1 year run of MPTER, run number 4.

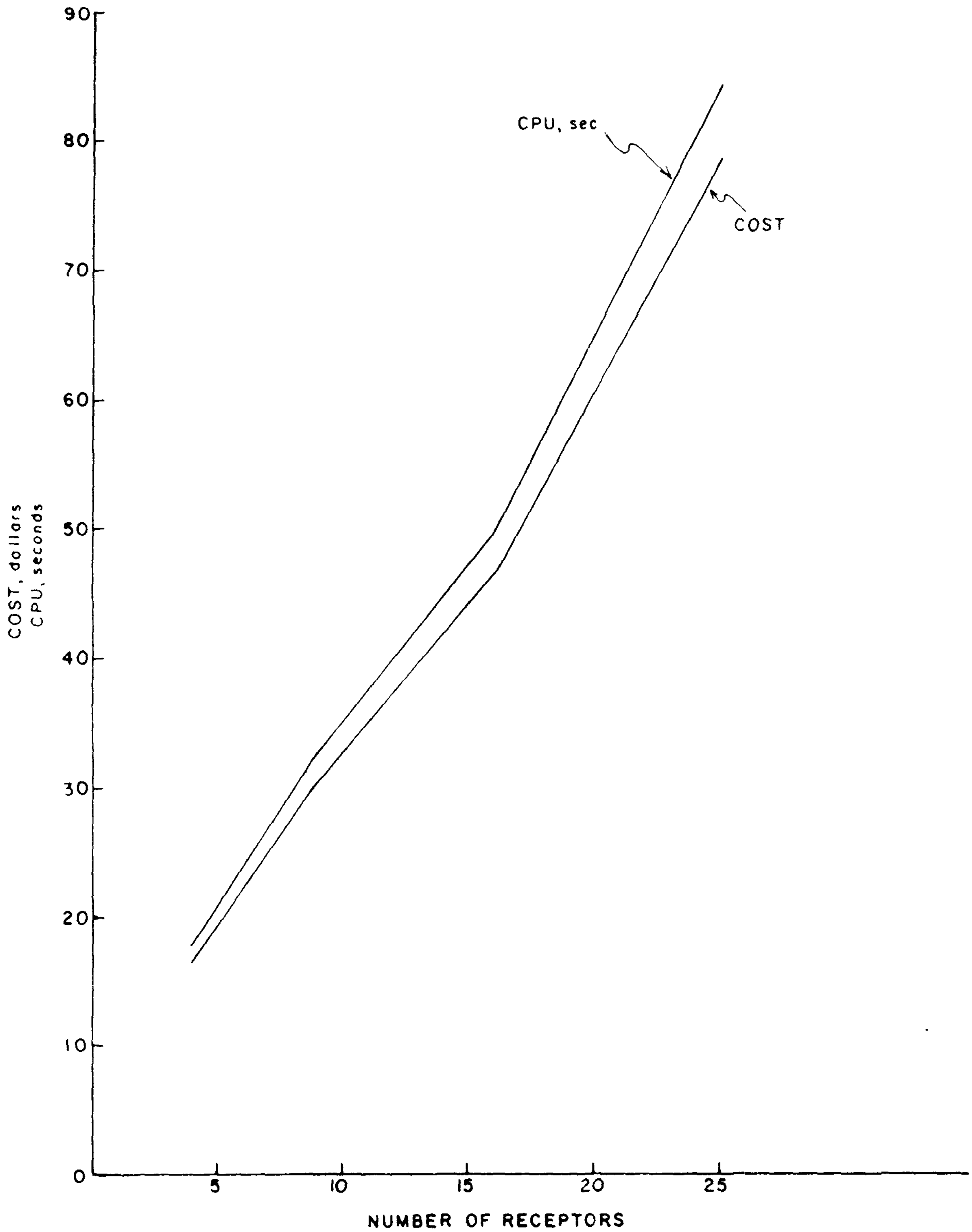

Figure C-3. Results of cost sensitivity study of RAM performed for run number 5.

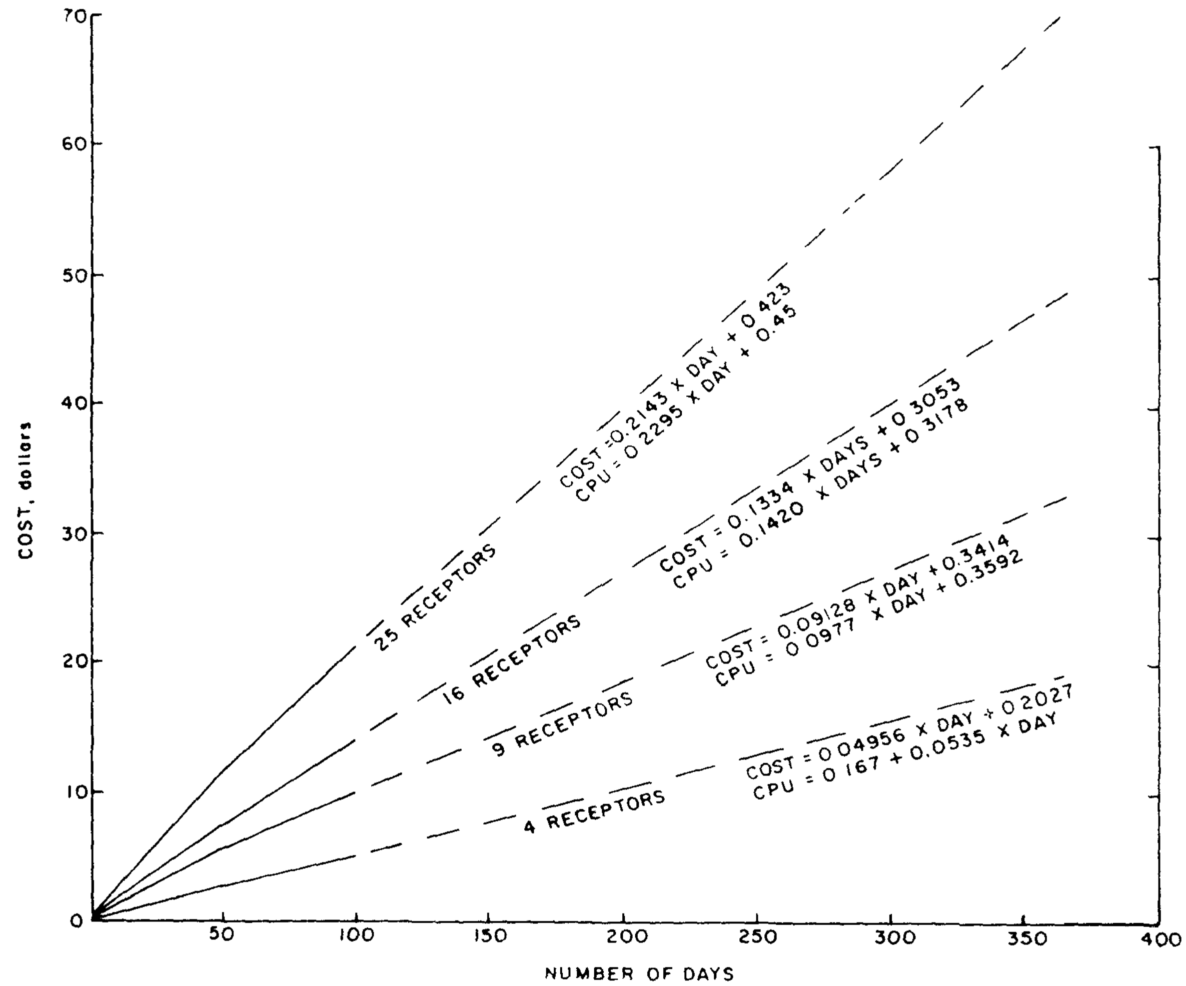

Figure C-4. Projected cost of a 1 year run of RAM, run number 5.

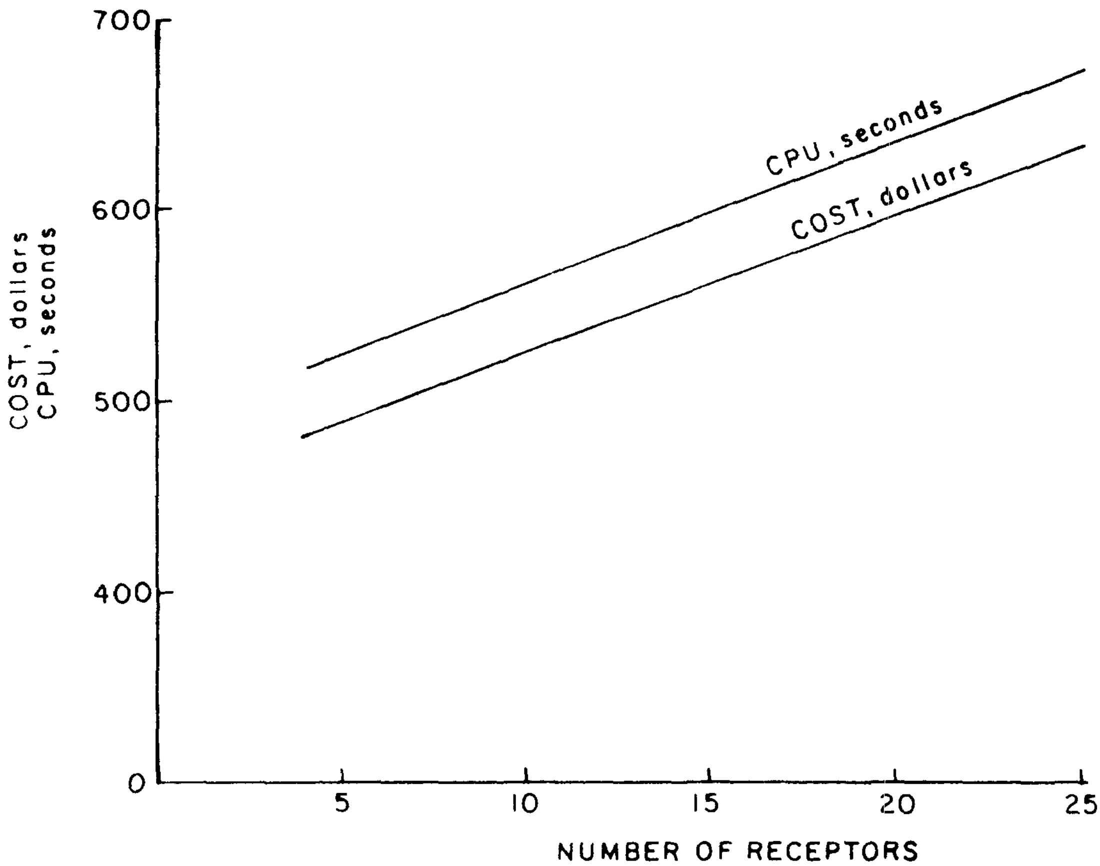

Figure C-5. Project cost of a 1 year run of RAM for run number 6.

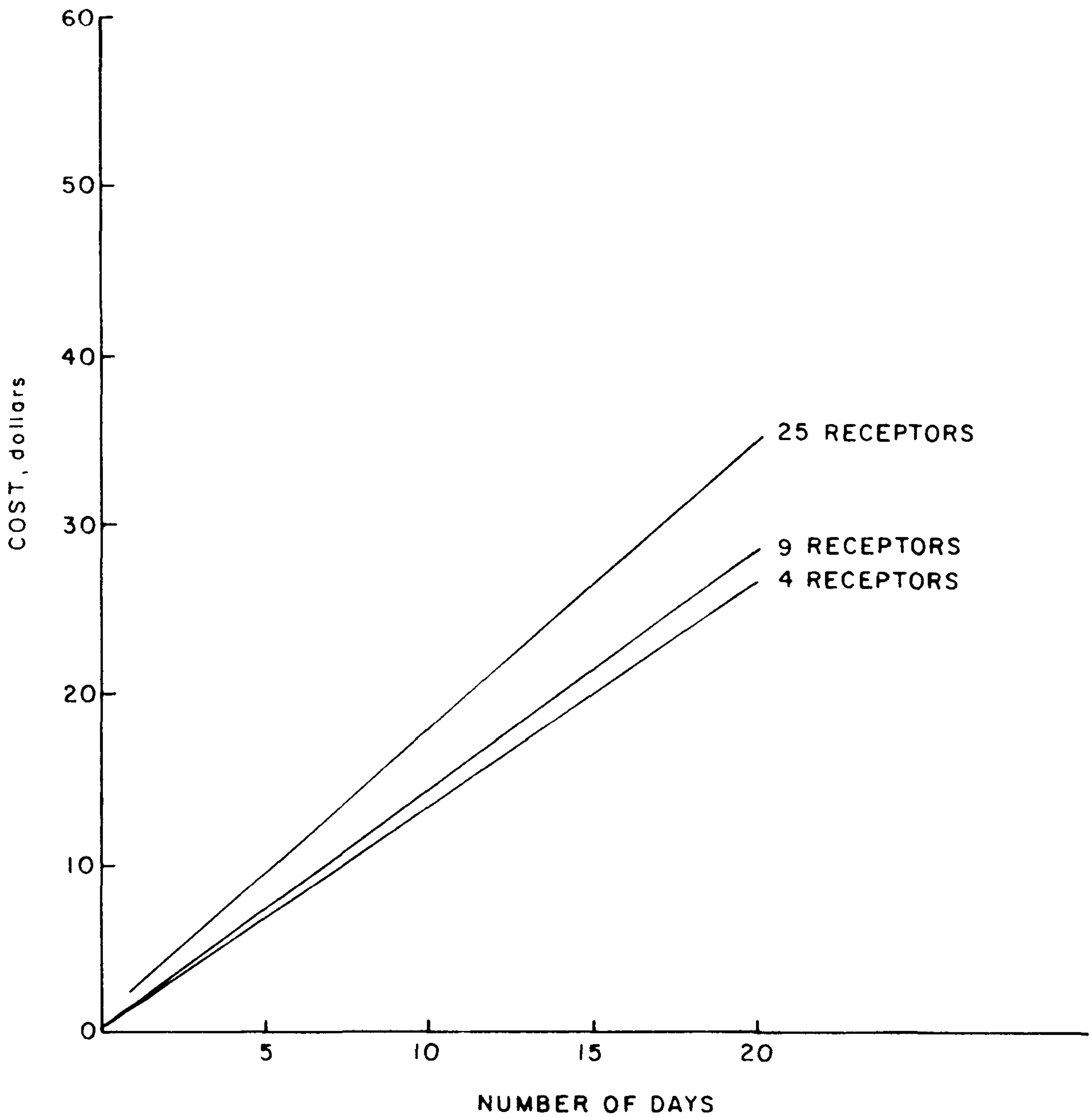

Figure C-6. Results of a cost sensitivity study of RAM performed for run number 5.

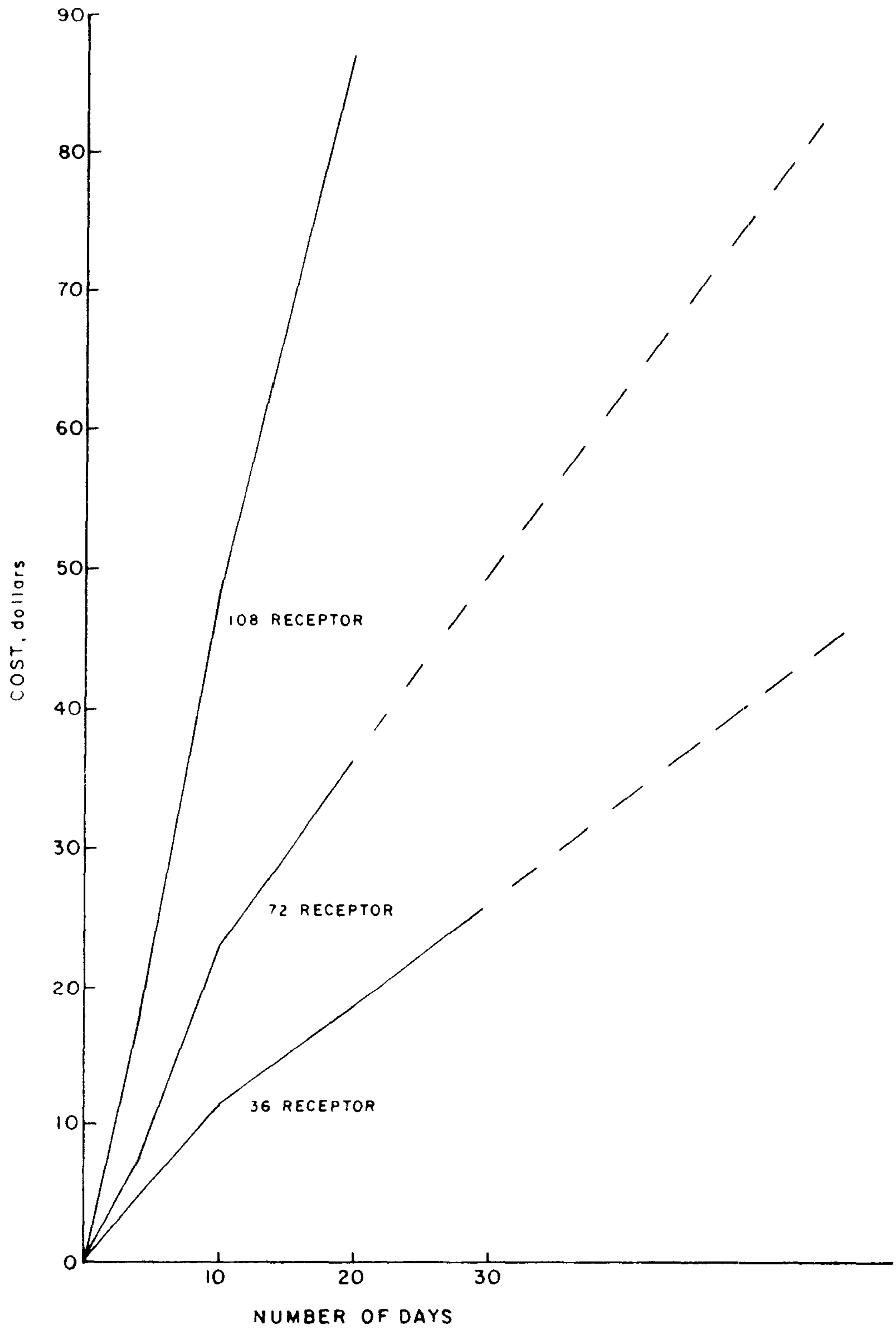

Figure C-7. Results of sensitivity study of ISCST for run number 7.

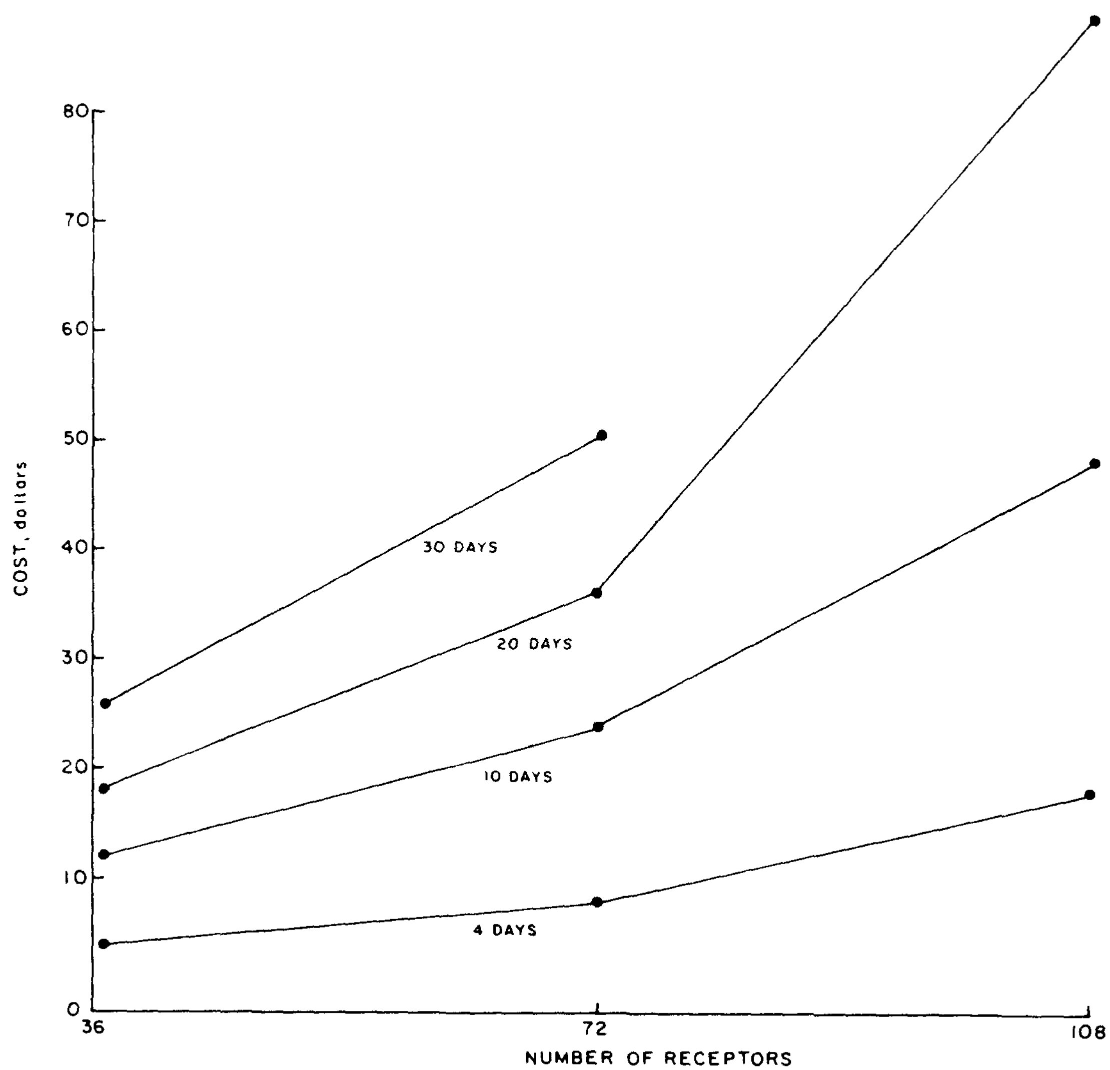

Figure C-8. Results of a sensitivity study of ISCST for run number 7.

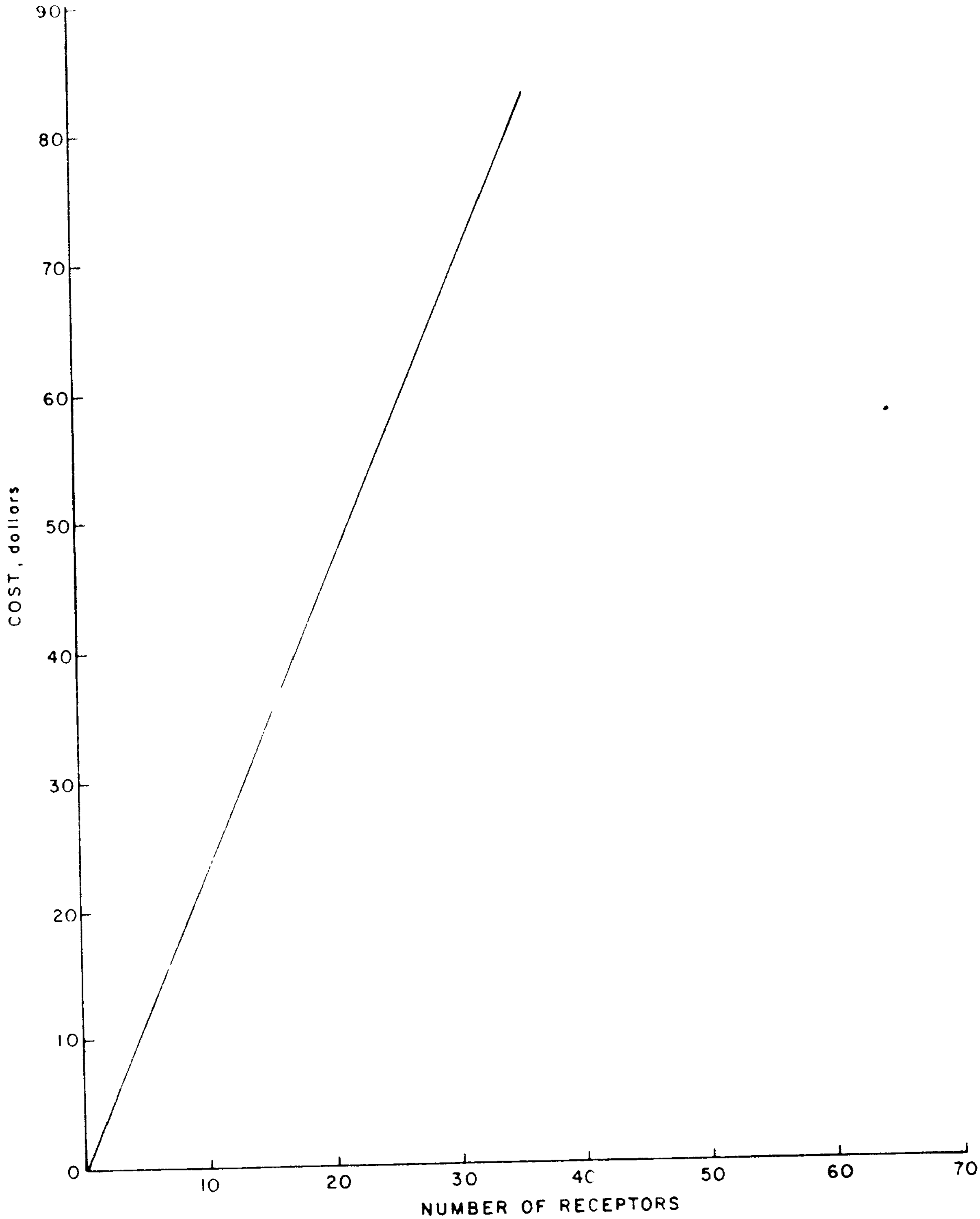

Figure C-9. Result of sensitivity study for run number 8.

