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Research Triangle Park NC 27711

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USER'S MANUAL FOR MODIFIED ROLLBACK/EKMA STRATEGY ASSESSMENT MODEL

USER'S MANUAL
MODIFIED ROLLBACK/EKMA STRATEGY
ASSESSMENT MODEL

Air Management Technology Branch
Monitoring and Data Analysis Division
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina 27711

July 1981

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PREFACE

This report contains information on, and the computer programs for, the Modified Rollback/EKMA Strategy Assessment Model. The model can be used to generate emission inventories in future years for alternative mobile source control strategies and growth rate scenarios. Ambient concentration estimates can be generated for the pollutants carbon monoxide (CO), nitrogen dioxide (NO_2), and ozone (O_3). These air quality estimates are obtained using the modified rollback equations of de Nevers and Morris for CO and annual average NO_2 and the standard isopleth diagram of the Empirical Kinetic Modeling Approach (EKMA) for ozone. The model is useful for conducting air quality assessments of mobile source control strategies which are national in scope.

The program is written in ASCII FORTRAN for the UNIVAC 1100 Operating System; thus, this manual only illustrates the use of the model with the UNIVAC EXEC 8 Control Language. Applications on other computing systems may require some minor programming changes and the substitution of a comparable system sort routine.

A more detailed description of the assumptions and limitations of the Modified Rollback Model in national strategy assessments is contained in EPA-450/4-80-026, Methodology to Conduct Air Quality Assessments of National Mobile Source Emissions Control Strategies. This report presents methodologies for estimating selected input parameters for the rollback model. In some cases, default values for missing data are also provided.

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ABSTRACT

The Modified Rollback/EKMA Strategy Assessment Model provides a computerized procedure for conducting air quality assessments of national emission control strategies for mobile source related pollutants. Air quality projections of carbon monoxide and annual average nitrogen dioxide concentrations are made using the Modified Rollback equations of de Nevers and Morris. Ozone air quality concentrations are projected using the OZIPP/EKMA procedure. Emission inventories are also projected for each source region and control scenario.

Major differences between this model and the earlier Modified Rollback Model are: (1) use of the OZIPP/EKMA procedure for ozone projections; (2) no upper limit on the number of source regions that can be considered; (3) high-altitude and California strategies can be considered simultaneously with 49-State strategies; and (4) the maximum number of mobile source categories which can be listed in the inventory has been increased to 22.

The material presented is directed toward the model user familiar with the UNIVAC 1100 System at the National Computing Center. Technical details of the computer programming are discussed and complete descriptions of input and output formats are given. Brief program descriptions and source code listings are provided as appendices.

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1.0 INTRODUCTION

This report describes the Modified Rollback/EKMA Strategy Assessment Model and its use in estimating emission inventories and ambient air quality concentrations in future years for alternative control strategies and growth rate scenarios. The three emission inventory pollutants considered by the model are carbon monoxide (CO), nitrogen oxides (NO_x) and Volatile Organic Compounds (VOC). Ambient concentration estimates can be obtained for carbon monoxide (CO), annual average nitrogen dioxide (NO_2) and ozone (O_3). Table 1-1 provides a summary of the modeled pollutants. The program is written in the ASCII FORTRAN language for the UNIVAC 1100 operating system.

This model differs from the earlier Modified Rollback Model primarily in the way in which concentration estimates for ozone are made. Future ozone air quality concentrations are now obtained using an algorithm which solves the standard isopleth diagram of the Empirical Kinetic Modeling Approach (EKMA). As a result, changes in both VOC and NO_x emissions can now be considered, simultaneously. Other changes include: (1) no upper limit on the number of source areas which may be modeled, (2) high-altitude and California regions can be modeled simultaneously with the 49-State regions, (3) an increase in the number of control strategies and emission source categories, and (4) the creation of emission inventory and air quality data files for use in graphical or statistical post-processors.

The material presented is directed toward the user familiar with computer techniques. Technical details of the computer programming are discussed; complete descriptions of input, output and test examples are given; and the FORTRAN source statements are presented as appendices.

Table 1-1. SUMMARY OF MODELED POLLUTANTS

POLLUTANT NAME	AIR QUALITY CODE	AVERAGING TIME	DEFAULT UNITS	EMISSIONS CODE
Carbon Monoxide	ØCOØ	1-Hour	MG/M3	ØCOØ
	ØCO8	8-hour	MG/M3	ØCOØ
Oxone*	Ø03Ø	Daily Max 1-Hour	UG/M3	ØVOC
Nitrogen Dioxide	ØNO2	Annual Average	UG/M3	ØNOX

*NOTE: If ozone is the pollutant modeled, the user must assign the OZIPP Isopleth Data File to input Unit 11. (See Example #2).

A system overview, including flow charts, is presented in Section 2. Control and data card preparation and input card sequence are discussed in Section 3. Section 4 provides examples of the computational output from the program. Finally, Section 5 provides several test examples. For a complete discussion of the formulation and limitations of the air quality algorithms used, the reader should consult Reference 1.

2.0 SYSTEM DESCRIPTION

A system flow diagram of the Modified Rollback/EKMA Strategy Assessment Model is presented in Figure 2-1. As indicated in the diagram, there are three basic modules: the main emissions and air quality projection program, the system sort routine, and the air quality summary report program. Each module is briefly described in the following sections. More detailed descriptions of the computational aspects of the individual routines are contained in Appendix A.

2.1 Air Quality and Emission Projections

All air quality and emissions projections are performed by program ROLLBACK. Program options, mobile and stationary source control strategies, base year air quality concentrations and emission inventories for each source region are input on cards. ROLLBACK performs card sequence checks and data screening for selected parameters. If ozone is the pollutant being modeled, the data file containing the digitized Standard EKMA Isopleths must also be assigned to the run.

Depending on the options selected, the program may output an emissions data file, an emissions summary report for each source region, and an air quality data file. The size of each data file and summary report is a function of the number of source regions being modeled and the number of growth rates, projection years, and control strategies.

2.1.1 Emission Projections in Rollback

Source region emission inventories are projected to future years on a disaggregated basis. This procedure allows explicit consideration of different control and growth rate assumptions for individual source categories. Also, a distinction is made between existing stationary sources and new sources coming on

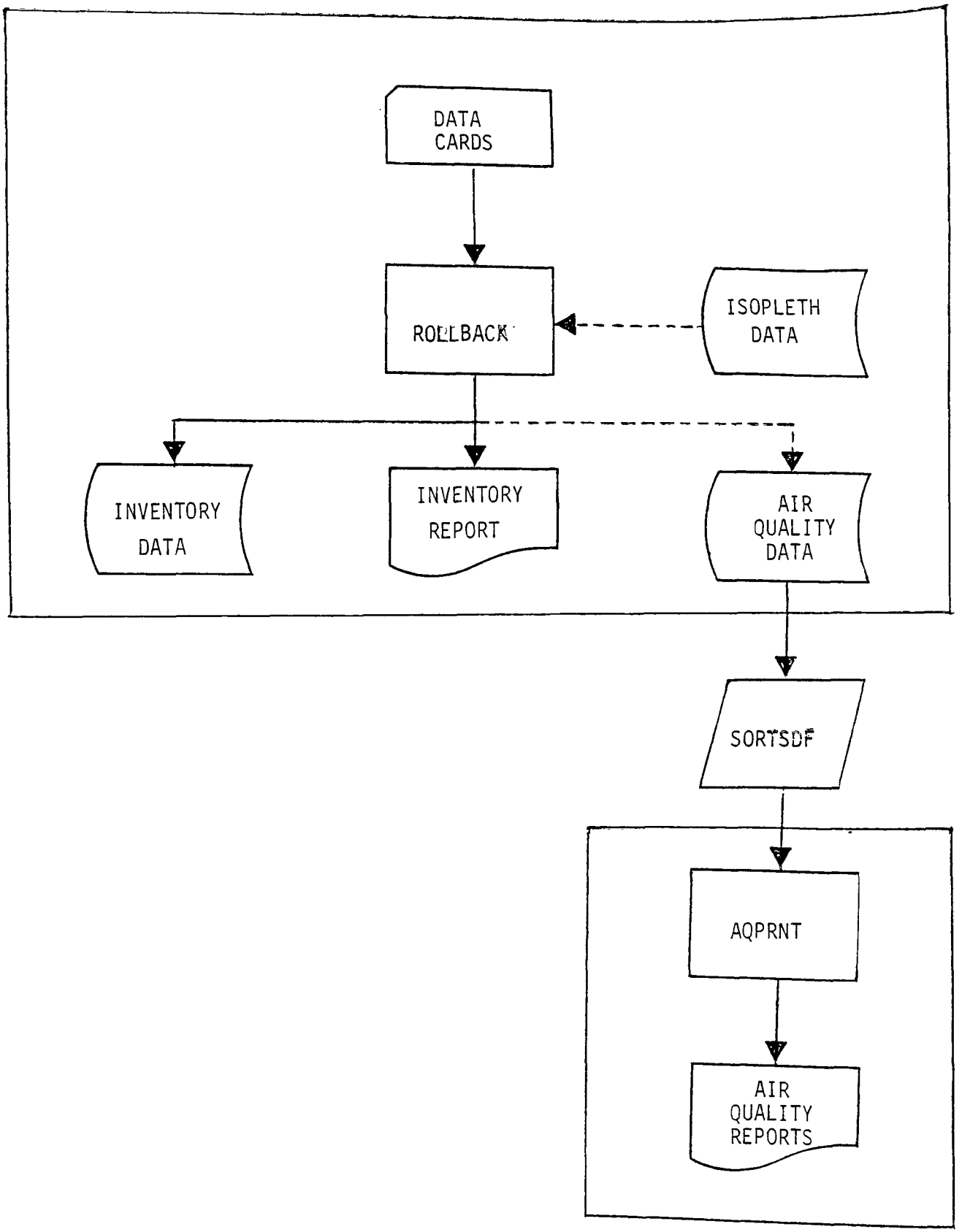

Figure 2-1. SYSTEM FLOW DIAGRAM

line through growth and replacement of existing facilities. It should be noted that these rates are assumed to represent the growth and retirement of uncontrolled emissions or emission indicators.

As a matter of programming convenience, growth and retirement factors are calculated as compound growth rates. Thus, an exponential growth pattern is assumed to represent the growth in emissions between the base year and the projection year. For some applications, it may be desirable to provide separate growth rates for each projection year. For example, the growth between the base year and the two intermediate projection years shown in Figure 2-2 would be significantly understated by the single compound growth rate represented by G85. In this situation, two additional growth rate scenarios, G75 and G80, should be input to the model following the procedures described in Section 3.3.

Summary reports of the base year and projection year inventories are available from each source region, control scenario and growth rate combination. A compact data file can also be output for post-processing by statistical or graphics procedures.

Finally, the projected changes in the emission inventories form the basis for the air quality projections.

2.1.2 Air Quality Projections in Rollback

Air quality projections for future calendar years are available for each control scenario and growth rate combination. The deNevers and Morris modified rollback equations are used to project CO and annual average NO_2 concentrations (Reference 2). For ozone, the EKMA procedure is used to project future concentration levels (References 3 and 4).

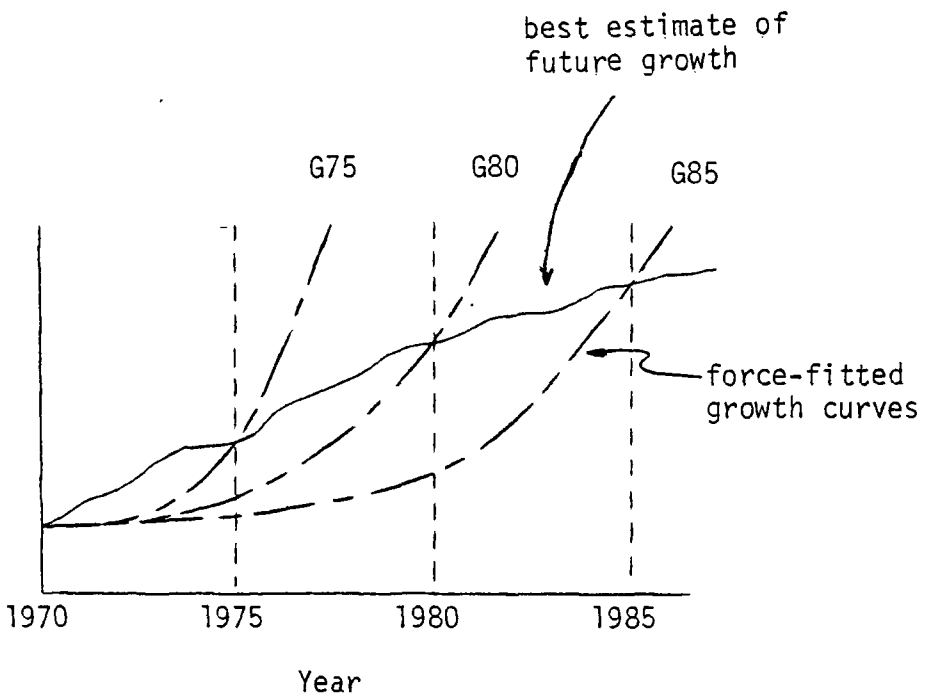

Figure 2-2. Estimating Projection Year Growth Rates

The modified rollback model merely extends basic, linear rollback to multiple categories of sources, which may experience different rates of growth, degree of control, and source-receptor relationships. The equation for this model is expressed as:

$$X_j = (X_o - B) * \frac{\sum_{i=1}^{m} Q_i \; G_{ij} \; F_{ij} \; K_i}{\sum_{i=1}^{n} Q_i \; K_i} + B \qquad (2.1.2\text{-}1)$$

where

X_j = the air quality concentration in year j

X_o = the base year air quality concentration

B = the background concentration

Q_i = the base year emissions in source category i

G_{ij} = the growth rate between the base year and projection year j

F_{ij} = the emission factor ratios for source category i in year j, i.e., $F_{ij} = E_{ij} / E_{io}$

K_i = the source contribution factor for category i

i = the source category index

j = the projection year index

As noted above, the modified rollback equation is used by the Rollback/EKMA Strategy Assessment Model to project both 8-hour and 1-hour CO and annual average NO_2 concentrations. Discussions of the assumptions and limitations of rollback are contained in References 1 through 3.

Projections of ozone air quality concentrations are obtained from an algorithm which solves the EKMA procedure for the Standard Isopleth Diagram generated by the OZIPP Model (see Figure 2-3). Input to the procedure consists of region specific ambient NMHC/NO_x ratios, the projected change in VOC emissions* and the expected changes in NO_x emissions. The latter parameter must be determined exogenously, perhaps by previous model simulations for NO_x. If an NMHC/NO_x ratio is not available, a default ratio of 9.5:1 is assumed.

Reference 3 provides a detailed description of the assumptions and limitations of the EKMA procedure. A User's Guide for the OZIPP Model used to generate the isopleth diagram is the subject of Reference 4. Finally, a description of the specific mathematical solution technique used in this EKMA algorithm is provided in Appendix A.

2.2 System Sort Routine

A UNIVAC standalone sort routine, SORTSDF, is used to sort the air quality data file prior to printing the air quality summary reports. The records are sorted in ascending sequence by growth rate scenario name, control strategy name and region name, respectively. The user must provide an estimate of the maximum number of records to be sorted. This number must be greater than or equal to the product of the number of source regions times the number of growth rate scenarios times the number of control strategies.

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* In the EKMA routine, ambient organic concentrations are referred to collectively as "NMHC," and initial concentrations are assumed to be reduced in the same proportion as VOC emissions. Hence, NMHC is also reduced in the same proportion as VOC emissions.

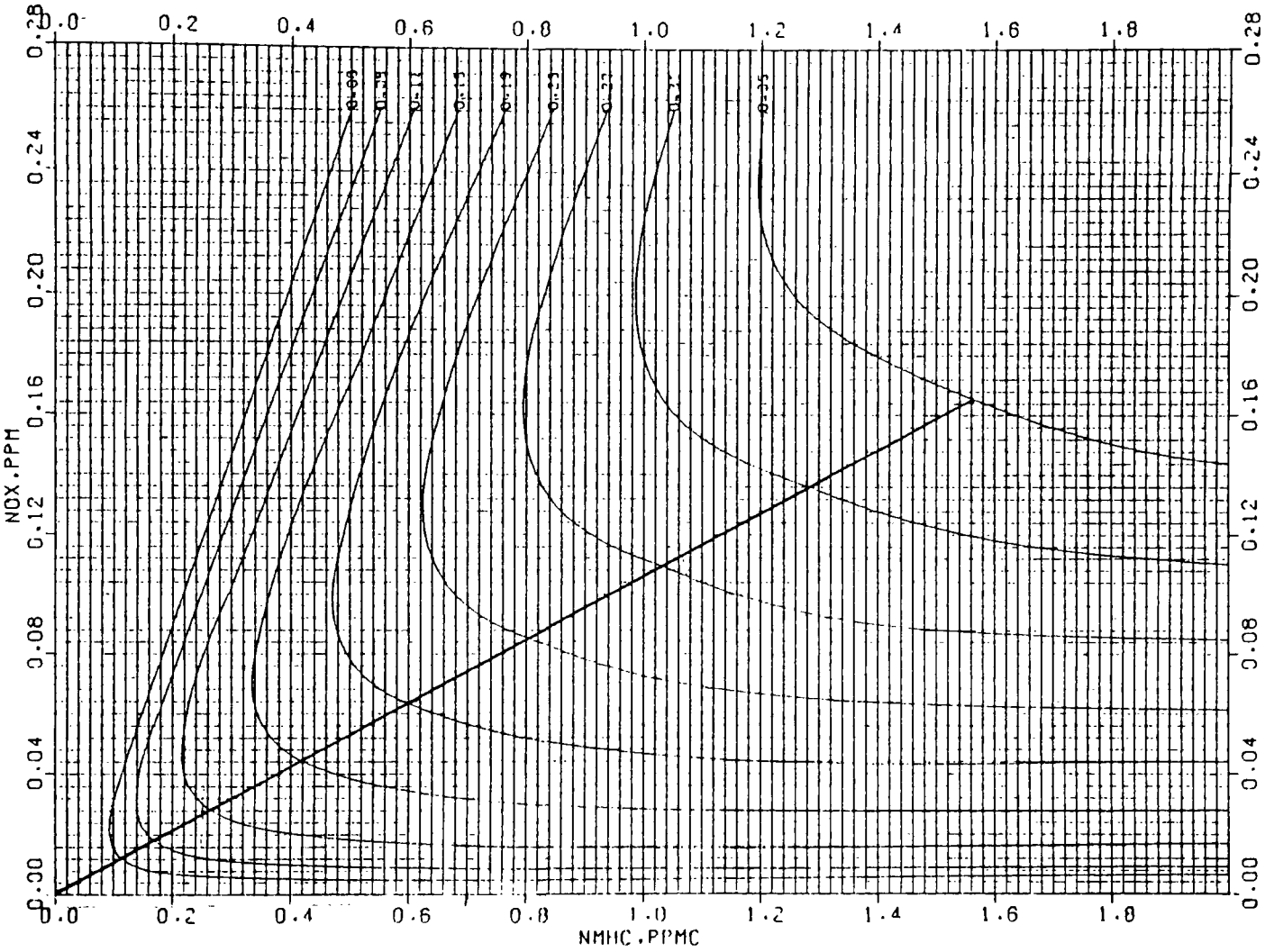

Figure 2-3. Standard EKMA Isopleths

2.3 Air Quality Reports

The program, AQPRNT, produces the air quality summary reports from the data contained in the air quality data file. The input data are read from FORTRAN Unit 9.

Air quality summary reports are output on the system print device (default = Unit 6) for each control scenario and growth rate combination. As noted above, the data file must be sorted prior to printing the Summary Reports. The number of expected exceedances of the NAAQS are estimated by fitting a one-parameter exponential distribution through the projected air quality concentration. Summary statistics are presented on the number of source regions above the level of the standard, the average percent change in air quality and the total number of expected exceedances. The reporting format varies by pollutant. Example air quality summary reports are provided in Section 4.

3.0 PREPARATION OF INPUT DATA

This section provides a description of the input data parameters, card formats and input sequence. Reference 1 contains default values and/or recommended methodologies for estimating the following input parameters: mobile source emission factor ratios, stationary source control efficiencies, VMT growth rates, stationary source growth and retirement rates, base year air quality design values, and background concentrations and emissions inventories. The input card sequence is summarized in Table 3-1.

3.1 Control Cards

The first control card in each model run establishes the types of reports to be printed, the input/output unit numbers, the inventory pollutant to be modeled, and the number of control scenarios, growth rates and projection years. Table 3-2 presents the card format and default values.

The second control card identifies the emission inventory source categories to be included in the base year inventory. Only emissions data from the selected categories will be included in subsequent calculations. Table 3-3 contains the source category selection codes, whereas Table 3-4 presents the control card format.