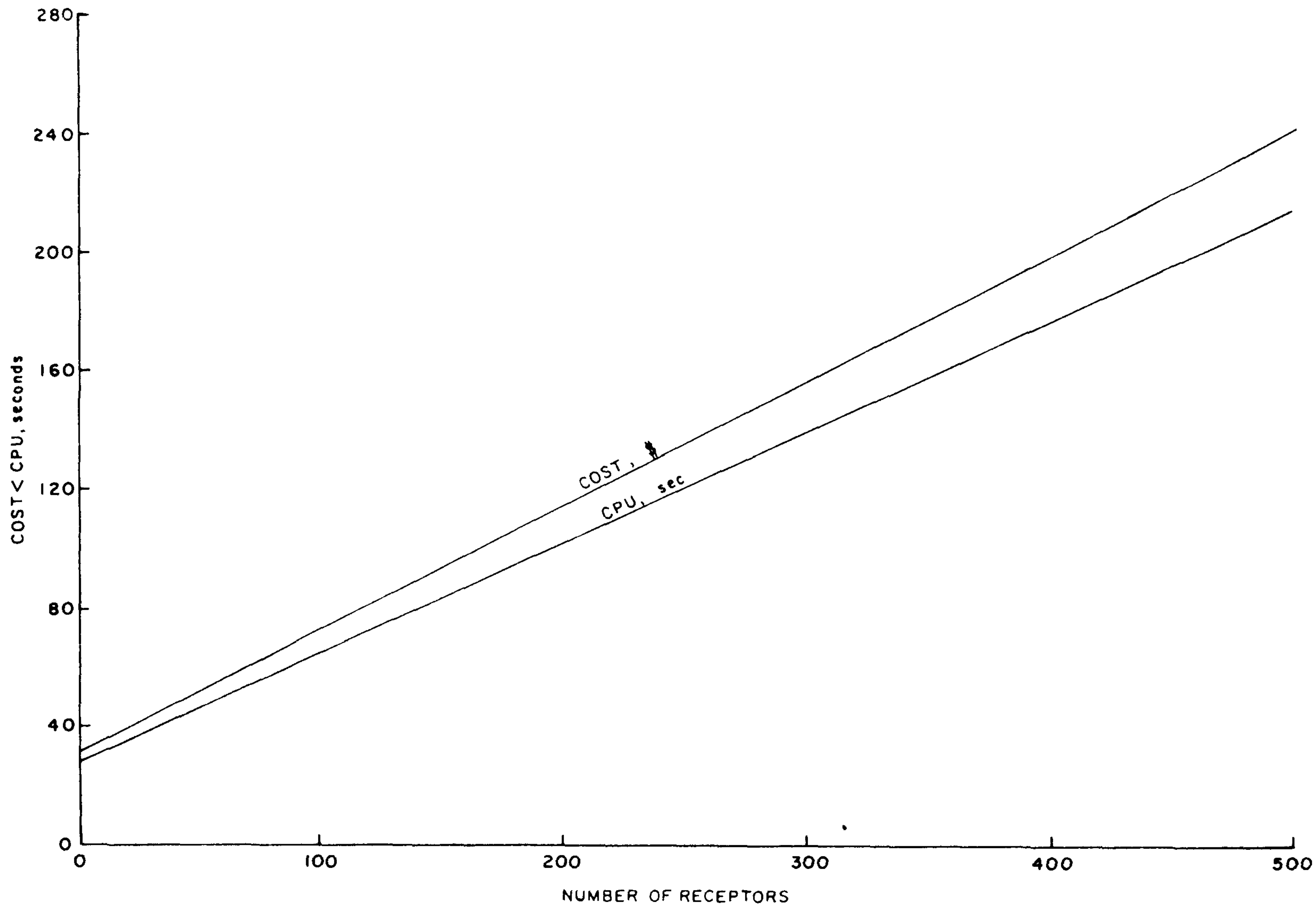

Figure C-10. Results of sensitivity study of TEM8A for run number 9.

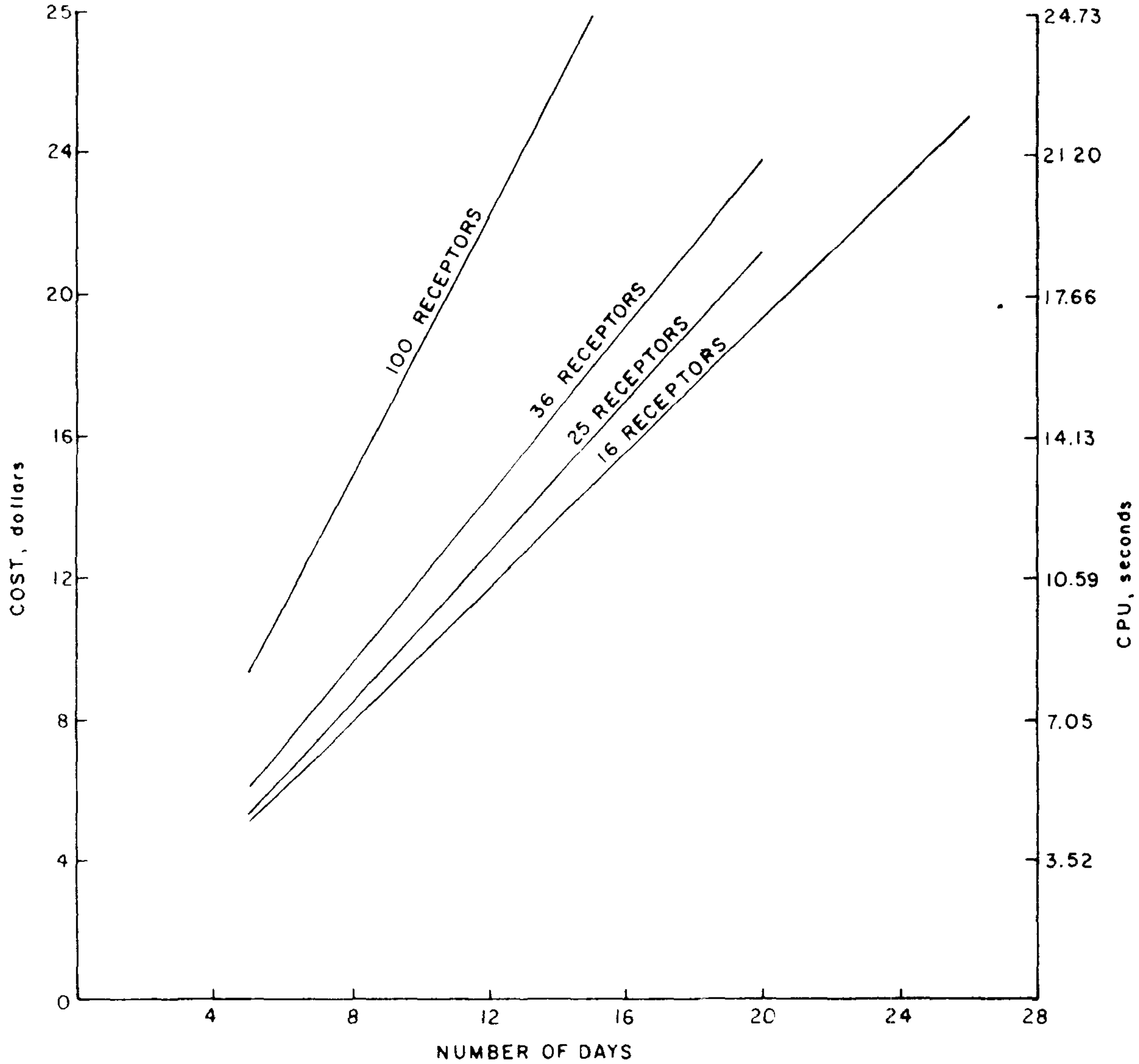

Figure C-11. Results of sensitivity study of TEM8A for run 10. Cost and CPU seconds by number of days for selected grid squares.

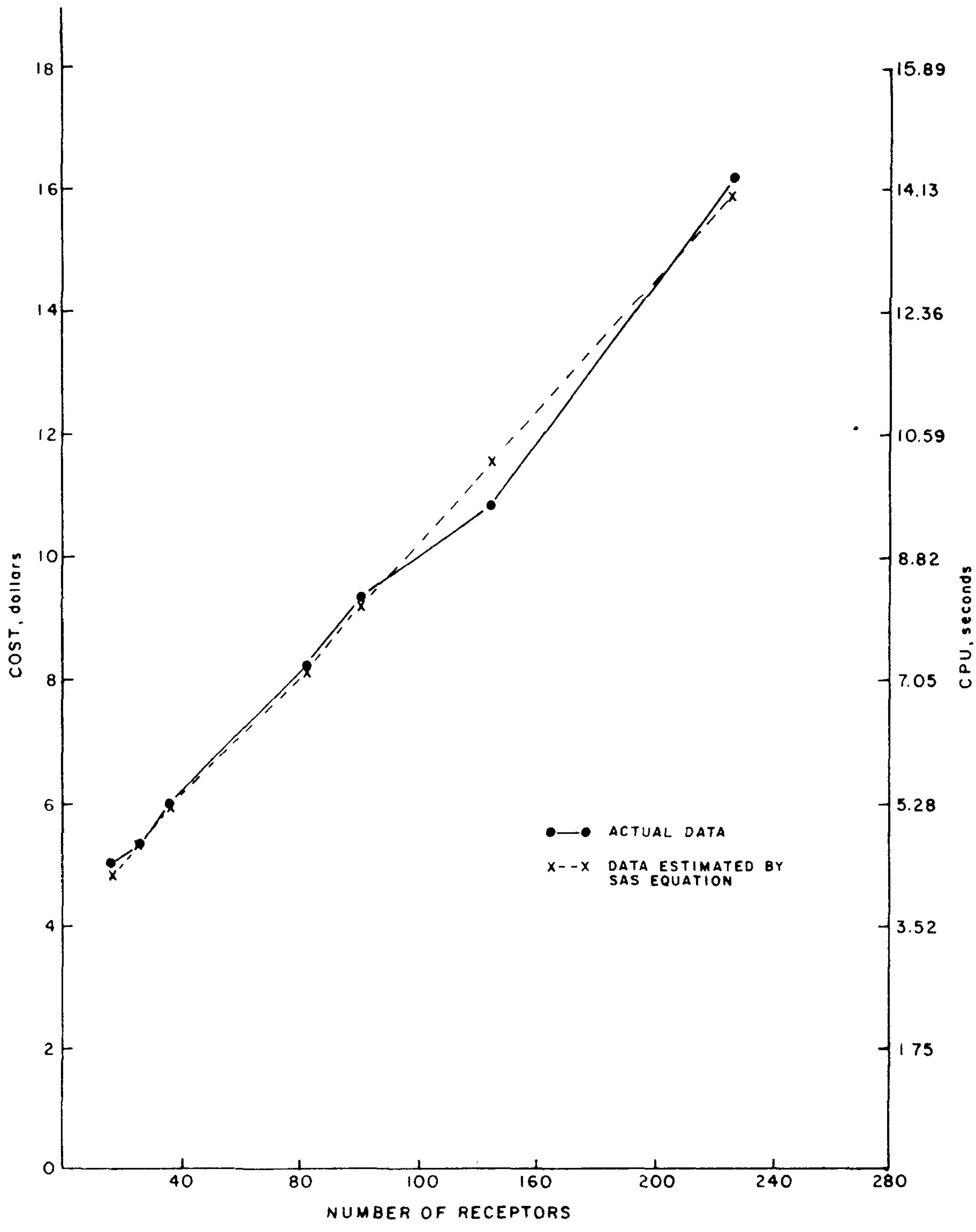

Figure C-12. Results of sensitivity study of TEM8A for run 10. Cost and CPU seconds by number of receptors for 5 days and 2 pollutants.

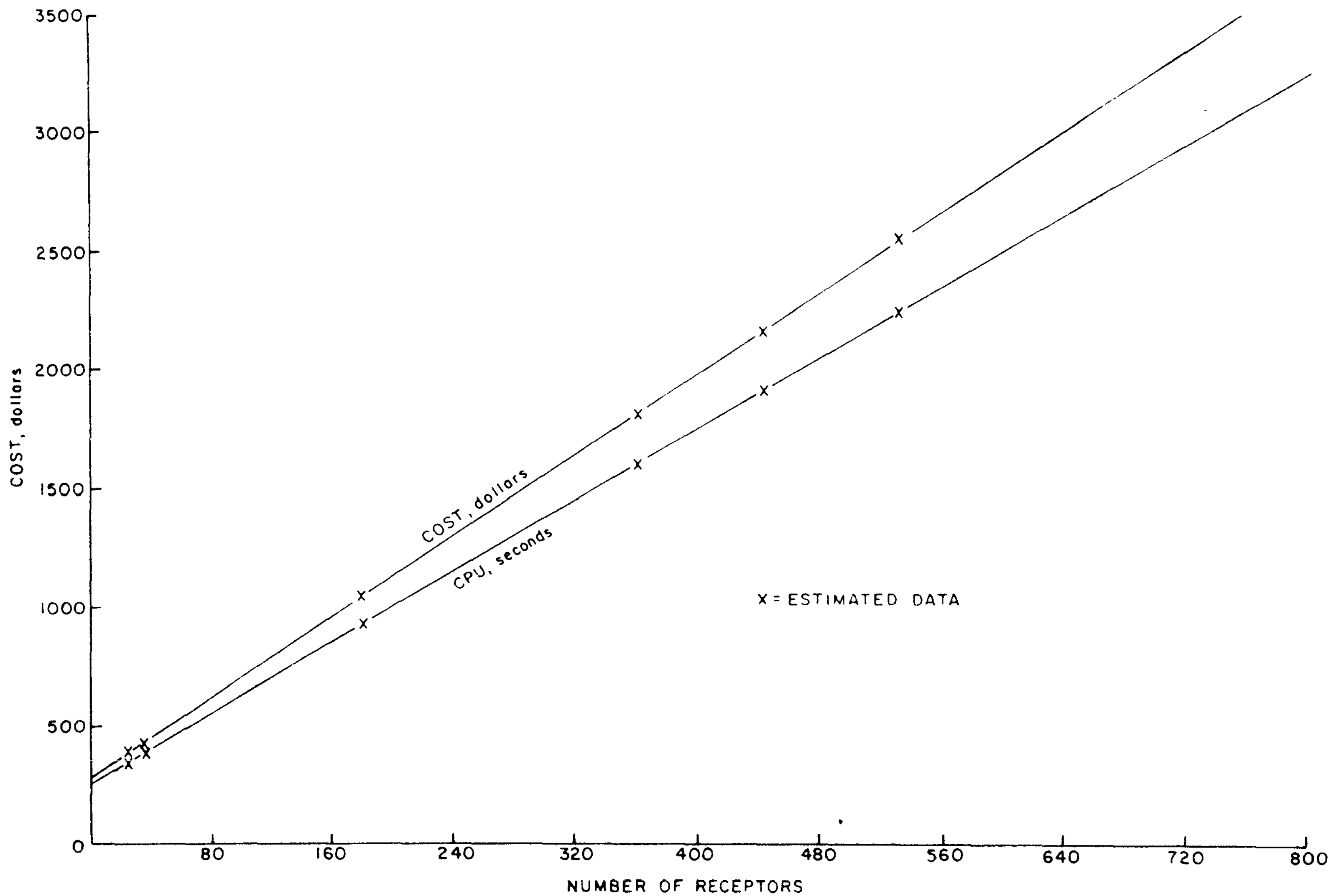

Figure C-13. Result of sensitivity study of TEM8A for run 10. Cost and CPU seconds by number of receptors for 365 days and 2 pollutants.

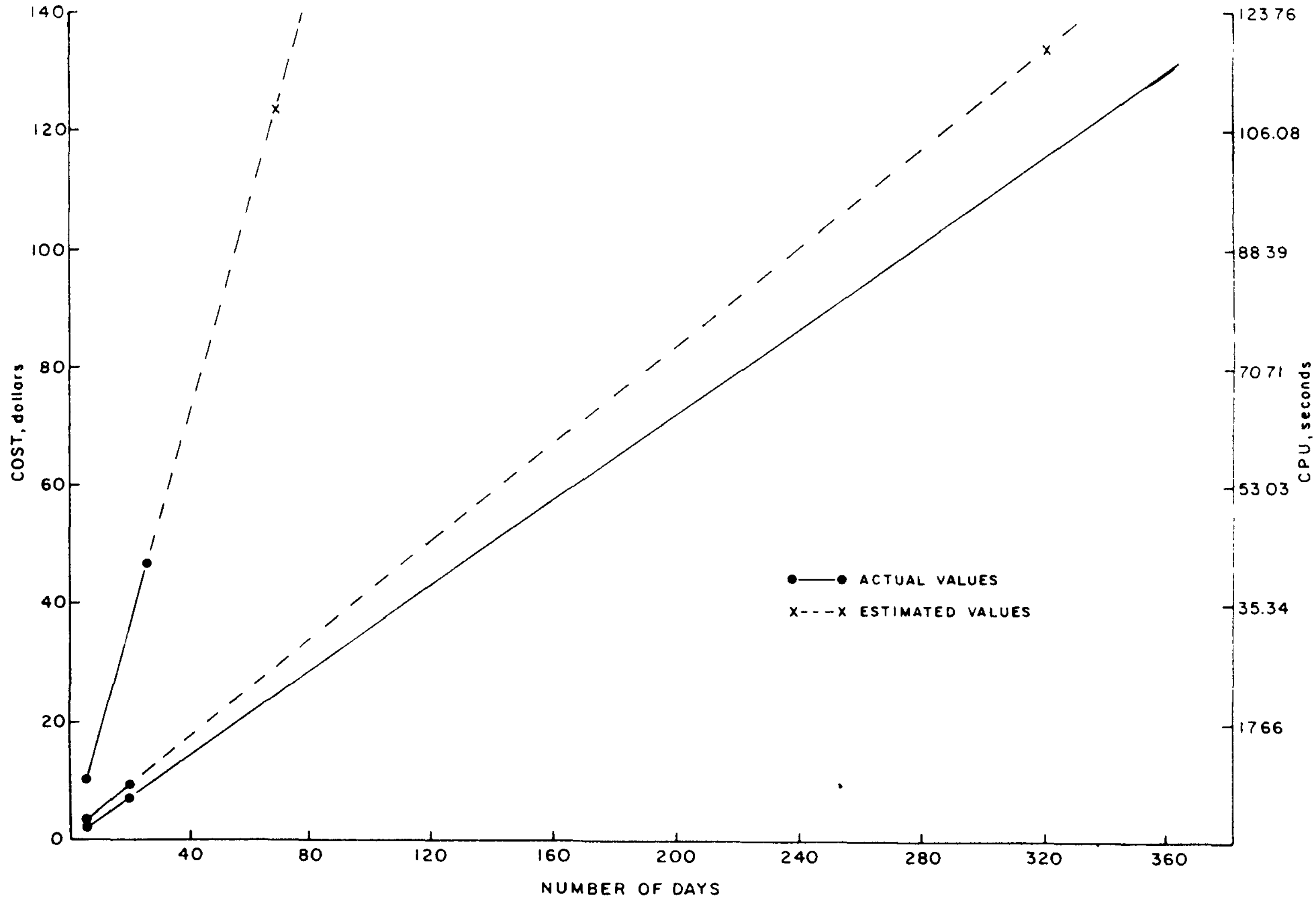

Figure C-14. Results of sensitivity study of TEM8A for run 11. Cost and CPU seconds by number of days for selected grid sizes.

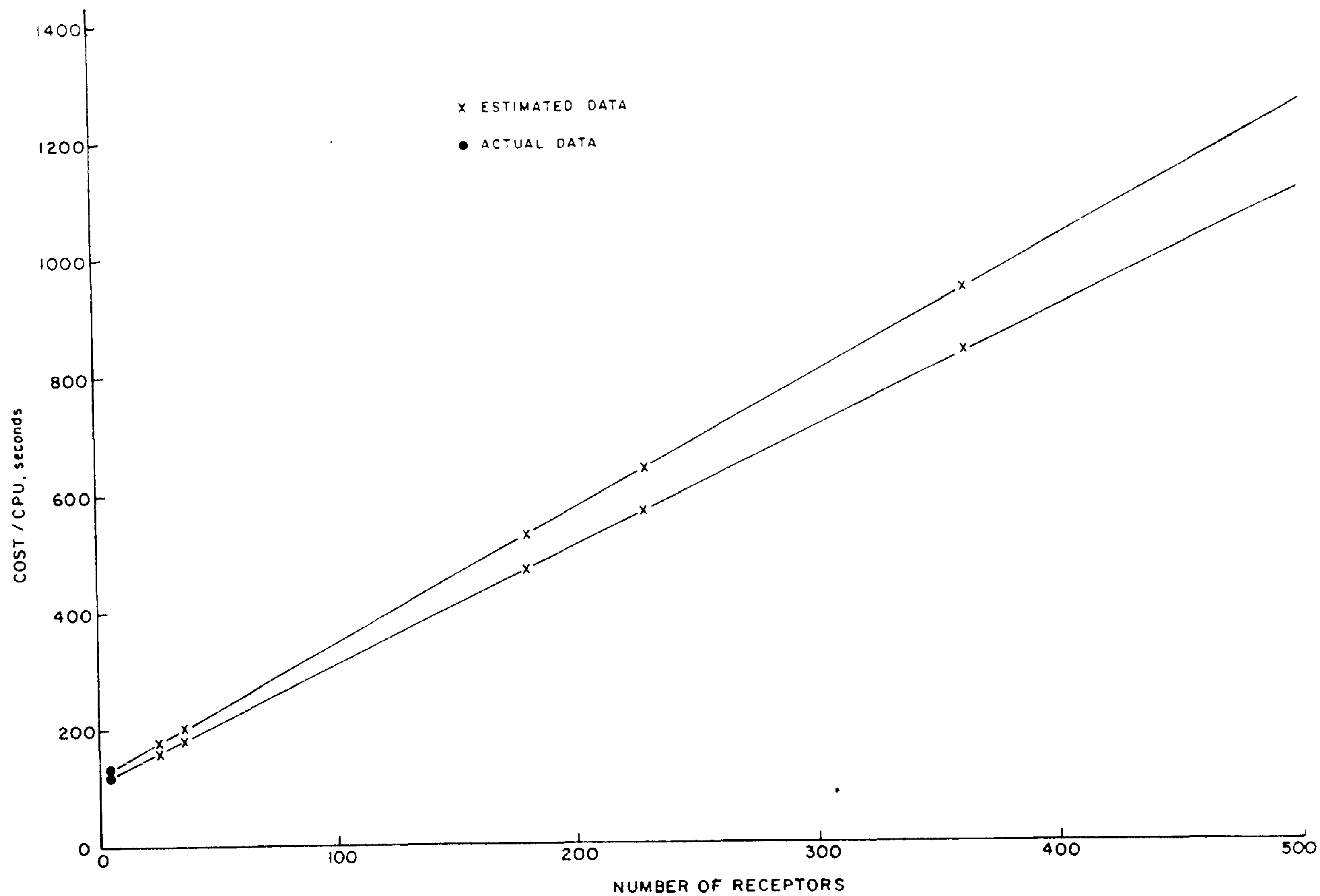

Figure C-15. Results of sensitivity study of TEM8A for run 11. Cost and CPU seconds by number of receptors for 365 days and 2 pollutants.

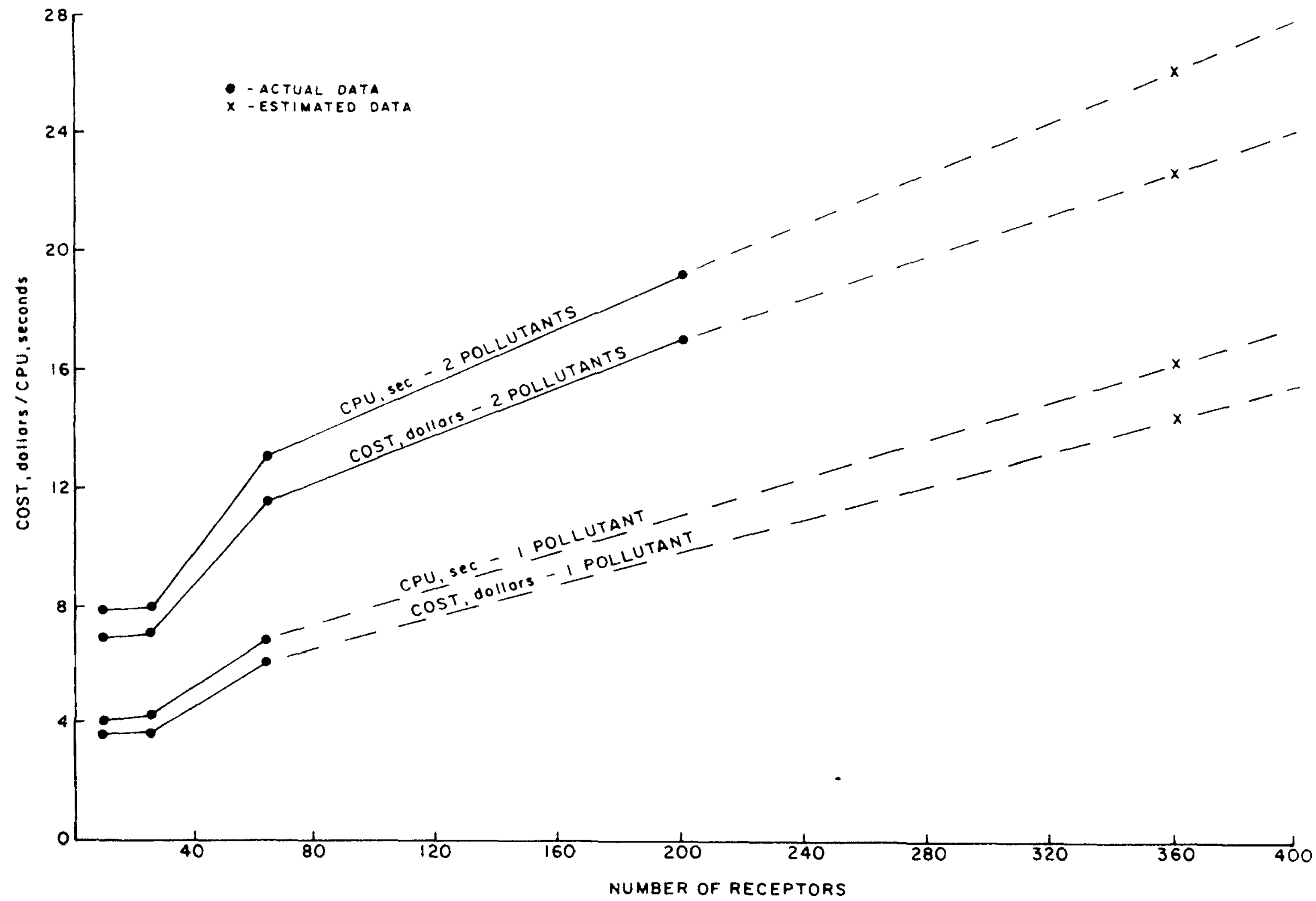

Figure C-16. Results of sensitivity study of TCM for run 12. Cost and CPU seconds by number of receptors with grid resolution of 1 kilometer.

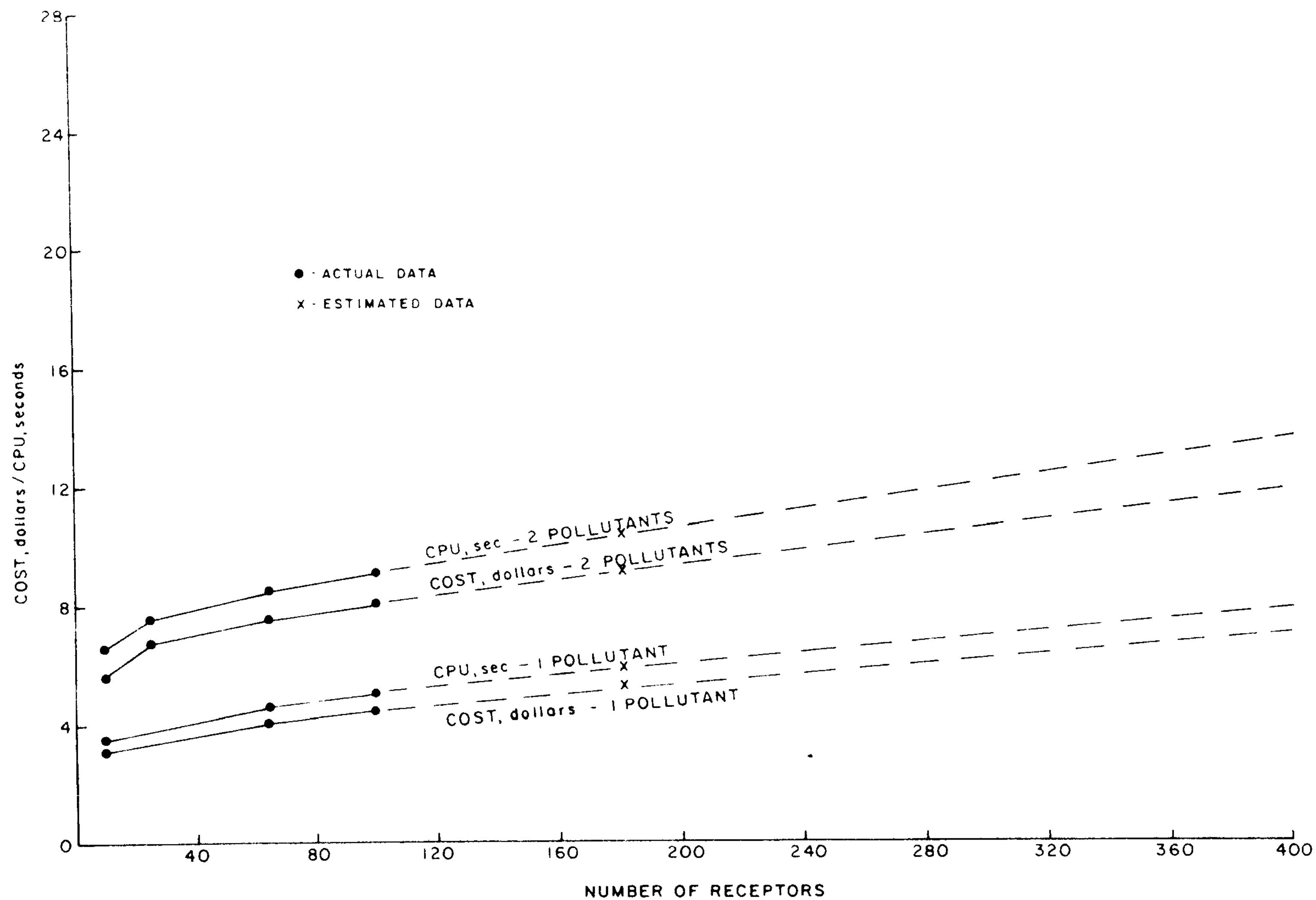

Figure C-17. Results of sensitivity study of TCM for run 12. Costs and CPU seconds by number of receptors with grid resolution of 5 kilometers.

TABLE C-1. COMPUTER COSTS FOR CRSTER RUNS USING FIVE RECEPTOR RINGS, 3-HOUR AND 24-HOUR AVERAGING TIMES

MODEL: CRSTER

MET DATA: Cleveland/Buffalo

DAYS RAN: 365 days

Run I.D.	No. of stacks	Emission set	CPU (sec)	Cost (1980 $)
1	3	1	76.82	65.05
2*	1	2	40.83	34.26
3	4	3	78.43	65.79

Cost for SO_2 and TSP are identical

*This modeling situation would require 7 CRSTER runs, because there are 7 clusters of point sources. The cost listed here is for a single run.

TABLE C-2. RESULTS OF A SENSITIVITY STUDY OF MPTER FOR RUN NUMBER 4, 3-HOUR AND 24-HOUR AVERAGING TIMES.

RUN I.D.: 4
MODEL: MPTER
EMISSION SET: 2
MET DATA: Cleveland/Buffalo

Receptor No.	No. of days	CPU (sec)	Cost (1980 $)
4	20	8.06	8.18
4	2	1.04	1.09
4	10	4.07	4.28
4	100	38.61	40.64
4	365	136.29	143.46
9	2	1.51	1.58
9	10	6.50	6.84
9	20	12.38	13.04
9	365	220.46[a]	232.51[b]
25	2	4.45	4.68
25	10	18.00	18.94
25	20	37.12	39.06
25	365	664.39[c]	699.09[d]
36	2	6.80	7.16
36	10	27.06	28.48
36	20	57.33	60.34
36	365	1,028.20[e]	1,082.24[f]
180	365	5,051.62[g]	5,314.79[h]/6272.51[i]
360	365	10,110.88[g]	10,637.39[h]/10,546.86[i]

[a]Estimated from CPU (sec) = 0.603 * days + 0.362.

[b]Estimated from Cost ($) = 0.636 * days + 0.3695.

[c]Estimated from CPU (sec) = 1.819 * days + 0.454.

[d]Estimated from Cost ($) = 1.914 * days + 0.475.

[e]Estimated from CPU (sec) = 2.816 * days + 0.357.

[f]Estimated from Cost ($) = 2.964 * days + 0.378.

[g]Estimated from CPU (sec) = 28.107 * Receptor - 7.645.

[h]Estimated from Cost ($) = 29.57 * Receptor - 7.815

[i]Estimated from Cost ($) = 0.0955 * Receptor * day - 1.844.

TABLE C-3. SUMMARY OF FINDINGS OF MPTER SENSITIVITY STUDY

1. Cost increases rapidly with increase in the number of receptors.
2. Cost varies slightly with location of receptors, that is for the same number of days and receptors the cost would vary slightly when the location of the receptor was changed.

TABLE C-4. RESULTS OF A SENSITIVITY STUDY OF RAM FOR RUN NUMBER 5, 3-HOUR AND 24-HOUR AVERAGING TIME

RUN I.D.: 5
MODEL: RAM
EMISSION SET: 1
MET DATA: Cleveland/Buffalo

Receptor No.	No. of days	CPU (sec)	Cost (1980 $)
4	2	0.32	0.30
4	6	0.35	0.47
4	10	0.71	0.66
4	50	3.00	2.81
4	100	5.45	5.10
4	365	17.50	16.36
9	2	0.45	0.43
9	50	5.45	5.09
9	100	10.03	9.38
9	365	32.99	30.82
16	2	0.55	0.52
16	50	7.57	7.08
16	100	14.56	13.60
16	365	49.33	46.08
25	10	2.47	2.31
25	50	12.42	11.60
25	100	23.18	21.65
25	365	84.22[a]	78.64[b]
180	365	565.65[c]	527.44[d]
360	365	1,143.03[c]	1,050.05[d]

[a]Estimated from CPU (sec) = 0.2295 * days + 0.45.

[b]Estimated from Cost ($) = 0.2143 * days + 0.423.

[c]Estimated from CPU (sec) = 3.121 * Receptor No. + 3.87.

[d]Estimated from Cost ($) = 2.91 * Receptor No. + 3.64.

TABLE C-5. RESULTS OF A SENSITIVITY STUDY OF RAM FOR RUN NUMBER 6, 3-HOUR AND 24-HOUR AVERAGING TIMES

RUN I.D.: 6
MODEL: RAM
EMISSION SET: 4
MET DATA: Cleveland/Buffalo

Receptor No.	No. of days	CPU (sec)	Cost (1980 $)
4	2	3.27	3.05
4	10	14.75	13.77
4	20	28.83	26.92
4	365	518.59[a]	484.28[b]
9	2	3.42	3.20
9	10	15.89	14.89
9	20	30.83	28.78
9	365	555.87[c]	518.71[d]
25	2	4.18	3.90
25	10	19.43	18.14
25	20	37.64	35.14
25	365	678.41[e]	633.47[f]
180	365	1,859.70[g]	1,737.06[h]

[a]Estimated CPU from CPU (sec) = 1.4195 * days + 0.4752, 4 Receptors.

[b]Estimated Cost from Cost ($) = 1.3256 * days + 0.43967, 4 Receptors.

[c]Estimated CPU from CPU (sec) = 1.5216 * days + 0.4829, 9 receptors.

[d]Estimated Cost from Cost ($) = 1.4198 * days + 0.4788, 9 Receptors.

[e]Estimated CPU from CPU (sec) = 1.857 * days + 0.605, 25 Receptors.

[f]Estimated Cost from Cost ($) = 1.734 * days + 0.56, 25 Receptors.

[g]Estimated from CPU (sec) = 7.622 * No. of Receptors + 487.74, 1 year.

[h]Estimated from Cost ($) = 7.1209 * No. of Receptors + 455.298, 1 year.

TABLE C-6. SUMMARY OF FINDINGS OF RAM SENSITIVITY STUDY

1. Cost with respect to number of days is linear.

2. Cost with respect to number of receptors is not clearly a linear relationship.

3. Cost difference in keeping the same number of receptors but varying the location is minimal.

4. Cost difference for different averaging times is not significant.

TABLE C-7. RESULTS OF A SENSITIVITY STUDY OF ISCST FOR RUN NUMBER 7 (SHORT-TERM VERSION OF ISC)

RUN I.D.: 7
MODEL: ISCST
EMISSION SET: 3
MET DATA: Cleveland/Buffalo

Receptor No.	No. of days	CPU (sec)	Cost (1980 $)
36	4	3.18	4.31
36	10	8.51	11.50
36	20	13.80	18.65
36	30	19.21	25.94
36	365	198.42[a]	267.79[b]
72	4	5.69	7.70
72	10	17.08	23.06
72	20	26.84	36.25
72	30	37.62	50.79
72	365	381.50[c]	514.86[d]
108	4	13.33	18.00
108	10	36.06	48.69
108	20	65.01	87.75
108	365	1,168.45[e]	1,576.84[f]
180	365	2,037.36[g,i]	2,749.85[h,i]
360	365	4,461.96[g]	6,022.25[h]

[a]Estimated from CPU (sec) = 0.535 * days + 3.14.

[b]Estimated from Cost ($) = 0.722 * days + 4.256.

[c]Estimated from CPU (sec) = 1.027 * days + 6.64.

[d]Estimated from Cost ($) = 1.386 * days + 8.97.

[e]Estimated from CPU (sec) = 3.196 * days + 1.914.

[f]Estimated from Cost ($) = 4.313 * days + 2.598.

[g]Estimated from CPU (sec) = 13.47 * Receptor No. - 387.24.

[h]Estimated from Cost ($) = 18.18 * Receptor No. - 522.55.

[i]Calculating 3-hour, as well as 24-hour average concentrations increases cost by a factor of 1.15.

TABLE C-8. SUMMARY OF FINDINGS OF ISCST (SHORT-TERM VERSION OF ISC) SENSITIVITY STUDY

1. Calculating 3-hour averages at the same time as 24-hour averages results in an incease in cost by a factor of 1.15.

2. Use of daily tables option is very expensive. For example, one of the sensitivity runs cost $12.35 with daily tables and $4.31 without.

3. Costs increase dramatically with the number of days simulated.

TABLE C-9. RESULTS OF SENSITIVITY STUDY OF CDM, RUN NUMBER 8

RUN I.D.: 8
MODEL: CDM
EMISSION SET: 5
MET DATA: Hartford/Albany

Receptor No.	CPU (sec)	Cost (1980 $)	Days
4	11.09	9.04	365
9	23.73	19.34	365
16	45.01	36.68	365
25	70.55	57.49	365
180	513.45[a]	418.42[b]	365
360	1,027.89[a]	837.64[b]	365

[a]Estimated from CPU (sec) = 2.858 * Receptor No. - 0.9916.

[b]Estimated from Cost ($) = 2.329 * Receptor No. - 0.804.

TABLE C-10. RESULTS OF SENSITIVITY STUDY OF TEM8-A FOR RUN NUMBER 9

RUN I.D.: 9
MODEL: TEM8-A
EMISSION SET: 1
MET DATA: 1977 Cleveland/Buffalo

No. of receptors	No. of days	No. of pollutants	CPU (sec)	Cost (1980 $)
Actual Data				
36	10	1	1.04	1.20
36	10	2	1.30	1.50
36	365	1	37.98	43.00
441	5	1	2.67	3.04
441	5	2	2.92	3.32
441	365	1	187.66	212.39
441	365	2	191.95	217.25
Estimated Data[a]				
180	365	1	91.20	103.19
360	365	1	157.72	178.43
180	365	2	93.28	105.55
360	365	2	161.33	182.51

[a]For one pollutant and 365 days, estimates are derived from linear interpolation of data for actual runs (36 and 441 receptors, for 365 days):

CPU (sec) = 24.675 + 0.36958 * R
Cost ($) = 27.95 + 0.418 * R

where: R = number of receptors.

Execution time increases only slightly when two pollutants are processed instead of one pollutant (see actual data). A scaling factor of 1.02 was used to arrive at the estimated 2 pollutant values.

TABLE C-11. SUMMARY OF FINDINGS OF TEM8-A SENSITIVITY STUDY FOR RUN NUMBER 9

1. Cost is directly proportional to number of print sources in input set.

2. The placement of receptor affects the costs. TEM8-A uses the meteorological data for each day to isolate those receptors at which concentrations may be measured that day; only these receptors are dealt with in the calculations. Therefore, both the distance and the direction of the receptors from the point sources will affect the cost of the runs. (For runs listed in the above table, the furthest receptors were placed at a distance of approximately 5 kilometers from the sources in each direction.)

3. Only 24-hour averaging times can be computed when a year of hourly meteorological data is input.

4. The automatic grid selection option cannot be chosen when a year of hourly met data is input.

5. Emissions for a second pollutant were added to Emission Set 1 for indicated runs. (Two pollutants can be processed in one run.)

6. Printing daily arrays of concentrations at each receptor in grid adds only minimally to cost.

TABLE C-12. RESULTS OF SENSITIVITY STUDY OF TEM8-A FOR RUN NUMBER 10

RUN I.D.: 10
MODEL: TEM8-A
EMISSION SET: 2[a]
MET DATA: 1977 Cleveland/Buffalo

Receptor No.	No. of days	29 sources CPU (sec)[b]	29 sources Cost ($)[b]	30 sources CPU (sec)[b]	30 sources Cost ($)[b]
Actual Data					
16	5	4.27	4.85	4.42	5.02
16	26	21.47	24.31	22.21	25.15
25	5	4.54	5.16	4.70	5.34
25	20	18.17	20.58	18.80	21.29
36	5	5.14	5.84	5.32	6.04
36	20	20.43	23.13	21.13	23.93
81	5	7.02	7.96	7.26	8.23
100	5	8.00	9.07	8.28	9.38
100	15	23.82	26.98	24.64	27.91
144	5	9.24	10.48	9.56	10.84
225	5	13.82	15.66	14.30	16.20
Estimated Data[c]					
25	365	334	378	346	391
36	365	374	423	387	438

(continued)

TABLE C-12 (continued)

Receptor No.	No. of days	29 sources		30 sources	
		CPU (sec)[b]	Cost ($)[b]	CPU (sec)[b]	Cost ($)[b]
180	365	900	1,018	931	1,053
360	365	1,558	1,761	1,612	1,822
441	365	1,854	2,096	1,918	2,168
529	365	2,175	2,459	2,250	2,544

[a]Measurable emissions for a second pollutant were added to Emission Set II for this run. Emission set actually used consisted of 29 point sources instead of the 30 point sources contained in Emission Set II. Since the execution time of TEM8-A is directly proportional to the number of point sources, the cost and CPU time for 30 sources were computed by multiplying the cost and CPU for 29 sources by a factor of 30/29.

[b]For 29 or 30 sources: Cost ($) = 0.02 + 1.1312 * CPU (sec)
CPU (sec) = - 0.02 + 0.884 * Cost ($)

[c]Estimates for 29 sources were made as follows:
CPU (sec) = 0.97 + 0.663798 * D - 0.0055 * R + 0.010027 * D * R
Cost ($) = 0.13 + 0.751163 * D - 0.0061478 * R + 0.0113323 * D * R
where: D = number of days and R = number of receptors

Or, for 365 days: CPU (sec) = 242.38 + 3.654 * R
Cost ($) = 274.30 + 4.130 * R

These estimates were multiplied by the factor of 30/29 to derive the estimates for 30 sources n the above table.

Equations were generated by the general linear model program of the SAS statistical package.

Note: All costs are in 1980 dollars.

TABLE C-13. RESULTS OF SENSITIVITY STUDY OF TEM8-A FOR RUN 11

RUN I.D.: 11
MODEL: TEM8-A
EMISSION SET: IV
MET DATA: 1977 Columbus/Patterson

Receptor No.	No. of days	CPU (sec)[a]	Cost ($)[a]
Actual Data			
4	5	1.84	2.11
4	20	6.48	7.35
4	365	116.68	132.06
9	5	2.01	2.30
25	5	2.31	2.64
25	20	8.38	9.50
28	5	2.47	2.82
36	26	15.21	17.23
228	5	8.61	9.77
228	26	40.94	46.35
Estimated Data[b]			
25	365	159	180
36	365	181	205
180	365	471	533
228	365	568	642
360	365	834	943

[a]Cost ($) = 0.023 + 1.1316 * CPU (sec)
CPU (sec) = - 0.02 + 0.8841 * Cost ($)

[b]Estimates were made as follows:

CPU (sec) = 0.365 + 0.296759 * D + 0.00179 * R + 0.005512 * D * R
Cost ($) = 0.4356 + 0.335823 * D + 0.002057 * R + 0.006236 * D * R
where: D = number of days and R = number of receptors

Or, for 365 days: CPU (sec) = 108.68 + 2.0137 * R
Cost ($) = 123.01 + 2.2782 * R

Equations were generated by the general linear model program of the SAS statistical package.

Note: All costs are in 1980 dollars.

TABLE C-14. RESULTS OF SENSITIVITY STUDY OF TCM FOR RUN 12

RUN I.D.: 12
MODEL: TCM
EMISSION SET: 5
MET DATA: 1974 Hartford/Albany

Receptor No.	Receptor spacing (km)	No. of pollutants	CPU (sec)	Cost ($)
Actual Data				
9	5	1	3.51	3.12
64	5	1	4.58	4.06
100	5	1	5.02	4.45
9	5	2	6.62	5.58
25	5	2	7.64	6.78
64	5	2	8.55	7.59
100	5	2	9.10	8.08
9	1	1	4.05	3.60
25	1	1	4.16	3.70
64	1	1	6.80	6.04
9	1	2	7.84	6.96
25	1	2	7.98	7.08
64	1	2	13.09	11.61
200	1	2	19.18	17.00
Estimated Data[a]				
180	5	1	6	5
180	5	2	10	9
360	1	1	16	14
360	1	2	26	23

[a]Estimates for Run 12 were derived by graphing the actual data and extending the plotted curves to 180 or 360 receptors.

Note: All costs are in 1980 dollars.

TABLE C-15. SUMMARY OF FINDING FROM SENSITIVITY STUDY OF TCM

1. It is more efficient to run TCM with grid receptor squares equal to the size of area sources than with grid squares smaller than the area sources. (This is because more calculations are required to apportion emissions if an area source spreads over several receptors.) Since the area sources in Emission Set V are squares of 5 km per side, it is more efficient to run TCM with receptors spaced at 5 km than with receptors spared at 1 km.

2. Two pollutants can be modeled in one run.

TABLE C-16. REQUIRED COMPUTER BUDGETS FOR A TSP AND SO_2 AIR QUALITY ANALYSIS, ASSUMING VARIOUS COMBINATIONS OF METEOROLOGICAL DATA, RECEPTOR RESOLUTION, AND NUMBER OF LOAD CONDITIONS

a) Run ID: 1 Model: CRSTER Number of Pollutants/Run: 1

Met. data	Number of load cond.	Receptor Res.	Number of runs[a]	Computer Budget[b] CPU (sec)	Computer Budget[b] Cost ($)
1 yr NWS	1	5 rings (5 Km)	2	180	160
5 yrs NWS	1	5 rings (5 Km)	10	920	780
1 yr onsite	1	5 rings (5 Km)	2	180	160
1 yr NWS	1	10 rings (1 Km)	4	360	320
5 yrs NWS	1	10 rings (1 Km)	20	1,840	1,560
1 yr onsite	1	10 rings (1 Km)	4	360	320
1 yr NWS	3	10 rings (1 Km)	12	1,080	960
5 yrs NWS	1 + 2 additional load cond. in worst yr	10 rings (1 Km)	28	2,580	2,190
1 yr onsite	3	10 rings (1 Km)	12	1,080	960

[a]The cost of one run is defined in Table 3.

[b]Computer budget is based on the cost of a single run, (presented in Table 3), times the number of runs, times an error factor of 1.2. The error factor accounts for "bad" runs. CRSTER can model only one pollutant per run. Budget figures are rounded to the nearest 10.

Note: All costs are in 1980 dollars.

TABLE C-16 (continued)

b) Run ID: 2[a] Model: CRSTER Number of Pollutants/Run: 1

Met. data	Number of load cond.	Receptor Res.	Number of runs[b]	Computer Budget CPU (sec)	Computer Budget Cost ($)
1 yr NWS	1	5 rings (5 Km)	14	690	580
5 yrs NWS	1	5 rings (5 Km)	22	1,080	900
1 yr onsite	1	5 rings (5 Km)	14	690	580
1 yr NWS	1	10 rings (1 Km)	28	1,370	1,150
5 yrs NWS	1	10 rings (1 Km)	44	2,160	1,800
1 yr onsite	1	10 rings (1 Km)	28	1,370	1,150
1 yr NWS	1 + 2 load cond.	10 rings (1 Km)	36	1,760	1,480
5 yrs NWS	1 + 2 additional load cond. in worst yr	10 rings (1 Km)	52	2,450	2,140
1 yr onsite	1 + 2 additional load cond.	10 rings (1 Km)	36	1,760	1,480

[a]In order to adequately evaluate this situation, 7 source clusters must be considered. Thus, a complete set of runs for 2 pollutants, 5 Km resolution, and a 1 year simulation would equal 14; and for 1 Km resolution 28. For the multi-year or multi-load situations, it would not be reasonable to expect more than one complete set of runs be done. Therefore, we will assume that the worst of the 7 source clusters, as predicted by the screening model PTPLU, will be modeled in all years or load conditions. The only complete set of runs will be done for the year or load condition with the highest values.

[b]The cost of 1 run is defined in Table 3.

Note: All costs are in 1980 dollars.

TABLE C-16 (continued)

c) Run ID: 3 Model: CRSTER Number of Pollutants/Run: 1

Met. data	Number of load cond.	Receptor Res.	Number of runs[a]	Computer Budget[b] CPU (sec)	Cost ($)
1 yr NWS	1	5 rings (5 Km)	2	190	160
5 yrs NWS	1	5 rings (5 Km)	10	940	790
1 yr onsite	1	5 rings (5 Km)	2	190	160
1 yr NWS	1	10 rings (1 Km)	4	380	320
5 yrs NWS	1	10 rings (1 Km)	20	1,880	1,580
1 yr onsite	1	10 rings (1 Km)	4	380	320
1 yr NWS	3	10 rings (1 Km)	12	1,130	950
5 yrs NWS	1 + 2 additional load cond. in worst yr	10 rings (1 Km)	28	2,640	2,210
1 yr onsite	3	10 rings (1 Km)	12	1,130	950

[a]The cost of one run is defined in Table 3.