3.2 Strategy Cards

Mobile and stationary source control strategy cards are required for each control scenario to be evaluated. Within each control scenario, one mobile and one stationary source control strategy card must be supplied for each projection year. These cards contain the emission factor ratios for each source category selected. That is, the ratio of the source category emission factor in the

Table 3-1. INPUT CARD SEQUENCE

	Control Card 1: Analysis Options
	Control Card 2: Source Categories
GEOGRAPHICAL GROUP 1	Mobile Source Strategy Card: Scenario #1, Projection Year #1
	Stationary Source Strategy Card: Scenario #1, Projection Year #1
	⋮
	Mobile Source Strategy Card: Scenario #1, Projection Year #n
	Stationary Source Strategy Card: Scenario #1, Projection Year #n
	⋮
	Mobile Source Strategy Card: Scenario #j, Projection Year #1
	Stationary Source Strategy Card: Scenario #j, Projection Year #1
	⋮
	Mobile Source Strategy Card: Scenario #j, Projection Year #n
	Stationary Source Strategy Card: Scenario #j, Projection Year #n
	⋮
GEOGRAPHICAL GROUP i (max = 6)	Same Card Sequence As Geographical Group 1
SOURCE REGION 1	Region Header Card
	Region Card 2: Mobile Source Emissions, Categories 1 through 11
	Region Card 3: Mobile Source Emissions, Categories 12 through 23
	Region Card 4: Stationary Source Emissions
	Region Card 5: Mobile Source Growth Rates, Growth Scenario #1
	Region Card 6: Stationary Source Growth Rates, Growth Scenario #1
	⋮
	Region Card 5: Mobile Source Growth Rates, Growth Scenario #3
	Region Card 6: Stationary Source Growth Rates, Growth Scenario #3
	⋮
LAST SOURCE REGION	Same Card Sequence As Source Region 1

TABLE 3-2. INPUT FORMAT FOR CONTROL CARD 1

CARD COLUMNS	FORMAT	DESCRIPTION
1-2	I2	Report Selection Flag, 'EIFLAG" (0 = emissions and air quality projections with SSCF's; 1 = emission projections with SSCF's only; 2 = emission projections without SSCF's, only)
3-4	I2	Emissions Inventory Summary Report Output Unit 'EI' (Default = 6)
5-6	I2	Emissions Inventory Data File Output Unit 'IO' (Default = 8)
7-8	I2	Air Quality Data File Output Unit 'IAQ' (Default = 9)
9-12	A4	Emissions Inventory Pollutant Name (see Table 1-1)
19-20	I2	Number of Geographical Groups, Maximum = 6
24-25	I2	Number of Control Scenarios Per Group, Maximum = 9
29-30	I2	Number of projection Years Per Control Scenario, Maximum = 9
34-35	I2	Number of Growth Rate Scenarios, Maximum = 3
39-40	I2	Number of Mobile Source Categories, Maximum = 23
44-45	I2	Number of Stationary Source Categories, Maximum = 9

Table 3-3. SOURCE CATEGORIES

SELECTION CODE	REPORT LABEL	DESCRIPTION
01	LDV-G	Light Duty Vehicles - gasoline powered
02	LDT1-G	Light Duty Trucks (< 6000 lbs. GVW) - gas
03	LDT2-G	Light Duty Trucks (6 - 8500 lbs. GVW) gas
04	HDG	Heavy Duty Vehicles - gas
05	CYCLES	Motorcycles
06	LDV-D	Light Duty Vehicles - diesel powered
07	LDT1-D	Light Duty Vehicles (< 6000 lbs. GVW) - diesel
08	LDT2-D	Light Duty Trucks (6-8500 lbs. GVW) - diesel
09	HDD	Heavy Duty Vehicles - diesel
10	RAILRD	Railroads
11	VESSELS	Vessels
12	ACR-MT	Military Aircraft
13	ACR-CV	Civilian Aircraft
14	ACR-CM	Commercial Aircraft
15	FARM-G	Farm Machinery - gas
16	LAWN	Lawn Equipment
17	SNOW-M	Snow mobiles
18	INMCH	Industrial Machinery - gas
19	CONST-G	Construction Equipment - gas
20	FARM-D	Farm Machinery - diesel
21	INMCH-D	Industrial Machinery - diesel
22	CONST-D	Construction Equipment - diesel
23	OFFHGWY	Off Highway Vehicles
24	POINT	Point Sources
25	AREA	Area Sources
26	COMB-PT	Fuel Combustion - Point Sources
27	OTHER	Miscellaneous Area Sources
28	PETROL	Petroleum Industry
29	STORAGE	Petroleum Storage and Transport
30	INDUST	Miscellaneous Industrial Process Sources
31	A-SOLV	Area Source Solvent Evaporation
32	IN-SOLV	Industrial Solvent Evaporation

Table 3-4. INPUT FORMAT FOR CONTROL CARD 2

CARD COLUMNS	FORMAT	DESCRIPTION
1-2	I2	Source Category Selection Code for First Source Category (see Table 3-3)
3-4	I2	Source Category Selection Code for Second Source Category
.	.	.
.	.	.
.	.	.
.	.	.
65-66	I2	Source Category Selection Code for Source Category Number 33

projection year to the emission factor for that source category in the base year. An example of alternative control scenarios might be the Federal Motor Vehicle Control Program (FMVCP) with and without an inspection and maintenance program.

A given control scenario may result in different emission factor ratios for different geographical areas, e.g., the FMVCP in high versus low altitude regions To account for this situation, the strategy cards may be grouped by geographical areas. That is, the set of control strategies is repeated for each different geographical grouping, up to a maximum of six groups. It should be noted, however, that air quality summary reports are prepared for each control scenario, thus all geographical areas are combined in one report.

The input card formats for the mobile and stationary source strategy cards are presented in Tables 3-5 and 3-6, respectively. Reference 1 contains recommended methodologies for calculating the emission factor ratios.

3.3 Source Region Data Cards

Six data cards are required for each source region modeled. Card input formats and default values are given in Tables 3-7 through 3-12. Recommended default values and calculation methodologies are also contained in Reference 1. The last group of six region cards must be followed by either an end-of-file indicator (@EOF) or an EXEC 8 control card.

Table 3-5. INPUT FORMAT FOR MOBILE SOURCE STRATEGY CARD(S)

CARD COLUMNS	FORMAT	DESCRIPTION
1-8	A8	Control Scenario Name
10-12	F3.2	Emission Factor Ratio For LDV-G
13-15	F3.2	Emission Factor Ratio For LDT1-G
16-18	F3.2	Emission Factor Ratio For LDT2-G
19-21	F3.2	Emission Factor Ratio For HDG
22-24	F3.2	Emission Factor Ratio For CYCLES
25-27	F3.2	Emission Factor Ratio For LDV-D
28-30	F3.2	Emission Factor Ratio For LDT1-D
31-33	F3.2	Emission Factor Ratio For LDT2-D
34-36	F3.2	Emission Factor Ratio For HDD
37-39	F3.2	Emission Factor Ratio For RAILRD
40-42	F3.2	Emission Factor Ratio For VESSELS
43-45	F3.2	Emission Factor Ratio For ACR-MT
46-48	F3.2	Emission Factor Ratio For ACR-CV
49-51	F3.2	Emission Factor Ratio For ACR-CM
52-54	F3.2	Emission Factor Ratio For FARM-G
55-57	F3.2	Emission Factor Ratio For LAWN
58-60	F3.2	Emission Factor Ratio For SNOW-M
61-63	F3.2	Emission Factor Ratio For INMCH-G
64-66	F3.2	Emission Factor Ratio For CONST-G
67-69	F3.2	Emission Factor Ratio For FARM-D
70-72	F3.2	Emission Factor Ratio For INMCH-D
73-75	F3.2	Emission Factor Ratio For CONST-D
76-78	F3.2	Emission Factor Ratio For OFFHGWY
79-80	I2	Projection Year ($1971 \leq PY \leq 2069$)

Table 3-6. INPUT FORMAT FOR STATIONARY SOURCE STRATEGY CARD(S)

CARD COLUMNS	FORMAT	DESCRIPTION
10-12	F3.2	New Point Source Emission Factor Ratio
13-15	F3.2	Existing Point Source Emission Factor Ratio
16-18	F3.2	New Area Source Emission Factor Ratio
19-21	F3.2	Existing Area Source Emission Factor Ratio
22-24	F3.2	New Fuel Combustion Emission Factor Ratio
25-27	F3.2	Existing Fuel Combustion Emission Factor Ratio
28-30	F3.2	New Miscellaneous Area Source Emission Factor Ratio
31-33	F3.2	Existing Miscellaneous Area Source Emission Factor Ratio
34-36	F3.2	New Petroleum Industry Emission Factor Ratio
37-39	F3.2	Existing Petroleum Industry Emission Factor Ratio
40-42	F3.2	New Petroleum Storage & Transport Emission Factor Ratio
43-45	F3.2	Existing Petroleum Storage & Transport Emission Factor Ratio
46-48	F3.2	New Industrial Process Sources Emission Factor Ratio
49-51	F3.2	Existing Industrial Process Sources Emission Factor Ratio
52-54	F3.2	New Area Source Solvent Evaporation Emission Factor Ratio
55-57	F3.2	Existing Area Source Solvent Evaporation Emission Factor Ratio
58-60	F3.2	New Industrial Solvent Evaporation Emission Factor Ratio
61-63	F3.2	Existing Industrial Solvent Evaporation Emission Factor Ratio

Table 3-7. INPUT FORMAT FOR REGION HEADER CARD

CARD COLUMNS	FORMAT	DESCRIPTION
1-3	A3	Region Identification Number, e.g. AQCR, FIPS County Code
4-18	3A4,A3	Region Name
20-24	F5.2	Base Year Air Quality Design Value
25-29	F5.2	Air Quality Background Concentration
31-34	A4	Air Quality Pollutant Name, (see Table 1-1)
36-39	A4	Pollutant Concentration Units, (e.g. PPM)
40-43	F4.1	If Pollutant is Ozone, NMHC/NOX Ratio (Default Ratio 9.5)
44-46	F4.1	If Pollutant is Ozone, NOX Ratio For First Projection Year, Blank = 1.0 (i.e.. NOX_1/NOX_B)
47-49	F4.1	If Pollutant is Ozone, NOX Ratio For Second Projection Year, (i.e. NOX_2/NOX_B)
50-52	F4.1	If Pollutant is Ozone, NOX Ratio For Third Projection Year, (i.e.NOX_3/NOX_B)
53-55	F4.1	If Pollutant is Ozone, NOX Ratio For Fourth Projection Year, (i.e. NOX_4/NOX_B)
56-58	F4.1	If Pollutant is Ozone, NOX Ratio For Fifth Projection Year, (i.e. NOX_5/NOX_B)
59-61	F4.1	If Pollutant is Ozone, NOX Ratio For Sixth Projection Year, (i.e. NOX_6/NOX_B)
62-64	F4.1	If Pollutant is Ozone, NOX Ratio For Seventh Projection Year, (i.e. NOX_7/NOX_B)
65-67	F4.1	If Pollutant is Ozone, NOX Ratio For Eighth Projection Year, (i.e. NOX_8/NOX_B)
68-70	F4.1	If Pollutant is Ozone, NOX Ratio For Ninth Projection Year, (i.e. NOX_9/NOX_B)
77	I1	Strategy Geographical Group Number, (i.e., 1,2,or3, DEFAULT=1)
78-79	I2	Base Year (must be greater than 1970)

Table 3-8. INPUT FORMAT FOR REGION CARD 2

CARD COLUMNS	FORMAT	DESCRIPTION
1-3	A3	Region Identification Number
6-11	F6.0	Base Year Emissions For LDV-G, (1000 tons/year
12-17	F6.0	Base Year Emissions For LDT1-G
18-23	F6.0	Base Year Emissions For LDT2-G
24-29	F6.0	Base Year Emissions For HDG
30-35	F6.0	Base Year Emissions For CYCLES
36-41	F6.0	Base Year Emissions For LDV-D
42-47	F6.0	Base Year Emissions For LDT1-D
48-53	F6.0	Base Year Emissions For LDT2-D
54-59	F6.0	Base Year Emissions For HDD
60-65	F6.0	Base Year Emissions For RAILRD
66-71	F6.0	Base Year Emissions For VESSELS

Table 3-9. INPUT FORMAT FOR REGION CARD 3

CARD COLUMNS	FORMAT	DESCRIPTION
6-11	F6.0	Base Year Emissions For AC-MT, (1000 tons/year)
12-17	F6.0	Base Year Emissions For AC-CV
18-23	F6.0	Base Year Emissions For AC-CM
24-29	F6.0	Base Year Emissions For FARM-G
30-35	F6.0	Base Year Emissions For LAWN
36-41	F6.0	Base Year Emissions For SNOW-M
42-47	F6.0	Base Year Emissions For INMCH-G
48-53	F6.0	Base Year Emissions For CONST-G
54-59	F6.0	Base Year Emissions For FARM-G
60-65	F6.0	Base Year Emissions For INMCH-D
66-71	F6.0	Base Year Emissions For CONST-D
72-77	F6.0	Base Year Emissions For OFFHGWY

Table 3-10. INPUT FORMAT FOR REGION CARD 4

CARD COLUMNS	FORMAT	DESCRIPTION
6-11	F6.0	Base Year Emissions For Point Sources (1000 tons/year)
12-17	F6.0	Base Year Emissions For Area Sources
18-23	F6.0	Base Year Emissions For Fuel Combustion
24-29	F6.0	Base Year Emissions For Misc. Area Sources
30-35	F6.0	Base Year Emissions For Petroleum Industry
36-41	F6.0	Base Year Emissions For Petroleum Storage and Transport
42-47	F6.0	Base Year Emissions For Industrial Process
48-53	F6.0	Base Year Emissions For Area Solvent Evapora
54-59	F6.0	Base Year Emissions For Industrial Solvent Evaporation
60-61	F2.1	Stationary Source Contribution Factor ($0 \leq SSCF \leq 1.0$) (Blank = 1.0)
62-63	F2.1	Area source Contribution Factor
64-65	F2.1	Fuel Combustion Contribution Factor
66-67	F2.1	Miscellaneous Area Source Contribution Factor
68-69	F2.1	Petroleum Industry Contribution Factor
70-71	F2.1	Petroleum Storage & Transport Contribution Fa
72-73	F2.1	Industrial Process Contribution Factor
74-75	F2.1	Area Solvent Evaporation Contribution Factor
76-77	F2.1	Industrial Solvent Evaporation Contribution Factor

Table 3-11. INPUT FORMAT FOR REGION CARD 5

CARD COLUMNS	FORMAT	DESCRIPTION
1-3	A3	Region Identification Number
4-5	A2	Growth Rate Scenario Name, (e.g. HI, LO, etc.)
10-12	F3.1	Growth Rate For LDV-G, (percent/year)
13-15	F3.1	Growth Rate For LDT1-G
16-18	F3.1	Growth Rate For LDT2-G
19-21	F3.1	Growth Rate For HDG
22-24	F3.1	Growth Rate For CYCLES
25-27	F3.1	Growth Rate For LDV-D
28-30	F3.1	Growth Rate For LDT1-D
31-33	F3.1	Growth Rate For LDT2-D
34-36	F3.1	Growth Rate For HDD
37-39	F3.1	Growth Rate For RAILRD
40-42	F3.1	Growth Rate For VESSELS
43-45	F3.1	Growth Rate For ACR-MT
46-48	F3.1	Growth Rate For ACR-CV
49-51	F3.1	Growth Rate For ACR-CM
52-54	F3.1	Growth Rate For FARM-G
55-57	F3.1	Growth Rate For LAWN
58-60	F3.1	Growth Rate For SNOW-M
61-63	F3.1	Growth Rate For INMCH-G
64-66	F3.1	Growth Rate For CONST-G
67-69	F3.1	Growth Rate For FARM-D
70-72	F3.1	Growth Rate For INMCH-D
73-75	F3.1	Growth Rate For CONST-D
76-78	F3.1	Growth Rate For OFFHGWY

Table 3-12. INPUT FORMAT FOR REGION CARD 6

CARD COLUMNS	FORMAT	DESCRIPTION
10-12	F3.1	Point Source Growth Rate, (percent/year)
13-15	F3.1	Point Source Retirement Rate, (percent/year)
16-18	F3.1	Area Source Growth Rate
19-21	F3.1	Area Source Retirement Rate
22-24	F3.1	Fuel Combustion Point Source Growth Rate
25-27	F3.1	Fuel Combustion Point Source Retirement Rate
28-30	F3.1	Miscellaneous Area Sources Growth Rate
31-33	F3.1	Miscellaneous Area Sources Retirement Rate
34-36	F3.1	Petroleum Industry Growth Rate
37-39	F3.1	Petroleum Industry Retirement Rate
40-42	F3.1	Petroleum Storage and Transport Growth Rate
43-45	F3.1	Petroleum Storage and Transport Retirement Rate
46-48	F3.1	Industrial Process Growth Rate
49-51	F3.1	Industrial Process Retirement Rate
52-54	F3.1	Area Source Solvent Evaporation Growth Rate
55-57	F3.1	Area Source Solvent Evaporation Retirement Rate
58-60	F3.1	Industrial Solvent Evaporation Growth Rate
61-63	F3.1	Industrial Solvent Evaporation Retirement Rate

4.0 COMPUTATIONAL OUTPUT

Strategy model outputs include: (a) the Emissions Inventory Summary Report, (b) the emissions inventory data file, (c) the air quality data file, and (d) the Air Quality Summary Report. Each type of output, described in the following sections, is accompanied by illustrative examples.

4.1 Emissions Summary Report

Examples of the Emissions Inventory Summary Report are provided as Figures 4-1 and 4-2. The report illustrated in Figure 4-2 is an example of a case where the source category totals "wrap-around" due to the width limitation for a print line. A summary report of emission projections is output for each source region, control scenario and growth rate combination.

4.2 Emissions Data File

The output format for the emissions data file is shown in Table 4-1. The file is output on the unit number designated in the third data field of Control Card 1 (see Table 3-2). If a blank or zeros are encountered in this field, the emissions data file is routed to output Unit 8. Emissions inventory data files corresponding to the Emissions Inventory Summary Report examples are displayed as Figures 4-3 and 4-4, respectively.

4.3 Air Quality Data File

The air quality data file is used to produce the air quality summary reports. The output unit number is designated in the fourth data field of Control Card 1 (see Table 3-2). If the field is blank or zero-filled, Unit 9 is assumed. The output format of the air quality data file is given in Table 4-2, whereas an example air quality data file is shown in Figure 4-5. After the header record,

*** EMISSIONS INVENTORY PROJECTIONS ***

LOCATION: 100 COUNTY A STRATEGY:SCEN #1 GROWTH RATE:HI

POLLUTANT: CO

EMISSIONS (1000 TONS/YEAR)

S O U R C E C A T E G O R I E S

	LDV-G	LDT1-G	HDG	HDD	POINT	AREA	OTHER
BASE YR							
1978	403.0	79.3	151.6	8.1	.9	7.5	16.6
PROJ YR							
1984	169.8	34.5	122.7	10.6	1.1	7.9	19.3
1985	150.0	29.5	101.7	10.9	1.1	7.9	19.7
1990	127.1	22.0	41.7	13.2	1.4	8.3	22.3
1995	135.5	24.2	23.0	20.2	1.6	8.6	25.3

YEAR	MOBILE TOTAL	STATIONARY TOTAL	GRAND TOTAL
1978	642.0	25.0	667.0
1984	337.6	28.2	365.9
1985	292.1	28.8	320.9
1990	203.9	31.9	235.8
1995	203.0	35.5	238.5

Figure 4-1. Example Emissions Inventory Summary Report for Carbon Monoxide

*** EMISSIONS INVENTORY PROJECTIONS ***

:ON: 001 AQCR A STRATEGY:BASELINE GROWTH RATE:LO

ANT: VOC

EMISSIONS (1000 TONS/YEAR)

S O U R C E C A T E G O R I E S

R	LDV-G	LDT1-G	HDG	HDD	RAILRD	VESSELS	ACR-MT	ACR-CV	ACR-CM	OFFHGWY	FUEL-CM	OTHER
R	61.9	12.5	11.6	4.2	2.2	.1	.4	.6	2.2	2.6	.4	4.4
	22.0	4.7	6.4	4.9	2.2	.1	.5	.7	2.6	3.0	.5	4.4
	18.9	4.1	5.2	5.0	2.2	.1	.5	.7	2.7	3.0	.5	4.4
	11.4	2.4	2.0	5.2	2.3	.1	.6	.8	3.0	3.4	.6	4.4
	9.3	2.0	1.1	7.5	2.3	.2	.6	.9	3.5	3.8	.7	4.4

R	PETROL	STORAGE	INDUST	A-SOLV	IN-SOLV
R	.1	8.8	.0	47.8	.3
	.0	2.0	.0	35.1	.1
	.0	2.0	.0	35.4	.2
	.0	2.2	.0	36.8	.2
	.0	2.4	.0	38.3	.2

MOBILE TOTAL	STATIONARY TOTAL	GRAND TOTAL
98.3	61.8	160.1
47.0	42.1	89.1
42.3	42.5	84.8
31.3	44.2	75.5
31.2	46.1	77.3

Figure 4-2. Example Emissions Inventory Summary Report for Volatile Organic Compounds (VOC)

Table 4-1. EMISSIONS DATA FILE OUTPUT FORMAT

RECORD NUMBER	COLUMNS	FORMAT	DESCRIPTION
1	1-3	A3	Region identification number
	4-18	3A4,A3	Region name
	20-27	A8	Control scenario name
	28-31	A4	Growth rate name
	34-37	A4	Inventory pollutant name
	38-39	I2	Number of projection years, NPY
	42-43	I2	Number of source categories, NS
	44-45	I2	First source category code
	46-47	I2	Second source category code
	⋮	⋮	⋮
	108-109	I2	Thirty-third source category code
2	1-4	I4	Base year
	8-12	F8.1	Mobile source base year emissions total, (1000 tons/year)
	13-20	F8.1	Stationary source base year emissions total, (1000 tons/year)
	21-28	F8.1	Total region base year emissions, (1000 tons/year)
	29-36	F8.1	First source category base year emissions, (1000 tons/year)
	37-44	F8.1	Second source category base year emissions, (1000 tons.year)
	⋮	⋮	⋮
	109-116	F8.1	Eleventh source category base year emissions, (1000 tons/year)
2a (optional)	29-116	11F8.1	Base year emissions, source categories 12 thru 22, (1000 tons/year)
2b (optional)	29-116	11F8.1	Base year emissions, source categories 23 thru 33, (1000 tons/year)
3	1-4	I4	First projection year
	8-116	14F8.1	First projection year emission totals, (1000 tons/year)
3a (optional)	29-116	11F8.1	First projection year emission totals, (1000 tons/year)
3b (optional)	29-116	11F8.1	First projection year emission totals, (100 tons/year)
⋮	⋮	⋮	⋮
N	1-4	I4	Last projection year
	8-116	14F8.1	Last projection year emission totals, (1000 tons/year)
N+1 (optional)	29-116	11F8.1	Last projection year emission totals, (1000 tons/year)
N+2 (optional)	29-116	11F8.1	Last projection year emission totals, (1000 tons/year)