[b]Computer budget is based on the cost of a single run, (presented in Table 3), times the number of runs, times an error factor of 1.2. The error factor accounts for "bad" runs. CRSTER can model only one pollutant per run. Budget figures are rounded to the nearest 10.

Note: All costs are in 1980 dollars.

TABLE C-16 (continued)

d) Run ID: 4 Model: MPTER Number of Pollutants/Run: 2

Met. data	Number of load cond.	Receptor Res.	Number of runs[a]	Computer Budget[b] CPU (sec)	Computer Budget[b] Cost ($)
1 yr NWS	1	5 rings (5 Km)	1	6,060	6,380
5 yrs NWS	1	5 rings (5 Km)	5	30,310	31,890
1 yr onsite	1	5 rings (5 Km)	1	6,060	6,380
1 yr NWS	1	10 rings (1 Km)	2	12,120	12,760
5 yrs NWS	1	10 rings (1 Km)	10	60,620	63,780
1 yr onsite	1	10 rings (1 Km)	2	12,120	12,760
1 yr NWS	3	10 rings (1 Km)	6	36,370	38,270
5 yrs NWS	1 + 2 additional load cond. in worst yr	10 rings (1 Km)	14	84,870	89,290
1 yr onsite	3	10 rings (1 Km)	6	36,370	38,270

[a]The cost of one run is defined in Table 3.

[b]Computer budget is based on the cost of a single run, (presented in Table 3), times the number of runs, times an error factor of 1.2. The error factor accounts for "bad" runs. MPTER can model two pollutants per run. Budget figures are rounded to the nearest 10.

Note: All costs are in 1980 dollars.

TABLE C-16 (continued)

e) Run ID: 5 Model: RAM Number of Pollutants/Run: 2

Met. data	Number of load cond.	Receptor Res.	Number of runs[a]	Computer Budget[b] CPU (sec)	Cost ($)
1 yr NWS	1	5 rings (5 Km)	1	680	630
5 yrs NWS	1	5 rings (5 Km)	5	3,390	3,160
1 yr onsite	1	5 rings (5 Km)	1	680	630
1 yr NWS	1	10 rings (1 Km)	2	1,360	1,270
5 yrs NWS	1	10 rings (1 Km)	10	6,790	6,330
1 yr onsite	1	10 rings (1 Km)	2	1,360	1,270
1 yr NWS	3	10 rings (1 Km)	6	4,070	3,800
5 yrs NWS	1 + 2 additional load cond. in worst yr	10 rings (1 Km)	14	9,500	8,860
1 yr onsite	3	10 rings (1 Km)	6	4,070	3,800

[a]The cost of one run is defined in Table 3.

[b]Computer budget is based on the cost of a single run, (presented in Table 3), times the number of runs, times an error factor of 1.2. The error factor accounts for "bad" runs. RAM can model two pollutants per run. Budget figures are rounded to the nearest 10.

Note: All costs are in 1980 dollars.

TABLE C-16 (continued)

f) Run ID: 6 Model: RAM Number of Pollutants/Run: 2

Met. data	Number of load cond.	Receptor Res.	Number of runs[a]	Computer Budget[b] CPU (sec)	Computer Budget[b] Cost ($)
1 yr NWS	1	5 rings (5 Km)	1	2,230	2,080
5 yrs NWS	1	5 rings (5 Km)	5	11,160	10,420
1 yr NWS	1	10 rings (1 Km)	2	4,460	4,170
5 yrs NWS	1	10 rings (1 Km)	10	22,320	20,840
1 yr NWS	1 + 2 control strategies	10 rings (1 Km)	6	13,390	12,510
5 yrs NWS	1 + 2 control strategies in worst year	10 rings (1 Km)	14	31,240	29,180

[a]The cost of one run is defined in Table 3.

[b]Computer budget is based on the cost of a single run, (presented in Table 3), times the number of runs, times an error factor of 1.2. The error factor accounts for "bad" runs. RAM can model two pollutants per run. Budget figures are rounded to the nearest 10.

Note: All costs are in 1980 dollars.

TABLE C-16 (continued)

g) Run ID: 7 Model: ISC Number of Pollutants/Run: 1

Met. data	Number of load cond.	Receptor Res.	Number of runs[a]	Computer Budget[b] CPU (sec)	Computer Budget[b] Cost ($)
1 yr NWS	1	5 rings (5 Km)	2	5,260	7,090
5 yrs NWS	1	5 rings (5 Km)	10	26,280	35,470
1 yr onsite	1	5 rings (5 Km)	2	5,260	7,090
1 yr NWS	1	10 rings (1 Km)	4	10,510	14,190
5 yrs NWS	1	10 rings (1 Km)	20	52,560	70,950
1 yr onsite	1	10 rings (1 Km)	4	10,510	14,190
1 yr NWS	3	10 rings (1 Km)	12	31,540	42,570
5 yrs NWS	1 + 2 additional load cond. in worst yr	10 rings (1 Km)	28	73,590	99,320
1 yr onsite	3	10 rings (1 Km)	12	31,540	42,570

[a]The cost of one run is defined in Table 3.

[b]Computer budget is based on the cost of a single run, (presented in Table 3), times the number of runs, times an error factor of 1.2. The error factor accounts for "bad" runs. ISC can model only one pollutant per run. Budget figures are rounded to the nearest 10.

Note: All costs are in 1980 dollars.

TABLE C-16 (continued)

h) Run ID: 8 Model: CDM Number of Pollutants/Run: 2

Met. data[a]	Number of load cond.	Receptor Res.	Number of runs[b]	Computer Budget[c] CPU (sec)	Cost ($)
1 NWS STAR	1	5 rings (5 Km)	1	620	500
5 annual NWS STAR	1	5 rings (5 Km)	5	3,080	2,510
1 NWS STAR	1	10 rings (1 Km)	2	1,230	1,000
5 annual NWS STAR	1	10 rings (1 Km)	10	6,160	5,020
1 NWS STAR	1 + 2 control strategies	10 rings (1 Km)	6	3,700	3,010
5 annual NWS STAR	1 + 2 control strategies	10 rings (1 Km)	14	8,630	7,030

[a] 1 NWS STAR means 1 STAR data set, 5 annual NWS STAR means that there are 5 yearly STAR data sets.

[b] The cost of one run is defined in Table 3.

[c] Computer budget is based on the cost of a single run, (presented in Table 3), times the number of runs, times an error factor of 1.2. The error factor accounts for "bad" runs. CDM can model two pollutants per run. Budget figures are rounded to the nearest 10.

Note: All costs are in 1980 dollars.

TABLE C-16 (continued)

i) Run ID: 9 Model: TEM8-A Number of Pollutants/Run: 2

Met. data	Number of load cond.	Receptor Res.	Number of runs[a]	Computer Budget[b] CPU (sec)	Cost ($)
1 yr NWS	1	5 rings (5 Km)	1	110	130
5 yrs NWS	1	5 rings (5 Km)	5	560	630
1 yr onsite	1	5 rings (5 Km)	1	110	130
1 yr NWS	1	10 rings (1 Km)	2	220	250
5 yrs NWS	1	10 rings (1 Km)	10	1,120	1,270
1 yr onsite	1	10 rings (1 Km)	2	220	250
1 yr NWS	3	10 rings (1 Km)	6	670	760
5 yrs NWS	1 + 2 additional load cond. in worst yr	10 rings (1 Km)	14	1,570	1,770
1 yr onsite	3	10 rings (1 Km)	6	670	760

[a]The cost of one run is defined in Table 3.

[b]Computer budget is based on the cost of a single run, (presented in Table 3), times the number of runs, times an error factor of 1.2. The error factor accounts for "bad" runs. TEM8-A can model two pollutants per run. Budget figures are rounded to the nearest 10.

Note: All costs are in 1980 dollars.

TABLE C-16 (continued)

j) Run ID: 10 Model: TEM8-A Number of Pollutants/Run: 2

Met. data	Number of load cond.	Receptor Res.	Number of runs[a]	Computer Budget[b] CPU (sec)	Cost ($)
1 yr NWS	1	5 rings (5 Km)	1	1,120	1,260
5 yrs NWS	1	5 rings (5 Km)	5	5,590	6,320
1 yr onsite	1	5 rings (5 Km)	1	1,120	1,260
1 yr NWS	1	10 rings (1 Km)	2	2,230	2,530
5 yrs NWS	1	10 rings (1 Km)	10	11,170	12,640
1 yr onsite	1	10 rings (1 Km)	2	2,230	2,530
1 yr NWS	3	10 rings (1 Km)	6	6,700	7,580
5 yrs NWS	1 + 2 additional load cond. in worst yr	10 rings (1 Km)	14	15,640	17,690
1 yr onsite	3	10 rings (1 Km)	6	6,700	7,580

[a]The cost of one run is defined in Table 3.

[b]Computer budget is based on the cost of a single run, (presented in Table 3), times the number of runs, times an error factor of 1.2. The error factor accounts for "bad" runs. TEM8-A can model two pollutants per run. Budget figures are rounded to the nearest 10.

Note: All costs are in 1980 dollars.

TABLE C-16 (continued)

k) Run ID: 11 Model: TEM8-A Number of Pollutants/Run: 2

Met. data	Number of load cond.	Receptor Res.	Number of runs[a]	Computer Budget[b] CPU (sec)	Computer Budget[b] Cost ($)
1 yr NWS	1	5 rings (5 Km)	1	570	640
5 yrs NWS	1	5 rings (5 Km)	5	2,830	3,200
1 yr NWS	1	10 rings (1 Km)	2	1,130	1,280
5 yrs NWS	1	10 rings (1 Km)	10	5,650	6,400
1 yr NWS	1 + 2 control strategies	10 rings (1 Km)	6	3,400	3,840
5 yrs NWS	1 + 2 control strategies in worst year	10 rings (1 Km)	14	7,910	8,950

[a]The cost of one run is defined in Table 3.

[b]Computer budget is based on the cost of a single run, (presented in Table 3), times the number of runs, times an error factor of 1.2. The error factor accounts for "bad" runs. TEM8-A can model two pollutants per run. Budget figures are rounded to the nearest 10.

Note: All costs are in 1980 dollars.

TABLE C-16 (continued)

1) Run ID: 12 Model: TCM Number of Pollutants/Run: 2

Met. data	Number of load cond.	Receptor Res.	Number of runs[a]	Computer Budget[b] CPU (sec)	Cost ($)
1 NWS STAR set	1	5 rings (5 Km)	1	10	10
5 annual NWS STAR sets	1	5 rings (5 Km)	5	60	50
1 NWS STAR set	1	10 rings (1 Km)	2	20	20
5 annual NWS STAR sets	1	10 rings (1 Km)	10	120	110
1 NWS STAR set	1 + 2 control strategies	10 rings (1 Km)	6	70	60
5 annual NWS STAR sets	1 + 2 control strategies in worst year	10 rings (1 Km)	14	170	150

[a]The cost of one run is defined in Table 3.

[b]Computer budget is based on the cost of a single run, (presented in Table 3), times the number of runs, times an error factor of 1.2. The error factor accounts for "bad" runs. TCM can model two pollutants per run. Budget figures are rounded to the nearest 10.

Note: All costs are in 1980 dollars.

TABLE C-17. LABOR COSTS OF MODEL EXECUTION

(a) Meteorological Data Set: 1 year NWS or 1 year onsite
Receptor Resolution: 5 rings or 5 km.
Number of Load Conditions: One

Run No.	Modeling situation	Labor grade 5 Hours	5 Dollars	6 Hours	6 Dollars	7 Hours	7 Dollars	8 Hours	8 Dollars	10 Hours	10 Dollars	Total cost Hours	Total cost Dollars
1	CRSTER, Rural, Single Point Source	8	160			16	470					24	630
2	CRSTER, Rural, Multipoint Source	24	470			24	710	8	280			56	1,460
3	CRSTER, Rural/Urban, Industrial Source Complex	16	310			16	470					32	780
4	MPTER, Rural, Multipoint Source	16	310			16	470					32	780
5	RAM, Urban, Single Point Source	16	310			16	470					32	780
6	RAM, Urban, Multiple Point and Area Source	24	470			16	470					40	940
7	ISC, Rural/Urban, Industrial Source Complex	16	310			16	470					32	780
8[a]	CDM, Urban, Multiple Point and Area Source	16	310			8	240					24	550
9	TEM8-A, Rural, Single Point Source	8	160			16	470					24	630
10	TEM8-A, Rural, Multipoint Source	16	310			16	470					32	780
11	TEM8-A, Urban, Multiple Point and Area Source	24	470			16	470					40	940
12[a]	TCM, Urban, Multiple Point and Area Source	16	310			8	240					24	550

(continued)

Note: All costs are in 1980 dollars.

TABLE C-17 (continued)

(b) Meteorological Data Set: 5 years NWS hourly or 5 Annual NWS Star Data Sets
Receptor Resolution. 5 rings or 5 km.
Number of Load Condtions: One

Run No.	Modeling situation	Labor grade 5 Hours	5 Dollars	6 Hours	6 Dollars	7 Hours	7 Dollars	8 Hours	8 Dollars	10 Hours	10 Dollars	Total cost Hours	Total cost Dollars
1	CRSTER, Rural, Single Point Source	16	310			16	470					32	780
2	CRSTER, Rural, Multipoint Source	32	620			24	710	8	280			64	1610
3	CRSTER, Rural/Urban, Industrial Source Complex	24	470			16	470					40	940
4	MPTER, Rural, Multipoint Source	24	470			16	470					40	940
5	RAM, Urban, Single Point Source	24	470			16	470					40	940
6	RAM, Urban, Multiple Point and Area Source	40	780			16	470					56	1250
7	ISC, Rural/Urban, Industrial Source Complex	24	470			16	470					40	940
8[a]	CDM, Urban, Multiple Point and Area Source	24	470			8	240					32	710
9	TEM8-A, Rural, Single Point Source	16	310			16	470					32	780
10	TEM8-A, Rural, Multipoint Source	24	470			16	470					40	940
11	TEM8-A, Urban, Multiple Point and Area Source	40	780			16	470					56	1250
12[a]	TCM, Urban, Multiple Point and Area Source	24	470			8	240					32	710

Note: All costs are in 1980 dollars.

(continued)

TABLE C-17 (continued)

(c) Meteorological Data Set: 1 year NWS or 1 year onsite
Receptor Resolution: 10 rings or 1 km.
Number of Load Condtions: One

Run No.	Modeling situation	Labor grade 5		6		7		8		10		Total cost	
		Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars
1	CRSTER, Rural, Single Point Source	16	310			16	470					32	780
2	CRSTER, Rural, Multipoint Source	48	940			24	710	8	280			80	1930
3	CRSTER, Rural/Urban, Industrial Source Complex	24	470			16	470					40	940
4	MPTER, Rural, Multipoint Source	32	620			16	470					48	1090
5	RAM, Urban, Single Point Source	24	470			16	470					40	940
6	RAM, Urban, Multiple Point and Area Source	40	780			16	470					56	1250
7	ISC, Rural/Urban, Industrial Source Complex	24	470			16	470					40	940
8[a]	CDM, Urban, Multiple Point and Area Source	24	470			8	240					32	710
9	TEM8-A, Rural, Single Point Source	16	310			16	470					32	780
10	TEM8-A, Rural, Multipoint Source	32	620			16	470					48	1090
11	TEM8-A, Urban, Multiple Point and Area Source	40	780			16	470					56	1250
12[a]	TCM, Urban, Multiple Point and Area Source	24	470			8	240					32	710

(continued)

Note: All costs are in 1980 dollars.

TABLE C-17 (continued)

(d) Meteorological Data Set. 5 years NWS Hourly or 5 Annual STAR data sets
Receptor Resolution: 10 rings or 1 km.
Number of Load Condtions. One

Run No.	Modeling situation	Labor grade 5 Hours	5 Dollars	6 Hours	6 Dollars	7 Hours	7 Dollars	8 Hours	8 Dollars	10 Hours	10 Dollars	Total cost Hours	Total cost Dollars
1	CRSTER, Rural, Single Point Source	24	470			16	470					40	940
2	CRSTER, Rural, Multipoint Source	64	1250			24	710	8	280			96	2240
3	CRSTER, Rural/Urban, Industrial Source Complex	32	620			16	470					48	1090
4	MPTER, Rural, Multipoint Source	40	780			16	470					56	1250
5	RAM, Urban, Single Point Source	32	620			16	470					48	1090
6	RAM, Urban, Multiple Point and Area Source	56	1100			16	470					72	1570
7	ISC, Rural/Urban, Industrial Source Complex	32	620			16	470					48	1090
8[a]	CDM, Urban, Multiple Point and Area Source	32	620			8	240					40	860
9	TEM8-A, Rural, Single Point Source	24	470			16	470					40	940
10	TEM8-A, Rural, Multipoint Source	40	780			16	470					56	1250
11	TEM8-A, Urban, Multiple Point and Area Source	56	1100			16	470					72	1570
12[a]	TCM, Urban, Multiple Point and Area Source	32	470			8	240					40	860

Note: All costs are in 1980 dollars.

(continued)

TABLE C-17 (continued)

(e) Meteorological Data Set: 1 year NWS or 1 year onsite
Receptor Resolution: 10 rings or 1 km.
Number of Load Condtions. Three or Baseline plus Control Strategies

Run No.	Modeling situation	Labor grade 5 Hours	5 Dollars	6 Hours	6 Dollars	7 Hours	7 Dollars	8 Hours	8 Dollars	10 Hours	10 Dollars	Total cost Hours	Total cost Dollars
1	CRSTER, Rural, Single Point Source	16	310			16	470					32	780
2	CRSTER, Rural, Multipoint Source	40	780			24	710	8	280			72	1770
3	CRSTER, Rural/Urban, Industrial Source Complex	24	470			16	470					40	940
4	MPTER, Rural, Multipoint Source	24	470			16	470					40	940
5	RAM, Urban, Single Point Source	24	470			16	470					40	940
6[b]	RAM, Urban, Multiple Point and Area Source	40	780			16	470					56	1250
7	ISC, Rural/Urban, Industrial Source Complex	32	620			16	470					48	1090
8[a,b]	CDM, Urban, Multiple Point and Area Source	24	470			8	240					32	710
9	TEM8-A, Rural, Single Point Source	16	310			16	470					32	780
10	TEM8-A, Rural, Multipoint Source	24	470			16	470					40	940
11[b]	TEM8-A, Urban, Multiple Point and Area Source	40	780			16	470					56	1250
12[a,b]	TCM, Urban, Multiple Point and Area Source	24	470			8	240					32	710

Note: All costs are in 1980 dollars.

(continued)

TABLE C-17 (continued)

(f) Meteorological Data Set: 5 years NWS Hourly or 5 Annual STAR data sets
Receptor Resolution. 10 rings or 1 km.
Number of Load Condtions: Three or Baseline plus Control Strategies

Run No.	Modeling situation	Labor grade 5 Hours	5 Dollars	6 Hours	6 Dollars	7 Hours	7 Dollars	8 Hours	8 Dollars	10 Hours	10 Dollars	Total cost Hours	Total cost Dollars
1	CRSTER, Rural, Single Point Source	32	620			16	470					48	1090
2	CRSTER, Rural, Multipoint Source	64	1250			32	940	8	280			104	2470
3	CRSTER, Rural/Urban, Industrial Source Complex	40	780			16	470					56	1250
4	MPTER, Rural, Multipoint Source	40	780			16	470					56	1250
5	RAM, Urban, Single Point Source	40	780			16	470					56	1250
6[b]	RAM, Urban, Multiple Point and Area Source	64	1250			24	710					88	1960
7	ISC, Rural/Urban, Industrial Source Complex	48	940			16	470					56	1250
8[a,b]	CDM, Urban, Multiple Point and Area Source	40	780			8	240					48	1020
9	TEM8-A, Rural, Single Point Source	32	620			16	470					48	1090
10	TEM8-A, Rural, Multipoint Source	40	780			16	470					56	1250
11[b]	TEM8-A, Urban, Multiple Point and Area Source	64	1250			24	710					88	1960
12[a,b]	TCM, Urban, Multiple Point and Area Source	40	780			16	470					56	1250

[a]These models are climatological. They use STAR (frequency distribution) meteorological data to calculate annual average concentrations.

[b]Control strategy analysis performed for these runs.

Note: All costs are in 1980 dollars.

APPENDIX D

COST ESTIMATES FOR ANALYSIS OF RESULTS AND REPORT PREPARATION

A detailed cost breakdown for the component of a modeling analysis associated with analysis of results and preparation of report is presented in this Appendix. The tables are grouped as follows:

- Tables D-1(a) through D-1(i) are cost breakdowns applicable to emission sets 1, 2 and 3 for various combinations of meteorological data, receptor resolution and load conditions.

- Tables D-1(j) through D-1(o) are cost breakdowns applicable to emission sets 4 and 5, models using hourly meteorological data. Cost tables are provided for various combinations of meteorological data, receptor resolution, and baseline plus control strategies.

- Tables D-1(p) through D-1(u) are cost breakdowns applicable to emission sets 4 and 5, models using STAR meteorological data. Various combinations of meteorological data, receptor resolution and baseline plus control strategies are considered. In the table headings, a STAR (NWS) meteorological data set is a single frequency distribution summary of 1 or more years of wind data. Where 5 years STAR (NWS) is noted, five separate sets of annual frequency distribution wind data are used.

The costs presented in these tables are used in the Appendix E total cost of an air quality analysis Tables.

TABLE D-1. COST ESTIMATE FOR ANALYSIS OF RESULTS AND PREPARATION OF REPORT ON TSP AND SO_2

(a) Emission Data Set(s): 1, 2, 3
Meteorological Data Set: NWS 1 year hourly
Receptor Resolution: 5 rings (5 kilometers) plus high impact receptors
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	16	780
8 Staff Scientist	120	4,150
7 Senior Scientist	40	1,180
6 Scientist	40	990
5 Junior Scientist	40	780
4 Technical Illustrator	24	290
3 Technical Typist	24	370
Total	304	8,540

(b) Emission Data Set(s): 1, 2, 3
Meteorological Data Set: NWS 5 years hourly
Receptor Resolution: 5 rings (5 kilometers) plus high impact receptors
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	16	780
8 Staff Scientist	160	5,540
7 Senior Scientist	64	1,890
6 Scientist	64	1,580
5 Junior Scientist	64	1,250
4 Technical Illustrator	20	360
3 Technical Typist	40	610
Total	428	12,010

Note: All costs are in 1980 dollars.

(continued)

TABLE D-1 (continued)

(c) Emission Data Set(s): 1, 2, 3
Meteorological Data Set: NWS 1 year hourly
Receptor Resolution: 10 rings (1 kilometer) plus high impact receptors
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	200	6,920
7 Senior Scientist	80	2,360
6 Scientist	80	1,970
5 Junior Scientist	80	1,560
4 Technical Illustrator	24	430
3 Technical Typist	48	740
Total	528	14,780

(d) Emission Data Set(s): 1, 2, 3
Meteorological Data Set: NWS 5 years hourly
Receptor Resolution: 10 rings (1 kilometer) plus high impact receptors
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	240	8,300
7 Senior Scientist	100	2,950
6 Scientist	100	2,470
5 Junior Scientist	100	1,950
4 Technical Illustrator	32	580
3 Technical Typist	56	860
Total	644	17,910

Note: All costs are in 1980 dollars.

(continued)

TABLE D-1 (continued)

(e) Emission Data Set(s): 1, 2, 3
Meteorological Data Set: 1 year onsite
Receptor Resolution: 5 rings (5 kilometers) plus high impact receptors
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	160	5,540
7 Senior Scientist	60	1,770
6 Scientist	40	990
5 Junior Scientist	40	780
4 Technical Illustrator	16	290
3 Technical Typist	32	490
Total	364	10,660

(f) Emission Data Set(s): 1, 2, 3
Meteorological Data Set: 1 year onsite
Receptor Resolution: 10 ring (1 kilometer) plus high impact receptors
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	240	8,300
7 Senior Scientist	100	2,950
6 Scientist	80	1,970
5 Junior Scientist	100	1,950
4 Technical Illustrator	24	430
3 Technical Typist	56	860
Total	616	17,260

Note: All costs are in 1980 dollars.

(continued)

TABLE D-1 (continued)

(g) Emission Data Set(s): 1, 2, 3
Meteorological Data Set: NWS 1 year hourly
Receptor Resolution: 10 rings (1 kilometer) plus high impact receptors
Number of Load Conditions: 3

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	240	8,300
7 Senior Scientist	80	2,360
6 Scientist	100	2,470
5 Junior Scientist	100	1,950
4 Technical Illustrator	32	580
3 Technical Typist	56	860
Total	624	17,320

(h) Emission Data Set(s): 1, 2, 3
Meteorological Data Set: NWS 5 years hourly
Receptor Resolution: 10 rings (1 kilometer) plus high impact receptors
Number of Load Conditions: 3

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	280	9,690
7 Senior Scientist	100	2,950
6 Scientist	120	2,960
5 Junior Scientist	120	2,340
4 Technical Illustrator	40	720
3 Technical Typist	64	980
Total	740	20,440

Note: All costs are in 1980 dollars.

(continued)

TABLE D-1 (continued)

(i) Emission Data Set(s): 1, 2, 3
Meteorological Data Set: 1 year onsite
Receptor Resolution: 10 rings (1 kilometer) plus high impact receptors
Number of Load Conditions: 3

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	280	9,690
7 Senior Scientist	120	3,540
6 Scientist	100	2,470
5 Junior Scientist	100	1,950
4 Technical Illustrator	32	580
3 Technical Typist	56	860
Total	704	19,890

(j) Emission Data Set(s): 4, 5
Meteorological Data Set: 1 year hourly
Receptor Resolution: 5 rings (5 kilometers) plus high impact receptors
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	160	5,540
7 Senior Scientist	60	1,770
6 Scientist	60	1,490
5 Junior Scientist	60	1,170
4 Technical Illustrator	24	430
3 Technical Typist	36	550
Total	416	11,750

Note: All costs are in 1980 dollars.