NOTE: N = 1 + (NPY + 1) * IFIX (NS/11)

```
&DATA,L 8.
DATA 9R1Q1 SL74T9 06/15/81 15:58:51 (1)
  1.    100 COUNTY A        SCEN #1  LO    CO  4   7 1 2 4 9242527
  2.    1978   642.0   25.0   667.0   403.0    79.3   151.6     8.1      .9     7.5    16.6
  3.    1984   299.4   28.2   327.6   150.7    30.7   108.6     9.4     1.1     7.9    19.3
  4.    1985   253.9   28.8   282.7   130.4    25.8    88.2     9.5     1.1     7.9    19.7
  5.    1990   160.5   31.9   192.5   100.0    17.5    32.6    10.4     1.4     8.3    22.3
  6.    1995   144.8   35.5   180.3    96.6    17.5    16.3    14.6     1.6     8.6    25.3
  7.    100 COUNTY A        SCEN #1  MD    CO  4   7 1 2 4 9242527
  8.    1978   642.0   25.0   667.0   403.0    79.3   151.6     8.1      .9     7.5    16.6
  9.    1984   318.0   28.2   346.3   160.0    32.5   115.5    10.0     1.1     7.9    19.3
 10.    1985   272.4   28.8   301.3   139.9    27.6    94.8    10.2     1.1     7.9    19.7
 11.    1990   181.0   31.9   213.0   112.8    19.6    36.9    11.7     1.4     8.3    22.3
 12.    1995   171.6   35.5   207.1   114.5    20.6    19.4    17.2     1.6     8.6    25.3
 13.    100 COUNTY A        SCEN #1  HI    CO  4   7 1 2 4 9242527
 14.    1978   642.0   25.0   667.0   403.0    79.3   151.6     8.1      .9     7.5    16.6
 15.    1984   337.6   28.2   365.9   169.8    34.5   122.7    10.6     1.1     7.9    19.3
 16.    1985   292.1   28.8   320.9   150.0    29.5   101.7    10.9     1.1     7.9    19.7
 17.    1990   203.9   31.9   235.8   127.1    22.0    41.7    13.2     1.4     8.3    22.3
 18.    1995   203.0   35.5   238.5   135.5    24.2    23.0    20.2     1.6     8.6    25.3
 19.    100 COUNTY A        SCEN #2  LO    CO  4   7 1 2 4 9242527
 20.    1978   642.0   25.0   667.0   403.0    79.3   151.6     8.1      .9     7.5    16.6
 21.    1984   299.4   28.2   327.6   150.7    30.7   108.6     9.4     1.1     7.9    19.3
 22.    1985   250.1   28.8   278.9   126.6    25.8    88.2     9.5     1.1     7.9    19.7
 23.    1990   156.8   31.9   188.8    96.3    17.5    32.6    10.4     1.4     8.3    22.3
 24.    1995   141.3   35.5   176.7    93.0    17.5    16.3    14.6     1.6     8.6    25.3
 25.    100 COUNTY A        SCEN #2  MD    CO  4   7 1 2 4 9242527
 26.    1978   642.0   25.0   667.0   403.0    79.3   151.6     8.1      .9     7.5    16.6
 27.    1984   318.0   28.2   346.3   160.0    32.5   115.5    10.0     1.1     7.9    19.3
 28.    1985   268.3   28.8   297.1   135.8    27.6    94.8    10.2     1.1     7.9    19.7
 29.    1990   176.8   31.9   208.8   108.6    19.6    36.9    11.7     1.4     8.3    22.3
 30.    1995   167.4   35.5   202.8   110.3    20.6    19.4    17.2     1.6     8.6    25.3
 31.    100 COUNTY A        SCEN #2  HI    CO  4   7 1 2 4 9242527
 32.    1978   642.0   25.0   667.0   403.0    79.3   151.6     8.1      .9     7.5    16.6
 33.    1984   337.6   28.2   365.9   169.8    34.5   122.7    10.6     1.1     7.9    19.3
 34.    1985   287.7   28.8   316.5   145.6    29.5   101.7    10.9     1.1     7.9    19.7
 35.    1990   199.2   31.9   231.1   122.3    22.0    41.7    13.2     1.4     8.3    22.3
 36.    1995   199.0   35.5   233.4   130.5    24.2    23.0    20.2     1.6     8.6    25.3
 37.    041 COUNTY B        SCEN #1  LO    CO  4   7 1 2 4 9242527
 38.    1978   194.9   17.2   212.1   141.5    28.1    24.8      .5      .5     7.2     9.5
 39.    1984    82.1   19.2   101.3    52.9    10.9    17.8      .6      .6     7.6    11.0
 40.    1985    70.0   19.5    89.5    45.8     9.1    14.4      .6      .6     7.6    11.3
 41.    1990    47.3   21.5    68.7    35.1     6.2     5.3      .6      .8     7.9    12.8
 42.    1995    43.7   23.6    67.2    33.9     6.2     2.7      .9      .9     8.2    14.5
 43.    041 COUNTY B        SCEN #1  MD    CO  4   7 1 2 4 9242527
 44.    1978   194.9   17.2   212.1   141.5    28.1    24.8      .5      .5     7.2     9.5
 45.    1984    87.2   19.2   106.4    56.2    11.5    18.9      .6      .6     7.6    11.0
 46.    1985    75.0   19.5    94.6    49.1     9.8    15.5      .6      .6     7.6    11.3
 47.    1990    53.3   21.5    74.8    39.6     7.0     6.0      .7      .8     7.9    12.8
 48.    1995    51.7   23.6    75.3    40.2     7.3     3.2     1.1      .9     8.2    14.5
 49.    041 COUNTY B        SCEN #1  HI    CO  4   7 1 2 4 9242527
 50.    1978   194.9   17.2   212.1   141.5    28.1    24.8      .5      .5     7.2     9.5
 51.    1984    92.6   19.2   111.8    59.6    12.2    20.1      .7      .6     7.6    11.0
 52.    1985    80.4   19.5   100.0    52.7    10.5    16.6      .7      .6     7.6    11.3
 53.    1990    60.0   21.5    81.5    44.6     7.8     6.8      .8      .8     7.9    12.8
 54.    1995    61.2   23.6    84.8    47.5     8.6     3.8     1.2      .9     8.2    14.5
 55.    041 COUNTY B        SCEN #2  LO    CO  4   7 1 2 4 9242527
 56.    1978   194.9   17.2   212.1   141.5    28.1    24.8      .5      .5     7.2     9.5
 57.    1984    82.1   19.2   101.3    52.9    10.9    17.8      .6      .6     7.6    11.0
 58.    1985    68.6   19.5    88.2    44.5     9.1    14.4      .6      .6     7.6    11.3
 59.    1990    46.0   21.5    67.4    33.8     6.2     5.3      .6      .8     7.9    12.8
 60.    1995    42.4   23.6    66.0    32.6     6.2     2.7      .9      .9     8.2    14.5
 61.    041 COUNTY B        SCEN #2  MD    CO  4   7 1 2 4 9242527
 62.    1978   194.9   17.2   212.1   141.5    28.1    24.8      .5      .5     7.2     9.5
 63.    1984    87.2   19.2   106.4    56.2    11.5    18.9      .6      .6     7.6    11.0
 64.    1985    73.6   19.5    93.1    47.7     9.8    15.5      .6      .6     7.6    11.3
 65.    1990    51.8   21.5    73.3    38.1     7.0     6.0      .7      .8     7.9    12.8
 66.    1995    50.2   23.6    73.8    38.7     7.3     3.2     1.1      .9     8.2    14.5
 67.    041 COUNTY B        SCEN #2  HI    CO  4   7 1 2 4 9242527
 68.    1978   194.9   17.2   212.1   141.5    28.1    24.8      .5      .5     7.2     9.5
 69.    1984    92.6   19.2   111.8    59.6    12.2    20.1      .7      .6     7.6    11.0
 70.    1985    78.9   19.5    98.4    51.1    10.5    16.6      .7      .6     7.6    11.3
 71.    1990    58.4   21.5    79.8    43.0     7.8     6.8      .8      .8     7.9    12.8
 72.    1995    59.4   23.6    83.0    45.8     8.6     3.8     1.2      .9     8.2    14.5
 73.    001 COUNTY C        SCEN #1  LO    CO  4   7 1 2 4 9242527
 74.    1978   185.8   23.2   209.0   132.6    26.7    23.3     3.2      .0    13.6     9.6
 75.    1984    80.3   25.4   105.7    49.6    10.3    16.7     3.7      .0    14.3    11.1
```

Figure 4-3. Emissions Data File - Example Listing

```
@DATA,L 8.
DATA 9R1Q1 SL74T9 07/01/81 12:36:21 (0)
  1.   001 AQCR A        BASELINE LO    VOC 4  17 1 2 4 910111213142326272829303132
  2.   1978   98.3   61.8   160.1    61.9   12.5   11.6    4.2    2.2     .1     .4     .6    2.2    2.6
  3.                                   4.4     .1    8.8     .0   47.8     .3
  4.   1984   47.0   42.1    89.1    22.0    4.7    6.4    4.9    2.2     .1     .5     .7    2.6    3.0
  5.                                   4.4     .0    2.0     .0   35.1     .1
  6.   1985   42.3   42.5    84.8    18.9    4.1    5.2    5.0    2.2     .1     .5     .7    2.7    3.0
  7.                                   4.4     .0    2.0     .0   35.4     .2
  8.   1990   31.3   44.2    75.5    11.4    2.4    2.0    5.2    2.3     .1     .6     .8    3.0    3.4
  9.                                   4.4     .0    2.2     .0   36.8     .2
 10.   1995   31.2   46.1    77.3     9.3    2.0    1.1    7.5    2.3     .2     .6     .9    3.5    3.8
 11.                                   4.4     .0    2.4     .0   38.3     .2
 12.   001 AQCR A        BASELINE MD    VOC 4  17 1 2 4 910111213142326272829303132
 13.   1978   98.3   61.8   160.1    61.9   12.5   11.6    4.2    2.2     .1     .4     .6    2.2    2.6
 14.                                   4.4     .1    8.8     .0   47.8     .3
 15.   1984   49.3   42.1    91.5    23.3    5.0    6.8    5.2    2.2     .1     .5     .7    2.6    3.0
 16.                                   4.4     .0    2.0     .0   35.1     .1
 17.   1985   44.7   42.5    87.2    20.2    4.4    5.5    5.4    2.2     .1     .5     .7    2.7    3.0
 18.                                   4.4     .0    2.0     .0   35.4     .2
 19.   1990   33.9   44.2    78.1    12.8    2.7    2.3    5.9    2.3     .1     .6     .8    3.0    3.4
 20.                                   4.4     .0    2.2     .0   36.8     .2
 21.   1995   34.9   46.1    81.0    11.1    2.3    1.3    8.9    2.3     .2     .6     .9    3.5    3.8
 22.                                   4.4     .0    2.4     .0   38.3     .2
 23.   001 AQCR A        BASELINE HI    VOC 4  17 1 2 4 910111213142326272829303132
 24.   1978   98.3   61.8   160.1    61.9   12.5   11.6    4.2    2.2     .1     .4     .6    2.2    2.6
 25.                                   4.4     .1    8.8     .0   47.8     .3
 26.   1984   51.8   42.1    93.9    24.7    5.3    7.2    5.5    2.2     .1     .5     .7    2.6    3.0
 27.                                   4.4     .0    2.0     .0   35.1     .1
 28.   1985   47.3   42.5    89.7    21.7    4.7    5.9    5.7    2.2     .1     .5     .7    2.7    3.0
 29.                                   4.4     .0    2.0     .0   35.4     .2
 30.   1990   36.9   44.2    81.1    14.5    3.0    2.6    6.6    2.3     .1     .6     .8    3.0    3.4
 31.                                   4.4     .0    2.2     .0   36.8     .2
 32.   1995   39.2   46.1    85.3    13.1    2.7    1.6   10.5    2.3     .2     .6     .9    3.5    3.8
 33.                                   4.4     .0    2.4     .0   38.3     .2
 34.   002 AQCR B        BASELINE LO    VOC 4  17 1 2 4 910111213142326272829303132
 35.   1978   33.4   15.0    48.4    21.3    4.3    2.3     .4     .7     .2    2.9     .2     .2     .9
 36.                                   2.6     .0    3.0     .3    8.8     .0
 37.   1984   16.7   14.8    31.6     7.6    1.6    1.3     .5     .7     .2    3.4     .2     .2    1.0
 38.                                   2.6     .0    2.5     .3    9.1     .0
 39.   1985   15.4   14.8    30.2     6.5    1.4    1.0     .5     .7     .2    3.5     .2     .2    1.1
 40.                                   2.6     .0    2.4     .3    9.2     .0
 41.   1990   12.4   14.8    27.2     3.9     .8     .4     .5     .7     .3    4.0     .3     .3    1.2
 42.                                   2.6     .0    2.1     .2    9.4     .0
 43.   1995   12.4   15.0    27.4     3.2     .7     .2     .7     .7     .3    4.6     .3     .3    1.3
 44.                                   2.6     .0    1.9     .2    9.7     .0
 45.   002 AQCR B        BASELINE MD    VOC 4  17 1 2 4 910111213142326272829303132
 46.   1978   33.4   15.0    48.4    21.3    4.3    2.3     .4     .7     .2    2.9     .2     .2     .9
 47.                                   2.6     .0    3.0     .3    8.8     .0
 48.   1984   17.4   14.8    32.2     8.0    1.7    1.3     .5     .7     .2    3.4     .2     .2    1.0
 49.                                   2.6     .0    2.5     .3    9.1     .0
 50.   1985   16.0   14.8    30.9     7.0    1.5    1.1     .5     .7     .2    3.5     .2     .2    1.1
 51.                                   2.6     .0    2.4     .3    9.2     .0
 52.   1990   13.1   14.8    27.9     4.4     .9     .5     .6     .7     .3    4.0     .3     .3    1.2
 53.                                   2.6     .0    2.1     .2    9.4     .0
 54.   1995   13.3   15.0    28.3     3.8     .8     .3     .8     .7     .3    4.6     .3     .3    1.3
 55.                                   2.6     .0    1.9     .2    9.7     .0
 56.   002 AQCR B        BASELINE HI    VOC 4  17 1 2 4 910111213142326272829303132
 57.   1978   33.4   15.0    48.4    21.3    4.3    2.3     .4     .7     .2    2.9     .2     .2     .9
 58.                                   2.6     .0    3.0     .3    8.8     .0
 59.   1984   18.1   14.8    33.0     8.5    1.8    1.4     .5     .7     .2    3.4     .2     .2    1.0
 60.                                   2.6     .0    2.5     .3    9.1     .0
 61.   1985   16.8   14.8    31.6     7.5    1.6    1.2     .5     .7     .2    3.5     .2     .2    1.1
 62.                                   2.6     .0    2.4     .3    9.2     .0
 63.   1990   13.9   14.8    28.7     5.0    1.0     .5     .6     .7     .3    4.0     .3     .3    1.2
 64.                                   2.6     .0    2.1     .2    9.4     .0
 65.   1995   14.3   15.0    29.3     4.5     .9     .3    1.0     .7     .3    4.6     .3     .3    1.3
 66.                                   2.6     .0    1.9     .2    9.7     .0
 67.   003 AQCR C        BASELINE LO    VOC 4  17 1 2 4 910111213142326272829303132
 68.   1978   21.3   13.5    34.8    13.3    2.7    1.2    1.4    1.3     .0     .4     .0     .4     .6
 69.                                   2.5     .0    2.4     .0    8.6     .0
 70.   1984   11.0   13.4    24.4     4.7    1.0     .7    1.6    1.3     .0     .5     .0     .5     .7
 71.                                   2.5     .0    2.0     .0    8.9     .0
 72.   1985   10.1   13.4    23.5     4.1     .9     .5    1.7    1.3     .0     .5     .0     .5     .7
 73.                                   2.5     .0    1.9     .0    8.9     .0
 74.   1990    8.1   13.4    21.6     2.4     .5     .2    1.7    1.3     .0     .6     .0     .6     .8
 75.                                   2.5     .0    1.7     .0    9.2     .0
```

Figure 4-4. VOC Emissions Data File - Example Listing

Table 4-2. Air Quality Data File Output Format

RECORD NUMBER	COLUMNS	FORMAT	DESCRIPTION
1	1-4	A4	Pollutant name, e.g. 03.
	5-8	A4	Pollutant units, e.g. PPM.
	9-14	F6.2	Ambient Standard
	15-19	F5.3	Value for rounding
	21-22	I2	Pollutant sequence code number
	23-24	I2	Number of projection years
2 to NREC*	2-4	A3	Region ID number
	5-19	3A4,A3	Region name
	21-28	A8	Control strategy name
	30-31	A2	Growth rate name
	34-37	I4	Base year
	38-42	F5.1	Base year air quality concentration
	43-47	F5.1	Background for CO, NO_2; NMHC/NO_x Ratio for ozone
	51-54	I5	First projection year
	55-58	F5.1	Projected concentration
	61-64	I5	Second projection year
	65-69	F5.1	Projected concentration
	⋮	⋮	⋮
	131-134	I5	Ninth projection year
	135-139	F5.1	Projected concentration

* The total number of records is given by, NREC = strategies* growth rates* source regions + 1

```
@DATA,L 9.
DATA 9R1Q1 SL74T9 07/01/81 12:36:07 (0)
    1.       C08 PPM  9.00 .500  2 4
    2.       100 COUNTY A       SCEN #1  LO  1978 24.6   .0   1984 11.6 1985  9.9 1990  6.3 1995  5.8
    3.       100 COUNTY A       SCEN #1  MD  1978 24.6   .0   1984 12.3 1985 10.6 1990  7.1 1995  6.8
    4.       100 COUNTY A       SCEN #1  HI  1978 24.6   .0   1984 13.1 1985 11.3 1990  8.0 1995  8.0
    5.       100 COUNTY A       SCEN #2  LO  1978 24.6   .0   1984 11.6 1985  9.7 1990  6.2 1995  5.6
    6.       100 COUNTY A       SCEN #2  MD  1978 24.6   .0   1984 12.3 1985 10.4 1990  7.0 1995  6.6
    7.       100 COUNTY A       SCEN #2  HI  1978 24.6   .0   1984 13.1 1985 11.2 1990  7.8 1995  7.8
    8.       041 COUNTY B       SCEN #1  LO  1978 13.1   .0   1984  5.7 1985  4.9 1990  3.4 1995  3.2
    9.       041 COUNTY B       SCEN #1  MD  1978 13.1   .0   1984  6.0 1985  5.2 1990  3.8 1995  3.7
   10.       041 COUNTY B       SCEN #1  HI  1978 13.1   .0   1984  6.4 1985  5.6 1990  4.3 1995  4.4
   11.       041 COUNTY B       SCEN #2  LO  1978 13.1   .0   1984  5.7 1985  4.8 1990  3.3 1995  3.1
   12.       041 COUNTY B       SCEN #2  MD  1978 13.1   .0   1984  6.0 1985  5.1 1990  3.7 1995  3.6
   13.       041 COUNTY B       SCEN #2  HI  1978 13.1   .0   1984  6.4 1985  5.5 1990  4.1 1995  4.2
   14.       001 COUNTY C       SCEN #1  LO  1978 21.9   .0   1984  9.8 1985  8.5 1990  6.2 1995  6.0
   15.       001 COUNTY C       SCEN #1  MD  1978 21.9   .0   1984 10.4 1985  9.1 1990  6.9 1995  6.9
   16.       001 COUNTY C       SCEN #1  HI  1978 21.9   .0   1984 11.0 1985  9.7 1990  7.6 1995  8.1
   17.       001 COUNTY C       SCEN #2  LO  1978 21.9   .0   1984  9.8 1985  8.4 1990  6.0 1995  5.8
   18.       001 COUNTY C       SCEN #2  MD  1978 21.9   .0   1984 10.4 1985  8.9 1990  6.7 1995  6.8
   19.       001 COUNTY C       SCEN #2  HI  1978 21.9   .0   1984 11.0 1985  9.5 1990  7.5 1995  7.9
   20.       035 COUNTY D       SCEN #1  LO  1978 15.7   .0   1984  7.4 1985  6.3 1990  4.3 1995  4.0
   21.       035 COUNTY D       SCEN #1  MD  1978 15.7   .0   1984  7.8 1985  6.8 1990  4.8 1995  4.7
   22.       035 COUNTY D       SCEN #1  HI  1978 15.7   .0   1984  8.3 1985  7.2 1990  5.3 1995  5.5
   23.       035 COUNTY D       SCEN #2  LO  1978 15.7   .0   1984  7.4 1985  6.2 1990  4.2 1995  3.9
   24.       035 COUNTY D       SCEN #2  MD  1978 15.7   .0   1984  7.8 1985  6.7 1990  4.7 1995  4.6
   25.       035 COUNTY D       SCEN #2  HI  1978 15.7   .0   1984  8.3 1985  7.1 1990  5.2 1995  5.3
END DATA. ERRORS: NONE. TIME:  0.540 SEC. IMAGE COUNT: 25
```

Figure 4-5. Unsorted CO Air Quality Data File

the data records are output in source region - growth rate - control scenario sequence. These data must be sorted in reverse sequence, control scenario-growth rate - source region, before the air quality summary reports can be generated. Figure 4-6 shows the sorted air quality data file.

4.4 Air Quality Summary Reports

These reports summarize the air quality projections across all source regions for each control scenario - growth rate combination. Figure 4-7 illustrates an example Linear Rollback Report for CO. The format of the EKMA report for ozone is shown as Figure 4-8. Note that the ambient NMHC/NO_x ratio is displayed for each source region. A default ratio of 9.5:1 is assumed in the absence of measured data.

4.4.1 Source Region Projections

Estimated air quality concentrations and expected exceedances of the NAAQS in each projection year are displayed for the individual source regions. As described in Section 2.1, CO and NO_2 concentrations are estimated using the Modified Rollback Model, whereas ozone concentrations are estimated from the standard isopleth diagram of EKMA.

Accompanying each projected air quality concentration is the number of expected exceedances of the NAAQS. For CO and O_3, the number of exceedances is obtained from a one-parameter exponential distribution fitted through the design value concentration. Studies have shown the exponential distribution to provide a good description of air quality concentration distributions, especially in the upper tail of the distribution.[5,6] As shown in Figure 4-9, the exponential distribution plots as a straight line on semilog paper.

```
@DATA,L 9.
DATA 9R1Q1 SL74T9 07/01/81 12:36:09 (0)
    1.       CO8 PPM  9.00 .500  2 4
    2.       100 COUNTY A       SCEN #1  HI  1978 24.6   .0   1984 13.1 1985 11.3 1990  8.0 1995  8.0
    3.       041 COUNTY B       SCEN #1  HI  1978 13.1   .0   1984  6.4 1985  5.6 1990  4.3 1995  4.4
    4.       001 COUNTY C       SCEN #1  HI  1978 21.9   .0   1984 11.0 1985  9.7 1990  7.6 1995  8.1
    5.       035 COUNTY D       SCEN #1  HI  1978 15.7   .0   1984  8.3 1985  7.2 1990  5.3 1995  5.5
    6.       100 COUNTY A       SCEN #2  HI  1978 24.6   .0   1984 13.1 1985 11.2 1990  7.8 1995  7.8
    7.       041 COUNTY B       SCEN #2  HI  1978 13.1   .0   1984  6.4 1985  5.5 1990  4.1 1995  4.2
    8.       001 COUNTY C       SCEN #2  HI  1978 21.9   .0   1984 11.0 1985  9.5 1990  7.5 1995  7.9
    9.       035 COUNTY D       SCEN #2  HI  1978 15.7   .0   1984  8.3 1985  7.1 1990  5.2 1995  5.3
   10.       100 COUNTY A       SCEN #1  LO  1978 24.6   .0   1984 11.6 1985  9.9 1990  6.3 1995  5.8
   11.       041 COUNTY B       SCEN #1  LO  1978 13.1   .0   1984  5.7 1985  4.9 1990  3.4 1995  3.2
   12.       001 COUNTY C       SCEN #1  LO  1978 21.9   .0   1984  9.8 1985  8.5 1990  6.2 1995  6.0
   13.       035 COUNTY D       SCEN #1  LO  1978 15.7   .0   1984  7.4 1985  6.3 1990  4.3 1995  4.0
   14.       100 COUNTY A       SCEN #2  LO  1978 24.6   .0   1984 11.6 1985  9.7 1990  6.2 1995  5.6
   15.       041 COUNTY B       SCEN #2  LO  1978 13.1   .0   1984  5.7 1985  4.8 1990  3.3 1995  3.1
   16.       001 COUNTY C       SCEN #2  LO  1978 21.9   .0   1984  9.8 1985  8.4 1990  6.0 1995  5.8
   17.       035 COUNTY D       SCEN #2  LO  1978 15.7   .0   1984  7.4 1985  6.2 1990  4.2 1995  3.9
   18.       100 COUNTY A       SCEN #1  MD  1978 24.6   .0   1984 12.3 1985 10.6 1990  7.1 1995  6.8
   19.       041 COUNTY B       SCEN #1  MD  1978 13.1   .0   1984  6.0 1985  5.2 1990  3.8 1995  3.7
   20.       001 COUNTY C       SCEN #1  MD  1978 21.9   .0   1984 10.4 1985  9.1 1990  6.9 1995  6.9
   21.       035 COUNTY D       SCEN #1  MD  1978 15.7   .0   1984  7.8 1985  6.8 1990  4.8 1995  4.7
   22.       100 COUNTY A       SCEN #2  MD  1978 24.6   .0   1984 12.3 1985 10.4 1990  7.0 1995  6.6
   23.       041 COUNTY B       SCEN #2  MD  1978 13.1   .0   1984  6.0 1985  5.1 1990  3.7 1995  3.6
   24.       001 COUNTY C       SCEN #2  MD  1978 21.9   .0   1984 10.4 1985  8.9 1990  6.7 1995  6.8
   25.       035 COUNTY D       SCEN #2  MD  1978 15.7   .0   1984  7.8 1985  6.7 1990  4.7 1995  4.6
END DATA. ERRORS: NONE. TIME:  0.540 SEC. IMAGE COUNT: 25

@XQT TDS*ROLLBACK.AQPRNT
```

Figure 4-6. Sorted CO Air Quality Data File

L I N E A R R O L L B A C K

STRATEGY: SCEN #1 GROWTH RATE SCENARIO: HI

CO8 AIR QUALITY CONCENTRATION (PPM) AND VIOLATIONS
(STANDARD IS 9.00 PPM)

P R O J E C T E D

	B A S E			1984		1985		1990		1995	
G I O N	YEAR	CONC	BKGD	CONC	EXEX	CONC	EXEX	CONC	EXEX	CONC	EXEX
UNTY A	1978	25.	0.	13.	10	11.	4	8.	0	8.	0
UNTY B	1978	13.	0.	6.	0	6.	0	4.	0	4.	0
UNTY C	1978	22.	0.	11.	3	10.	1	8.	0	8.	0
UNTY D	1978	16.	0.	8.	0	7.	0	5.	0	6.	0

E PERCENT CHANGE	-49.	-55.	-67.	-65.
REGIONS ABOVE STD	2	2	0	0
NO. OF EXCEEDANCES	13	5	0	0

)TE: AIR QUALITY CONCENTRATIONS ARE ROUNDED FOR DISPLAY FOLLOWING EPA GUIDELINES.
COMPARISONS WITH STANDARDS AND PERCENT CHANGES ARE BASED ON ONE ADDITIONAL SIGNIFICANT FIGURE.

Figure 4-7. Example CO Air Quality Summary Report

E K M A

STRATEGY: BASELINE GROWTH RATE SCENARIO: HI

O3 AIR QUALITY CONCENTRATION (PPM) AND VIOLATIONS
(STANDARD IS .12 PPM)

P R O J E C T E D

	B A S E			1984		1985		1990		1995	
R E G I O N	YEAR	CONC	RATIO	CONC	EXEX	CONC	EXEX	CONC	EXEX	CONC	EXEX
001 AQCR A	1978	.16	9.50	.13	1	.12	0	.12	0	.12	0
002 AQCR B	1978	.09	9.50	.08	0	.07	0	.07	0	.07	0
003 AQCR C	1978	.13	9.50	.11	0	.11	0	.11	0	.11	0
004 AQCR D	1978	.18	9.50	.15	3	.14	2	.14	2	.14	2

AVERAGE PERCENT CHANGE	-17.	-19.	-23.	-21.
NO. OF REGIONS ABOVE STD	2	1	1	1
TOTAL NO. OF EXCEEDANCES	4	2	2	2

*** NOTE: AIR QUALITY CONCENTRATIONS ARE ROUNDED FOR DISPLAY FOLLOWING EPA GUIDELINES.
THUS, COMPARISONS WITH STANDARDS AND PERCENT CHANGES ARE BASED ON ONE ADDITIONAL SIGNIFICANT FIGURE.

Figure 4-8. Example Ozone Air Quality Summary Report

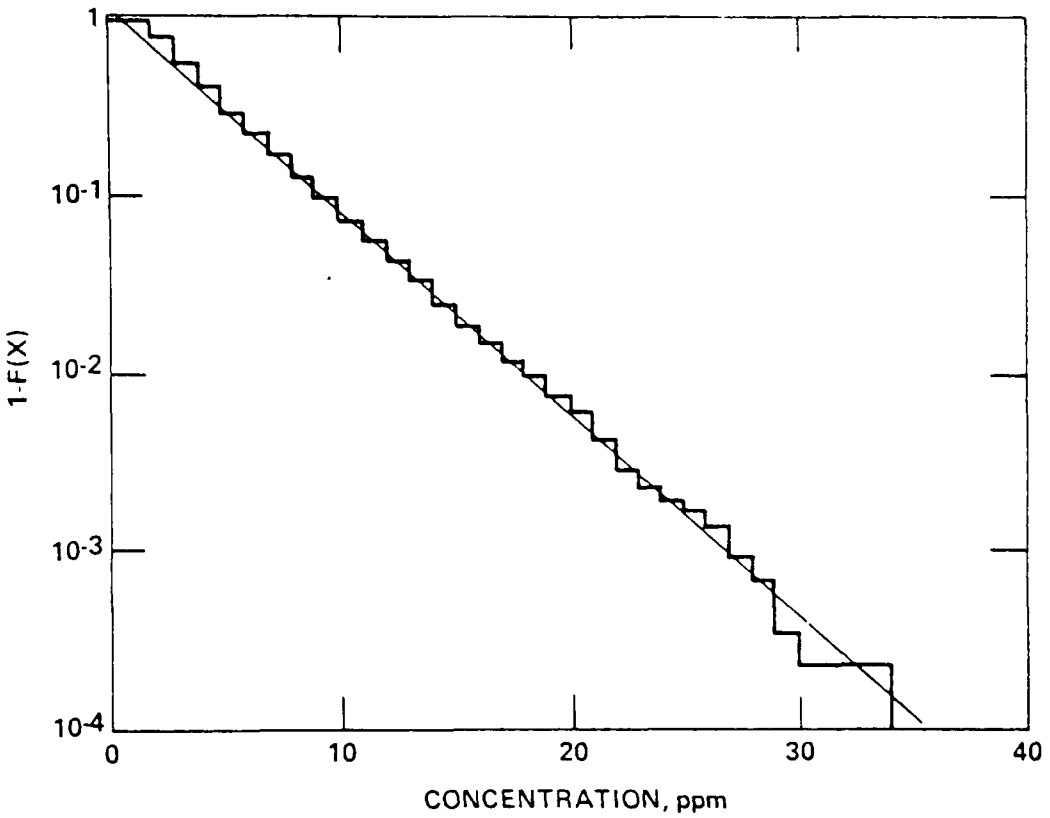

Figure 4-9. Hourly carbon monoxide measurements for 1972 in Los Angeles, CA

SOURCE: Reference 1

The only parameter needed to fully describe the one-parameter exponential distribution is the mean. Since the mean can be estimated from the projected design value and its corresponding frequency of occurrence, an exponential distribution unique to each area being modeled can be obtained. Using the definition of the NAAQS for CO from Reference 7 and the tabular procedure for ozone in Reference 8, the design value is assumed to be the second highest value for the specified averaging time. For the annual average NO_2 standard, a direct comparison between the projected concentration and the level of the NAAQS is made.

4.4.2 Average Percent Changes

The air quality summary statistic, average percent change, is calculated as the average of the average percent change between the base year air quality concentration and the projection year concentration in each region, i.e., each region is given equal weight in the averaging process. These calculations are performed using one more significant figure than displayed for the air quality concentrations.

4.4.3 Number of Source Regions Above the Level of the NAAQS

Following the guidelines in References 7 and 8, the stated level of the standard is taken as defining the number of significant figures to be used in comparisons with the standard. For example, the standard level of 0.12 ppm for the ozone NAAQS means that measurements are to be rounded to two decimal places (0.005 rounds up); therefore 0.125 ppm is the smallest concentration in excess of the level of the standard. Since the model performs all its calculations in ppm, the comparisons with the CO and NO_2 standards are based on two and three significant figures, respectively. Thus, the number of regions above the level of the NAAQS is simply the sum of all those regions meeting the above criteria for that projection year.

4.4.4 Total Number of Exceedances

As the name suggests, this statistic is simply the total number of exceedances across all regions for each projection year.

5.0 EXAMPLE MODEL RUNS

Three example model simulations are presented in the following sections. Example 1 illustrates the use of the model to project emission inventories, only. Example 2 illustrates how both CO and VOC emission inventories and CO and ozone air quality projections can be obtained in a single run. Finally, Example 3 shows how to reprint the Air Quality Summary Reports from a demand terminal using an air quality data file saved from a previous model simulation.

5.1 Emission Projections

Figure 5-1 presents a sample batch run for projecting CO emission inventories. Control Card 1, displayed on line 8 of Figure 5-1, sets the simulation parameters. Emission Summary Reports and an emissions data file will be output by ROLLBACK (EIFLAG=2). Also, if the source region data cards contain stationary source contribution factors, they will be set equal to 1.0 prior to projecting future emissions. The input/output unit selections indicate that the Emissions Summary Report will be output on the system print device and the emissions data file will be written on the public disk file named "CO-EMISS." The remaining fields on Control Card 1 indicate that the source areas fall within a single group; two control scenarios are to be evaluated; emissions are to be estimated for four projection years; there are three growth rate scenarios; and there are four mobile and three stationary source emissions categories. The source selection codes, shown on line 1 of Figure 5-2, refer to the source categories in Table 3-3. The remaining control strategy and source region input data cards and selected model outputs for this example are shown in Figures 5-2 through 5-5.

```
 1      1.  @RUN,R/R RUNID,ACCOUNT/USERID,PROJID,TIME,PAGES
 2      2.  @PASSWD XYZ
 3      3.  @SYM PRINT$,2,DATA1J
 4      4.  @ASG,CP CO-EMISS.
 5      5.  @USE 8,CO-EMISS.
 6      6.  @HDG,P   CO EMISSIONS PROJECTIONS - EXAMPLE #1
 7      7.  @XQT TDS*ROLLBACK.ROLLBACK
 8      8.  02060809 CO     R=01 S=02 N=04 G=03 M=04 S=03
 9      9.  @ADD,P MY*FILE.CO-STRATEGY
10     10.  @ADD,P MY*FILE.CO-DATA
11     11.  @FIN
12
13
14
15     EXPLANATION:
16
17      1.  RUN CARD FOR ROUTINE BATCH RUN WITH DEFAULT CORE ALLOCATION (50K)
18      2.  USER PASSWORD
19      3.  SEND TWO COPIES OF PRINTER OUTPUT TO TERMINAL 'DATA1J'.
20      4.  ASSIGN A NEW PUBLIC DATA FILE NAMED 'CO-EMISS'.
21      5.  USE UNIT #8 WITH FILE 'CO-EMISS'. ( EMISSIONS DATA FILE )
22      6.  PRINTS HEADING, DATE, AND NUMBERS EACH PAGE.
23      7.  EXECUTE THE STRATEGY MODEL TO PROJECT CO EMISSIONS ONLY.
24      8.  THE CONTROL CARD SELECTS EMISSIONS REPORTS ONLY, IGNORING
25          THE STATIONARY SOURCE CONTRIBUTION FACTORS.
26      9.  ADD THE CO STRATEGY CARDS TO THE RUN STREAM.
27     10.  ADD THE CO EMISSIONS AND AIR QUALITY DATA TO THE RUN STREAM.
28     11.  TERMINATES THE RUN.
**
```

Figure 5-1. Example #1 - Run Stream

```
01020409242527
SCEN #1 1 39 33    86              58                                        84
SCEN #1 1100100100100      100100
SCEN #1 1 34 27    72              52                                        85
SCEN #1 1100100100100      100100
SCEN #1 1 27 16    31              32                                        90
SCEN #1 1100100100100      100100
SCEN #1 1 27 14    18              25                                        95
SCEN #1 1100100100100      100100
SCEN #2 1 39 33    86              58                                        84
SCEN #2 1100100100100      100100
SCEN #2 1 33 27    72              52                                        85
SCEN #2 1100100100100      100100
SCEN #2 1 26 16    31              32                                        90
SCEN #2 1100100100100      100100
SCEN #2 1 26 14    18              25                                        95
SCEN #2 1100100100100      100100
```

Figure 5-2. Example #1 - Control Card 2 and Mobile/Stationary Source Strategy Cards in MY*FILE.CO-STRATEGY

```
 1      100 COUNTY A        28.3  0.0  CO8 MG/M                                  1781
 2      100   403.0  79.3       151.6                          8.1                 2
 3      100                                                                        3
 4      100     0.9   7.5        16.6                             .0.2  .2        4
 5      100LO    -07 27   -3            123                                       5
 6      100LO     35 43 08 00       25 00                                         6
 7      100MD     03 37   -2            134                                       5
 8      100MD     35 43 08 00       25 00                                         6
 9      100HI     13 47   -1            145                                       5
10      100HI     35 43 08 00       25 00                                         6
11      041 COUNTY B        15.1  0.0  CO8 MG/M                                  1781
12      041   141.5  28.1        24.8                          .5                  2
13      041                                                                        3
14      041     0.5   7.2         9.5                             .0.2  .2        4
15      041LO    -07 27   -3            123                                       5
16      041LO     35 43 08 00       25 00                                         6
17      041MD     03 37   -2            134                                       5
18      041MD     35 43 08 00       25 00                                         6
19      041HI     13 47   -1            145                                       5
20      041HI     35 43 08 00       25 00                                         6
21      001 COUNTY C        25.2  0.0  CO8 MG/M                                  1781
22      001   132.6  26.7        23.3                          3.2                 2
23      001                                                                        3
24      001     0.0  13.6         9.6                             .0.2  .2        4
25      001LO    -07 27   -3            123                                       5
26      001LO     35 43 08 00       25 00                                         6
27      001MD     03 37   -2            134                                       5
28      001MD     35 43 08 00       25 00                                         6
29      001HI     13 47   -1            145                                       5
30      001HI     35 43 08 00       25 00                                         6
31      035 COUNTY D        18.1  0.0  CO8 MG/M                                  1781
32      035   183.0  35.8        58.0                          4.7                 2
33      035                                                                        3
34      035     2.2   7.2        14.6                             .0.2  .2        4
35      035LO    -07 27   -3            123                                       5
36      035LO     35 43 08 00       25 00                                         6
37      035MD     03 37   -2            134                                       5
38      035MD     35 43 03 00       25 00                                         6
39      035HI     13 47   -1            145                                       5
40      035HI     35 43 08 00       25 00                                         6
**
```

Figure 5-3. Example #1 - Source Region Data Cards for CO in MY*FILE.CO-DATA

ISSIONS PROJECTIONS - EXAMPLE #1 DATE 070181 PAGE

*** EMISSIONS INVENTORY PROJECTIONS ***

ON: 100 COUNTY A STRATEGY:SCEN #1 GROWTH RATE:LO

NT: CO

EMISSIONS (1000 TONS/YEAR)

S O U R C E C A T E G O R I E S

	LDV-G	LDT1-G	HDG	HDD	POINT	AREA	OTHER
R							
	403.0	79.3	151.6	8.1	.9	7.5	16.6
R							
	150.7	30.7	108.6	9.4	1.1	7.9	19.3
	130.4	25.8	88.2	9.5	1.1	7.9	19.7
	100.0	17.5	32.6	10.4	1.4	8.3	22.3
	96.6	17.5	16.3	14.6	1.6	8.6	25.3

MOBILE TOTAL	STATIONARY TOTAL	GRAND TOTAL
642.0	25.0	667.0
299.4	28.2	327.6
253.9	28.8	282.7
160.5	31.9	192.5
144.8	35.5	180.3

Figure 5-4. Example #1 - CO Emissions Inventory Summary Report

```
CO EMISSIONS PROJECTIONS - EXAMPLE #1

@DATA,L 8.
DATA 9R1Q1 SL74T9 07/01/81 12:35:52 (0)
  1.    100 COUNTY A      SCEN #1  LO    CO  4   7 1 2 4 9242527
  2.    1978   642.0    25.0   667.0   403.0    79.3   151.6     8.1      .9     7.5    16.6
  3.    1984   299.4    28.2   327.6   150.7    30.7   108.6     9.4     1.1     7.9    19.3
  4.    1985   253.9    28.8   282.7   130.4    25.8    88.2     9.5     1.1     7.9    19.7
  5.    1990   160.5    31.9   192.5   100.0    17.5    32.6    10.4     1.4     8.3    22.3
  6.    1995   144.8    35.5   180.3    96.6    17.5    16.3    14.6     1.6     8.6    25.3
  7.    100 COUNTY A      SCEN #1  MD    CO  4   7 1 2 4 9242527
  8.    1978   642.0    25.0   667.0   403.0    79.3   151.6     8.1      .9     7.5    16.6
  9.    1984   318.0    28.2   346.3   160.0    32.5   115.5    10.0     1.1     7.9    19.3
 10.    1985   272.4    28.8   301.3   139.9    27.6    94.8    10.2     1.1     7.9    19.7
 11.    1990   181.0    31.9   213.0   112.8    19.6    36.9    11.7     1.4     8.3    22.3
 12.    1995   171.6    35.5   207.1   114.5    20.6    19.4    17.2     1.6     8.6    25.3
 13.    100 COUNTY A      SCEN #1  HI    CO  4   7 1 2 4 9242527
 14.    1978   642.0    25.0   667.0   403.0    79.3   151.6     8.1      .9     7.5    16.6
 15.    1984   337.6    28.2   365.9   169.8    34.5   122.7    10.6     1.1     7.9    19.3
 16.    1985   292.1    28.8   320.9   150.0    29.5   101.7    10.9     1.1     7.9    19.7
 17.    1990   203.9    31.9   235.8   127.1    22.0    41.7    13.2     1.4     8.3    22.3
 18.    1995   203.0    35.5   238.5   135.5    24.2    23.0    20.2     1.6     8.6    25.3
 19.    100 COUNTY A      SCEN #2  LO    CO  4   7 1 2 4 9242527
 20.    1978   642.0    25.0   667.0   403.0    79.3   151.6     8.1      .9     7.5    16.6
 21.    1984   299.4    28.2   327.6   150.7    30.7   108.6     9.4     1.1     7.9    19.3
 22.    1985   250.1    28.8   278.9   126.6    25.8    88.2     9.5     1.1     7.9    19.7
 23.    1990   156.8    31.9   188.8    96.3    17.5    32.6    10.4     1.4     8.3    22.3
 24.    1995   141.3    35.5   176.7    93.0    17.5    16.3    14.6     1.6     8.6    25.3
 25.    100 COUNTY A      SCEN #2  MD    CO  4   7 1 2 4 9242527
 26.    1978   642.0    25.0   667.0   403.0    79.3   151.6     8.1      .9     7.5    16.6
 27.    1984   318.0    28.2   346.3   160.0    32.5   115.5    10.0     1.1     7.9    19.3
 28.    1985   268.3    28.8   297.1   135.8    27.6    94.8    10.2     1.1     7.9    19.7
 29.    1990   176.8    31.9   208.8   108.6    19.6    36.9    11.7     1.4     8.3    22.3
 30.    1995   167.4    35.5   202.8   110.3    20.6    19.4    17.2     1.6     8.6    25.3
 31.    100 COUNTY A      SCEN #2  HI    CO  4   7 1 2 4 9242527
 32.    1978   642.0    25.0   667.0   403.0    79.3   151.6     8.1      .9     7.5    16.6
 33.    1984   337.6    28.2   365.9   169.8    34.5   122.7    10.6     1.1     7.9    19.3
 34.    1985   287.7    28.8   316.5   145.6    29.5   101.7    10.9     1.1     7.9    19.7
 35.    1990   199.2    31.9   231.1   122.3    22.0    41.7    13.2     1.4     8.3    22.3
 36.    1995   198.0    35.5   233.4   130.5    24.2    23.0    20.2     1.6     8.6    25.3
 37.    041 COUNTY B      SCEN #1  LO    CO  4   7 1 2 4 9242527
 38.    1978   194.9    17.2   212.1   141.5    28.1    24.8      .5      .5     7.2     9.5
 39.    1984    82.1    19.2   101.3    52.9    10.9    17.8      .6      .6     7.6    11.0
 40.    1985    70.0    19.5    89.5    45.8     9.1    14.4      .6      .6     7.6    11.3
 41.    1990    47.3    21.5    68.7    35.1     6.2     5.3      .6      .8     7.9    12.8
 42.    1995    43.7    23.6    67.2    33.9     6.2     2.7      .9      .9     8.2    14.5
 43.    041 COUNTY B      SCEN #1  MD    CO  4   7 1 2 4 9242527
 44.    1978   194.9    17.2   212.1   141.5    28.1    24.8      .5      .5     7.2     9.5
 45.    1984    87.2    19.2   106.4    56.2    11.5    18.9      .6      .6     7.6    11.0
 46.    1985    75.0    19.5    94.6    49.1     9.8    15.5      .6      .6     7.6    11.3
 47.    1990    53.3    21.5    74.8    39.6     7.0     6.0      .7      .8     7.9    12.8
 48.    1995    51.7    23.6    75.3    40.2     7.3     3.2     1.1      .9     8.2    14.5
 49.    041 COUNTY B      SCEN #1  HI    CO  4   7 1 2 4 9242527
 50.    1978   194.9    17.2   212.1   141.5    28.1    24.8      .5      .5     7.2     9.5
 51.    1984    92.6    19.2   111.8    59.6    12.2    20.1      .7      .6     7.6    11.0
 52.    1985    80.4    19.5   100.0    52.7    10.5    16.6      .7      .6     7.6    11.3
 53.    1990    60.0    21.5    81.5    44.6     7.8     6.8      .8      .8     7.9    12.8
 54.    1995    61.2    23.6    84.8    47.6     8.6     3.8     1.2      .9     8.2    14.5
 55.    041 COUNTY B      SCEN #2  LO    CO  4   7 1 2 4 9242527
 56.    1978   194.9    17.2   212.1   141.5    28.1    24.8      .5      .5     7.2     9.5
 57.    1984    82.1    19.2   101.3    52.9    10.9    17.8      .6      .6     7.6    11.0
 58.    1985    68.6    19.5    88.2    44.5     9.1    14.4      .6      .6     7.6    11.3
 59.    1990    46.0    21.5    67.4    33.8     6.2     5.3      .6      .8     7.9    12.8
 60.    1995    42.4    23.6    66.0    32.6     6.2     2.7      .9      .9     8.2    14.5
 61.    041 COUNTY B      SCEN #2  MD    CO  4   7 1 2 4 9242527
 62.    1978   194.9    17.2   212.1   141.5    28.1    24.8      .5      .5     7.2     9.5
 63.    1984    87.2    19.2   106.4    56.2    11.5    18.9      .6      .6     7.6    11.0
 64.    1985    73.6    19.5    93.1    47.7     9.8    15.5      .6      .6     7.6    11.3
 65.    1990    51.8    21.5    73.3    38.1     7.0     6.0      .7      .8     7.9    12.8
 66.    1995    50.2    23.6    73.8    38.7     7.3     3.2     1.1      .9     8.2    14.5
 67.    041 COUNTY B      SCEN #2  HI    CO  4   7 1 2 4 9242527
 68.    1978   194.9    17.2   212.1   141.5    28.1    24.8      .5      .5     7.2     9.5
 69.    1984    92.6    19.2   111.8    59.6    12.2    20.1      .7      .6     7.6    11.0
 70.    1985    78.9    19.5    98.4    51.1    10.5    16.6      .7      .6     7.6    11.3
 71.    1990    58.4    21.5    79.8    43.0     7.8     6.8      .8      .8     7.9    12.8
 72.    1995    59.4    23.6    83.0    45.8     8.6     3.8     1.2      .9     8.2    14.5
 73.    001 COUNTY C      SCEN #1  LO    CO  4   7 1 2 4 9242527
 74.    1978   185.8    23.2   209.0   132.6    26.7    23.3     3.2      .0    13.6     9.6
 75.    1984    80.3    25.4   105.7    49.6    10.3    16.7     3.7      .0    14.3    11.1
```