(continued)

TABLE D-1 (continued)

(k) Emission Data Set(s): 4, 5
Meteorological Data Set: 5 years hourly
Receptor Resolution: 5 rings (5 kilometers) plus high impact receptors
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	200	6,920
7 Senior Scientist	80	2,360
6 Scientist	80	1,970
5 Junior Scientist	80	1,560
4 Technical Illustrator	32	570
3 Technical Typist	44	680
Total	532	14,860

(l) Emission Data Set(s): 4, 5
Meteorological Data Set: 1 year hourly
Receptor Resolution: 10 rings (1 kilometer) plus high impact receptors
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	240	8,300
7 Senior Scientist	100	2,950
6 Scientist	100	2,470
5 Junior Scientist	100	1,950
4 Technical Illustrator	36	650
3 Technical Typist	52	800
Total	644	17,920

Note: All costs are in 1980 dollars.

(continued)

TABLE D-1 (continued)

(m) Emission Data Set(s): 4, 5
Meteorological Data Set: 5 years hourly
Receptor Resolution: 10 rings (1 kilometer) plus high impact receptors
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	300	10,380
7 Senior Scientist	120	3,540
6 Scientist	120	2,960
5 Junior Scientist	120	2,340
4 Technical Illustrator	40	720
3 Technical Typist	60	1,080
Total	776	21,820

(n) Emission Data Set(s): 4, 5
Meteorological Data Set: 1 year hourly
Receptor Resolution: 10 rings (1 kilometer) plus high impact receptors
Number of Load Conditions: Baseline plus control strategy analysis

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	320	11,070
7 Senior Scientist	120	3,540
6 Scientist	120	2,960
5 Junior Scientist	120	2,340
4 Technical Illustrator	48	860
3 Technical Typist	64	980
Total	808	22,550

Note: All costs are in 1980 dollars.

(continued)

TABLE D-1 (continued)

(o) Emission Data Set(s): 4, 5
Meteorological Data Set: 5 years hourly
Receptor Resolution: 10 rings (1 kilometer) plus high impact receptors
Number of Load Conditions: Baseline plus control strategies

Labor Grade	Hours	Dollars
10 Group Scientist	16	800
8 Staff Scientist	400	13,840
7 Senior Scientist	160	4,720
6 Scientist	160	3,950
5 Junior Scientist	160	3,120
4 Technical Illustrator	56	1,010
3 Technical Typist	80	1,230
Total	1032	28,670

(p) Emission Data Set(s): 4, 5
Meteorological Data Set: STAR (NWS)
Receptor Resolution: 5 kilometers plus high impact receptors
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	8	400
8 Staff Scientist	120	4,150
7 Senior Scientist	40	1,180
6 Scientist	40	990
5 Junior Scientist	40	780
4 Technical Illustrator	16	290
3 Technical Typist	24	370
Total	288	8,160

Note: All costs are in 1980 dollars.

(continued)

TABLE D-1 (continued)

(q) Emission Data Set(s): 4, 5
Meteorological Data Set: 5 years (NWS) STAR Annual Data Sets
Receptor Resolution: 5 kilometers
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	8	400
8 Staff Scientist	200	6,920
7 Senior Scientist	80	2,360
6 Scientist	60	1,480
5 Junior Scientist	60	1,170
4 Technical Illustrator	24	430
3 Technical Typist	40	610
Total	472	13,370

(r) Emission Data Set(s): 4, 5
Meteorological Data Set: STAR (NWS)
Receptor Resolution: 1 kilometer
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	8	400
8 Staff Scientist	160	5,540
7 Senior Scientist	40	1,180
6 Scientist	60	1,480
5 Junior Scientist	60	1,170
4 Technical Illustrator	16	290
3 Technical Typist	32	490
Total	376	10,550

Note: All costs are in 1980 dollars.

(continued)

TABLE D-1 (continued)

(s) Emission Data Set(s): 4, 5
Meteorological Data Set: 5 STAR (NWS) Annual Data Sets
Receptor Resolution: 1 kilometer
Number of Load Conditions: 1

Labor Grade	Hours	Dollars
10 Group Scientist	8	400
8 Staff Scientist	240	8,300
7 Senior Scientist	60	1,770
6 Scientist	80	1,970
5 Junior Scientist	80	1,560
4 Technical Illustrator	24	430
3 Technical Typist	42	640
Total	534	15,070

(t) Emission Data Set(s): 4, 5
Meteorological Data Set: STAR (NWS)
Receptor Resolution: 1 kilometer
Number of Load Conditions: Baseline plus control strategies

Labor Grade	Hours	Dollars
10 Group Scientist	8	400
8 Staff Scientist	220	7,610
7 Senior Scientist	60	1,770
6 Scientist	80	1,970
5 Junior Scientist	80	1,560
4 Technical Illustrator	24	430
3 Technical Typist	42	640
Total	514	14,380

Note: All costs are in 1980 dollars.

(continued)

TABLE D-1 (continued)

(u) Emission Data Set(s): 4, 5
Meteorological Data Set: 5 STAR (NWS) Annual Data Sets
Receptor Resolution: 1 kilometer
Number of Load Conditions: Baseline plus control strategies

Labor Grade	Hours	Dollars
10 Group Scientist	8	400
8 Staff Scientist	260	9,000
7 Senior Scientist	80	2,360
6 Scientist	80	1,970
5 Junior Scientist	80	1,560
4 Technical Illustrator	28	500
3 Technical Typist	50	770
Total	586	16,560

Note: All costs are in 1980 dollars.

APPENDIX E

COST ESTIMATES OF TSP AND SO_2 AIR QUALITY MODELING ANALYSES

The total cost of an air quality modeling analysis for SO_2 and TSP are presented in sets of Tables E-1 through E-12. The combinations of modeling situation and model are addressed in the following order:

- Tables E-1 a) through E-1i), a point source modeling situation using the CRSTER air quality model. Cost estimates are presented for nine combinations of meteorological data, receptor resolution, and number of load conditions.

- Tables E-2a) through E-2i), a multi-point source modeling situation using the CRSTER air quality model. Cost estimates are presented for nine combinations of meteorological data, receptor resolution, and number of load conditions.

- Tables E-3a) through E-3i), a complex industrial source using the CRSTER air quality model. Cost estimates are presented for nine combinations of meteorological data, receptor resolution, and number of load conditions.

- Tables E-4a) through E-4i), a multi-point source modeling situation using the MPTER air quality model. Cost estimates are presented for nine combinations of meteorological data, receptor resolution, and number of load conditions.

- Tables E-5a) through E-5i), a point source modeling situation using the RAM air quality model. Cost estimates are presented for nine combinations of meteorological data, receptor resolution, and number of load conditions.

- Tables E-6a) through E-6f), point and area sources in an urban area using the RAM air quality model. Cost estimates are presented for six combinations of meteorological data, receptor resolution and number of load conditions and control strategies. Unlike the modeling situations addressed in Tables E-1 through E-5, onsite meteorological data is not an available option. Also, rather than differing load conditions, the cost of analyzing the effect of emissions from point and area sources at present and the cost of analyzing the effect of emissions at present and under two control strategies is considered.

- Tables E-7a) through E-7i), a complex industrial source using the ISC air quality model. Cost estimates are presented for nine combinations of meteorological data, receptor resolutions and number of load conditions.

- Tables E-8a) through E-8f), point and area sources in a mid-sized urban area using the CDM air quality model. Cost estimates are presented for six combinations of meteorological data, receptor resolution, and number of load conditions and control strategies. As in Table E-6, onsite meteorological data is not an available option. Also, because is it an urban area complex, the cost of analyzing the present emission configuration and the present plus two control strategies are examined rather than one and three load conditions.

- Tables E-9a) through E-9i), a point source modeling situation using TEM8-A air quality model. Cost estimates are presented for nine combinations of meteorological data, receptor resolution, and number of load conditions.

- Tables E-10a) through E-10i), a multi-point source modeling situation using the TEM8-A air quality model. Cost estimates are presented for nine combinations of meteorological data, receptor resolution, and number of load conditions.

- Tables E-11a) through E-11f), a point and area sources in an urban area using the TEM8-A air quality model. Cost estimates are presented for six combinations of meteorological data, receptor resolution and number of load conditions and control strategies. As in Table E-6, onsite meteorological data is not an available option. Also, because it is an urban area complex of sources, the cost of analyzing emissions from the present configuration of sources and the present plus two control strategies are examined rather than one and three load conditions.

- Tables E-12a) through E-12f), point and area sources in a mid-sized urban area using the TCM air quality model. Cost estimates are presented for six combinations of meteorological data, receptor resolution and control strategies. As in Table E-8, onsite meteorological data ia not an available option. Also, because it is an urban area complex of sources, the cost of analyzing emissions from the present configuration of sources and the present plus two control strategies are examined rather than one and three load conditions.

In preparing the cost estimates in Appendix E, no new cost data was formulated. Rather, this Appendix is a compilation of cost estimates documented in Appendices A through D. The references for the cost by modeling analysis task in the tables in this appendix is as follows:

Acquisition and preparation of emissions data - Table A-3.

Acquisition and preparation of meteorological data - Table A-6.

Receptor Siting and model option selection - Table A-8.

Model Execution - Tables C-16 and C-17.

Analysis of Results and report preparation - Table D-1.

At the bottom of each Table, a "call" value is presented. This is the cost estimate referred to in the main text.

TABLE E-1. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 1, A POINT SOURCE MODELING SITUATION

(a) RUN NUMBER: 1 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 5 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	24	630			180	160	24	790
Analysis of Results and Report Preparation	304	8,540					304	8,540
					Total Cost (dollars)			11,600
					"Call Value (dollars)			11,600

Note: All costs are in 1980 dollars.

(continued)

TABLE E-1. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 1, A POINT SOURCE MODELING SITUATION

(b) RUN NUMBER: 1 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 5 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (s c)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63.920
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	24	630			180	160	24	790
Analysis of Results and Report Preparation	364	10,660					364	10,660
					Total Cost (dollars)			75,400
					"Call" Value (dollars)			75,400

Note: All costs are in 1980 dollars.

(continued)

TABLE E-1. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 1, A POINT SOURCE MODELING SITUATION

(c) RUN NUMBER: 1 MODEL: CRSTER
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 5 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	[illegible]		M t rials		puter		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	32	780			920	780	32	1,560
Analysis of Results and Report Preparation	428	12,010					428	12,010
					Total Cost (dollars)			16,000
					"Call" Value (dollars)			16,000

Note: All costs are in 1980 dollars.

(continued)

TABLE E-1. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 1, A POINT SOURCE MODELING SITUATION

(d) RUN NUMBER: 1 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	1	720
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	32	780			360	320	32	1,100
Analysis of Results and Report Preparation	528	14,780					528	14,780
					Total Cost (dollars)			18,580
					"Call" Value (dollars)			18,600

Note: All costs are in 1980 dollars.

(continued)

TABLE E-1. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 1, A POINT SOURCE MODELING SITUATION

(e) RUN NUMBER: 1 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	32	780			360	320	32	1,100
Analysis of Results and Report Preparation	616	17,260					616	17,260
					Total Cost (dollars)			84,260
					"Call" Value (dollars)			84,300

Note: All costs are in 1980 dollars.

(continued)

TABLE E-1. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 1, A POINT SOURCE MODELING SITUATION

(f) RUN NUMBER: 1 MODEL: CRSTER
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation f Meteorological Data	17	430		370	90	80	17	880
R c p r Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	40	940			1,840	1,560	40	2,500
Analysis of Results and Report Preparation	644	17,910					644	17,910
					Total Cost (dollars)			23,270
					"Call" Value (dollars)			23,300

Note: All costs are in 1980 dollars.

(continued)

TABLE E-1. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 1, A POINT SOURCE MODELING SITUATION

(g) RUN NUMBER: 1 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dolla s	ours	Dollars
Acquisition and Preparation of Emission Data	20	530					20	530
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	32	780			1,080	960	48	1,740
Analysis of Results and Report Preparation	704	19,890					704	19,890
					Total Cost (dollars)			88,090
					"Call" Value (dollars)			88,100

Note: All costs are in 1980 dollars.

(continued)

TABLE E-1. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 1, A POINT SOURCE MODELING SITUATION

(h) RUN NUMBER: 1 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	20	530					20	530
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	32	780			1,080	960	32	1,740
Analysis of Results and Report Preparation	624	17,320					624	17,320
					Total Cost (dollars)			22,320
					"Call" Value (dollars)			22,300

Note: All costs are in 1980 dollars.

(continued)

TABLE E-1. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 1, A POINT SOURCE MODELING SITUATION

(i) RUN NUMBER: 1 MODEL: CRSTER
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	20	530					20	530
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	48	1,090			2,580	2,190	48	3,280
Analysis of Results and Report Preparation	740	20,440					740	20,440
					Total Cost (dollars)			27,140
					"Call" Value (dollars)			27,100

Note: All costs are in 1980 dollars.

TABLE E-2. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 2, A MULTI-POINT SOURCE MODELING SITUATION

(a) RUN NUMBER: 2 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 5 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	56	1,460			690	580	56	2,040
Analysis of Results and Report Preparation	304	8,540					304	8,540
					Total Cost (dollars)			13,750
					"Call" Value (dollars)			13,800

Note: All costs are in 1980 dollars.

(continued)

TABLE E-2. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 2, A MULTI-POINT SOURCE MODELING SITUATION

(b) RUN NUMBER: 2 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 5 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	56	1,460			690	580	56	2,040
Analysis of Results and Report Preparation	364	10,660					364	10,660
					Total Cost (dollars)			79,070
					"Call" Value (dollars)			79,100

Note: All costs are in 1980 dollars.

(continued)

TABLE E-2. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 2, A MULTI-POINT SOURCE MODELING SITUATION

(c) RUN NUMBER: 2 MODEL: CRSTER
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 5 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	64	1,610			1,080	900	64	2,510
Analysis of Results and Report Preparation	428	12,010					428	12,010
					Total Cost (dollars)			17,850
					"Call" Value (dollars)			17,900

Note: All costs are in 1980 dollars.

(continued)

TABLE E-2. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 2, A MULTI-POINT SOURCE MODELING SITUATION

(d) RUN NUMBER: 2 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	80	1,930			1,370	1,150	80	3,080
Analysis of Results and Report Preparation	528	14,780					528	14,780
					Total Cost (dollars)			21,460
					"Call" Value (dollars)			21,500

Note: All costs are in 1980 dollars.

(continued)

TABLE E-2. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 2, A MULTI-POINT SOURCE MODELING SITUATION

(e) RUN NUMBER: 2 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	11,340
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	80	1,930			1,370	1,150	80	3,080
Analysis of Results and Report Preparation	616	17,260					616	17,260
					Total Cost (dollars)			87,140
					"Call" Value (dolars)			87,100

Note: All costs are in 1980 dollars.

(continued)

TABLE E-2. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 2, A MULTI-POINT SOURCE MODELING SITUATION

(f) RUN NUMBER: 2 MODEL: CRSTER
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	96	2,240			2,160	1,800	96	4,040
Analysis of Results and Report Preparation	644	17,910					644	17,910
					Total Cost (dollars)			25,710
					"Call" Value (dollars)			25,700

Note: All costs are in 1980 dollars.

(continued)

TABLE E-2. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 2, A MULTI-POINT SOURCE MODELING SITUATION

(g) RUN NUMBER: 2 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	76	1,890					76	1,890
Acquisition and Preparation	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	72	1,770			1,760	1,480	72	3,250
Analysis of Results and 19,890 Report Preparation	704		19,890					704
					Total Cost (dollars)			90,960
					"Call" Value (dollars)			91,000

Note: All costs are in 1980 dollars.

(continued)

TABLE E-2. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 2, A MULTI-POINT SOURCE MODELING SITUATION

(h) RUN NUMBER: 2 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	76	1,890					76	1,890
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	72	1,770			1,760	1,480	72	3,250
Analysis of Results and Report Preparation	624	17,320					624	17,320
					Total Cost (dollars)			25,190
					"Call" Value (dollars)			25,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-2. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 2, A MULTI-POINT SOURCE MODELING SITUATION

(i) RUN NUMBER: 2 MODEL: CRSTER
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	76	1,890					76	1,890
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	104	2,470			2,450	2,140	104	4,610
Analysis of Results and Report Preparation	740	20,440					740	20,440
					Total Cost (dollars)			29,830
					"Call" Value (dollars)			29,800

Note: All costs are in 1980 dollars.

TABLE E-3. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 3, A COMPLEX INDUSTRIAL SOURCE

(a) RUN NUMBER: 3 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 5 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	44	1,040					44	1,040
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	32	780			190	160	32	940
Analysis of Results and Report Preparation	304	8,540					304	8,540
					Total Cost (dollars)			12,350
					"Call" Value (dollars)			12,400

Note: All costs are in 1980 dollars.

(continued)

TABLE E-3. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 3, A COMPLEX INDUSTRIAL SOURCE

(b) RUN NUMBER: 3 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 5 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	44	1,040					44	1,040
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	32	780			190	160	32	940
Analysis of Results and 10,660 Report Preparation	364		10,660					364
					Total Cost (dollars)			77,670
					"Call" Value (dollars)			77,700

Note: All costs are in 1980 dollars.

(continued)

TABLE E-3. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 3, A COMPLEX INDUSTRIAL SOURCE

(c) *RUN NUMBER:* 3 *MODEL:* CRSTER
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 5 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	44	1,040					44	1,040
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	40	940			940	790	40	1,730
Analysis of Results and Report Preparation	428	12,010					428	12,010
					Total Cost (dollars)			16,770
					"Call" Value (dollars)			16,800

Note: All costs are in 1980 dollars.

(continued)

TABLE E-3. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 3, A COMPLEX INDUSTRIAL SOURCE

(d) RUN NUMBER: 3 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	44	1,040					44	1,040
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	40	940			380	320	40	1,260
Analysis of Results and Report Preparation	528	14,780					528	14,780
					Total Cost (dollars)			19,340
					"Call" Value (dollars)			19,300

Note: All costs are in 1980 dollars.

(continued)

TABLE E-3. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 3, A COMPLEX INDUSTRIAL SOURCE

(e) RUN NUMBER: 3   MODEL: CRSTER
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	44	1,040					44	1,040
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	40	940			380	320	40	
Analysis of Results and Report Preparation	616	17,260					616	1,260
					Total Cost (dollars)			85,020
					"Call" Value (dollars)			85,000

Note: All costs are in 1980 dollars.

(continued)

TABLE E-3. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 3, A COMPLEX INDUSTRIAL SOURCE

(f) RUN NUMBER: 3 MODEL: CRSTER
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	44	1,040					44	1,040
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	48	1,090			1,880	1,580	48	2,670
Analysis of Results and Report Preparation	644	17,910					644	17,910
					Total Cost (dollars)			24,040
					"Call" Value (dollars)			24,000

Note: All costs are in 1980 dollars.

(continued)

TABLE E-3. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 3, A COMPLEX INDUSTRIAL SOURCE

(g) RUN NUMBER: 3 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	62	1,580					76	1,580
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	40	940			1,130	950	40	1,890
Analysis of Results and Report Preparation	704	19,890					704	19,890
					Total Cost (dollars)			82,290
					"Call" Value (dollars)			89,300

Note: All costs are in 1980 dollars.

(continued)

TABLE E-3. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 3, A COMPLEX INDUSTRIAL SOURCE

(h) RUN NUMBER: 3 MODEL: CRSTER
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	64	1,580					76	1,580
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	40	940			1,130	950	40	1,890
Analysis of Results and Report Preparation	624	17,320					624	17,320
					Total Cost (dollars)			23,520
					"Call" Value (dollars)			23,500

Note: All costs are in 1980 dollars.

(continued)

TABLE E-3. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CRSTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISIONS TO THE AQMG, AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 3, A COMPLEX INDUSTRIAL SOURCE

(i) RUN NUMBER: 3 MODEL: CRSTER
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	64	1,580					76	1,580
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	56	1,250			2,640	2,210	56	3,460
Analysis of Results and Report Preparation	740	20,440					740	20,440
					Total Cost (dollars)			28,370
					"Call" Value (dollars)			28,400

Note: All costs are in 1980 dollars.

TABLE E-4. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING MPTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 4, A MULTI-POINT SOURCE MODELING SITUATION

(a) RUN NUMBER: 4 MODEL: MPTER
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	32	780			6,060	6,380	32	7,160
Analysis of Results and Report Preparation	296	8,540					296	8,540
					Total Cost (dollars)			18,870
					"Call" Value (dollars)			18,900

Note: All costs are in 1980 dollars.

(continued)

TABLE E-4. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING MPTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 4, A MULTI-POINT SOURCE MODELING SITUATION

(b) RUN NUMBER: 4 MODEL: MPTER
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and	42	1,100			10	10	42	1,110
Model Execution	32	780			6,060	6,380	32	7,160
Analysis of Results and 10,660 Report Preparation	364		10,660					364
					Total Cost (dollars)			84,190
					"Call" Value (dollrs)			84,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-4. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING MPTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 4, A MULTI-POINT SOURCE MODELING SITUATION

(c) RUN NUMBER: 4 MODEL: MPTER
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	40	940			30,310	31,890	40	32,830
Analysis of Results and Report Preparation	428	12,010					428	12,010
					Total Cost (dollars)			48,170
					"Call" Value (dollars)			48,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-4. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING MPTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 4, A MULTI-POINT SOURCE MODELING SITUATION

(d) RUN NUMBER: 4 MODEL: MPTER
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	48	1,090			12,120	12,760	48	13,850
Analysis of Results and Report Preparation	528	14,780					528	14,780
					Total Cost (dollars)			32,230
					"Call" Value (dollars)			32,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-4. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING MPTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 4, A MULTI-POINT SOURCE MODELING SITUATION

(e) RUN NUMBER: 4 MODEL: MPTER
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	48	1,090			12,120	12,760	48	13,850
Analysis of Results and Report Preparation	616	17,260					616	17,260
					Total Cost (dollars)			97,910
					"Call" Value (dollars)			97,900

Note: All costs are in 1980 dollars.

(continued)

TABLE E-4. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING MPTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 4, A MULTI-POINT SOURCE MODELING SITUATION

(f) RUN NUMBER: 4 MODEL: MPTER
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	56	1,250			60,620	63,780	56	65,030
Analysis of Results and Report Preparation	644	17,910					644	17,910
					Total Cost (dollars)			86,700
					"Call" Value (dollars)			86,700

Note: All costs are in 1980 dollars.

(continued)

TABLE E-4. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING MPTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 4, A MULTI-POINT SOURCE MODELING SITUATION

(g) RUN NUMBER: 4 MODEL: MPTER
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	76	1,890					76	1,890
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	40	940			36,370	38,270	40	39,210
Analysis of Results and Report Preparation	704	19,890					704	19,890
					Total Cost (dollars)			126,900
					"Call" Value (dollars)			126,900

Note: All costs are in 1980 dollars.

(continued)

TABLE E-4. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING MPTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 4, A MULTI-POINT SOURCE MODELING SITUATION

(h) *RUN NUMBER:* 4 *MODEL:* *MPTER*
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	76	1,890					76	1,890
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	40	940			36,370	38,270	40	39,210
Analysis of Results and Report Preparation	624	17,320					624	17,320
					Total Cost (dollars)			61,150
					"Call" Value (dollars)			61,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-4. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING MPTER AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 4, A MULTI-POINT SOURCE MODELING SITUATION

(i) RUN NUMBER: 4 MODEL: MPTER
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	76	1,890					76	1,890
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	56	1,250			84,870	89,290	56	90,540
Analysis of Results and Report Preparation	740	20,440					740	20,440
					Total Cost (dollars)			115,760
					"Call" Value (dollars)			115,800

Note: All costs are in 1980 dollars.

TABLE E-5. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 5, A POINT SOURCE

(a) RUN NUMBER: 5 MODEL: RAM
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	32	780			680	630	32	1,410
Analysis of Results and Report Preparation	304	8,540					304	8,540
					Total Cost (dollars)			12,220
					"Call Value (dollars)			12,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-5. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 5, A POINT SOURCE

(b) RUN NUMBER: 5 MODEL: RAM
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	4440
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	32	780			680	630	32	1,410
Analysis of Results and Report Preparation	364	10,660					364	10,660
					Total Cost (dollars)			77,540
					"Call" Value (dollars)			77,500

Note: All costs are in 1980 dollars.

TABLE E-5. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 5, A POINT SOURCE

(c) RUN NUMBER: 5 MODEL: RAM
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	42	1,110			10	10	42	1,110
Model Execution	40	940			3,390	3,160	40	4,100
Analysis of Results and Report Preparation	428	12,010					428	12,010
					Total Cost (dollars)			18,540
					"Call" Value (dollars)			18,500

Note: All costs are in 1980 dollars.

(continued)

TABLE E-5. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBLR 5, A POINT SOURCE

(d) RUN NUMBER: 5 MODEL: RAM
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	40	940			1,360	1,270	40	2,210
Analysis of Results and Report Preparation	528	14,780					528	14,780
					Total Cost (dollars)			19,690
					"Call" Value (dollars)			19,700

Note: All costs are in 1980 dollars.

(continued)

TABLE E-5. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 5, A POINT SOURCE

(e) RUN NUMBER: 5 MODEL: RAM
METEOROLOGICAL DATA: 1 year NWS onsite
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	40	940			1,360	1,270	40	2,210
Analysis of Results and Report Preparation	616	17,260					616	17,260
					Total Cost (dollars)			85,370
					"Call" Value (dollars)			85,400

Note: All costs are in 1980 dollars.

(continued)

TABLE E-5. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 5, A POINT SOURCE

(f) RUN NUMBER: 5 MODEL: RAM
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	48	1,090			6,790	6,330	48	7,420
Analysis of Results and Report Preparation	644	17,910					644	17,910
					Total Cost (dollars)			28,190
					"Call" Value (dollars)			28,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-5. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 5, A POINT SOURCE

(g) RUN NUMBER: 5 MODEL: RAM
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	20	530					20	530
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	40	940			4,070	3,800	40	4,740
Analysis of Results and Report Preparation	704	19,890					704	19,890
					Total Cost (dollars)			91,090
					"Call" Value (dollars)			91,100

Note: All costs are in 1980 dollars.

(continued)

TABLE E-5. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 5, A POINT SOURCE

(h) RUN NUMBER: 5 MODEL: RAM
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	20	530					20	530
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	40	940			4,070	3,800	40	4,740
Analysis of Results and Report Preparation	624	17,320					624	17,320
					Total Cost (dollars)			25,320
					"Call" Value (dollars)			25,300

Note: All costs are in 1980 dollars.

(continued)

TABLE E-5. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 5, A POINT SOURCE

(i) RUN NUMBER: 5 MODEL: RAM
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	20	530					20	530
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	56	1,250			9,500	8,860	56	10,110
Analysis of Results and Report Preparation	740	20,440					740	20,440
					Total Cost (dollars)			33,970
					"Call" Value (dollars)			34,000

Note: All costs are in 1980 dollars.

TABLE E-6. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 6, POINT AND AREA SOURCES IN AN URBAN AREA

(a) RUN NUMBER: 6 MODEL: RAM
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	100	2,510					100	2,510
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	60	1,560			10	10	60	1,570
Model Execution	40	940			2,230	2,080	40	3,020
Analysis of Results and Report Preparation	416	11,750					416	11,750
					Total Cost (dollars)			19,570
					"Call" Value (dollars)			19,600

Note: All costs are in 1980 dollars.

(continued)

TABLE E-6. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 6, POINT AND AREA SOURCE COMPLEX IN AN URBAN AREA

(b) RUN NUMBER: 6 MODEL: RAM
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	100	2,510					100	2,510
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	60	1,560			10	10	60	1,570
Model Execution	56	1,250			11,160	10,420	56	11,670
Analysis of Results and Report Preparation	532	14,860					532	14,860
					Total Cost (dollars)			31,490
					"Call" Value (dollars)			31,500

Note: All costs are in 1980 dollars.

(continued)

TABLE E-6. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 6, POINT AND AREA SOURCE COMPLEX IN AN URBAN AREA

(c) RUN NUMBER: 6 MODEL: RAM
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	100	2,510					100	2,510
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	96	2,500		**	10	10	96	2,510
Model Execution	56	1,250			4,460	4,170	56	5,420
Analysis of Results and Report Preparation	776	17,920					776	17,920
					Total Cost (dollars)			29,080
					"Call" Value (dollars)			29,100

Note: All costs are in 1980 dollars.

(continued)

TABLE E-6. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 6, POINT AND AREA SOURCE COMPLEX IN AN URBAN AREA

(d) RUN NUMBER: 6 MODEL: RAM
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	100	2,510					100	2,510
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	96	2,500			10	10	96	2,510
Model Execution	72	1,570			22,320	20,840	72	22,410
Analysis of Results and Report Preparation	776	21,820					776	21,820
					Total Cost (dollars)			50,130
					"Call" Value (dollars)			50,100

Note: All costs are in 1980 dollars.

(continued)

TABLE E-6. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE ACMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 6, POINT AND AREA SOURCES IN AN URBAN AREA

(e) RUN NUMBER: 6 MODEL: RAM
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR OR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	140	3,570					140	3,570
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	144	3,750			10	10	144	3,760
Model Execution	56	1,250			13,390	12,510	88	13,760
Analysis of Results and Report Preparation	808	22,550					808	22,550
					Total Cost (dollars)			44,360
					"Call" Value (dollars)			44,400

Note: All costs are in 1980 dollars.

(continued)

TABLE E-6. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING RAM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 6, POINT AND AREA SOURCES IN AN URBAN AREA

(f) RUN NUMBER: 6 MODEL: RAM
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	140	3,570					140	3,570
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	144	3,750			10	10	144	3,760
Model Execution	88	1,960			31,240	29,180	88	31,140
Analysis of Results and Report Preparation	1,032	28,670					1,032	28,670
					Total Cost (dollars)			68,020
					"Call" Value (dollars)			68,000

Note: All costs are in 1980 dollars.

TABLE E-7. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING ISC AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 7, A COMPLEX INDUSTRIAL SOURCE

(a) RUN NUMBER: 7 MODEL: ISC
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	44	1,040					44	1,040
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	32	780			5,260	7,090	32	7,870
Analysis of Results and Report Preparation	304	8,540					304	8,540
					Total Cost (dollars)			19,280
					"Call" Value (dollars)			19,300

Note: All costs are in 1980 dollars.

(continued)

TABLE E-7. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING ISC AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 7, A COMPLEX INDUSTRIAL SOURCE

(b) RUN NUMBER: 7 MODEL: ISC
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	44	1,040					44	1,040
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	32	780			5,260	7,090	32	7,870
Analysis of Results and Report Preparation	364	10,660					364	10,660
					Total Cost (dollars)			84,600
					"Call" Value (dollars)			84,600

Note: All costs are in 1980 dollars.

(continued)

TABLE E-7. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING ISC AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 7, A COMPLEX INDUSTRIAL SOURCE

(c) RUN NUMBER: 7 MODEL: ISC
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	44	1,040					44	1,040
Acquisition and Preparation of Meteorological Data	17	430		370	90	8C	17	880
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	40	940			26,280	35,470	40	36,410
Analysis of Results and Report Preparation	428	12,010					428	12,010
					Total Cost (dollars)			51,450
					"Call" Value (dollars)			51,500

Note: All costs are in 1980 dollars.

(continued)

TABLE E-7. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING ISC AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 7, A COMPLEX INDUSTRIAL SOURCE

(d) RUN NUMBER: 7 MODEL: ISC
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

Modeling analysis task	Cost: Labor		Cost: Materials		Computer		Total cost	
	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	44	1,040					44	1,040
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	40	940			10,510	14,190	40	15,130
Analysis of Results and Report Preparation	528	14,780					528	14,780
					Total Cost (dollars)			33,210
					"Call" Value (dollars)			33,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-7. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING ISC AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 7, A COMPLEX INDUSTRIAL SOURCE

(e) RUN NUMBER: 7 MODEL: ISC
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	44	1,040					44	1,040
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	40	940			10,510	14,190	40	15,130
Analysis of Results and Report Preparation	616	17,260					616	17,260
					Total Cost (dollars)			98,890
					"Call" Value (dollars)			98,900

Note: All costs are in 1980 dollars.

(continued)

TABLE E-7. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING ISC AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 7, A COMPLEX INDUSTRIAL SOURCE

(f) RUN NUMBER: 7 MODEL: ISC
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	44	1,040					44	1,040
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	48	1,090			52,560	70,950	48	72,040
Analysis of Results and Report Preparation	644	17,910					644	17,910
					Total Cost (dollars)			93,410
					"Call" Value (dollars)			93,400

Note: All costs are in 1980 dollars.

(continued)

TABLE E-7. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING ISC AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 7, A COMPLEX INDUSTRIAL SOURCE

(g) RUN NUMBER: 7 MODEL: ISC
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	64	1,580					64	1,580
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	48	1,090			31,540	42,570	48	43,660
Analysis of Results and Report Preparation	704	19,890					740	19,890
					Total Cost (dollars)			131,060
					"Call" Value (dollars)			131,100

Note: All costs are in 1980 dollars.

(continued)

TABLE E-7. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING ISC AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 7, A COMPLEX INDUSTRIAL SOURCE

(h) RUN NUMBER: 7 MODEL: ISC
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	64	1,580					64	1,580
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	48	1,090			31,540	42,570	48	43,660
Analysis of Results and Report Preparation	624	17,320					624	17,320
					Total Cost (dollars)			65,290
					"Call" Value (dollars)			65,300

Note: All costs are in 1980 dollars.

(continued)

TABLE E-7. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING ISC AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 7, A COMPLEX INDUSTRIAL SOURCE

(i) RUN NUMBER: 7 MODEL: ISC
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	64	1,580					64	1,580
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	56	1,250			73,590	99,320	56	100,570
Analysis of Results and Report Preparation	740	20,440					740	20,440
					Total Cost (dollars)			125,480
					"Call" Value (dollars)			125,500

Note: All costs are in 1980 dollars.

TABLE E-8. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CDM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 8, POINT AND AREA SOURCES IN A MID-SIZED URBAN AREA

(a) RUN NUMBER: 8 MODEL: CDM
METEOROLOGICAL DATA: One NWS Star Data Set
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	128	3,140					128	3,140
Acquisition and Preparation of Meteorological Data	7	150		70	10	10	7	230
Receptor Siting and Model Option Selection	60	1,560			10	10	60	1,570
Model Execution	24	550			620	500	24	1,050
Analysis of Results and Report Preparation	288	8,160					288	8,160
					Total Cost (dollars)			14,150
					"Call" Value (dollars)			14,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-8. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CDM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 8, POINT AND AREA SOURCES IN A MID-SIZED URBAN AREA

(b) RUN NUMBER: 8 MODEL: CDM
METEOROLOGICAL DATA: 5 Annual NWS Star Data Set
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	128	3,140					128	3,140
Acquisition and Preparation of Meteorological Data	11	220		350	10	10	11	580
Receptor Siting and Model Option Selection	60	1,560			10	10	60	1,570
Model Execution	32	710			3,080	2,510	32	3,220
Analysis of Results and Report Preparation	472	13,370					472	13,370
					Total Cost (dollars)			21,880
					"Call" Value (dollars)			21,900

Note: All costs are in 1980 dollars.

(continued)

TABLE E-8. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CDM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 8, POINT AND AREA SOURCES IN A MID-SIZED URBAN AREA

(c) RUN NUMBER: 8 MODEL: CDM
METEOROLOGICAL DATA: One NWS Star Data Set
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	128	3,140					128	3,140
Acquisition and Preparation of Meteorological Data	7	150		70	10	10	7	230
Receptor Siting and Model Option Selection	96	2,500			10	10	96	2,510
Model Execution	32	710			1,230	1,000	32	1,710
Analysis of Results and Report Preparation	376	10,550					376	10,550
					Total Cost (dollars)			18,140
					"Call" Value (dollars)			18,100

Note: All costs are in 1980 dollars.

(continued)

TABLE E-8. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CDM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 8, POINT AND AREA SOURCES IN A MID-SIZED URBAN AREA

(d) RUN NUMBER: 8 MODEL: CDM
METEOROLOGICAL DATA: 5 Annual NWS Star Data Sets
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	128	3,140					128	3,140
Acquisition and Preparation of Meteorological Data	11	220		350	10	10	11	580
Receptor Siting and Model Option Selection	96	2,500			10	10	96	2,510
Model Execution	40	860			6,160	5,020	40	5,880
Analysis of Results and Report Preparation	534	15,070					534	15,070
					Total Cost (dollars)			27,180
					"Call" Value (dollars)			27,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-8. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CDM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 8, POINT AND AREA SOURCES IN A MID-SIZED URBAN AREA

(e) RUN NUMBER: 8 MODEL: CDM
METEOROLOGICAL DATA: One NWS Star Data Set
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	168	4,210					168	4,210
Acquisition and Preparation of Meteorological Data	7	150		70	10	10	7	230
Receptor Siting and Model Option Selection	144	3,750			10	10	144	3,760
Model Execution	32	710			3,700	3,010	32	3,720
Analysis of Results and Report Preparation	514	14,380					514	14,380
					Total Cost (dollars)			26,300
					"Call" Value (dollars)			26,300

Note: All costs are in 1980 dollars.

(continued)

TABLE E-8. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING CDM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 8, POINT AND AREA SOURCES IN A MID-SIZED URBAN AREA

(f) RUN NUMBER: 8 MODEL: CDM
METEOROLOGICAL DATA: 5 Annual NWS Star Data Sets
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	168	4,210					168	4,210
Acquisition and Preparation of Meteorological Data	11	220		350	10	10	11	580
Receptor Siting and Model Option Selection	144	3,750			10	10	144	3,760
Model Execution	48	1,020			8,630	7,030	48	8,050
Analysis of Results and Report Preparation	586	16,560					586	16,560
					Total Cost (dollars)			33,160
					"Call" Value (dollars)			33,200

Note: All costs are in 1980 dollars.

TABLE E-9. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 9, A POINT SOURCE MODELING SITUATION

(a) RUN NUMBER: 9 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	24	630			130	130	24	760
Analysis of Results and Report Preparation	304	8,540					304	8,540
					Total Cost (dollars)			11,570
					"Call" Value (dollars)			11,600

Note: All costs are in 1980 dollars.

(continued)

TABLE E-9. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 9, A POINT SOURCE MODELING SITUATION

(b) RUN NUMBER: 9 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,010	1,020	2,097	63,920
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	24	630			110	130	24	760
Analysis of Results and Report Preparation	364	10,660					364	10,660
					Total Cost (dollars)			76,890
					"Call" Value (dollars)			76,900

Note: All costs are in 1980 dollars.

(continued)

TABLE E-9. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 9, A POINT SOURCE MODELING SITUATION

(c) RUN NUMBER: 9 MODEL: TEM8-A
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	32	780			560	630	32	1,410
Analysis of Results and Report Preparation	428	12,010					428	12,010
					Total Cost (dollars)			15,850
					"Call" Value (dollars)			15,900

Note: All costs are in 1980 dollars.

(continued)

TABLE E-9. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 9, A POINT SOURCE MODELING SITUATION

(d) RUN NUMBER: 9 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	32	780			220	250	32	1,030
Analysis of Results and Report Preparation	528	14,780					528	14,780
					Total Cost (dollars)			18,510
					"Call" Value (dollars)			18,500

Note: All costs are in 1980 dollars.

(continued)

TABLE E-9. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 9, A POINT SOURCE MODELING SITUATION

(e) RUN NUMBER: 9 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	60	1,530			10	10		1,540
Model Execution	32	780			220	250	32	1,030
Analysis of Results and Report Preparation	616	17,260					616	17,260
					Total Cost (dollars)			84,190
					"Call" Value (dollars)			84,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-9. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 9, A POINT SOURCE MODELING SITUATION

(f) RUN NUMBER: 9 MODEL: TEM8-A
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	16	440					16	440
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	40	940			1,120	1,270	40	2,210
Analysis of Results and Report Preparation	644	17,910					644	17,910
					Total Cost (dollars)			22,980
					"Call" Value (dollars)			23,000

Note: All costs are in 1980 dollars.

(continued)

TABLE E-9. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 9, A POINT SOURCE MODELING SITUATION

(g) RUN NUMBER: 9 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	20	530					20	530
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	32	780			670	760	32	1,540
Analysis of Results and Report Preparation	704	19,890					704	19,890
					Total Cost (dollars)			87,890
					"Call" Value (dollars)			87,900

Note: All costs are in 1980 dollars.

(continued)

TABLE E-9. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 9, A POINT SOURCE MODELING SITUATION

(h) RUN NUMBER: 9 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	20	530					20	530
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	32	780			670	760	32	1,540
Analysis of Results and Report Preparation	624	17,320					624	17,320
					Total Cost (dollars)			22,120
					"Call" Value (dollars)			22,100

Note: All costs are in 1980 dollars.

(continued)

TABLE E-9. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 9, A POINT SOURCE MODELING SITUATION

(i) RUN NUMBER: 9 MODEL: TEM8-A
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	20	530					20	530
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	48	1,090			1,570	1,770	48	2,860
Analysis of Results and Report Preparation	740	20,440					740	20,440
					Total Cost (dollars)			26,720
					"Call" Value (dollars)			26,700

Note: All costs are in 1980 dollars.

TABLE E-10. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 10, A MULTI-POINT SOURCE MODELING SITUATION

(a) RUN NUMBER: 10 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	32	780			1,120	1,260	32	2,040
Analysis of Results and Report Preparation	304	8,540					304	8,540
					Total Cost (dollars)			13,750
					"Call" Value (dollars)			13,800

Note: All costs are in 1980 dollars.

(continued)

TABLE E-10. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 10, A MULTI-POINT SOURCE MODELING SITUATION

(b) RUN NUMBER: 10 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

Modeling analysis task	Cost: Labor Hours	Cost: Labor Dollars	Cost: Materials Hours	Cost: Materials Dollars	Computer CPU (sec)	Computer Dollars	Total cost Hours	Total cost Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	32	780			1,260	1,260	32	2,040
Analysis of Results and Report Preparation	364	10,660					364	10,660
					Total Cost (dollars)			79,070
					"Call" Value (dollars)			79,100

Note: All costs are in 1980 dollars.

(continued)

TABLE E-10. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 10, A MULTI-POINT SOURCE MODELING SITUATION

(c) RUN NUMBER: 10 MODEL: TEM8-A
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	42	1,100			10	10	42	1,110
Model Execution	40	940			5,590	6,320	40	7,260
Analysis of Results and Report Preparation	428	12,010					428	12,010
					Total Cost (dollars)			22,600
					"Call" Value (dollars)			22,600

Note: All costs are in 1980 dollars.

(continued)

TABLE E-10. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 10, A MULTI-POINT SOURCE MODELING SITUATION

(d) RUN NUMBER: 10 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	48	1,090			2,230	2,530	48	3,620
Analysis of Results and Report Preparation	528	14,780					528	14,780
					Total Cost (dollars)			22,000
					"Call" Value (dollars)			22,000

Note: All costs are in 1980 dollars.

(continued)

TABLE E-10. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 10, A MULTI-POINT SOURCE MODELING SITUATION

(e) RUN NUMBER: 10 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year Onsite hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	48	1,090			2,230	2,530	48	3,620
Analysis of Results and Report Preparation	616	17,260					616	17,260
					Total Cost (dollars)			87,680
					"Call" Value (dollars)			87,800

Note: All costs are in 1980 dollars.

(continued)

TABLE E-10. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 10, A MULTI-POINT SOURCE MODELING SITUATION

(f) RUN NUMBER: 10 MODEL: TEM8-A
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	60	1,530			10	10	60	1,540
Model Execution	56	1,250			11,170	12,640	72	13,890
Analysis of Results and Report Preparation	644	17,910					644	17,910
					Total Cost (dollars)			35,560
					"Call" Value (dollars)			35,600

Note: All costs are in 1980 dollars.

(continued)

TABLE E-10. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 10, A MULTI-POINT SOURCE MODELING SITUATION

(g) RUN NUMBER: 10 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	76	1,890					76	1,890
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	40	940			6,700	7,580	40	8,520
Analysis of Results and Report Preparation	704	19,890					704	19,890
					Total Cost (dollars)			96,230
					"Call" Value (dollars)			96,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-10. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 10, A MULTI-POINT SOURCE MODELING SITUATION

(h) RUN NUMBER: 10 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	76	1,890					76	1,890
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	40	940			6,700	7,580	40	8,520
Analysis of Results and Report Preparation	624	17,320					624	17,320
					Total Cost (dollars)			30,460
					"Call" Value (dollars)			30,500

Note: All costs are in 1980 dollars.

(continued)

TABLE E-10. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 10, A MULTI-POINT SOURCE MODELING SITUATION

(i) RUN NUMBER: 10 MODEL: TEM8-A
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	76	1,890					76	1,890
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	56	1,250			15,690	17,690	56	18,940
Analysis of Results and Report Preparation	740	20,440					740	20,440
					Total Cost (dollars)			44,160
					"Call" Value (dollars)			44,200

Note: All costs are in 1980 dollars.

TABLE E-11. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 11, A POINT AND AREA SOURCES IN AN URBAN AREA

(a) RUN NUMBER: 11 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	100	2,510					100	2,510
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	60	1,560			10	10	60	1,570
Model Execution	40	940			570	640	40	1,580
Analysis of Results and Report Preparation	416	11,750					416	11,750
					Total Cost (dollars)			18,130
					"Call" Value (dollars)			18,100

Note: All costs are in 1980 dollars.

(continued)

TABLE E-11. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 11, POINT AND AREA SOURCES IN AN URBAN AREA

(b) RUN NUMBER: 11 MODEL: TEM8-A
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	100	2,510					100	2,510
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	60	1,560			10	10	60	1,570
Model Execution	56	1,250			2,830	3,200	56	4,450
Analysis of Results and Report Preparation	532	14,860					532	14,860
					Total Cost (dollars)			24,270
					"Call" Value (dollars)			24,300

Note: All costs are in 1980 dollars.

(continued)

TABLE E-11. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 11, POINT AND AREA SOURCES IN AN URBAN AREA

(c) RUN NUMBER: 11 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	100	2,510					100	2,510
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	96	2,500			10	10	96	2,510
Model Execution	56	1,250			1,130	1,280	56	2,530
Analysis of Results and Report Preparation	644	17,920					644	17,920
					Total Cost (dollars)			26,190
					"Call" Value (dollars)			26,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-11. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 11, POINT AND AREA SOURCES IN AN URBAN AREA

(d) RUN NUMBER: 11 MODEL: TEM8-A
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	100	2,510					100	2,510
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	96	2,500			10	10	96	2,510
Model Execution	72	1,570			5,650	6,400	72	7,970
Analysis of Results and Report Preparation	776	21,820					776	21,820
					Total Cost (dollars)			35,690
					"Call" Value (dollars)			35,700

Note: All costs are in 1980 dollars.

(continued)

TABLE E-11. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 11, POINT AND AREA SOURCES IN AN URBAN AREA

(e) RUN NUMBER: 11 MODEL: TEM8-A
METEOROLOGICAL DATA: 1 year NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	140	3,570					140	3,570
Acquisition and Preparation of Meteorological Data	13	330		370	20	20	13	720
Receptor Siting and Model Option Selection	144	3,750			10	10	144	3,760
Model Execution	56	1,250			3,400	3,840	56	5,090
Analysis of Results and Report Preparation	808	22,550					808	22,550
					Total Cost (dollars)			35,690
					"Call" Value (dollars)			35,700

Note: All costs are in 1980 dollars.

(continued)

TABLE E-11. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TEM8-A AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 11, POINT AND AREA SOURCES IN AN URBAN AREA

(f) RUN NUMBER: 11 MODEL: TEM8-A
METEOROLOGICAL DATA: 5 years NWS hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	140	3,570					140	3,570
Acquisition and Preparation of Meteorological Data	17	430		370	90	80	17	880
Receptor Siting and Model Option Selection	144	3,750			10	10	144	3,760
Model Execution	88	1,960			7,910	8,950	88	10,910
Analysis of Results and Report Preparation	1,032	28,670					1,032	28,670
					Total Cost (dollars)			47,790
					"Call" Value (dollars)			47,800

Note: All costs are in 1980 dollars.

TABLE E-12. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TCM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 12, POINT AND AREA SOURCES IN A MID-SIZED URBAN AREA

(a) RUN NUMBER: 12 MODEL: TCM
METEOROLOGICAL DATA: One NWS Star Data Set
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	128	3,140					128	3,140
Acquisition and Preparation of Meteorological Data	7	150		70	10	10	7	230
Receptor Siting and Model Option Selection	60	1,560			10	10	60	1,570
Model Execution	24	550			10	10	24	560
Analysis of Results and Report Preparation	288	8,160					288	8,160
					Total Cost (dollars)			13,660
					"Call" Value (dollars)			13,700

Note: All costs are in 1980 dollars.

(continued)

TABLE E-12. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TCM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 12, POINT AND AREA SOURCES IN A MID-SIZED URBAN AREA

(b) RUN NUMBER: 12 MODEL: TCM
METEOROLOGICAL DATA: 5 Annual NWS Star Data Sets
RECEPTOR RESOLUTION: 5 rings (or 5 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	128	3,140					128	3,140
Acquisition and Preparation of Meteorological Data	11	220		350	10	10	11	580
Receptor Siting and Model Option Selection	60	1,560			10	10	60	1,570
Model Execution	32	710			60	50	32	760
Analysis of Results and Report Preparation	472	13,370					472	13,370
					Total Cost (dollars)			19,420
					"Call" Value (dollars)			19,400

Note: All costs are in 1980 dollars.

continued)

TABLE E-12. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TCM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 12, POINT AND AREA SOURCES IN A MID-SIZED URBAN AREA

(c) RUN NUMBER: 12 MODEL: TCM
METEOROLOGICAL DATA: One NWS Star Data Set
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	128	3,140					128	3,140
Acquisition and Preparation of Meteorological Data	7	150		70	10	10	7	230
Receptor Siting and Model Option Selection	96	2,500			10	10	96	2,510
Model Execution	32	710			20	20	32	730
Analysis of Results and Report Preparation	376	10,550					376	10,550
					Total Cost (dollars)			17,160
					"Call" Value (dollars)			17,200

Note: All costs are in 1980 dollars.

(continued)

TABLE E-12. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TCM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 12, POINT AND AREA SOURCES IN A MID-SIZED URBAN AREA

(d) RUN NUMBER: 12 MODEL: TCM
METEOROLOGICAL DATA: 5 Annual NWS Star Data Sets
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: One

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	128	3,140					128	3,140
Acquisition and Preparation of Meteorological Data	11	220		350	10	10	11	580
Receptor Siting and Model Option Selection	96	2,500			10	10	96	2,510
Model Execution	40	860			120	110	32	970
Analysis of Results and Report Preparation	534	15,070					534	15,070
					Total Cost (dollars)			22,270
					"Call" Value (dollars)			22,300

Note: All costs are in 1980 dollars.

(continued)

TABLE E-12. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TCM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 12, POINT AND AREA SOURCES IN A MID-SIZED URBAN AREA

(e) RUN NUMBER: 12 MODEL: TCM
METEOROLOGICAL DATA: One NWS Star Data Set
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	168	4,210					168	4,210
Acquisition and Preparation of Meteorological Data	7	150		70	10	10	7	230
Receptor Siting and Model Option Selection	144	3,750			10	10	144	3,760
Model Execution	32	710			70	60	32	770
Analysis of Results and Report Preparation	514	14,380					514	14,380
					Total Cost (dollars)			23,350
					"Call" Value (dollars)			23,400

Note: All costs are in 1980 dollars.