Figure 5-5. Example #1. - CO Emissions Data File Listing

5.2 Carbon Monoxide and Ozone Projections

Example 2 illustrates a run stream for carbon monoxide and ozone projections which can be @STARTed from a demand terminal. The control cards and functional descriptions are shown in Figure 5-6. Figures 5-7 through 5-14 present the input data and output data files and selected summary reports. In this example, Control Cards 1 and 2, and the mobile/stationary source strategy cards for CO, are found in the data element MY*FILE.CO-SCENARIOS and for ozone in MY*FILE.O3-SCENARIOS. Note that both the CO and ozone emissions and air quality data files are output to temporary disk files which are deleted at completion of the run. Also, the CO data files are overwritten by the ozone data files. Since ozone is one of the pollutants being modeled, the EKMA isopleth data file is assigned to Input Unit 11. All printed output is directed to the remote batch terminal named 'DATA1J.'

5.3 Reprinting a Previous Simulation

Example 3 in Figure 5-15 illustrates a procedure for obtaining Air Quality Summary Reports using data from a previous model simulation which has been saved in a program file element. This procedure is executed from a demand terminal and routes the Air Quality Summary Reports to a remote batch terminal.

```
 1.  @RUN,R/R RUNID,ACCOUNT/USERID,PROJID,TIME,PAGES
 2.  @SYM PRINT$,1,DATA1J
 3.  @ASG,A TDS*OZIPP-ASCII.
 4.  @USE 11,TDS*OZIPP-ASCII.
 5.  @ASG,CP VOC-REPORT.
 6.  @USE 40,VOC-REPORT.
 7.  @ASG,T 8.
 8.  @ASG,T 9.
 9.  @HDG,P   CO AND OZONE AIR QUALITY PROJECTIONS - EXAMPLE #2
10.  @XQT TDS*ROLLBACK.ROLLBACK
11.  @ADD,P MY*FILE.CO-SCENARIOS
12.  @ADD,P MY*FILE.CO-DATA
13.  @US*ER.SORTSDF,A 9.,9.,100,132,KEY/29/3.A,KEY/20/8.A,KEY/5/15.A
14.  @XQT TDS*ROLLBACK.AQPRNT
15.  @XQT TDS*ROLLBACK.ROLLBACK
16.  @ADD,P MY*FILE.O3-SCENARIOS
17.  @ADD,P MY*FILE.O3-DATA
18.  @US*ER.SORTSDF,A 9.,9.,100,132,KEY/29/3.A,KEY/20/8.A,KEY/5/15.A
19.  @XQT TDS*ROLLBACK.AQPRNT
20.  @FREE VOC-REPORT.
21.  @SYM,U VOC-REPORT.,2,PR
22.  @FIN


EXPLANATION:

 1.  RUN CARD FOR @START RUN.
 2.  SEND ONE COPY OF PRINTER OUTPUT TO TERMINAL 'DATA1J'.
 3.  ASSIGN THE CATALOGED OZIPP DIAGRAM DATA FILE (ASCII).
 4.  READ THE OZIPP FILE ON UNIT #11.
 5.  ASSIGN A PUBLIC FILE NAMED PROJID*VOC-REPORT.
 6.  ASSIGN ALTERNATE PRINT$ UNIT #40 TO VOC-REPORT.( VOC EMISSIONS REPORT ).
 7.  ASSIGN A TEMPORARY FILE #8. ( EMISSIONS DATA FILE ).
 8.  ASSIGN A TEMPORARY FILE #9. ( AIR QUALITY DATA FILE OUTPUT ).
 9.  PRINTS HEADING, DATE, AND NUMBERS EACH PAGE.
10.  EXECUTE THE STRATEGY MODEL FOR CO.
11.  ADD THE CONTROL CARD AND CO STRATEGY DATA TO THE RUN STREAM.
12.  ADD THE CO EMISSIONS AND AIR QUALITY DATA TO THE RUN STREAM.
13.  SORT THE CO AIR QUALITY OUTPUT DATA FILE (ASCII) BY GROWTH RATE,
     STRATEGY AND REGION.
14.  PRINT THE CO AIR QUALITY SUMMARY REPORTS FOR EACH STRATEGY/GROWTH
     RATE COMBINATION.
15.  EXECUTE THE STRATEGY MODEL FOR OZONE.
16.  ADD THE CONTROL CARD AND OZONE STRATEGY DATA TO THE RUN STREAM.
17.  ADD THE VOC EMISSIONS AND OZONE AIR QUALITY DATA TO THE RUN STREAM.
18.  SORT THE OZONE AIR QUALITY OUTPUT DATA FILE (ASCII) BY GROWTH RATE,
     STRATEGY AND REGION.
19.  PRINT THE OZONE AIR QUALITY SUMMARY REPORTS FOR EACH STRATEGY/GROWTH
     RATE COMBINATION.
20.  FREE AND CATALOG THE FILE NAMED VOC-REPORT.
21.  SEND TWO COPIES OF THE EMISSIONS SUMMARY REPORT TO THE CENTRAL
     PRINTER AT NCC. DO NOT DELETE THE SYMBIONT PRINT FILE PROJID*VOC-REPORT.
22.  TERMINATES THE RUN.
```

**

Figure 5-6. Example #2 - Run Stream

```
00060809 CO      R= 1 S= 2 N= 4 G= 3 M=04 S= 3
01020409242527
SCEN #1 1 39 33    86              58                                          84
SCEN #1 1100100100100        100100
SCEN #1 1 34 27    72              52                                          85
SCEN #1 1100100100100        100100
SCEN #1 1 27 16    31              32                                          90
SCEN #1 1100100100100        100100
SCEN #1 1 27 14    18              25                                          95
SCEN #1 1100100100100        100100
SCEN #2 1 39 33    86              58                                          84
SCEN #2 1100100100100        100100
SCEN #2 1 33 27    72              52                                          85
SCEN #2 1100100100100        100100
SCEN #2 1 26 16    31              32                                          90
SCEN #2 1100100100100        100100
SCEN #2 1 26 14    18              25                                          95
SCEN #2 1100100100100        100100
```

Figure 5-7. Example #2 - CO Control Cards 1 and 2 and Source Strategy Cards in MY*FILE.CO-SCENARIOS

```
 1      00400809 VOC    R= 2 S= 1 N= 4 G= 3 M=10 S= 7
 2      01020409101112131423262728293031 32
 3      BASELINE1 37 32    66             58100100100100100                        10084
 4      BASELINE1            100100100100 10100 20100 35100 70100 40100
 5      BASELINE1 32 27    55             53100100100100100                        10085
 6      BASELINE1            100100100100 10100 20100 35100 70100 40100
 7      BASELINE1 20 14    25             31100100100100100                        10090
 8      BASELINE1            100100100100 10100 20100 35100 70100 40100
 9      BASELINE1 17 10    16             25100100100100100                        10095
10      BASELINE1            100100100100 10100 20100 35100 70100 40100
11      BASELINE2 37 32    66             58100100100100100                        10084
12      BASELINE2            100100100100 10 10 20 20 35 35 70 70 40 40
13      BASELINE2 32 27    55             53100100100100100                        10085
14      BASELINE2            100100100100 10 10 20 20 35 35 70 70 40 40
15      BASELINE2 20 14    25             31100100100100100                        10090
16      BASELINE2            100100100100 10 10 20 20 35 35 70 70 40 40
17      BASELINE2 17 10    16             25100100100100100                        10095
18      BASELINE2            100100100100 10 10 20 20 35 35 70 70 40 40
**
```

Figure 5-8. Example #2 - Ozone Control Cards 1 and 2 and Source Strategy Cards in MY*FILE.03-SCENARIOS

```
001 AQCR A          .157  0.0  O3   PPM 9.5 1. 1. 1. 1. 1. 1. 1. 1. 1.      2781
001    61.9  12.5        11.6                            4.2   2.2   0.1        2
001     0.4   0.6   2.2                                                   2.6  3
001                 0.4   4.4   0.1   8.8   0.0  47.8   0.3                    4
001LO    -07 27   -3            123 02 27 27 27 27                         23 5
001LO                35 43 00 00 19 45 19 45 33 44 08 00 33 44                6
001MD     03 37   -2            134 02 27 27 27 27                         23 5
001MD                35 43 00 00 19 45 19 45 33 44 08 00 33 44                6
001HI     13 47   -1            145 02 27 27 27 27                         23 5
001HI                35 43 00 00 19 45 19 45 33 44 08 00 33 44                6
002 AQCR B          .090  0.0  O3   PPM 9.5 1. 1. 1. 1. 1. 1. 1. 1. 1.      1781
002    21.3   4.3         2.3                                .4   0.7   0.2        2
002     2.9   0.2   0.2                                                   0.9  3
002                 0.3   2.6   0.0   3.0   0.3   8.8   0.0                    4
002LO    -07 27   -3            123 02 27 27 27 27                         23 5
002LO                35 43 00 00 19 45 19 45 24 50 08 00 33 44                6
002MD     03 37   -2            134 02 27 27 27 27                         23 5
002MD                35 43 00 00 19 45 19 45 24 50 08 00 33 44                6
002HI     13 47   -1            145 02 27 27 27 27                         23 5
002HI                35 43 00 00 19 45 19 45 24 50 08 00 33 44                6
003 AQCR C          .133  0.0  O3   PPM 9.5 1. 1. 1. 1. 1. 1. 1. 1. 1.      1781
003    13.3   2.7         1.2                            1.4   1.3   0.0        2
003     0.4   0.0   0.4                                                   0.6  3
003                 0.0   2.5   0.0   2.4   0.0   8.6   0.0                    4
003LO    -07 27   -3            123 02 27 27 27 27                         23 5
003LO                35 43 00 00 19 45 19 45 33 44 08 00 33 44                6
003MD     03 37   -2            134 02 27 27 27 27                         23 5
003MD                35 43 00 00 19 45 19 45 33 44 08 00 33 44                6
003HI     13 47   -1            145 02 27 27 27 27                         23 5
003HI                35 43 00 00 19 45 19 45 33 44 08 00 33 44                6
004 AQCR D          .180  0.0  O3   PPM 9.5 1. 1. 1. 1. 1. 1. 1. 1. 1.      2781
004    31.3   6.3         4.9                            2.6   3.0   0.8        2
004     1.0   0.3   0.6                                                   1.8  3
004                 0.2   3.3   2.6   6.4   0.5  27.4   0.0                    4
004LO    -07 27   -3            123 02 27 27 27 27                         23 5
004LO                35 43 00 00 19 45 19 45 13 49 08 00 33 44                6
004MD     03 37   -2            134 02 27 27 27 27                         23 5
004MD                35 43 00 00 19 45 19 45 13 49 08 00 33 44                6
004HI     13 47   -1            145 02 27 27 27 27                         23 5
004HI                35 43 00 00 19 45 19 45 13 49 08 00 33 44                6
```

Figure 5-9. Example #2 - Source Region Data Cards 1 through 6 for Ozone in MY*FILE.O3-DATA

CO AND OZONE AIR QUALITY PROJECTIONS - EXAMPLE #2

*** EMISSIONS INVENTORY PROJECTIONS ***

LOCATION: 100 COUNTY A STRATEGY:SCEN #1 GROWTH RATE:LO

POLLUTANT: CO

EMISSIONS (1000 TONS/YEAR)

S O U R C E C A T E G O R I E S

BASE YR	LDV-G	LDT1-G	HDG	HDD	POINT	AREA	OTHER
1978	403.0	79.3	151.6	8.1	.0	1.5	3.3
PROJ YR							
1984	150.7	30.7	108.6	9.4	.0	1.6	3.9
1985	130.4	25.8	88.2	9.5	.0	1.6	3.9
1990	100.0	17.5	32.6	10.4	.0	1.7	4.5
1995	96.6	17.5	16.3	14.6	.0	1.7	5.1

YEAR	MOBILE TOTAL	STATIONARY TOTAL	GRAND TOTAL
1978	642.0	4.8	646.8
1984	299.4	5.4	304.8
1985	253.9	5.5	259.5
1990	160.5	6.1	166.6
1995	144.8	6.8	151.6

Figure 5-10. Example #2 - CO Emissions Inventory Summary Report

```
. 9.
?1Q1 SL74T9 07/01/81 12:36:07 (0)
      CO8 PPM  9.00 .500  2 4
      100 COUNTY A        SCEN #1  LO  1978 24.6    .0   1984 11.6 1985  9.9 1990  6.3 1995  5.8
      100 COUNTY A        SCEN #1  MD  1978 24.6    .0   1984 12.3 1985 10.6 1990  7.1 1995  6.8
      100 COUNTY A        SCEN #1  HI  1978 24.6    .0   1984 13.1 1985 11.3 1990  8.0 1995  8.0
      100 COUNTY A        SCEN #2  LO  1978 24.6    .0   1984 11.6 1985  9.7 1990  6.2 1995  5.6
      100 COUNTY A        SCEN #2  MD  1978 24.6    .0   1984 12.3 1985 10.4 1990  7.0 1995  6.6
      100 COUNTY A        SCEN #2  HI  1978 24.6    .0   1984 13.1 1985 11.2 1990  7.8 1995  7.8
      041 COUNTY B        SCEN #1  LO  1978 13.1    .0   1984  5.7 1985  4.9 1990  3.4 1995  3.2
      041 COUNTY B        SCEN #1  MD  1978 13.1    .0   1984  6.0 1985  5.2 1990  3.8 1995  3.7
      041 COUNTY B        SCEN #1  HI  1978 13.1    .0   1984  6.4 1985  5.6 1990  4.3 1995  4.4
      041 COUNTY B        SCEN #2  LO  1978 13.1    .0   1984  5.7 1985  4.8 1990  3.3 1995  3.1
      041 COUNTY B        SCEN #2  MD  1978 13.1    .0   1984  6.0 1985  5.1 1990  3.7 1995  3.6
      041 COUNTY B        SCEN #2  HI  1978 13.1    .0   1984  6.4 1985  5.5 1990  4.1 1995  4.2
      001 COUNTY C        SCEN #1  LO  1978 21.9    .0   1984  9.8 1985  8.5 1990  6.2 1995  6.0
      001 COUNTY C        SCEN #1  MD  1978 21.9    .0   1984 10.4 1985  9.1 1990  6.9 1995  6.9
      001 COUNTY C        SCEN #1  HI  1978 21.9    .0   1984 11.0 1985  9.7 1990  7.6 1995  8.1
      001 COUNTY C        SCEN #2  LO  1978 21.9    .0   1984  9.8 1985  8.4 1990  6.0 1995  5.8
      001 COUNTY C        SCEN #2  MD  1978 21.9    .0   1984 10.4 1985  8.9 1990  6.7 1995  6.8
      001 COUNTY C        SCEN #2  HI  1978 21.9    .0   1984 11.0 1985  9.5 1990  7.5 1995  7.9
      035 COUNTY D        SCEN #1  LO  1978 15.7    .0   1984  7.4 1985  6.3 1990  4.3 1995  4.0
      035 COUNTY D        SCEN #1  MD  1978 15.7    .0   1984  7.8 1985  6.8 1990  4.8 1995  4.7
      035 COUNTY D        SCEN #1  HI  1978 15.7    .0   1984  8.3 1985  7.2 1990  5.3 1995  5.5
      035 COUNTY D        SCEN #2  LO  1978 15.7    .0   1984  7.4 1985  6.2 1990  4.2 1995  3.9
      035 COUNTY D        SCEN #2  MD  1978 15.7    .0   1984  7.8 1985  6.7 1990  4.7 1995  4.6
      035 COUNTY D        SCEN #2  HI  1978 15.7    .0   1984  8.3 1985  7.1 1990  5.2 1995  5.3
ATA. ERRORS: NONE. TIME:  0.540 SEC. IMAGE COUNT: 25
```

Figure 5-11. Example #2 - Unsorted CO Air Quality Data File

```
@DATA,L 9.
DATA 9R1Q1 SL74T9 07/01/81 12:36:09 (0)
    1.       CO8 PPM  9.00 .500  2 4
    2.       100 COUNTY A       SCEN #1  HI  1978 24.6   .0   1984 13.1 1985 11.3 1990  8.0 1995  8.0
    3.       041 COUNTY B       SCEN #1  HI  1978 13.1   .0   1984  6.4 1985  5.6 1990  4.3 1995  4.4
    4.       001 COUNTY C       SCEN #1  HI  1978 21.9   .0   1984 11.0 1985  9.7 1990  7.6 1995  8.1
    5.       035 COUNTY D       SCEN #1  HI  1978 15.7   .0   1984  8.3 1985  7.2 1990  5.3 1995  5.5
    6.       100 COUNTY A       SCEN #2  HI  1978 24.6   .0   1984 13.1 1985 11.2 1990  7.8 1995  7.8
    7.       041 COUNTY B       SCEN #2  HI  1978 13.1   .0   1984  6.4 1985  5.5 1990  4.1 1995  4.2
    8.       001 COUNTY C       SCEN #2  HI  1978 21.9   .0   1984 11.0 1985  9.5 1990  7.5 1995  7.9
    9.       035 COUNTY D       SCEN #2  HI  1978 15.7   .0   1984  8.3 1985  7.1 1990  5.2 1995  5.3
   10.       100 COUNTY A       SCEN #1  LO  1978 24.6   .0   1984 11.6 1985  9.9 1990  6.3 1995  5.8
   11.       041 COUNTY B       SCEN #1  LO  1978 13.1   .0   1984  5.7 1985  4.9 1990  3.4 1995  3.2
   12.       001 COUNTY C       SCEN #1  LO  1978 21.9   .0   1984  9.8 1985  8.5 1990  6.2 1995  6.0
   13.       035 COUNTY D       SCEN #1  LO  1978 15.7   .0   1984  7.4 1985  6.3 1990  4.3 1995  4.0
   14.       100 COUNTY A       SCEN #2  LO  1978 24.6   .0   1984 11.6 1985  9.7 1990  6.2 1995  5.6
   15.       041 COUNTY B       SCEN #2  LO  1978 13.1   .0   1984  5.7 1985  4.8 1990  3.3 1995  3.1
   16.       001 COUNTY C       SCEN #2  LO  1978 21.9   .0   1984  9.8 1985  8.4 1990  6.0 1995  5.8
   17.       035 COUNTY D       SCEN #2  LO  1978 15.7   .0   1984  7.4 1985  6.2 1990  4.2 1995  3.9
   18.       100 COUNTY A       SCEN #1  MD  1978 24.6   .0   1984 12.3 1985 10.6 1990  7.1 1995  6.8
   19.       041 COUNTY B       SCEN #1  MD  1978 13.1   .0   1984  6.0 1985  5.2 1990  3.8 1995  3.7
   20.       001 COUNTY C       SCEN #1  MD  1978 21.9   .0   1984 10.4 1985  9.1 1990  6.9 1995  6.9
   21.       035 COUNTY D       SCEN #1  MD  1978 15.7   .0   1984  7.8 1985  6.8 1990  4.8 1995  4.7
   22.       100 COUNTY A       SCEN #2  MD  1978 24.6   .0   1984 12.3 1985 10.4 1990  7.0 1995  6.6
   23.       041 COUNTY B       SCEN #2  MD  1978 13.1   .0   1984  6.0 1985  5.1 1990  3.7 1995  3.6
   24.       001 COUNTY C       SCEN #2  MD  1978 21.9   .0   1984 10.4 1985  8.9 1990  6.7 1995  6.8
   25.       035 COUNTY D       SCEN #2  MD  1978 15.7   .0   1984  7.8 1985  6.7 1990  4.7 1995  4.6
END DATA. ERRORS: NONE. TIME:  0.540 SEC. IMAGE COUNT: 25
```

Figure 5-12. Example #2 - Sorted CO Air Quality Data File

L I N E A R R O L L B A C K

STRATEGY: SCEN #1 GROWTH RATE SCENARIO: LO

CO8 AIR QUALITY CONCENTRATION (PPM) AND VIOLATIONS
(STANDARD IS 9.00 PPM)

P R O J E C T E D

	B A S E			1984		1985		1990		1995	
G I O N	YEAR	CONC	BKGD	CONC	EXEX	CONC	EXEX	CONC	EXEX	CONC	EXEX
UNTY A	1978	25.	0.	12.	5	10.	1	6.	0	6.	0
UNTY B	1978	13.	0.	6.	0	5.	0	3.	0	3.	0
UNTY C	1978	22.	0.	10.	1	9.	0	6.	0	6.	0
UNTY D	1978	16.	0.	7.	0	6.	0	4.	0	4.	0

E PERCENT CHANGE	-54.	-61.	-73.	-75.
REGIONS ABOVE STD	2	1	0	0
NO. OF EXCEEDANCES	6	1	0	0

TE: AIR QUALITY CONCENTRATIONS ARE ROUNDED FOR DISPLAY FOLLOWING EPA GUIDELINES.
COMPARISONS WITH STANDARDS AND PERCENT CHANGES ARE BASED ON ONE ADDITIONAL SIGNIFICANT FIGURE.