(continued)

TABLE E-12. COST OF A SO_2 AND TSP AIR QUALITY ANALYSIS INVOLVING TCM AND FOLLOWING REQUIREMENTS OF: THE 1978 AQMG, THE 1980 PROPOSED REVISION TO THE AQMG AND COMBINATIONS OF THE TWO. RESULTS ARE FOR RUN NUMBER 12, POINT AND AREA SOURCES IN A MID-SIZED URBAN AREA

(f) RUN NUMBER: 12 MODEL: TCM
METEOROLOGICAL DATA: 5 Annual NWS Star Data Sets
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	168	4,210					168	4,210
Acquisition and Preparation of Meteorological Data	11	220		350	10	10	11	580
Receptor Siting and Model Option Selection	144	3,750			10	10	144	3,760
Model Execution	56	1,250			170	150	48	1,400
Analysis of Results and Report Preparation	586	16,560					586	16,560
					Total Cost (dollars)			26,510
					"Call" Value (dollars)			26,500

Note: All costs are in 1980 dollars.

APPENDIX F

COST OF AN AIR QUALITY ANALYSIS FOR MODELS RECOMMENDED FOR GUIDELINE STATUS

COST OF APPLYING SHORT Z

SHORT Z is a short-term average atmospheric dispersion model designed to be used with onsite data measurements. The EPA is considering recommending its use to estimate concentrations of 24 hours or less in complex terrain comprised of urban area or industrialized valleys. A full year of meteorological data may be processed or the user may select any shorter periods. The resulting concentration estimates assume the same averaging time as the meteorological data input, which may be any averaging time of 24 hours or less.

SHORT Z Characteristics

Met data -	Short-term (1-hour, 3-hour, etc.) average values of specified meteorological parameters are required. These are normally derived from onsite measurements but may also be developed from NWS data.
Pollutants -	One pollutant is modeled per run; the output can be scaled to calculate concentrations for additional pollutants.
Averaging times -	Up to four averaging periods may be selected per run.
Receptors -	Cartesian or polar grid may be defined; discrete receptors may also be defined. Up to 1000 receptors may be defined.*
Sources -	Any combination of point, area, and building sources may be input, up to a total of 300 sources.* Sources may be grouped for output reporting.
Computer Core -	55K of core is required.

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*Storage is dynamically allocated for efficiency; maximum numbers of receptors and sources cannot be run at the same time.

Execution time - On an IBM 3033N, execution is as follows:

$$\text{CPU (sec)*} = \frac{1}{3.5} \cdot \left\{ \left[N_s \cdot \left(N_x \cdot N_y + N_{xy} \right) \cdot N_h \cdot N_d \cdot f \right. \right.$$
$$\left. + \left[\left(I + J + K \right) \cdot \left(N_x \cdot N_y + N_{xy} \right) \cdot N_h \cdot N_d \right] \cdot g \right\}$$

where N_s = the total number of input sources (card and tape) for which concentration is to be calculated

N_x = the total number of points in the grid system X-axis, NXPNTS

N_y = the total number of points in the grid system Y-axis, NYPNTS

N_{xy} = the total number of discrete (arbitrarily placed) points NXWYPT

N_h = the total number of input meteorological observations, NHOURS, per day

N_d = the total number of days or cases, NDAYS

I = the number of sources read from an input tape

J = the number of sources written to an output tape

K = the summation of the total number of sources in each source combination printed. For example, if NGROUP were equal to "4" and 3 sources were combined for the first group, 10 for the second, 13 for the third and 26 for the fourth group, then K would be equal to 52.

$f = 2.1 \times 10^{-3}$

$g = 2.2 \times 10^{-3}$

Computer cost - For 55K of core on the IBM 3033N, the cost (in dollars) is: CPU (sec) 0.758.

In Table F-1 the model execution cost of running SHORT Z is presented for three modeling scenarios. The center modeling scenario, with 20 sources is representative of a typical application. This scenario will form the basis of GCA's model execution cost estimate.

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*Formula is based on information provided by H.E. Cramer Company, Inc., in its Technical Report TR-79-131-01, December 1979.

TABLE F-1. ASSUMPTIONS FOR TYPICAL SHORT Z SCENARIOS

N_s (No. output source groups)	6	20	20
N_x (No. receptors on x axis)	19	19	19
N_y (No. receptors on y axis)	19	19	19
N_{xy} (No. discrete receptors)	28	28	28
N_h (No. hours per day of met)	24	24	24
N_d (No. days)	1	10	10
I (No. sources read from tape)	0	0	0
J (No. sources written to tape)	0	0	0
K (No. input sources)	12	20	100
Cost ($) on IBM 3033N	$ 79	$1739	$5298
CPU (sec) on IBM 3033N	104	2294	6989

As in Section 2 of the report, the total cost of an air quality analysis will be made based on cost tables in Appendices A, C and D. The cost estimate was based on the following:

- Table A-3b, emission preparation estimates for an industrial source complex under the proposed revision document (three load conditions),
- Acquisition and preparation of onsite meteorological data, Table A-6,e).
- Table A-8c, receptor siting and model option selection cost estimates for emission sets 1, 2, and 3,
- Table F-1, computer cost estimates for 20 sources, 389 receptors and 10 days, times a 1.2 error factor, times three load conditions,
- Table C-17e, ISC labor cost estimates for model execution, and
- Analysis of results and preparation of report cost estimates based on GCA experience.

The cost breakdown and total estimated cost is presented in Table F-2.

COST OF APPLYING LONG Z

LONG Z is a long term version of SHORT Z. It is designed to provide seasonal or annual average air quality impacts. A summary of LONG Z features and a method for estimating computer cost follows.

TABLE F-2. COST OF AN AIR QUALITY ANALYSIS USING SHORT Z AND FOLLOWING 1980 PROPOSED AQMG FOR A COMPLEX INDUSTRIAL SOURCE

MODEL: SHORT Z
METEOROLOGICAL DATA: 1 year onsite hourly - Only 10 days modeled
RECEPTOR RESOLUTION: 10 rings (or 1 km), 389
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	64	1,580					64	1,580
Acquisition and Preparation of Onsite Meteorological Data	2,097	49,300		12,420[a]	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	48	1,090			8,260	6,260	48	7,350
Analysis of Results and Report Preparation	352	9,950					352	9,950
					Total Cost (dollars)			84,810
					"Call" Value (dollars)			84,800

[a]This is the annual cost of meteorological equipment amortized over it's useful life (see Appendix B for details).
Note: All costs in 1980 dollars.

LONG Z Characteristics

Met data - STAR data

Pollutants - One pollutant is modelled per run; the output can be scaled to calculate concentrations for additional pollutants.

Averaging times - Seasonal only.

Receptors - Cartesian or polar grid may be defined; discrete receptors may also be defined. Up to 1000 receptors may be defined.*

Sources - Any combination of point, area, and building sources may be input, up to a total of 300 sources.* Sources may be grouped for output reporting.

Computer Core - 50K of core is required.

Execution time - On an IBM 3033N, execution is as follows:

$$\text{CPU (sec)}^{**} = \frac{1}{3.5} \cdot \left\{ \left[N_s \cdot \left(N_x \cdot N_y + N_{xy} \right) \cdot N_{se} \cdot N_{st} \cdot N_{sp} \right] \cdot f + \left[\left(I + J + K \right) \cdot \left(N_x \cdot N_y + N_{xy} \right) \cdot N_{se} \cdot g \right\} \right.$$

where N_s = the total number of sources (card and tape) for which concentration calculations are to be made

N_x = the total number of points in the grid system X-axis, NXPNTS

N_y = the total number of points in the grid system Y-axis, NYPNTS

N_{xy} = the total number of discrete (arbitrarily placed) points NXWYPT

N_{se} = the number of seasons, NSEASN

N_{st} = the number of stability categories, NSTBLE

N_{sp} = the number of wind speed categories, NSPEED

*Storage in dynamically determined for efficiency; maximum numbers of receptors and sources cannot be run at the same time.

**Formula based on information provided by H. E. Cramer Company, Inc., in its Technical Report TR-79-131-01, December 1979.

I = the number of sources read from an input tape

J = the number of sources written to an output tape

K = the summation of the total number of sources in each source combination printed. For example, if NGROUP were equal to "4" and 3 sources were combined for the first group, 10 for the second, 13 for the third and 26 for the fourth group, then K would be equal to 52.

$f = 2.1 \times 10^{-3}$

$g = 2.2 \times 10^{-3}$

Computer cost - For 50K of core on the IBM 3033N, the cost (in dollars) is: CPU (sec) x 0.758.

In Table F-3, the model execution cost of running LONG Z is presented for three modeling scenarios. The center modeling scenario, with 20 sources, is representative of a typical run. This scenario will form the basis for GCA's model execution cost estimates.

TABLE F-3. ASSUMPTIONS FOR TYPICAL LONG Z SCENARIOS

N_s (No. output source groups)	6	20	20
N_x (No. receptors on x axis)	19	19	19
N_y (No. receptors on y axis)	19	19	19
N_{xy} (No. discrete receptors)	28	28	28
N_{se} (No. seasons)	4	4	4
N_{st} (No. stability categories)	5	5	5
N_{sp} (No. wind speed categories)	6	6	6
I (No. sources read from tape)	0	0	0
J (No. sources written to tape)	0	0	0
K (No. input sources)	12	20	100
Cost ($) on IBM 3033N	$ 99	$316	$375
CPU (sec) on IBM 3033N	132	420	498

Note: All costs are in 1980 dollars.

As in Section 2 of this report, the total cost of an air quality analysis will be made based on cost tables in Appendices A, C, and D. The cost estimate is made based on the following:

- Table A-3b, emission preparation estimate for an industrial source complex under the proposed AQMG (three load conditions);

- Table A-6d, NWS STAR data acquisition and preparation estimates;

- Table A-8c, receptor siting and model option selection cost estimates for a 1-km resolution, three-load condition analysis;

- Table F-3, model execution costs for 20 sources with 389 receptors were extrapolated to a three-load condition modeling exercise using 5 annual NWS STAR data sets (7 model runs) and multiplied by an error factor of 1.2;

- Table C-17f, ISC labor cost estimates of model execution; and

- Analysis of results and preparation of report cost estimates based on GCA experience.

The cost breakdown and total cost of an air quality analysis using LONG Z are presented in Table F-4.

COST OF APPLYING BLP

BLP is a short-term air quality analysis model designed to use 1 year of hourly meteorological data. BLP model characteristics and computer costs of a typical run are provided below.

BLP Characteristics

Met data -	Hourly met data can be input for 1 year.
Pollutants -	One pollutant is modeled per run.
Averaging times -	One averaging time is calculated per run.
Receptors -	A maximum of 100 receptors is allowed; program is run two or more times for over 100 receptors (e.g., four runs are required for 360 receptors).
Sources -	Line sources and point sources are modeled. Typical runs include 2 to 10 line sources and 8 to 38 point sources.
Computer core -	190K of core is required for BLP; 140 K of core is required for the BLP post-processor.
Computer cost -	For 100 receptors and 365 days, the cost of a BLP run on an IBM 3033N computer is approximately $100 per line source and $20 per point source. The cost of a BLP post-processor run for these data is approximately $25. (Cost estimates were derived from information provided to GCA by developers and users of BLP.)
Execution time -	For 190K of storage, the number of CPU seconds required on an IBM 3033N is equal to: cost/0.8921. For 140K of storage, the CPU seconds required is: cost/0.8426.

TABLE F-4. COST OF AN AIR QUALITY ANALYSIS USING LONG Z AND FOLLOWING 1980 PROPOSED AQMG FOR A COMPLEX INDUSTRIAL SOURCE

MODEL: LONG Z
METEOROLOGICAL DATA: 5 Star Data Sets
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	64	1,580					64	1,580
Acquisition and Preparation of Meteorological Data	11	220		350	10	10	11	580
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	56	1,250			3,510	2,650	56	3,900
Analysis of Results and Report Preparation	352	9,950					352	9,950
					Total Cost (dollars)			18,020
					"Call" Value (dollars)			18,000

Note: All costs are in 1980 dollars.

Assumptions for a Typical BLP Scenario

• No. line sources -	6
• No. point sources -	20
• No. pollutants -	2
• No. pollutants per run -	2
• No. averaging times -	2
• No. receptors -	180
• No. days -	365

In Table F-5, the model execution cost of running BLP, using these assumptions is presented.

TABLE F-5. COST AND EXECUTION TIME FOR SCENARIO ON IBM 3033N

Run	CPU (sec)	Cost ($)
BLP for 100 receptors	1121	$1000
BLP for 80 receptors	897	800
BLP post-processor (two runs)	59	50
Total for scenario	2077	$1850

The totals for running this scenario with 360 receptors instead of 180, and 5 years of met data instead of 1 year, would be ten times the totals in the above table (for CPU seconds and cost).

BLP is used in complete yearly simulations of TSP and SO_2 air quality impacts. A cost of an air quality analysis using BLP and fulfilling the requirements of the 1980 proposed revisions to the AQMG will be made based on the following:

- Cost estimate for preparing emission data for an industrial source complex, as detailed in Table A-3b, will be used.
- Labor, material, and computer cost of preparing 1 year of onsite hourly data in Table A-6,e.
- Cost of siting receptors and selecting model option for emission set 3 in Table A-8c.

- Model execution costs in Table F-5 extrapolated to 360 receptors, times three-load conditions, times an error factor of 1.2.

- Labor cost estimates for ISC in Table C-17e.

- Analysis and report preparation costs based on GCA experience

Cost of an air quality analysis for SO_2 and TSP using BLP is presented in Table F-6.

COST OF AN AIR QUALITY ANALYSIS USING MESOPUFF

The characteristics of the MESOPUFF model are described below.

<u>MESOPUFF Characteristics</u>

Met data -	Prepared by MESOPAC program into gridded fields.
Pollutants -	SO_2 and $SO_4^{=}$ are modeled in one run.
Averaging times -	One averaging time is calculated per run; the MESOFILE post-processor can be used to calculate additional averaging times.
Receptors -	A receptor grid plus up to 10 arbitrary receptors may be defined.
Sources -	Up to 10 point sources may be input per run.
Time steps -	A time step of 1 to 12 hours may be specified.
PUFF emission rate -	A PUFF emission rate of 1/3 to 12 per time step may be specified.
PUFF sampling rate -	A PUFF sampling rate of 1/3 to 12 per time step may be specified.
Computer core -	300K of core is required.
Execution time -	Execution time is dependent on: No. of time steps (N), No. of PUFF releases per source per time step (N_p), No. of PUFF samples per time step (N_s), No. of sources (S), Various met conditions which control the average number of PUFFs resident on the grid, No. of receptors.

TABLE F-6. COST OF AN AIR QUALITY ANALYSIS USING BLP AND FOLLOWING PROPOSED AQMG FOR A COMPLEX INDUSTRIAL SOURCE

MODEL: BLP
METEOROLOGICAL DATA: 1 year onsite hourly
RECEPTOR RESOLUTION: 10 rings (or 1 km)
NUMBER OF LOAD CONDITIONS OR CONTROL STRATEGIES: Three

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	64	1,580					64	1,580
Acquisition and Preparation of Meteorological Data	2,097	49,300		12,420[a]	1,020	1,020	2,097	63,920
Receptor Siting and Model Option Selection	76	2,000			10	10	76	2,010
Model Execution	48	1,090			14,960	13,320	48	14,410
Analysis of Results and Report Preparation	352	9,950					352	9,950
					Total Cost (dollars)			91,870
					"Call" Value (dollars)			91,900

[a]This is the annual cost of meteorological equipment amortized over its useful life (see Appendix B for details.
Note: All costs are in 1980 dollars.

For a 26 x 26 grid with receptors spaced 40 km apart; with $N_p = 1$; and with N_s dynamically determined by the program, execution time of MESOPUFF on an IBM 3033N is as follows:

$$\text{CPU (sec)*} = \frac{1}{5.12} (0.38 \times S \times N + 0.43 \times N)$$

For this same grid, the execution time for MESOPAC is:

$$\text{CPU (sec)*} = \frac{1}{5.12} \frac{100N}{\Delta t}$$

where Δt equals the length of a time step in minutes.

Computer cost - For 300K of core on the IBM 3033N, the cost (in dollars) is: CPU (sec) x 1.429.

The model execution cost of a single 4-day run and of a 10-day run of MESOPUFF are presented in Table F-7. The cost of an air quality analysis of SO_2 and $SO_4^=$ transport using MESOPUFF will be made assuming four 4-day simulations. The cost of the modeling analysis tasks for such an air quality analysis were made as follows:

- Acquisition and preparation of emission data, Table A-3a for a multi-point source.
- Acquisition and preparation of meteorological data, Table A-4 plus labor estimates based on GCA experience. The computer cost estimates include running MESOPAC.
- Receptor siting and model option selection for a multipoint source in Table A-8a.
- Model execution costs are made, based on Table F-7, for four 4-day simulations, times an error factor of 1.2. Labor costs are based on GCA experience.
- Analysis of results and preparation of report costs are based on GCA experience.

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*Formulas are based on information in "Development of Mesoscale Air Quality Simulation Models, Volume 3: User's Guide to MESOPUFF (Mesoscale Puff) Model," EPA-600/7-80-058, U.S. EPA.

TABLE F-7. MODEL EXECUTION COST OF A TYPICAL MESOPUFF APPLICATION

Grid area		1000 km x 1000 km	1000 km x 1000 km
Receptor spacing		40 km	40 km
No. receptors in grid		676	676
No. days in simulation (D)		4	10
Length of time step (Δt)		60 min	60 min
No. of time steps ($N = \frac{1440}{\Delta t} \times D$)		96	240
No. sources		10	10
No. PUFFs emitted per time step		1	1
PUFF sampling rate		dyn. det.	dyn. det.
MESOPAC:	CPU (sec) on IBM 3033N	31	78
	Cost ($)	$ 44	$111
MESOPUFF:	CPU (sec)	79	198
	Cost ($)	$113	$283
Total:	CPU (sec)	110	276
	Cost ($)	$157	$394

The cost of an air quality analysis using MESOPUFF is presented in Table F-8.

COST OF A MESOGRID AIR QUALITY ANALYSIS

The characteristics of the MESOGRID model are described below.

MESOGRID Characteristics

Met data - Prepared by MESOPAC program into gridded fields.

Pollutants - SO_2 and $SO_4^=$ are modeled in same run, or SO_2 can be modeled alone for approximately one-half the execution time.

Averaging time - One averaging time is calculated per run; the MESOFILE post-processor can be used to calculate additional averaging times.

Receptors - A three-dimensional Cartesian coordinate system, plus up to 10 arbitrary receptors, may be specified.

Sources - Up to 50 point sources may be modeled in one run. MESOFILE may be used to merge results from two or more runs if more than 50 sources are to be modeled.

TABLE F-8. COST OF AN AIR QUALITY ANALYSIS USING MESOPUFF FOR A MULTIPOINT SOURCE SITUATION

MODEL: MESOPUFF
NUMBER OF GRIDS: 674
GRID RESOLUTION: 40 km
NUMBER OF 4-DAY SCENARIOS: 4

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	56	1,340					56	1,340
Acquisition and Preparation of Meteorological Data	112	2,840		370	200	300	112	3,510
Receptor Siting and Model Option Selection	42	1,110			10	10	42	1,110
Model Execution	64	1,610			530	750	64	2,360
Analysis of Results and Report Preparation	240	7,300					240	7,300
					Total Cost (dollars)			15,620
					"Call" Value (dollars)			15,600

Note: All costs are in 1980 dollars.

Time step - A time step of 5 minutes to 1 hour may be specified.

Computer core - 300K of core is required.

Execution time - Execution time is dependent on:

No. of time steps (N),
No. of grid points (direct dependency),
Various met factors which control the time step length (Δt) satisfying the horizontal and vertical computational stability criteria.

Execution time is independent of the number of sources.

For a 26 x 26 grid with receptors spaced at 40-km intervals, and three vertical layers of 500m, 1000m, and 2500m, the execution time of MESOGRID on an IBM 3033N is as follows:

$$\text{CPU (sec)*} = \frac{1}{5.12} \frac{300N}{t}$$

where time steps are of duration t minutes.

The execution time of MESOPAC is approximately one-third that of MESOGRID.

Computer cost - For 300K of core on the IBM 3033N, the cost (in dollars) is: CPU (sec) x 1.429.

The computer costs of two 4-day simulations and one 20-day simulation of SO_2 and $SO_4^=$ transport with MESOGRID, are estimated in Table F-9, these will form the basis for estimating computer costs of an air quality analysis. The computer costs will be equal to the cost of a 4-day simulation with 10-km grid spacing, times 4 scenarios, times an error factor of 1.2. Emission and meteorological data preparation costs for such a study are made based on GCA experience, as are receptor siting, analysis of results, and report preparation costs. The estimated cost of a MESOGRID air quality analysis is presented in Table F-10.

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*Formula is based on information in "Development of Mesoscale Air Quality Simulation Models, Volume 4: User's Guide to MESOGRID (Mesoscale Grid) Model," EPA-600/7-80-059, U.S. EPA.

TABLE F-9. COMPUTER COST OF A SINGLE 4-DAY SIMULATION WITH MESOGRID

Grid area		1000 km x 1000 km	500 km x 500 km	500 km x 500 km
Receptor spacing		40 km	10 km	10 km
No. receptors in grid		676	2601	2601
Vertical layers		500 m 1000 m 2500 m	500 m 1000 m 2500 m	500 m 1000 m 2500 m
No. days of simulation (D)		4	4	20
Length of time step (t)		30 min	30 min	30 min
No. of time steps ($N = \frac{1440}{t} \times D$)		192	192	960
MESOPAC:	CPU (sec) on IBM 3033N	125	481	2,405
	Cost ($)	$179	$ 687	$ 3,436
MESOGRID:	CPU (sec)	375	1,443	7,214
	Cost ($)	$536	$2,062	$10,309
Total:	CPU (sec)	500	1,924	9,619
	Cost ($)	$715	$2,749	$13,745

Note: All costs are in 1980 dollars.

TABLE F-10. COST OF AN AIR QUALITY ANALYSIS USING MESOGRID FOR A MULTIPOINT SOURCE SITUATION

MODEL: MESOGRID
NUMBER OF GRIDS: 2601
GRID RESOLUTION: 10 km
NUMBER OF 4-DAY SIMULATIONS: 4

	Cost							
	Labor		Materials		Computer		Total cost	
Modeling analysis task	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Acquisition and Preparation of Emission Data	104	2,600					104	2,600
Acquisition and Preparation of Meteorological Data	304	6,910			3,500	5,000	304	11,910
Receptor Siting and Model Option Selection	64	1,610					64	1,610
Model Execution	104	2,390			9,230	13,200	104	15,590
Analysis of Results and Report Preparation	240	7,300					240	7,300
					Total Cost (dollars)			39,010
					"Call" Value (dollars)			39,000

Note: All costs are in 1980 dollars.

APPENDIX G

COST OF A DEMONSTRATION STUDY

The cost of a demonstration study was determined for the three possible types of demonstration studies. The components of a demonstration study are:

- presentation of model theory,
- field study,
- model execution,
- comparison of model results to data, and
- analysis of comparison study and preparation of report.

There are three field study options:

- onsite field study, involving collection of meteorological data and SO_2 and TSP air quality data;
- tracer study, involving measurements of gas releases under worst-case conditions; and
- offsite study, involving the use of already existing data for a similar setting to demonstrate the validity of the model.

The cost of using each option in a demonstration study will be determined in this analysis. At the bottom of the final cost tables for each option; Tables G-8, G-9, G-10, a "call" value is cited. This is the value used in the main text.

The cost of presenting the model theory is minor. Documentation should be easily available through the model developers. Only a review and write up of the documentation would be required. The cost of such a review is presented in Table G-1.

Model execution costs will be estimated by GCA based on the cost of ISC, a recommended model. Estimates of the cost of processing the field data and comparing it to model calculations were made based on GCA experience and are presented in Table G-2. In Table G-3, the cost of analyzing the results and preparing a report, based on GCA experience, is presented.

The difference in cost of the three demonstration studies is due to the field study option used. Cost estimates were made for the three options as follows:

TABLE G-1. COST ESTIMATE FOR REVIEWING AND WRITING UP MODEL THEORY

Labor grade	Hours	Dollars
8	16	550
6	40	990
Total	56	1,540

Note: All costs are in 1980 dollars.

TABLE G-2. COST ESTIMATE FOR PROCESSING ONSITE AIR QUALITY AND METEOROLOGICAL DATA AND COMPARING MODEL CALCULATIONS TO DATA

Labor grade	Hours	Dollars
10	16	800
8	80	2,770
6	120	2,960
5	200	3,900
	Sec	Dollars
Computer costs	1,300	1,500
Total cost		11,930

Note: All costs are in 1980 dollars.

TABLE G-3. COST ESTIMATE FOR ANALYZING RESULTS AND PREPARING A DEMONSTRATION STUDY REPORT

Labor grade	Hours	Dollars
10	40	2,000
8	320	11,070
6	160	3,950
5	160	3,120
4	40	720
3	64	980
Total		21,840

Note: All costs are in 1980 dollars.

- Onsite field study--The cost estimate was made based on assuming a 4-month study. It was assumed that one meteorological station was in operation and 15 SO_2 and TSP monitors were placed in key locations within a 15-kilometer radius of the facility. The cost of meteorological equipment, as presented in Table B-1, was used. Labor costs for siting and operating the meteorological station were made, based on GCA experience, and are presented in Table G-4. The cost of air quality equipment for 15 sites was determined based on conversations with instrument firms, and the costs are presented in Table G-5. In Table G-6, GCA estimates the labor costs involved in operating the monitors.