Figure 5-13. Example #2 - CO Air Quality Summary Report

E K M A

STRATEGY: BASELINE GROWTH RATE SCENARIO: LO

O3 AIR QUALITY CONCENTRATION (PPM) AND VIOLATIONS
(STANDARD IS .12 PPM)

P R O J E C T E D

	B A S E			1984		1985		1990		1995	
R E G I O N	YEAR	CONC	RATIO	CONC	EXEX	CONC	EXEX	CONC	EXEX	CONC	EXEX
001 AQCR A	1978	.16	9.50	.12	0	.12	0	.11	0	.11	0
002 AQCR B	1978	.09	9.50	.07	0	.07	0	.07	0	.07	0
003 AQCR C	1978	.13	9.50	.11	0	.11	0	.10	0	.11	0
004 AQCR D	1978	.18	9.50	.14	2	.14	2	.13	1	.14	1
AVERAGE PERCENT CHANGE				-19.		-21.		-26.		-25.	
NO. OF REGIONS ABOVE STD				1		1		1		1	
TOTAL NO. OF EXCEEDANCES				2		2		1		1	

*** NOTE: AIR QUALITY CONCENTRATIONS ARE ROUNDED FOR DISPLAY FOLLOWING EPA GUIDELINES.
THUS, COMPARISONS WITH STANDARDS AND PERCENT CHANGES ARE BASED ON ONE ADDITIONAL SIGNIFICANT FIGURE.

Figure 5-14. Example #2 - Ozone Air Quality Summary Report

```
 1.  @ASG,CP PRINT.
 2.  @BRKPT PRINT$/PRINT
 3.  @ASG,T 9.
 4.  @DATA,I 9.
 5.  @ADD,D AQ.OZOUT9
 6.  @END
 7.  @XQT TDS*ROLLBACK.AQPRNT
 8.  @ASG,A CO-FILE.
 9.  @USE 9,CO-FILE.
10.  @XQT TDS*ROLLBACK.AQPRNT
11.  @BRKPT PRINT$
12.  @FREE PRINT.
13.  @SYM PRINT.,,DATA1J
```

EXPLANATION:

1. ASSIGN A NEW PUBLIC FILE NAMED 'PRINT'.
2. @BRKPT THE SYMBIONT PRINT FILE TO FILE PRINT.
3. ASSIGN A TEMPORARY FILE NAMED '9'.
4. CALL @DATA TO ADD DATA TO FILE 9.
5. ADD ELEMENT SAVED IN FILE 'AQ' CONTAINING SORTED OZONE AIR QUALITY DATA FROM EARLIER RUN.
6. END CALL TO @DATA PROCESSOR.
7. PRINT THE AIR QUALITY SUMMARY REPORTS FOR OZONE.
8. ASSIGN AN EXISTING SORTED CO AIR QUALITY DATA FILE.
9. READ THE SORTED CO DATA FILE ON UNIT #9.
10. PRINT THE CO AIR QUALITY SUMMARY REPORTS.
11. @BRKPT THE SYMBIONT PRINT$.
12. CATALOG AND FREE THE PRINT FILE 'PRINT'.
13. SEND ONE COPY OF PRINTER OUTPUT TO TERMINAL 'DATA1J' AND DELETE THE FILE 'PRINT.' (NO 'U' OPTION ON SYM COMMAND).

Figure 5-15. Example #3 - Run Stream

6.0 REFERENCES

1. J. H. Wilson, Methodology To Conduct Air Quality Assessments of National Mobile Source Emission Control Strategies, EPA-450/4-80-026, U. S. Environmental Protection Agency, Research Triangle Park, N.C., October 1980.

2. N. deNevers and J. R. Morris, "Rollback Modeling: Basic and Modified," JAPCA, 25, 943, September 1975.

3. Uses, Limitations and Technical Basis of Procedures for Quantifying Relationships between Photochemical Oxidants and Precursors, EPA-450/2-77-021a, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, November 1977.

4. G. Whitten and H. Hogo, User's Manual for Kinetics Model and Ozone Isopleth Plotting Package, EPA-600/8-78-014a, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, July 1978.

5. T. C. Curran and N. H. Frank, "Assessing the Validity of the Lognormal Model when Predicting Maximum Air Pollution Concentrations," presented at the 68th APCA Annual Meeting, June 1975.

6. L. Breiman, J. Gins and C. Stone, "Statistical Analysis and Interpretation of Peak Pollution Measurements." Final Report prepared by Technology Service Corporation under contract to the U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, November 1978.

7. Guidelines For The Interpretation of Air Quality Standards, OAQPS No. 1.2-008, U. S. Environmental Protection Agency, Research Triangle Park, N.C., February 1977.

8. Guideline for Interpretation of Ozone Air Quality Standards, EPA-450/4-79-003, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, January 1979.

9. National Computer Center User's Reference Manual, prepared by SDC Integrated Services, Inc. under contract to the U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, January 1980.

APPENDIX A

PROGRAM DESCRIPTIONS

SUBROUTINE DESCRIPTIONS

Program MAIN

Use. MAIN is the main program for the emissions inventory projection module of the Modified Rollback/EKMA Strategy Assessment Model. It reads the key control parameters, the mobile and stationary sources control strategy cards, and the emissions and air quality data for each source region to be evaluated. Depending on the options selected, MAIN outputs the Emissions Inventory Summary Report, the emissions data file and/or the projected air quality data file. The program also performs card sequence checks and data editing.

SUBROUTINE QBASE

Use. Obtains the total base year emissions inventory reduced by the source contribution factors, if appropriate. QBASE is called by MAIN.

Common Blocks STRAT
REGION
GROWTH
IO

ENTRY QPROJ (IRGN,IGR,IPY,ISTR,DYR)

Use. Provides emission projections for each source category, control scenario and growth rate combination. The procedure is a FORTRAN entry point in SUBROUTINE QBASE which is called from MAIN. Projection year total emissions are calculated using the following relationships:

$$QM_i = \sum_{j=1}^{k} [MS_j * EFR_j * (1+VMT_j)^n]$$

$$NEWSS_i = \sum_{l=1}^{m} QS_l * SSCF_l * SSNEW_l * \{ [(1+GR_l)^n - 1] + [1-(1-RR_l)^n] \}$$

$$OLDSS_i = \sum_{l=1}^{m} [QS_l * SSCF_l * SSOLD_l * (1-RR_l)^n]$$

$$QTOT_i = QM_i + NEWSS_i + OLDSS_i$$

where:

i = the projection year index

j = the mobile source category index

k = the number of mobile source categories

l = the stationary source category index

m = the number of stationary source categories

n = the difference between the projection year and the base year

MS_j = the base year emissions in mobile source category j

EFR_j = the ratio of the projection year emission factor to the base year emission factor obtained from MOBILE2

VMT = the compound growth rate in vehicle miles traveled

QM_i = the total mobile source emissions in projection year i

QS_l = the base year emissions in stationary source category l

$SSCF_l$ = the stationary source contribution factor for source category l

$SSNEW_l$ = the emission factor ratio for new sources in stationary source category l, i.e., $SSNEW_l$ = (100-NSPS)/100

$NSPS_l$ = the new source performance standard for cateogry l

GR_l = the growth rate for stationary source category l

RR_l = the retirement rate for stationary source category l

$NEWSS_i$ = the total stationary source emissions in projection year i due to growth and equipment replacement

$OLDSS_i$ = the total stationary source emissions in projection year i from existing stationary sources

$SSOLD_i$ = the emission factor ratio for existing stationary sources in source category 1

$QTOT_i$ = the total regional emissions in projection year i

Arguments IRGN = the control scenario group number

IGR = the growth rate sequence number

IPY = the projection year sequence number

ISTR = the control scenario sequence number

DYR = the difference between the projection year and the inventory base year

SUBROUTINE EIPRNT (NSTR,NGR,NPY)

Use. Outputs the Emissions Inventory Summary Report on unit device 'EI' (default = Unit 6). The report provides the base year inventory and the projected inventories for each source category selected. These data are also output, in a compact format, to alternate unit device 'IO' (default = Unit 8). The subroutine is called by MAIN.

Arguments NSTR = the number of control scenarios per group

NGR = the number of growth rate scenarios

NPY = the number of projection years

Common Blocks STRAT
REGION
GROWTH
IO

SUBROUTINE LINEAR (NSTR,NGR,NPY)

Use. Provides an estimate of future air quality concentrations using the following linear relationships:

$$x_i = (x_B - BKG) * \frac{Q_i}{Q_B} + BKG$$

where

x_i = air quality concentration in year i

x_B = base year air quality concentration

BKG = air quality background concentration

Q_i = emissions in year i

Q_B = base year emissions

This subroutine is called by MAIN, whereas the emissions fraction, Qi/Q_B is calculated by QPROJ. The air quality data file is output on unit device 'IAQ' (Default = Unit #9).

Common Blocks STRAT
REGION
GROWTH
IO

Arguments. NSTR = the number of control scenarios per group

NGR = the number of growth rate scenarios

NPY = the number of projection years

ENTRY EKMA (NSTR,NGR,NPY,RATIO, DELNOX)

Use. Provides an estimate of future ozone air quality concentrations by solving the Standard Isopleth Diagram from the Empirical Kinetic Modeling Approach (EKMA) using the ambient NMHC/NO_x ratio and expected changes in VOC and NO_x emissions. The starting point of the algorithm is obtained by finding the intersection of the ratio line and the base year concentration isopleth, e.g., point A on Figure A-1. The individual EKMA isopleths are represented by piece-wise line segments in the OZIPP data file. The isopleth file must be assigned to Unit 11. The NMHC, NO_x coordinates (X_o, Y_o) are multiplied by the expected percentage changes in emissions to obtain the post-control coordinates, X_o, Y. The post-control ozone value, Point A', is found by a sequential search which uses linear rollback to obtain a starting point. The procedure is a FORTRAN ENTRY POINT in LINEAR which is called by MAIN.

Arguments. NSTR = the number of control scenarios per group

NGR = the number of growth rate scenarios

NPY = the number of projection years

RATIO = the ambient NMOC/NO_x ratio

DELNOX = the ratio of projected to base year NO_x emissions

Program @US*ER.SORTSDF,A 9.,9.,NREC,132,KEY/29/3.A,KEY/20/8.A,KEY/5/15.A

Use. This UNIVAC processor performs an alphanumeric sort on the air quality data file. The sorted file is then read by program AQPRNT to produce the air quality summary results. The sort keys are growth rate scenario name, control scenario name and region name.

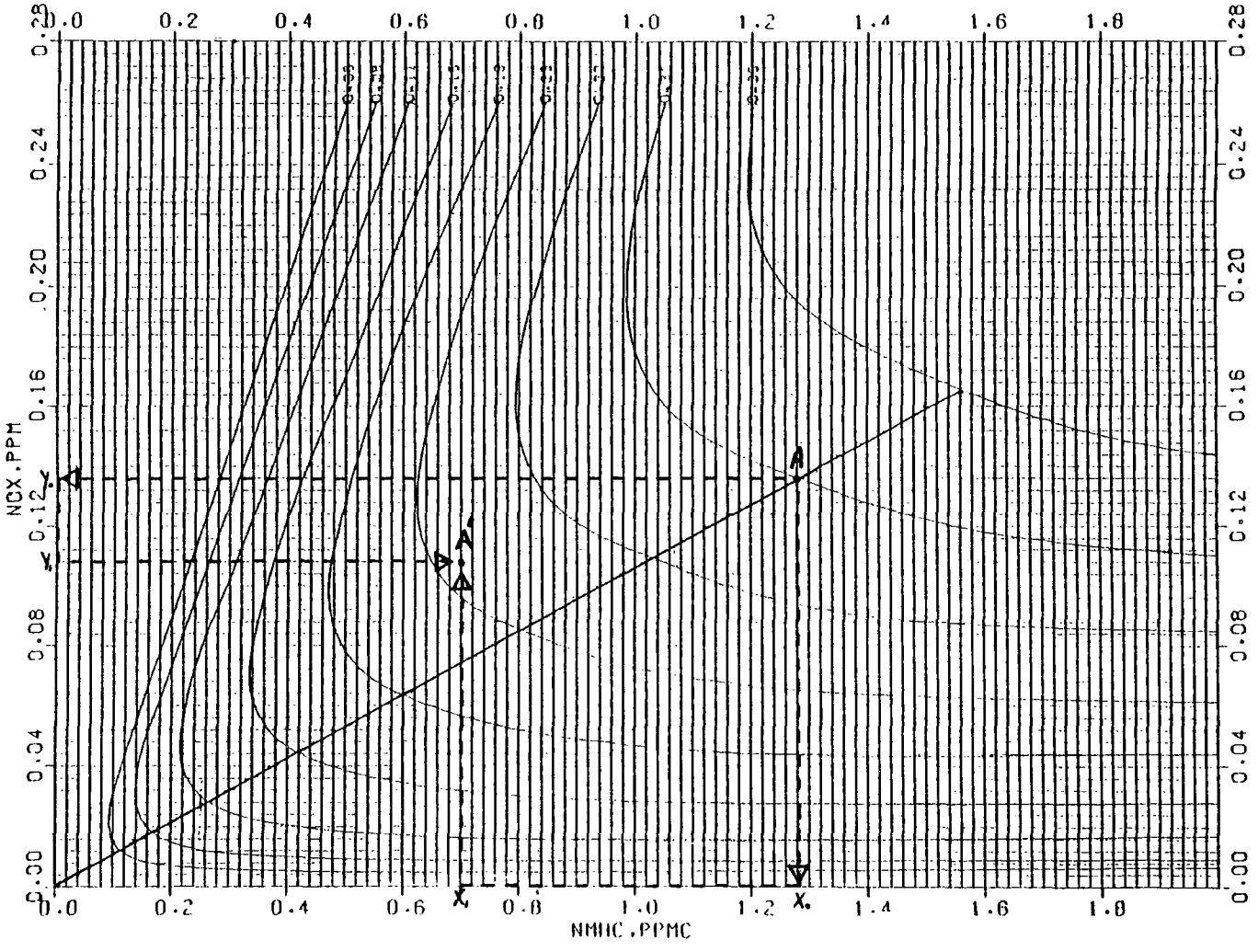

Figure A-1. Use of Standard EKMA Isopleth Diagram

Arguments. NREC = maximum number of records to be sorted

Program AQPRNT

Use. This program reads the sorted air quality data file and outputs the air quality summary reports. One report is generated for each growth rate/control scenario combination. These reports display the base year air quality design values, projection year air quality design values and expected exceedances for each source region modeled. Summary statistics include: (1) the average percent changes in air quality, (2) the number of source regions in violation of the NAAQS, and (3) the total number of expected exceedances. Data are input on Unit 9 and output on Unit 6.

SUBROUTINE VIOLA(PAQC,IPOLL,STD,NVIOL,RNDING)

Use. This subroutine is called by Program AQPRNT to calculate the expected number of exceedences of the appropriate NAAQS given the future year design value. The algorithm fits a tail-exponential distribution through the design value concentration point.

The exponential distribution has the form

$$F(C) = 1 - \exp(-C/\overline{C}) \qquad (1)$$

where

$F(C)$ = the fraction of the value which are less than or equal to the concentration(s).

$\overline{C}$ = the mean of the concentration.

As noted above, the only parameter needed to fully describe the exponential distribution is the mean. Thus, the projected design value, and its corresponding

frequency of occurrence, are sufficient to fully describe an exponential distribution unique to each area being modeled. For CO and O_3, the design value is assumed to be the second highest value for the specified averaging time.

The mean of an exponential distributed fitted through the projected design value for a specific source region is given by:

$$\overline{C}_j = DV_j/LOG(2/S) \qquad (2)$$

where

$\overline{C}$ = the mean of the exponential distribution for year j

DV_j = the design value for year j

S = the sample size, i.e., S= the number of hours in a year divided by the averaging time of the pollutant

j = year index.

Then the number of exceedances of the NAAQS can be estimated by

$$EXCEED = S*(EXP[-STD/\overline{C}]) - 1 \qquad (3)$$

where

EXCEED = the number of violations

S = the sample size

STD = the air quality standard

$\overline{C}$ = the mean from equation (2).

Obviously, if one is dealing with an annual standard, e.g., NO_2, then a direct comparison of the projected design value with the NAAQS can be made.

Arguments. PAQC = the future year design value

IPOLL = the pollutant sequence number

STD = the NAAQS concentration level

NVIOL = the calculated number of exceedances

RNDING = the rounding error used to determine violations of the NAAQS.

SUBROUTINE ACURAT (A, B, C, N)

Use. Adds a small number to single-precision floating point input values to account for machine accuracy differences.

Arguments. A = the first input variable

B = the second input variable

C = an input array

N = dimension of C

APPENDIX B

SOURCE PROGRAM LISTINGS

```
)LLBACK.MAIN
*07/01/81-12:36(8,)
C*********************************************************************
C  ROLLBACK MAIN ROUTINE -- HANDLES INPUT AND DRIVES SUBROUTINES      *
C*********************************************************************
      REAL*8 HDNGS(33),STRCHK
      REAL*4 RBCVNT(4)/1.15,1.15,1960.0,1880.0/
      INTEGER*4 EIFLAG,EIPLLS(4),GRWCHK(3),GRWRGN,LASTPY,DNOX(9)
      INTEGER*4 RECCNT/0/,RGNCHK(5),PREFIX,KODES(33),SSCF2(9)
      REAL*4 RBSTDS(4)/35.0,9.0,0.12,0.05/
      REAL*4 DECIML(4)/0.5,0.5,0.005,0.005/
      INTEGER*4 RBPLLS(4),RBPOLL,RBUNIT,RBPLCK,PPM
      REAL*4 SSCF(9),DELNOX(9)
      INTEGER*4 BLANK/'    '/
C  COMMON /STRAT/ DECLARATIONS
      REAL*8 SORCES(33),STRNAM(9)
      REAL*4 MSEFR(6,26,9,9),SSNEW(6,9,9,9),SSOLD(6,9,9,9)
      INTEGER*4 EIPOLL,IEIPLL,IRBPLL,PROJYR(9,9)
C  COMMON /REGION/ DECLARATIONS
      REAL*4 BAQC,BK,QMB(23),QSB(9),QBTOT
      INTEGER*4 BASEYR,RGNNAM(5)
C  COMMON /GROWTH/ DECLARATIONS
      REAL*4 MSGR(23,3),SSGR(9,3),SSRR(9,3),PAQC(3,9,9),PRPRTN(3,9,9),QM
     1P(23,3,9,9),QSP(9,3,9,9),QPTOT(3,9,9)
      INTEGER*4 GRWNAM(3)
C  COMMON /IO/ DECLARATIONS
      INTEGER*4 EI,IN,OUT
      COMMON /STRAT/ SORCES,STRNAM,MSEFR,SSNEW,SSOLD,EIPOLL,IEIPLL,IRBPL
     1L,PROJYR,RNDING,RBSTD
      COMMON /REGION/ BAQC,BK,QMB,QSB,QBTOT,BASEYR,RGNNAM,MS,NS,KODES
      COMMON /GROWTH/ MSGR,SSGR,SSRR,PAQC,PRPRTN,QMP,QSP,QPTOT,GRWNAM,SS
     1CF
      COMMON /IO/ EI,IN,OUT,IO,IAQ
      DATA NRBPLL /4/ ,RBPLLS /' CO ',' CO8',' O3 ',' NO2'/
C
      DATA HDNGS /'         ','  LDV-G ',' LDT1-G ',' LDT2-G ','   HDG  '
     1,' CYCLES ','  LDV-D ','  LDT1-D','  LDT2-D','   HDD  ',' RAILRD '
     2,' VESSELS','  ACR-MT','  ACR-CV','  ACR-CM',' FARM-G ','  LAWN  '
     3,'  SNOW-M',' INMCH-G',' CONST-G',' FARM-D ',' INMCH-D',' CONST-D'
     4,' OFFHGWY','  POINT ','   AREA ',' FUEL-CM',' OTHER  ',' PETROL '
     5,' STORAGE',' INDUST ',' A-SOLV ',' IN-SOLV'/
      DATA GRWCHK /3*'  '/ ,RBPLCK /'    '/ ,PPM /' PPM'/
C  VALID POLLUTANT ENTRY DECLARATIONS
      DATA NEIPLL /4/ ,EIPLLS /' CO ','NMHC',' VOC',' NOX'/
      DATA MXNGR /3/ ,MXNPY /9/ ,MXNSTR /9/ ,ISW /0/ ,KSW /1/
C
C-------------------------------------------------------------------*
C  START HERE                                                       *
C-------------------------------------------------------------------*
C  INITIALIZE COMMON AREAS
      IN=5
      OUT=6
C  GET I/O CONTROL CARD:
      READ (IN,10,ERR=520) EIFLAG,EI,IO,IAQ,EIPOLL,NRGN,NSTR,NPY,NGR,MS,
     1NS
   10 FORMAT (4I2,A4,3X,6(3X,I2))
      RECCNT=RECCNT+1
C  SET DEFAULTS
      IF (EI.EQ.0) EI=OUT
      IF (IAQ.EQ.0) IAQ=9
      IF (IO.EQ.0) IO=8
C  CHECK FOR DIMENSIONS OUT-OF-BOUNDS
      IF (NSTR.LT.1.OR.NSTR.GT.MXNSTR) GO TO 560
      IF (NPY.LT.1.OR.NPY.GT.MXNPY) GO TO 580
      IF (NGR.LT.1.OR.NGR.GT.MXNGR) GO TO 600
C  DETERMINE WHAT POLLUTANT IS BEING ANALYZED
      DO 20 IEIPLL=1,NEIPLL
        IF (EIPOLL.EQ.EIPLLS(IEIPLL)) GO TO 30
   20   CONTINUE
      GO TO 480
   30 NUM=MS+NS
      READ (IN,40) (KODES(I),I=1,NUM)
   40 FORMAT (33I2)
      RECCNT=RECCNT+1
C  SELECT HEADINGS FOR EACH SOURCE CATEGORY
      DO 50 I=1,NUM
        J=KODES(I)
```

```
1        76.          SORCES(I)=HDNGS(J+1)
1        77.     50   CONTINUE
         78.        IF (NUM.EQ.33) GO TO 70
         79.        IST=NUM+1
         80.        DO 60 I=IST,33
1        81.     60   SORCES(I)=HDNGS(1)
1        82.   C-----------------------------------------------------------------*
1        83.   C  GET THE STRATEGY SETS                                          *
1        84.   C-----------------------------------------------------------------*
         85.     70 DO 140 IRGN=1,NRGN
1        86.          DO 140 ISTR=1,NSTR
2        87.            DO 130 IPY=1,NPY
2        88.   C  GET THE PROJECTION YEAR CARDS FOR THIS STRATEGY.
3        89.              READ (IN,80,ERR=520,END=540) STRCHK,(MSEFR(IRGN,J,IPY,ISTR),
3        90.       1J=1,23),PROJYR(IPY,ISTR),(SSNEW(IRGN,J,IPY,ISTR),SSOLD(IRGN,J,IPY,
3        91.       2ISTR),J=1,9)
3        92.     80 FORMAT (A8,1X,23F3.2,I2,/,9X,18F3.2)
3        93.              RECCNT=RECCNT+2
3        94.              PREFIX=1900
3        95.              IF (PROJYR(IPY,ISTR).LT.70) PREFIX=2000
3        96.              PROJYR(IPY,ISTR)=PROJYR(IPY,ISTR)+PREFIX
3        97.              IF (IPY.NE.1) GO TO 90
3        98.   C  THIS IS THE FIRST PROJECTION YEAR
3        99.              STRNAM(ISTR)=STRCHK
3       100.              LASTPY=-1
3       101.     90       CONTINUE
3       102.   C  CHECK STRATEGY NAME AGAINST THAT GIVEN ON THE FIRST PROJECTION YEAR
3       103.              IF (STRNAM(ISTR).EQ.STRCHK) GO TO 110
3       104.   C  STRATEGY NAME DOES NOT MATCH
3       105.              WRITE (OUT,100) STRCHK,STRNAM(ISTR),RECCNT
3       106.    100 FORMAT (///1H0,'***WARNING: STRATEGY NAME CHECK: ','NAME IS ''',A8
3       107.       1,''', BUT EXPECTING ''',A8,''', AT RECCNT=',I5)
3       108.   C  CHECK PROJECTION YEAR FOR ASCENDING ORDER
3       109.    110       IF (PROJYR(IPY,ISTR).GT.LASTPY) GO TO 130
3       110.              WRITE (OUT,120) LASTPY,PROJYR(IPY,ISTR),RECCNT
3       111.    120 FORMAT (///1H0,'***WARNING: PROJECTION YEAR ','SEQUENCE CHECK:',/1
3       112.       1H ,T5,'PREVIOUS YEAR = ',I4,'. BUT THIS YEAR ','= ',I4,', AT RECCN
3       113.       2T=',I5)
3       114.    130       CONTINUE
2       115.    140     CONTINUE
2       116.   C  GET REGION CARD 1:
        117.    150 READ (IN,160,ERR=520,END=460) (RGNNAM(J),J=1,5),BAQC,BK,RBPOLL,RBU
        118.       1NIT,RATIO,DELNOX,DNOX,IRGN,BASEYR
        119.    160 FORMAT (A3,3A4,A3,1X,2F5.2,1X,A4,1X,A4,F4.1,9F3.2,T44,9A3,T77,I1,I
        120.       12)
        121.        CALL ACURAT(BAQC,BK,DUMMY,1)
        122.        IF(IRGN.EQ.0)IRGN=1
        123.        RECCNT=RECCNT+1
        124.        BASEYR=1900+BASEYR
        125.   C  GET REGION CARD 2,3,4:
        126.        READ (IN,170,ERR=520,END=540) RGNCHK(1),QMB,QSB,SSCF,SSCF2
        127.    170 FORMAT (A3,2X,11F6.0,/,5X,12F6.0,/,5X,9F6.0,9F2.1,T60,9A2)
        128.   C  INITIALIZE STATIONARY SOURCE CONTRIBUTION FACTORS, SSCF(I)
        129.        DO 180 I=1,9
1       130.          IF (SSCF2(I).EQ.BLANK) SSCF(I)=1.0
1       131.          IF (EIFLAG.EQ.2) SSCF(I)=1.0
1       132.          IF (DNOX(I).EQ.BLANK) DELNOX(I)=1.0
1       133.    180   CONTINUE
        134.        RECCNT=RECCNT+3
        135.   C  CHECK REGION CARDS FOR REGION NUMBER MATCH
        136.        IF (RGNNAM(1).EQ.RGNCHK(1)) GO TO 200
        137.        WRITE (OUT,190) (RGNNAM(I),I=1,5),RGNCHK,RECCNT
        138.    190 FORMAT (///1H0,'***WARNING: CHECK REGION NAMES.  ','REGION CARDS 1
        139.       1 AND 2 DO NOT MATCH:',/1H ,T5,'RGNNAM=''',A3,3A4,A3,''', BUT RGNCH
        140.       2K=''',A3,3A4,A3,''', AT RECCNT=',I5)
        141.        GO TO 210
        142.    200 CONTINUE
        143.    210 CONTINUE
        144.   C  CALCULATE BASE-YEAR COMPOSITE EMISSION RATE (Q)  (IN TONS/YEAR)
        145.        CALL QBASE
        146.   C-----------------------------------------------------------------*
        147.   C  GET GROWTH RATE CARDS:                                          *
        148.   C-----------------------------------------------------------------*
        149.        DO 270 IGR=1,NGR
1       150.          READ (IN,220,ERR=520,END=540) GRWRGN,GRWNAM(IGR),(MSGR(J,IGR),J=
1       151.       11,23),(SSGR(J,IGR),SSRR(J,IGR),J=1,9)
1       152.    220 FORMAT (A3,A2,4X,23F3.1,/,9X,18F3.1)
```

```
153.          RECCNT=RECCNT+2
154.   C  CHECK GROWTH CARD FOR PROPER REGION
155.          IF (RGNNAM(1).EQ.GRWRGN) GO TO 240
156.          WRITE (OUT,230) IRGN,RGNNAM(1),GRWRGN,RECCNT
157.     230 FORMAT (///1H0,'***WARNING: A GROWTH RATE CARD ','MAY BE IN THE WR
158.        1ONG REGION:',/1H ,T5,'RGNNAM(1,',I2,')=''',A3,''', BUT ','GRWRGN='
159.        2'',A3,''', AT RECCNT=',I5)
160.     240  CONTINUE
161.   C  CHECK THE ORDER OF NAMES OF GROWTH RATE SCENARIOS
162.          IF (KSW.EQ.1) GO TO 260
163.          IF (GRWNAM(IGR).EQ.GRWCHK(IGR)) GO TO 260
164.          WRITE (OUT,250) GRWNAM(IGR),GRWCHK(IGR),RECCNT
165.     250 FORMAT (///1H0,'***WARNING: CHECK GROWTH RATE ','SCENARIO NAME.  T
166.        1HE GROWTH NAMES UNDER THE ','FIRST REGION SHOULD CORRESPOND',/1H ,
167.        2T5,'EXACTLY WITH THOSE UNDER EVERY OTHER ','REGION.',/1H ,T5,'GRWN
168.        3AM=''',A2,''', BUT GRWCHK=''',A2,''', AT RECCNT=',I5)
169.     260  GRWCHK(IGR)=GRWNAM(IGR)
170.     270  CONTINUE
171.   C-----------------------------------------------------------------------*
172.   C  CALCULATE PROJECTED COMPOSITE EMISSION RATES (Q, IN TONS/YEAR)      *
173.   C  SAVE THE QP/QB PROPORTIONS FOR ROLLBACK PROJECTIONS                 *
174.   C-----------------------------------------------------------------------*
175.        DO 300 ISTR=1,NSTR
176.          DO 290 IPY=1,NPY
177.   C  DETERMINE TIME PERIOD FROM BASE-YEAR TO PROJECTION-YEAR
178.            DYR=PROJYR(IPY,ISTR)-BASEYR
179.            DO 280 IGR=1,NGR
180.   C  CALCULATE PROJECTION-YEAR COMPOSITE EMISSION RATE (Q)  (IN TONS/YEAR)
181.              CALL QPROJ (IRGN,IGR,IPY,ISTR,DYR)
182.   C  CALCULATE AND SAVE THE QP/QB PROPORTION
183.              PRPRTN(IGR,IPY,ISTR)=QPTOT(IGR,IPY,ISTR)/QBTOT
184.     280      CONTINUE
185.     290    CONTINUE
186.     300  CONTINUE
187.   C-----------------------------------------------------------------------*
188.   C  WRITE PROJECTION-YEAR AIR QUALITY DATA FILE
189.   C-----------------------------------------------------------------------*
190.        IF (EIFLAG.GE.1) GO TO 450
191.        DO 310 IRBPLL=1,NRBPLL
192.          IF (RBPOLL.EQ.RBPLLS(IRBPLL)) GO TO 320
193.     310  CONTINUE
194.   C  RBPOLL ON REGION-CARD-1 IS INVALID.
195.        GO TO 620
196.   C  RBPOLL ON REGION-CARD-1 IS VALID.
197.     320 RBPLCK=RBPOLL
198.   C  SET ROLLBACK STANDARD
199.        RBSTD=RBSTDS(IRBPLL)
200.        RNDING=DECIML(IRBPLL)
201.        IF (RBUNIT.EQ.PPM) GO TO 330
202.        BAQC=BAQC/RBCVNT(IRBPLL)
203.        BK=BK/RBCVNT(IRBPLL)
204.        RBUNIT=PPM
205.   C  PERFORM AIR QUALITY PROJECTIONS BASED ON POLLUTANT TYPE
206.   C
207.     330 IF (IRBPLL.EQ.3) CALL EKMA (NSTR,NGR,NPY,RATIO,DELNOX)
208.        IF (IRBPLL.NE.3) CALL LINEAR (NSTR,NGR,NPY)
209.   C
210.   C  WRITE HEADER RECORD ON AQ FILE
211.   C
212.        IF (ISW.NE.0) GO TO 350
213.        WRITE (IAQ,340) RBPOLL,RBUNIT,RBSTD,RNDING,IRBPLL,NPY
214.     340 FORMAT (2A4,F6.2,F5.3,1X,2I2)
215.        ISW=1
216.   C  SELECT THE PROPER FORMAT CODE (DEPENDS ON THE POLLUTANT)
217.     350 DO 440 ISTR=1,NSTR
218.          DO 430 IGR=1,NGR
219.            GO TO (360,360,380,380,380,380,380), IRBPLL
220.     360    WRITE (IAQ,370) (RGNNAM(J),J=1,5),STRNAM(ISTR),GRWNAM(IGR),BAS
221.        1EYR,BAQC,BK,(PROJYR(IPY,ISTR),PAQC(IGR,IPY,ISTR),IPY=1,NPY)
222.     370 FORMAT (1X,A3,3A4,A3,1X,A8,1X,A2,2X,I4,2F5.1,2X,9(I5,F5.1))
223.            GO TO 420
224.     380    IF (BK.LT.0.01) GO TO 400
225.            WRITE (IAQ,390) (RGNNAM(J),J=1,5),STRNAM(ISTR),GRWNAM(IGR),BAS
226.        1EYR,BAQC,BK,(PROJYR(IPY,ISTR),PAQC(IGR,IPY,ISTR),IPY=1,NPY)
227.     390 FORMAT (1X,A3,3A4,A3,1X,A8,1X,A2,2X,I4,F5.3,F5.2,2X,9(I5,F5.3))
228.            GO TO 420
229.   C  BK IS SMALL, SO DISPLAY EXTRA DIGIT SO IT WILL NOT APPEAR AS ZERO
```

```
2      400     WRITE (IAQ,410) (RGNNAM(J),J=1,5),STRNAM(ISTR),GRWNAM(IGR),BAS
2         1EYR,BAQC,BK,(PROJYR(IPY,ISTR),PAQC(IGR,IPY,ISTR),IPY=1,NPY)
2      410 FORMAT (1H ,A3,3A4,A3,1X,A8,1X,A2,2X,I4,2F5.3,2X,9(I5,F5.3))
2      420     CONTINUE
2      430     CONTINUE
1      440   CONTINUE
1    C-----------------------------------------------------------------*
1    C  PRINT PROJECTION-YEAR EMISSION INVENTORY                       *
1    C-----------------------------------------------------------------*
1    C
       450 CALL EIPRNT (NSTR,NGR,NPY)
           KSW=0
           GO TO 150
     C-----------------------------------------------------------------*
     C  PROGRAM EXIT POINT                                             *
     C-----------------------------------------------------------------*
       460 CONTINUE
           WRITE (OUT,470) RECCNT
       470 FORMAT (1H1,'*** STOP WITH RECCNT=',I5)
           STOP
     C-----------------------------------------------------------------*
     C  ERRORS:                                                        *
     C-----------------------------------------------------------------*
     C  INVALID POLLUTANT ENTRY ON SOURCE NAME CARD
       480 WRITE (OUT,490) EIPOLL
       490 FORMAT (1H ,'*** ERROR: ''',A4,''' IS NOT A VALID POLLUTANT ','ENT
          1RY FOR THIS PROGRAM.  VALID ENTRIES ARE:')
           DO 500 IEIPLL=1,NEIPLL
1      500   WRITE (OUT,510) EIPLLS(IEIPLL)
       510 FORMAT (1H ,T5,'''',A4,'''')
           GO TO 460
     C  ERROR ON READ
       520 RECCNT=RECCNT+1
           WRITE (OUT,530)
       530 FORMAT (///1H0,'***ERROR: READ ERROR...SEE RECCNT. ***')
           GO TO 460
     C  UNEXPECTED END-OF-FILE
       540 WRITE (OUT,550)
       550 FORMAT (///1H0,'***ERROR: UNEXPECTED END-OF-FILE ***')
           GO TO 460
     C  CONTROL ERRORS
       560 WRITE (OUT,570) NSTR,MXNSTR
       570 FORMAT (1H0,'*** ERROR: 1 <= (NSTR=',I2,') <= (MXNSTR=',I2,')  ??'
          1)
           GO TO 460
       580 WRITE (OUT,590) NPY,MXNPY
       590 FORMAT (1H0,'*** ERROR: 1 <= (NPY=',I2,') <= (MXNPY=',I2,') ??')
           GO TO 460
       600 WRITE (OUT,610) NGR,MXNGR
       610 FORMAT (1H0,'*** ERROR: 1 <= (NGR=',I2,') <= (MXNGR=',I2,') ??')
           GO TO 460
       620 WRITE (OUT,630) RBPOLL
       630 FORMAT (1H ,'*** ERROR:''',A4,''' IS NOT A VALID POLLUTANT')
           GO TO 460
     C
           END
```

END FTN 514 IBANK 1107 DBANK 30275 COMMON

ROLLBACK.RLLBCK
*07/01/81-12:36(5,)

```
C*********************************************************************
C  RLLBCK -- (ENTRIES: LINEAR,EKMA)
C*********************************************************************
C
      SUBROUTINE LINEAR (NSTR,NGR,NPY)
C  COMMON /STRAT/ DECLARATIONS
      REAL*8 SORCES(33),STRNAM(9)
      REAL*4 MSEFR(6,26,9,9),SSNEW(6,9,9,9),SSOLD(6,9,9,9)
      INTEGER*4 EIPOLL,IEIPLL,IRBPLL,PROJYR(9,9),SSCF(9)
C  COMMON /REGION/ DECLARATIONS
      REAL*4 BAQC,BK,QMB(23),QSB(9),QBTOT
      INTEGER*4 BASEYR,RGNNAM(5),KODES(33)
C  COMMON /GROWTH/ DECLARATIONS
      REAL*4 MSGR(23,3),SSGR(9,3),SSRR(9,3),PAQC(3,9,9),PRPRTN(3,9,9),QM
     1P(23,3,9,9),QSP(9,3,9,9),QPTOT(3,9,9)
      INTEGER*4 GRWNAM(3)
C  COMMON /IO/ DECLARATIONS
      INTEGER*4 EI,IN,OUT
      COMMON /STRAT/ SORCES,STRNAM,MSEFR,SSNEW,SSOLD,EIPOLL,IEIPLL,IRBPL
     1L,PROJYR,RNDING,RBSTD
      COMMON /REGION/ BAQC,BK,QMB,QSB,QBTOT,BASEYR,RGNNAM,MS,NS,KODES
      COMMON /GROWTH/ MSGR,SSGR,SSRR,PAQC,PRPRTN,QMP,QSP,QPTOT,GRWNAM,SS
     1CF
      COMMON /IO/ EI,IN,OUT,IO,IAQ
C  START HERE
      DO 30 ISTR=1,NSTR
        DO 20 IGR=1,NGR
          DO 10 IPY=1,NPY
C  CALCULATE LINEAR PROJECTIONS OF AIR QUALITY
            PAQC(IGR,IPY,ISTR)=BK+(BAQC-BK)*PRPRTN(IGR,IPY,ISTR)
   10       CONTINUE
   20     CONTINUE
   30   CONTINUE
      GO TO 250
C
C-----------------------------------------------------------------------*
C
      ENTRY EKMA (NSTR,NGR,NPY,RATIO,DELNOX)
      REAL HC(200),NOX(200),DELNOX(9)
      INTEGER TEST/0/
      IF(TEST.EQ.1)GO TO 35
      TEST=1
      DEFINE FILE 11(50,401,U,IPT)
   35 BK=RATIO
      IS=(BAQC*100+0.5)
      READ (11'IS) NP,HC,NOX
      ISTOP=NP-1
      DO 40 I=1,ISTOP
        IF (RATIO.GE.(HC(I)/NOX(I)).AND.RATIO.LE.(HC(I+1)/NOX(I+1))) GO
     1TO 50
   40   CONTINUE
      GO TO 200
   50 OZONE=FLOAT(IS)*0.01
      SLOPE=(NOX(I)-NOX(I+1))/(HC(I)-HC(I+1))
      B=NOX(I)-SLOPE*HC(I)
      YB=B/(1.0-SLOPE*RATIO)
      XB=RATIO*YB
      DO 190 ISTR=1,NSTR
        DO 180 IGR=1,NGR
          DO 170 IPY=1,NPY
            YP=DELNOX(IPY)*YB
            XP=PRPRTN(IGR,IPY,ISTR)*XB
            RSTAR=XP/YP
            N=FLOAT(IS)*PRPRTN(IGR,IPY,ISTR)
            IF (N.LT.4) N=4
   60       READ (11'N) NP,HC,NOX
            OZONE=FLOAT(N)*0.01
            ISTOP=NP-1
            DO 70 I=1,ISTOP
              IF (RSTAR.GE.(HC(I)/NOX(I)).AND.RSTAR.LE.(HC(I+1)/NOX(I+1)
     1)) GO TO 80
   70         CONTINUE
            GO TO 90
   80       SLOPE=(NOX(I)-NOX(I+1))/(HC(I)-HC(I+1))
            B=NOX(I)-SLOPE*HC(I)
```

```
3        76.                Y1=B/(1.0-SLOPE*RSTAR)
3        77.                X1=RSTAR*Y1
3        78.                IF (X1.LE.XP) GO TO 100
3        79.       90       N=N-1
3        80.                IF (N.LT.4) GO TO 150
3        81.                GO TO 60
3        82.      100       N=N+1
3        83.                IF (N.GT.40) GO TO 130
3        84.                READ (11'N) NP,HC,NOX
3        85.                OZONE=FLOAT(N)*0.01
3        86.                ISTOP=NP-1
3        87.                DO 110 I=1,ISTOP
4        88.                  IF (RSTAR.GE.(HC(I)/NOX(I)).AND.RSTAR.LE.(HC(I+1)/NOX(I+1)
4        89.          1)) GO TO 120
4        90.      110         CONTINUE
3        91.                GO TO 130
3        92.      120       SLOPE=(NOX(I)-NOX(I+1))/(HC(I)-HC(I+1))
3        93.                B=NOX(I)-SLOPE*HC(I)
3        94.                Y2=B/(1.0-SLOPE*RSTAR)
3        95.                X2=RSTAR*Y2
3        96.                IF (XP.GE.X1.AND.XP.LE.X2) GO TO 160
3        97.                X1=X2
3        98.    C     Y1=Y2
3        99.                GO TO 100
3       100.      130       CONTINUE
3       101.                WRITE (OUT,140) (RGNNAM(J),J=1,5),ISTR,IGR,IPY,XP,YP
3       102.      140 FORMAT (1H0,' *** EKMA ERROR *** ',/,1X,A3,3A4,A3,' STRAT=',I2,' G
3       103.          1R=',I2,' PY=',I2,' HC=',F5.2,' NOX=',F5.3)
3       104.                PAQC(IGR,IPY,ISTR)=99.99
3       105.                GO TO 170
3       106.      150       PAQC(IGR,IPY,ISTR)=.04
3       107.                GO TO 170
3       108.      160       DIFF=0.01
3       109.    C
3       110.    C   INTERPOLATE OZONE LEVEL ON HC BASIS
3       111.    C
3       112.                PAQC(IGR,IPY,ISTR)=((XP-X1)/(X2-X1))*DIFF+(OZONE-0.01)
3       113.      170       CONTINUE
2       114.      180     CONTINUE
1       115.      190   CONTINUE
        116.          GO TO 250
        117.      200 WRITE (6,210) (RGNNAM(J),J=1,5),BAQC,RATIO
        118.      210 FORMAT (1H0,' *** EKMA ERROR ***',/,1X,A3,3A4,A3,' DV=',F4.2,' RAT
        119.          1IO=',F5.1)
        120.          DO 240 ISTR=1,NSTR
1       121.            DO 230 IGR=1,NGR
2       122.              DO 220 IPY=1,NPY
3       123.                PAQC(IGR,IPY,ISTR)=9999.9
3       124.      220       CONTINUE
2       125.      230     CONTINUE
1       126.      240   CONTINUE
        127.      250 RETURN
        128.    C
        129.          END
```