- Tracer study--It was assumed that there would be four test periods with three releases per test period. The field study would take 4 months (1 in each season). The meteorological data costs in Tables B-1 and G-4 were extrapolated to the cost of operating three stations. Cost estimates of the tracer study were acquired from consultants, and they are documented in Table G-7.

- Offsite field study--Two steps were involved in using offsite data. First, the similarity of the two sites must be demonstrated. Second, the data must be acquired. The cost of these two steps was estimated by GCA and included in the total cost table, Table G-10.

ONSITE FIELD STUDY

In addition to the tasks addressed in Tables G-1, G-2, and G-3, a demonstration study using the onsite field study option would consist of the following:

- Collecting onsite meteorological data,

- Collecting air quality data, and

- Model execution.

The material cost of setting up a 10 meter meteorological tower was documented in Table B-2. The labor required for operating the meteorological station for one year was also addressed in Appendix B, in Table B-3. The 4 months of onsite meteorological data required for the onsite field study would consist of the same task breakdown as in Table B-3. Based on the one year labor estimates, the labor cost for the 4 month onsite study was prepared and is presented in Table G-4. The management tasks have been scaled down as appropriate for a smaller assignment. The labor task estimates in Table G-4 were made based on the following:

- the equipment calibration and setup would require two people for three weeks, just as in the one year analysis,

- there would be one calibration taking two people three days,

TABLE G-4. LABOR COSTS FOR RUNNING A METEOROLOGICAL STATION FOR 4 MONTHS

	Labor grade										Total cost	
	3		5		6		8		10			
Task description	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars
Management:												
Client Support							16	550	16	800	32	1,350
Presurvey of Site					8	200	8	280			16	480
Project Planning					8	200	8	280	4	200	20	680
Test Plan Preparation	8	120			8	200	24	830	4	200	44	1,350
Pretest Meeting					8	200			8	400	16	600
Labor:												
Equipment Calibration and Setup			120	2,340	120	2,960					240	5,300
Quarterly Calibrations			24	470	24	590					48	1,060
Routine Site Visits			108	2,100	108	2,670					216	4,770
Maintenance			24	470	24	590					48	1,060
Breakdown Time			40	780	40	990					80	1,770
Data Reduction					40	990					40	990
Quality Assurance					40	990					40	990
Report Writing	16	250			60	1,480					76	1,730
											Total cost	22,130

Note: All costs are in 1980 dollars.

TABLE G-5. SO_2 AND TSP AIR QUALITY MONITORING EQUIPMENT COSTS FOR 15 SITES

Quantity	Item	Cost
15	Shelters, 8 ft x 8 ft x 8 ft	63,900
15	Ladder and railing	7,425
15	Shipping	4,500
30	Hi-vol shelter and motor	11,850
15	Timer	3,825
17	Spare motors	2,210
32	Brushmisers	1,780
30 pair	Motor brushes	135
36 boxes	1-HV filters	1,500
17	Monitor Labs Model 8850 SO_2 Analyzer	123,675
17	Plus options	23,800
18	SO_2 permeation tube	3,150
15	H_2 pump module	3,375
15	Telemetry	3,000
15	Recorders	10,050
1	Monitor Labs Model 8500B SO_2 Calibrator	2,375
	Support material	
6	Magnetic tapes	75
60 rolls	Recorder chart paper	720
60	Recorder pens	210
	Miscellaneous fittings	250
	Envirodata--10% strip chart data reduction for QA	840
15	Power company electrical lines	3,000
3 days	Electrician	840
15	Fence surrounding each site	7,500
	Tool kit	175
4	Envelopes for Hi-vol filters	60
Total material costs		280,220
Annual Equipment Cost[a]		66,520
Categorized costs:	SO_2 equipment	169,425
	TSP equipment	21,320
	Support material	89,475

[a]This value is used in monitoring equipment cost estimates in this study. The annual equipment cost is equal to the total material costs times the capital recovery factor (CRF). CRF is defined in Appendix B. A 5-year useful life and a 6 percent inflation adjusted interest rate was assumed.

Note: All costs are in 1980 dollars.

TABLE G-6. LABOR COSTS FOR RUNNING A 15 SITE AIR QUALITY MONITORING NETWORK FOR 4 MONTHS

Task description	Labor grade 3 Hours	Labor grade 3 Dollars	Labor grade 5 Hours	Labor grade 5 Dollars	Labor grade 6 Hours	Labor grade 6 Dollars	Labor grade 8 Hours	Labor grade 8 Dollars	Labor grade 10 Hours	Labor grade 10 Dollars	Total cost Hours	Total cost Dollars
Management:												
Client Support					16	390	24	830	24	1,200	64	2,420
Presurvey of Site					40	990	40	1,380			80	2,370
Project Planning					24	600	40	1,380			64	1,980
Test Plan Preparation					32	800	40	1,380	4	200	76	2,380
Pretest Meeting							8	280	8	400	16	680
Labor:												
Equipment Calibration and Setup			520	10,130	520	12,840					1040	22,970
Quarterly Calibrations			240	4,680	240	5,920					480	10,600
Routine Site Visits	180	2,760	1890	36,830	1890	46,650					3960	86,240
Maintenance			40	780	40	990					80	1,770
Breakdown Time			120	2,340	120	2,960					240	5,300
Data Reduction					80	1,970					80	1,970
Quality Assurance					40	990	24	830			64	1,820
Report Writing	32	490			128	3,160					160	3,650
											Total cost	144,130

Note: All costs are in 1980 dollars.

TABLE G-7. DOCUMENTATION OF FIELD COSTS OF A TRACER STUDY

Several conditions have been established upon which the estimates for tracer studies have been solicited.

Assume:

- 100 meter release height
- Single source
- Rural, valley terrain
- Model being validated would be variation of Gaussian plume model such as CRSTER
- Four overall test periods, one in each season
- Three releases during each test period
- Receptors would be a combination of ground and airplane
- Ground receptors would be located up to 15 km downwind
- Helicopters not used to reach remote ground receptors

Source: Aerovironment, Inc.--Bob Baxter

- 20 to 25 ground receptors needed to provide fixed sampler data giving hourly concentration averages
- 5-hour releases at 50 lb/hr; tracer cost is $10,000
- Aircraft data provides real-time analysis to follow the plume and determine direction at $200 to $300/hour
- Need to determine upper air meteorology by tethersonde at $5,000
- Cost based on previous release study performed for Bureau of Land Management (BLM), validation of nonguideline model, two tests with four releases each, 2 weeks in the field for each one: $200,000 to $300,000

Cost of Tracer Study

- This program is basically double the size of the one performed for BLM and described above. Eight weeks would be required in the field instead of four, there are four tests instead of two. The 1981 price of the study conducted for BLM is approximately $275,000. Therefore, the cost of this program would be roughly $550,000

Source: North American Weather Consultants--Timothy Spangler

- Ground receptors to provide average hourly data, 20 to 30 samplers
- Release visible smoke to photograph plume and provide visible tracking
- Airplane tracking of plume also helps provide data
- Tracer released by balloon
- Cost based on previous release study where seven releases were made, visible smoke also released for tracking and aircraft tracking was used; cost: $260,000

(continued)

TABLE G-7 (continued)

<u>Cost of Tracer Study</u>

- For the program proposed in this report, North American Weather Consultants cost estimate was in agreement with Aerovironment, Inco. They estimated the cost of the proposed program to be $560,000

<u>Comments on Meteorological Requirements</u>

For both, the study would require at least one, and probably three, 10-meter met stations in a valley to give accurate readings of meteorological parameters. See 4-month met costs, Table B-2, for the price of one met station. For the labor cost of three met stations, use:

- 4-month met--Management x 2
  Labor x 3
  Equipment x 3

- there would be a routine site visit three days per week-4 hours per day by one person for 18 weeks,

- there would be unscheduled maintenance of 12 hours per month for four months,

- it would take two people one week of breakdown time to dismantle and pack up the system, and

- quality assurance, and report writing estimates were made based on GCA experience.

The price breakdown of the materials required for the 15 TSP and SO_2 air quality monitors is presented in Table G-5. The prices supplied are GCA estimates. The labor costs for setting up, operating and breaking down the 15 monitor sites are presented in Table G-6. The management labor estimates are based on GCA experience. The labor task estimates were made based on the following:

- equipment setup and calibration would require two people one week to set up all the sites and two people four days per site to calibrate,

- a calibration visit would be required, taking two people four days per site,

- routine maintenance would take two hours per site, seven days a week for 18 weeks,

- a breakdown time of three weeks for two people would be required to pack up the network, and

- data reduction, quality assurance, and report writing have been estimated by GCA.

Finally, a labor and computer budget estimate was made by GCA. The labor estimates were based on GCA experience. As a guide for estimating a computer budget, GCA allowed for the cost of running ISC for one year. The reasoning behind this is that ISC is representative of the type of model that could be tested and a budget equal to a one year run would allow for a reasonable amount of testing. The total cost estimate for a demonstration study is given in Table G-8. It is a sum of the cost breakdown in Tables G-1 through G-6, B-2, and computer budget estimates based on Table 3.

TRACER STUDY

The cost of a demonstration study using the tracer study option would be composed of all the components discussed above, with the following exceptions:

- three meteorological sites would be required to adequately document the tracer study; as a result, the costs presented in Table G-4 are adjusted as recommended in Table G-7, and

TABLE G-8. COST OF A DEMONSTRATION STUDY USING ONSITE FIELD STUDY OPTION

Task	Labor requirements												Computer costs		Total cost	
	3		4		5		6		8		10					
	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Presentation of Model Theory							40	990	16	550					56	1,540
Field Study Option:																
<u>Onsite</u>																
Collecting Meteorological Data	24	370			316	6,160	488	12,060	56	1,940	32	1,600		12,420[a]	910	34,550
Collecting Air Quality Data	212	3,250			2,810	54,760	3,170	78,260	176	6,080	40	1,800		66,520[b]	6,408	210,670
Model Execution					40	780	40	990	16	550			2,040	2,750	96	5,070
Model Results and Data Comparison					200	3,900	120	2,960	80	2,770	16	800	1,300	1,500	416	11,930
Analysis of Results and Preparation of Report	64	980	40	720	160	3,120	160	3,930	320	11,070	40	2,000			784	21,840
															Total cost	285,600
															"Call" Value	285,000

[a]Annual material cost for meteorological station, see Table B-1.

[b]Material cost of 15 air quality sites, Table G-5.

Note: All costs are in 1980 dollars.

- the cost of performing a tracer study (instead of collecting air quality data), which are presented (along with assumptions) in Table G-7.

The total cost of an onsite demonstration study using the tracer study option is presented in Table G-9. It is the sum of costs itemized in Tables G-1 through G-3, G-4 modified as recommended in Table G-7, G-7, and model execution costs as discussed above for the field study option.

OFFSITE FIELD STUDY

The cost of a demonstration study using off-site field study data is given in Table G-10. GCA made estimates for the tasks of demonstrating site similarity and acquire and process off-site data and included them in Table G-10. All other costs have already been discussed previously.

TABLE G-9. COST OF A DEMONSTRATION STUDY USING TRACER STUDY OPTION

Task	Labor requirements												Computer costs		Total cost	
	3		4		5		6		8		10					
	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Presentation of Model Theory							40	990	16	550					56	1,540
Field Study Option:																
<u>Tracer Study</u>																
Collecting Meteo-rological Data[a]	64	990			948	18,480	1,432	35,390	112	3,870	64	3,200		37,260[b]	2,620	99,190
Performing Tracer Study															3,000	550,000
Model Execution					40	780	40	990	16	550			2,040	2,750	96	5,070
Model Results and Data Comparison					200	3,900	120	2,960	80	2,770	16	800	1,300	1,500	416	11,930
Analysis of Results and Pre-paration of Report	64	980	40	720	160	3,120	160	3,950	320	11,070	40	2,000			784	21,840
															Total cost	689,570
															"Call" Value	689,600

[a]At three stations, for 4 months.

[b]Material costs for three meteorological stations amortized over 5 years assuming a 6 percent inflation adjusted interest rate.

[c]See Table G-7.

Note: All costs are in 1980 dollars.

TABLE G-10. COST OF A DEMONSTRATION STUDY USING OFF-SITE FIELD STUDY OPTION

Task	Labor requirements												Computer costs		Total cost	
	3		4		5		6		8		10					
	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	CPU (sec)	Dollars	Hours	Dollars
Presentation of Model Theory							40	990	16	550					56	1,540
Field Study Option:																
<u>Off-Site</u>																
Demonstrate Site Similarity							40	990	16	550					56	1,540
Acquire and Proces Off-site Data					160	3,120	40	990	8	280					208	4,390
Model Execution					40	780	40	990	16	550			2,040	2,750	96	5,070
Model Results and Data Comparison					200	3,900	120	2,960	80	2,770	16	800	1,300	1,500	416	11,930
Analysis of Results and Preparation of Report	64	980	40	720	160	3,120	160	3,950	320	11,070	40	2,000			784	21,840
															Total Cost	46,310
															"Call" Value	46,300

Note: All costs are in 1980 dollars.

APPENDIX H

COST OF DETERMINING EMISSION LIMITS FROM MONITORING DATA AND MODELING IN COMPLEX TERRAIN

SIP EMISSION LIMITS FROM MONITORING

The procedure for determining emission limits from monitoring data is as follows:

- 1 year of ambient data is collected for a monitoring network and documented.
- The network data is reviewed and design values are determined for pollutants for all averging times for which a standard or maximum allowable PSD increment exists.
- The meteorological conditions for the year are reviewed and compared to climatic norm from NWS data.

The cost for determining emission limits from monitoring data was estimated for a point source in a valley. In order to adequately identify design values, GCA estimated that 15 SO_2 and TSP monitoring sites would be required. The cost of the needed equipment was presented in Table G-5. In Table H-2, the cost of siting operating, and maintaining the network, as well as, the cost of reducing the data and writing a report are presented. The cost breakdown is very similar to the four month monitoring operating costs presented in Table G-6. The management hours have increased to reflect the increased magnitude of the work. Also, the costs for the one year program increase by a factor of three for the calibration, routine site visits, and maintenance tasks. The time required for report writing has also increased to account for the greater amount of data analysis. The cost of the remaining tasks: reviewing the data to determine design values, reviewing meteorological data and comparing it to climatic norm, and preparing a report are presented in Table H-3. The total cost of the SIP emission analysis is given in Table H-4.

SIP EMISSION LIMITS FROM MODELING

To determine emission limits from modeling in a complex terrain situation, a model like SHORT Z would be a reasonable candidate. The cost of a study of the type required here has already been analyzed in Appendix F. A cost breakdown is presented in Table F-2. The total cost for a point source modeling study in complex terrain using SHORT Z is $84 K.

TABLE H-1. LABOR NEEDS FOR OPERATING 15 TSP AND SO_2 MONITORS FOR 1 YEAR AND PREPARING A REPORT

Task description	Labor grade 3 Hours	Labor grade 3 Dollars	Labor grade 5 Hours	Labor grade 5 Dollars	Labor grade 6 Hours	Labor grade 6 Dollars	Labor grade 8 Hours	Labor grade 8 Dollars	Labor grade 10 Hours	Labor grade 10 Dollars	Total cost Hours	Total cost Dollars
Management:												
Client Support					32	790	48	1,660	48	2,400	128	4,850
Presurvey of Site					40	990	40	1,380			80	2,370
Project Planning					40	990	24	830			64	1,820
Test Plan Preparation					32	790	40	1,380	4	200	76	2,370
Pretest Meeting							8	280	8	400	16	680
Labor:												
Equipment Calibration and Setup			520	10,130	520	12,840					1,040	22,970
Quarterly Calibrations			720	14,030	720	17,770					1,440	31,800
Routine Site Visits	540	8,290	5,670	110,480	5,670	139,960					11,880	258,730
Maintenance			120	2,340	120	2,960					240	5,300
Breakdown Time			120	2,340	120	2,960					240	5,300
Data Reduction					160	3,950					160	3,950
Quality Assurance					48	1,180	32	1,110			80	2,290
Report Writing	56	860			304	1,500					360	2,360
										Total cost		344,790

Note: All costs are in 1980 dollars.

TABLE H-2. THE COST OF DATA REVIEW TASKS OF A TSP AND SO_2 MONITORING PROGRAM DESIGNED TO DETERMINE SIP EMISSION LIMITS

Task description	Labor grade[a]												Total cost	
	3		4		5		6		8		10			
	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars
Reivew TSP and SO_2 Monitoring Data to Determine Design Values									80	2,770	16	800	96	3,570
Review Meteorological Data and Compare to Climatic Norm									40	1,380			40	1,380
Prepare Report	40	610	24	430	80	1,560			160	5,540	16	800	320	8,940
													Total cost	13,890

[a]Defined in Table A-1.

Note: All costs are in 1980 dollars.

TABLE H-3. COST OF DETERMINING SIP EMISSION LIMITS FROM MONITORING DATA, A SUMMATION OF COST BREAKDOWNS PRESENTED IN TABLES G-6, H-1, and H-2.

Analysis component	Labor Hours	Labor Dollars	Materials (dollars)	Total cost
Air Quality Equipment			66,520	66,520
Operation of Monitoring Network	15,804	344,790		344,790
Review Monitoring Data and Prepare Report	456	13,890		13,890
			Total cost	425,200
			"Call" Value	$430 K

Note: All costs are in 1980 dollars.

APPENDIX I

COMPARISON OF CPU TIME ON AN IBM 3033N TO OTHER COMMONLY USED COMPUTERS

The requirements for running specific scenarios of various models are listed in this report in terms of the cost on the IBM 3033N computer used in this study, and in terms of the number of seconds of CPU execution time.

COST OF CPU TIME

The cost of running a program on an IBM 3033N computer was calculated as follows:

$$\text{Cost (\$)} = \text{Base Cost (\$)} + \text{High Core Cost (\$)},$$

where

$$\text{Base Cost (\$)} = 0.70400 \times S + 0.00099 \times C \times S + 0.00050 \times E$$

$$\text{High Core Cost (\$)} = 0.00396 \times (C-192) \times S \text{ for } C > 192 \text{ only}$$

S = number of CPU seconds

C = core storage used (in thousands)

E = number of EXCPs.

This formula should be viewed only as a general estimate of cost. The cost of running the same scenario of the same model on IBM 3033N computers at different installations may be calculated in markedly different ways. Further, the cost estimates listed in this report are only suggestive of the costs of running the models on processors other than the IBM 3033N.

EXECUTION TIME

Tables I-1, I-2, and I-3 provide listings of the relative performance of many widely used mainframe computers and super mini-computers. Most of the relative performance ratings were provided by the Computerworld newspaper.

Tables I-1 to I-3 may be used to convert execution time from the number of CPU seconds required on an IBM 3033N to the number of CPU seconds which would be required on other computers. To make the conversion for a specific scenario of a model, multiply the number of CPU seconds required on an IBM 3033N (as listed in this report) by the converstion factor listed in the tables. For example, if a model requires 100 CPU seconds on an IBM 3033N, it will require about 131 CPU seconds on an Amdahl 470V/6 Computer (100 x 1.31), and about 53 CPU seconds on a Univac 1100/84 computer (100 x 0.53).

The results of these conversions should be viewed only as general approximations of expected execution times. Computer performance varies greatly, not only with the processor and with the software, but also with such factors as the number of devices attached to the system and the number of users on the system.

TABLE I-1. RELATIVE PERFORMANCE OF IBM AND IBM-COMPATIBLE MAINFRAMES

Computer/model	Relative perfor-mance[a]	Conversion factor from IBM 3033N[b]	Computer/model	Relative perfor-mance[a]	Conversion factor from IBM 3033N[b]
IBM 3033N	210	1.00	CAMBEX 1636	23	9.13
3033S	120	1.75	1641	35	6.00
3033U	237	0.89	1651	52	4.04
3033-A	405	0.52			
3033-M	405	0.52	CDC OMEGA 480-1	22	9.55
8130	12	17.50	OMEGA 480-2	27	7.78
8140	20	10.50	OMEGA 480-3	52	4.04
SYSTEM 38, MOD 5	16	13.13			
4331-1	11	19.09	IPL 4436	35	6.00
4331-2	22	9.55	4443	45	4.67
4341-1	40	5.25	4446	73	2.88
4341-2	66	3.18			
370/158	41	5.12	MAGNUSON M80/31	26	8.08
370/158-MP	60	3.50	M80/32	32	6.56
370/158-3	45	4.67	M80/42	45	4.67
370/158-3AP	74	2.84	M80/43	54	3.89
370/158-3MP	74	2.84	M80/44	65	3.23
3081	465	0.45			
AMDAHL 470V/6	160	1.31	NAS AS/3000N	40	5.25
470V6-II	175	1.20	AS/3000	50	4.20
470V/7C	120	1.75	AS/5000N	50	4.20
470V/7B	160	1.31	AS/5000E	60	3.50
470V/7A	205	1.02	AS/5000	62	3.39
470V/7	255	0.82	AS/7000N	105	2.00
470V/8	310	0.68	AS/7000	143	1.47
580-5860	620	0.34	AS/7000-DPS	243	0.86
580-5880	1,085	0.19	AS/9000N	314	0.67
			AS/9000	393	0.53
			AS/9000-DPC	708	0.30

[a]Relative Performance ratings are from "Hardware Roundup," Computerworld, July 13, 1981: Tom Henkel.

[b]In this report, execution times for the models are listed in terms of the number of CPU seconds required on an IBM 3033N. You can estimate the execution time which a model will require on your computer by mulitplying the number of seconds required on an IBM 3033N by the conversion factor listed next to your computer in this table.

TABLE I-2. RELATIVE PERFORMANCE FOR NON-IBM (AND NON-IBM-COMPATIBLES) MAINFRAMES

Computer/model	Relative perfor-mance[a]	Conversion factor from IBM 3033N[b]	Computer/model	Relative perfor-mance[a]	Conversion factor from IBM 3033N[b]
Burroughs B1900 (1955)	19	11.05	LEVEL 68/DPS:		
B2900	28	7.50	LEVEL 1	61	3.44
B5900	30	7.00	LEVEL 2	95	2.21
B6900	61	3.44	LEVEL 3	136	1.54
B7800 Uniprocessor	199	1.06	LEVEL 4	179	1.17
CDC CYBER 170/720	47	4.47	NCR V8455	10	21.00
CYBER 170/730	65	3.23	V8555M	17	12.35
CYBER 170/740	155	1.35	V8565M	24	8.75
CYBER 170/750	274	0.77	V8575M	30	7.00
CYBER 170/760	368	0.57	V8585M	50	4.20
CYBER 176	614	0.34	V8650	116	1.81
			V8670	212	0.99
HONEYWELL DPS 8/20	22	9.55			
DPS 8/44	35	6.00	UNIVAC SYSTEM 80, MODEL 3	9	23.33
DPS 8/44D	62	3.39	SYSTEM 80, MODEL 5	15	14.00
(Dual Processor)			90/80, MODEL 3	46	4.57
DPS 8/52	61	3.44	1110, 1 x 1	60[c]	3.50
DPS 8/62	82	2.56	1110, 2 x 2	102[c]	2.06
DPS 8/70:			1110, 4 x 4	173[c]	1.21
Uni-processor	109	1.93	1100/81	114	1.84
Dual-processor	193	1.09	1100/82	208	1.01
Tri-processor	282	0.74	1100/83	307	0.68
Quad-processor	379	0.55	1100/84	397	0.53
LEVEL 66/DPS:					
LEVEL 1	57	3.68			
LEVEL 2	89	2.36			
LEVEL 3	119	1.76			
LEVEL 4	192	1.09			
LEVEL 5	257	0.82			
LEVEL 6	320	0.65			
LEVEL 7	384	0.55			

[a]Relative Performance ratings are from "Hardware Roundup," Computerworld, July 13, 1981: Tom Henkel.

[b]In this report, execution times for the models are listed in terms of the number of CPU seconds required on an IBM 3033N. You can estimate the execution time which a model will require on your computer by mulitplying the number of seconds required on an IBM 3033N by the conversion factor listed next to your computer in this table.

[c]Relative Performance estimate based on information obtained from Sperry-Univac.

TABLE I-3. RELATIVE PERFORMANCE FOR SUPER MINI-COMPUTERS

Computer/model	Relative performance[a]	Conversion factor from IBM 3033N[b]	Computer/model	Relative performance[a]	Conversion factor from IBM 3033N[b]
DEC VAX-11/750	60	3.50	PRIME Series 50-150II	26	8.08
VAX-11/780	100	2.10	Series 50-250II	26	8.08
Decsystem-10-1091	72	2.92	Series 50-550II	35	6.00
Decsystem-20-2060	72	2.92	Series 50-750	52	4.04
			Series 50-850	86	2.44
DG C/350	24	8.75			
M/600	24	8.75	Perkin-Elmer 3220	50	4.20
MV/8000	60	3.50	3230	53	3.96
			3240	92	2.28
HP HP3000, 30	17	12.35			
HP3000, 33	17	12.35			
HP3000, II	22	9.55			
HP3000, 44	32	6.56			

[a]Relative Performance ratings are from "Hardware Roundup," Computerworld, July 13, 1981: Tom Henkel.

[b]In this report, execution times for the models are listed in terms of the number of CPU seconds required on an IBM 3033N. You can estimate the execution time which a model will require on your computer by mulitplying the number of seconds required on an IBM 3033N by the conversion factor listed next to your computer in this table.

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

The Environmental Protection Agency (EPA) has developed a set of guidelines to be followed in any air quality modeling study performed for the EPA. The Guideline on Air Quality Models (AQMG) was issued in 1978 as a part of the Office of Air Quality Planning and Standards Guideline Series. Since the release of the 1978 AQMG, the EPA has had a chance to review its effectiveness and gather together recommendations on how the document could be improved. In 1980, a proposed revision to the 1978 AQMG was issued for review. In this report, GCA examines the costs associated with implementing certain features of the 1980 proposed revision.

17. KEY WORDS AND DOCUMENT ANALYSIS

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