END FTN 423 IBANK 571 DBANK 30275 COMMON

OLLBACK.EIPRNT
*07/01/81-12:36(4,)

```
C*********************************************************************
C   PRINTS EMISSION INVENTORY REPORTS
C*********************************************************************
C
      SUBROUTINE EIPRNT (NSTR,NGR,NPY)
C
C  COMMON /STRAT/ DECLARATIONS
      REAL*8 SORCES(33),STRNAM(9)
      REAL*4 MSEFR(6,26,9,9),SSNEW(6,9,9,9),SSOLD(6,9,9,9)
      INTEGER*4 EIPOLL,IEIPLL,IRBPLL,PROJYR(9,9),KODES(33)
C  COMMON /REGION/ DECLARATIONS
      REAL*4 QMB(23),QSB(9),QBTOT,BFILL(33),PFILL(33)
      REAL*4 QMSUB(9),QSUB(9),TOTAL(9)
      INTEGER*4 BASEYR,RGNNAM(5)
C  COMMON /GROWTH/ DECLARATIONS
      REAL*4 MSGR(23,3),SSGR(9,3),SSRR(9,3),PAQC(3,9,9),SSCF(9),PRPRTN(3
     1,9,9),QMP(23,3,9,9),QSP(9,3,9,9),QPTOT(3,9,9)
      INTEGER*4 GRWNAM(3)
C  COMMON /IO/ DECLARATIONS
      INTEGER*4 EI,IN,OUT
      COMMON /STRAT/ SORCES,STRNAM,MSEFR,SSNEW,SSOLD,EIPOLL,IEIPLL,IRBPL
     1L,PROJYR,RNDING,RBSTD
      COMMON /REGION/ BAQC,BK,QMB,QSB,QBTOT,BASEYR,RGNNAM,MS,NS,KODES
      COMMON /GROWTH/ MSGR,SSGR,SSRR,PAQC,PRPRTN,QMP,QSP,QPTOT,GRWNAM,SS
     1CF
      COMMON /IO/ EI,IN,OUT,IO,IAQ
      DATA BFILL /33*0.0/ ,PFILL /33*0.0/
      NUM=MS+NS
      SUB1=0.0
      SUB2=0.0
      DO 10 I=1,MS
        J=KODES(I)
        SUB1=SUB1+QMB(J)
   10   BFILL(I)=QMB(J)
      DO 20 I=1,NS
        J=KODES(I+MS)-23
        SUB2=SUB2+QSB(J)
   20   BFILL(I+MS)=QSB(J)
      QTOT=SUB1+SUB2
      DO 200 ISTR=1,NSTR
        DO 190 IGR=1,NGR
      IX=0
          IST=1
          ISTP=12
          IF (NUM.LT.12) ISTP=NUM
          WRITE (EI,30) (RGNNAM(J),J=1,5),STRNAM(ISTR),GRWNAM(IGR),EIPOL
     1L
   30 FORMAT (1H1,25X,'***   EMISSIONS INVENTORY PROJECTIONS','   ***',/
     11H0,' LOCATION: ',A3,3A4,A3,T50,'STRATEGY:',A8,T80,'GROWTH RATE:',
     2A4/1H0,'POLLUTANT: ',A4,/1H0,T27,14X,'EMISSIONS (1000 TONS/YEAR)',
     3//1H0,T27,10X,'S O U R C E  C A T E G O R I E S',//)
C
   40     WRITE (EI,50) (SORCES(I),I=IST,ISTP)
   50 FORMAT (//,T15,12A8)
          WRITE (EI,60)
   60 FORMAT (1X,'BASE YR',/)
          WRITE (EI,130) BASEYR,(BFILL(I),I=IST,ISTP)
          WRITE (EI,70)
   70 FORMAT (1X,'PROJ YR',/)
          IF (IX.NE.0) GO TO 100
          WRITE (IO,80) (RGNNAM(J),J=1,5),STRNAM(ISTR),GRWNAM(IGR),EIPOL
     1L,NPY,NUM,(KODES(J),J=1,NUM)
   80 FORMAT (A3,3A4,A3,1X,A8,2(1X,A4),I2,I4,33I2)
          WRITE (IO,90) BASEYR,SUB1,SUB2,QTOT,(BFILL(J),J=1,NUM)
   90 FORMAT (I4,14F8.1,2(/,28X,12F8.1))
  100     DO 140 IPY=1,NPY
            QMSUB(IPY)=0.0
            QSUB(IPY)=0.0
            DO 110 I=1,MS
              J=KODES(I)
              PFILL(I)=QMP(J,IGR,IPY,ISTR)
  110         QMSUB(IPY)=QMSUB(IPY)+PFILL(I)
            DO 120 I=1,NS
              J=KODES(I+MS)-23
              PFILL(I+MS)=QSP(J,IGR,IPY,ISTR)
```

```
4        76.     120          QSUB(IPY)=QSUB(IPY)+PFILL(I+MS)
3        77.                TOTAL(IPY)=QSUB(IPY)+QMSUB(IPY)
3        78.                WRITE (EI,130) PROJYR(IPY,ISTR),(PFILL(J),J=IST,ISTP)
3        79.     130 FORMAT (1H ,1X,I4,T15,12(1X,F6.1,1X))
3        80.                IF (IX.EQ.0) WRITE (IO,90) PROJYR(IPY,ISTR),QMSUB(IPY),QSUB(
3        81.        1IPY),TOTAL(IPY),(PFILL(J),J=1,NUM)
3        82.     140        CONTINUE
2        83.         IX=1
2        84.             IF (NUM.LE.ISTP) GO TO 150
2        85.             IST=IST+12
2        86.             ISTP=ISTP+12
2        87.             IF (NUM.LT.ISTP) ISTP=NUM
2        88.             GO TO 40
2        89.     150     WRITE (EI,160)
2        90.     160 FORMAT (/1H0,13X,'MOBILE',5X,'STATIONARY',5X,'GRAND',/2X,'YEAR',8X
2        91.        1,'TOTAL',8X,'TOTAL',8X,'TOTAL',/)
2        92.             WRITE (EI,170) BASEYR,SUB1,SUB2,QTOT
2        93.     170 FORMAT (I6,6X,F7.1,6X,F7.1,6X,F8.1)
2        94.             DO 180 I=1,NPY
3        95.     180       WRITE (EI,170) PROJYR(I,ISTR),QMSUB(I),QSUB(I),TOTAL(I)
2        96.     190     CONTINUE
1        97.     200   CONTINUE
         98.         RETURN
         99.   C
        100.         END

END FTN 247 IBANK 497 DBANK 30275 COMMON
```

OLLBACK.QBASE
*07/01/81-12:36(4,)

```
C*********************************************************************. *****
C   CALCULATES BASE YEAR AND PROJECTION YEAR INVENTORIES
C*********************************************************************. *****
C
      SUBROUTINE QBASE
      REAL*4 SSCF(9)
C  COMMON /STRAT/ DECLARATIONS
      REAL*8 SORCES(33),STRNAM(9)
      REAL*4 MSEFR(6,26,9,9),SSNEW(6,9,9,9),SSOLD(6,9,9,9)
      INTEGER*4 EIPOLL,IEIPLL,IRBPLL,PROJYR(9,9),KODES(33)
C  COMMON /REGION/ DECLARATIONS
      REAL*4 BAQC,BK,QMB(23),QSB(9),QBTOT
      INTEGER*4 BASEYR,RGNNAM(5)
C  COMMON /GROWTH/ DECLARATIONS
      REAL*4 MSGR(23,3),SSGR(9,3),SSRR(9,3),PAQC(3,9,9),PRPRTN(3,9,9),QM
     1P(23,3,9,9),QSP(9,3,9,9),QPTOT(3,9,9)
      INTEGER*4 GRWNAM(3)
C  COMMON /IO/ DECLARATIONS
      INTEGER*4 EI,IN,OUT
      COMMON /STRAT/ SORCES,STRNAM,MSEFR,SSNEW,SSOLD,EIPOLL,IEIPLL,IRBPL
     1L,PROJYR,RNDING,RBSTD
      COMMON /REGION/ BAQC,BK,QMB,QSB,QBTOT,BASEYR,RGNNAM,MS,NS,KODES
      COMMON /GROWTH/ MSGR,SSGR,SSRR,PAQC,PRPRTN,QMP,QSP,QPTOT,GRWNAM,SS
     1CF
      COMMON /IO/ EI,IN,OUT,IO,IAQ
      REAL*4 NEWGRW,OLDRET
C  DEFINE THE COMPOUND GROWTH RATE
      CMGRRT(GR)=(1.0+GR*0.01)**DYR
C
      QBTOT=0.0
      DO 10 I=1,MS
        J=KODES(I)
   10   QBTOT=QBTOT+QMB(J)
      DO 20 I=1,NS
        J=KODES(I+MS)-23
        QSB(J)=QSB(J)*SSCF(J)
   20   QBTOT=QBTOT+QSB(J)
      GO TO 50
C
C-----------------------------------------------------------------------*
C
      ENTRY QPROJ (IRGN,IGR,IPY,ISTR,DYR)
      QPTOT(IGR,IPY,ISTR)=0.0
      DO 30 I=1,MS
        J=KODES(I)
        QMP(J,IGR,IPY,ISTR)=QMB(J)*MSEFR(IRGN,J,IPY,ISTR)*CMGRRT(MSGR(J,
     1IGR))
   30   QPTOT(IGR,IPY,ISTR)=QPTOT(IGR,IPY,ISTR)+QMP(J,IGR,IPY,ISTR)
      DO 40 I=1,NS
        J=KODES(I+MS)-23
        NEWGRW=(CMGRRT(SSGR(J,IGR))-1.)*SSNEW(IRGN,J,IPY,ISTR)+(1.-CMGRR
     1T(-SSRR(J,IGR)))*SSNEW(IRGN,J,IPY,ISTR)
        OLDRET=(CMGRRT(-SSRR(J,IGR)))*SSOLD(IRGN,J,IPY,ISTR)
        QSP(J,IGR,IPY,ISTR)=QSB(J)*(NEWGRW+OLDRET)
   40   QPTOT(IGR,IPY,ISTR)=QPTOT(IGR,IPY,ISTR)+QSP(J,IGR,IPY,ISTR)
   50 RETURN
C
      END
```

I 278 IBANK 36 DBANK 30275 COMMON

```
)FTN,S ROLLBACK.ACURAT
FTN 8R1  *07/01/81-12:36(4,)
            1.          SUBROUTINE ACURAT(A,B,C,N)
            2.          DIMENSION C(N)
            3.          DATA X/1.E-6/
            4.          A=A+X
            5.          B=B+X
            6.          DO 1 I=1,N
  1         7.        1 C(I)=C(I)+X
            8.          RETURN
            9.          END

END FTN 45 IBANK 17 DBANK
```

```
OLLBACK.AQPRNT
 *07/01/81-12:36(13,)
C*********************************************************************
C   PRINTS ROLLBACK AIR QUALITY DATA FILE
C*********************************************************************
C
      REAL*4 AVRCHG(9),RGNNAM(5),PAQC(9),RBSTD
      INTEGER*4 PROJYR(9),NVIOL(9),BASEYR
      INTEGER*4 NCAS(9),KVIOL(9),OZONE/' O3 '/,CO8/' CO8'/,CO/' CO '/,OU
     1T,NO2/' NO2'/
      INTEGER*4 CONC/'CONC'/,EXEX/'EXEX'/,RBPOLL,RBUNIT
      REAL*8 STRNAM,STRAT,GRWNAM,GRWTH,HNDG(2)
      DATA HNDG /'BKGD ','RATIO'/
      IP=1
      OUT=6
      IN=9
      ISW=0
C  INITIALIZE SUMMARY COUNTERS (WHICH COUNT ACROSS REGIONS) TO ZERO
      READ (IN,10) RBPOLL,RBUNIT,RBSTD,RNDING,IRBPLL,NPY
   10 FORMAT (2A4,F6.0,F5.0,1X,2I2)
      CALL ACURAT(RBSTD,DUMMY,DUMMY,1)
      DO 20 IPY=1,NPY
        AVRCHG(IPY)=0.0
        NCAS(IPY)=0
   20   KVIOL(IPY)=0
      READ (IN,30,END=310) (RGNNAM(J),J=1,5),STRNAM,GRWNAM,BASEYR,BAQC,B
     1K,(PROJYR(J),PAQC(J),J=1,NPY)
   30 FORMAT (1X,A3,3A4,A3,1X,A8,1X,A2,2X,I4,2(1X,F4.0),2X,9(I5,F5.0))
      CALL ACURAT(BAQC,BK,PAQC,9)
      DO 40 I=1,NPY
        CALL VIOLA (PAQC(I),IRBPLL,RBSTD,NVIOL(I),RNDING)
   40   CONTINUE
   50 STRAT=STRNAM
      GRWTH=GRWNAM
      NRGN=0
      IF (RBPOLL.NE.OZONE) GO TO 70
      IP=2
      WRITE (OUT,60)
   60 FORMAT (1H1/1H0,31X,'E K M A ')
      GO TO 90
   70 WRITE (OUT,80)
   80 FORMAT (1H1/1H0,20X,'L I N E A R    R O L L B A C K')
   90 WRITE (OUT,100) STRNAM,GRWNAM
  100 FORMAT (1H0,12X,'STRATEGY:',1X,A8,4X,'GROWTH RATE SCENARIO:',1X,A2
     1)
      WRITE (OUT,110) RBPOLL,RBUNIT,RBSTD,RBUNIT
  110 FORMAT (1H0,9X,A4,' AIR QUALITY CONCENTRATION (',A4,') AND VIOLATI
     1ONS',/1H ,23X,'(STANDARD IS ',F5.2,1X,A4,')')
      WRITE (OUT,120)
  120 FORMAT (1H0,T36,'P R O J E C T E D',/)
      WRITE (OUT,130) (PROJYR(IPY),IPY=1,NPY)
  130 FORMAT (1H0,T21,3X,'B A S E',T36,9(3X,I4,3X))
      WRITE (OUT,140) HNDG(IP),(CONC,EXEX,I=1,NPY)
  140 FORMAT (/1H ,3X,'R E G I O N',T21,'YEAR CONC ',A5,T36,9(1X,A4,1X,A
     14))
C  PRINT LINEAR ROLLBACK TABLE OF PROJECTED AQC AND NUMB OF VIOLATIONS
  150 DO 160 IPY=1,NPY
        AVRCHG(IPY)=AVRCHG(IPY)+100.0*(PAQC(IPY)/BAQC-1.0)
        KVIOL(IPY)=KVIOL(IPY)+NVIOL(IPY)
        IF (NVIOL(IPY).GT.0) NCAS(IPY)=NCAS(IPY)+1
  160   CONTINUE
      IF (RBPOLL.EQ.CO8.OR.RBPOLL.EQ.CO) GO TO 180
      IF (RBPOLL.EQ.NO2) GO TO 200
      WRITE (OUT,170) (RGNNAM(J),J=1,5),BASEYR,BAQC,BK,(PAQC(IPY),NVIOL(
     1IPY),IPY=1,NPY)
  170 FORMAT (1H ,A3,3A4,A3,T21,I4,2F5.2,T35,9(F6.2,I4))
      GO TO 220
  180 WRITE (OUT,190) (RGNNAM(J),J=1,5),BASEYR,BAQC,BK,(PAQC(IPY),NVIOL(
     1IPY),IPY=1,NPY)
  190 FORMAT (1H ,A3,3A4,A3,T21,I4,2F5.0,T35,9(F6.0,I4))
      GO TO 220
  200 WRITE (OUT,210) (RGNNAM(J),J=1,5),BASEYR,BAQC,BK,(PAQC(IPY),NVIOL(
     1IPY),IPY=1,NPY)
  210 FORMAT (1H ,A3,3A4,A3,T21,I4,F5.2,F5.3,T35,9(F6.2,I4))
  220 READ (IN,30,END=310) (RGNNAM(J),J=1,5),STRNAM,GRWNAM,BASEYR,BAQC,B
     1K,(PROJYR(J),PAQC(J),J=1,NPY)
      CALL ACURAT(BAQC,BK,PAQC,9)
```

```
          DO 230 J=1,NPY
1           CALL VIOLA (PAQC(J),IRBPLL,RBSTD,NVIOL(J),RNDING)
1     230   CONTINUE
          NRGN=NRGN+1
          IF (STRNAM.EQ.STRAT.AND.GRWNAM.EQ.GRWTH) GO TO 150
C  DIVIDE THE TOTAL PERCENT CHANGE BY NUMBER OF REGIONS TO GET AVERAGE
      240 DO 250 IPY=1,NPY
1     250   AVRCHG(IPY)=AVRCHG(IPY)/NRGN
C  PRINT SUMMARY
          WRITE (OUT,260) (AVRCHG(IPY),IPY=1,NPY)
      260 FORMAT (/1H0,'AVERAGE PERCENT CHANGE',T36,9(5X,F5.0))
          WRITE (OUT,270) (NCAS(IPY),IPY=1,NPY)
      270 FORMAT (1H ,'NO. OF REGIONS ABOVE STD',T36,9(7X,I3))
          WRITE (OUT,280) (KVIOL(IPY),IPY=1,NPY)
      280 FORMAT (1H ,'TOTAL NO. OF EXCEEDANCES',T36,9(4X,I6))
          WRITE (OUT,290)
      290 FORMAT (/////,' *** NOTE: AIR QUALITY CONCENTRATIONS ARE ','ROUNDE
         1D FOR DISPLAY FOLLOWING EPA GUIDELINES.',/,' THUS, COMPARISONS WIT
         2H STANDARDS AND PERCENT CHANGES ARE BASED ON ONE ADDITIONAL SIGNIF
         3ICANT FIGURE.')
          DO 300 IPY=1,NPY
1           AVRCHG(IPY)=0.0
1           NCAS(IPY)=0
1     300   KVIOL(IPY)=0
          IF (ISW.EQ.1) GO TO 320
          GO TO 50
      310 ISW=1
          NRGN=NRGN+1
          GO TO 240
      320 STOP
C
          END
```

END FTN 212 IBANK 669 DBANK

ROLLBACK.VIOLA
*07/01/81-12:36(3,)

```
C*********************************************************************
C  VIOLA -- CALCULATES NUMBER OF VIOLATIONS                          *
C*********************************************************************
C
      SUBROUTINE VIOLA (PAQC,IPOLL,STD,NVIOL,RNDING)
      REAL*4 EXCEED,NPERDS
      INTEGER*4 NPRDS(4)/8760,1095,365,1/
      IF (NPRDS(IPOLL).EQ.1) GO TO 20
      NPERDS=NPRDS(IPOLL)
      FRACT=2.0/NPERDS
      CMEAN=-PAQC/ALOG(FRACT)
      EXCEED=NPERDS*(EXP(-(STD+RNDING)/CMEAN))
C  REMOVE THE HIGHEST PAQC VALUE
      NVIOL=IFIX((EXCEED-1.))
C  IF THE  HIGHEST PAQC VALUE DOES NOT EXCEED THE STANDARD, THEN
C  SIMPLY SET THE NVIOL TO ZERO.
      IF (NVIOL.LT.0) NVIOL=0
   10 RETURN
C
   20 NVIOL=0
      IF (PAQC.GE.(STD+RNDING)) NVIOL=1
      GO TO 10
C
      END
```

N 58 IBANK 23 DBANK

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16. ABSTRACT

This report contains information on, and the computer programs for, the Modified Rollback/EKMA Strategy Assessment Model. The model can be used to generate emission inventories in future years for alternative mobile source control strategies and growth rate scenarios. Ambient concentration estimates can be generated for the pollutants carbon monoxide (CO), nitrogen dioxide (NO_2), and ozone (O_3). These air quality estimates are obtained using the modified rollback equations of de Nevers and Morris for CO and annual average NO_2 and the standard isopleth diagram of the Empirical Kinetic Modeling Approach (EKMA) for ozone. The model is useful for conducting air quality assessments of mobile source control strategies which are national in scope.

17. KEY WORDS AND DOCUMENT ANALYSIS

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