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ASSESSMENT OF RAILROAD FUEL USE AND EMISSIONS FOR THE REGIONAL AIR POLLUTION STUDY

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

EPA-450/3-77-025

ASSESSMENT OF RAILROAD FUEL USE AND EMISSIONS FOR THE REGIONAL AIR POLLUTION STUDY

by

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I. INTRODUCTION

The Regional Air Pollution Study (RAPS), using as a study area the St. Louis Air Quality Control Region, (AQCR) is the largest and most comprehensive attempt to date to obtain a quantitative understanding of urban air pollution. Its aim is to describe the complex relationship between emissions to the atmosphere, atmospheric transport and transformation processes, and ambient concentrations of pollutants.

An accurate, detailed and comprehensive inventory of emission to the atmosphere constitutes a basic input to this understanding. The RAPS emission inventory was designed to provide more detailed information, spatially and temporally, than has been available in the past. The objective is to provide emission data commensurate in detail and accuracy with data on ambient concentrations and micrometeorology.

The objective of the current study was to develop a methodology for estimating fuel use and emissions from locomotives operating in the St. Louis AQCR and to allocate these estimates to the RAPS area source grid system. Railroad emissions of some pollutants have been estimated to comprise up to ten percent of total area source emissions in the AQCR [1] and, in areas of heavy rail activity, can have a significant impact on ambient air quality concentrations.

This report describes the methodology developed to estimate and allocate rail emissions and presents the results of its application to the St. Louis AQCR. As with many of the models developed for RAPS, this allocation methodology can be easily applied in other areas of the country. For this reason, a manual for coding the necessary input data (Appendix B) and examples of the control cards necessary to utilize the software package on the RTP UNIVAC 1110 computer are included (Appendix A).

II. SUMMARY

A methodology has been developed for calculating and reporting fuel use and air pollutant emissions from railroad locomotive activity. The procedure utilizes automated techniques to report rail activity on a variable-sized grid system.

Separate methodologies were developed for the two major types of rail activity - road or line-haul operation and activity within switch yards. The methodology for road locomotives utilizes a line source concept and synthesizes the rail network by a series of links connecting a system of node points within the study area. The methodology for switch yard operation utilizes an area source concept. Both methodologies use as a basic unit locomotive horsepower-hours and were programmed to provide an analysis of fuel use and emissions for five criteria pollutants on a grid-by-grid basis as well as for the entire study area.

Locomotive diesel engine fuel use and emissions vary considerably among the various engine types, sizes, and modes of operation. Thus, it was necessary to categorize each locomotive of the three principal manufacturers into one of five engine categories based on horsepower rating and maker. Load factors, representing the average portion of available horsepower typically used in performing an activity, were derived from previous studies.

Application of this methodology in the St. Louis AQCR required an inventory of railroad activity. This inventory was supplied by the U.S. Department of Transportation, Transportation Systems Center [2], and included information on the routing, run time, and locomotive(s) for each train in operation on a typical day plus estimates of switch yard and transfer activity. Fuel use and emission factors used in this study are those presented in the Environmental Protection Agency's document, Compilation of Air Pollutant Emission Factors (AP-42) [3].

This study was designed to inventory emissions only from diesel locomotive operations as diesel exhaust represents the most significant source of railroad emissions. The quantity of emissions from auxiliary engines in rolling stock and from evaporation and spillage of fuel and volatile freights have thus not been evaluated.

Application of this methodology in the St. Louis AQCR indicated that approximately 800 of the 1,850 grids comprising the RAPS grid system contained railroad activity. Annual fuel use by locomotives was estimated at 70,100 thousand gallons and total AQCR rail pollutant emissions are as follows:

Pollutant	Emissions (tons/yr)
Particulates	876
Sulfur Oxides	2,000
Carbon Monoxide	4,350
Hydrocarbons	4,220
Nitrogen Oxides	11,930

Locomotive emission factors (measured as pounds of pollutant emitted per thousand gallons of fuel used) were derived based on the mix of engine types in St. Louis. Comparison of these factors were similar values computed from a "nationwide" mix (and presented in "AP-42") indicated little difference except for hydrocarbons. The AQCR hydrocarbon emission factor is approximately 30 percent greater than the national average.

III. METHODOLOGY

Development of the methodology required to compute annual fuel use and emissions from locomotives by RAPS grid square involved two phases. The first was the allocation of railroad activity to the grids and the second was computation of fuel use and emissions.

The basic unit used in allocating activity to grids was the "horsepower-hour"*. Separate techniques were employed for allocating road activity and yard activity to grids. In summarizing road locomotive activity by grid, each train was represented as a line source and the amount of time each train spent in each grid, weighted by the horsepower being used to move the train, was summed by grids. Yard activity was estimated by determining the total activity in each yard, both from idling and active engines, and allocating this activity to grids based on the portion of the yard area contained in each grid.

In performing the allocation task, locomotive activity was classified by five engine "types" as well as by grid. This was necessary due to the difference in emission and fuel consumption characteristics of the five types of diesel engines which are presently in operation. (These types are listed in the following section). All locomotives were placed into one of the categories based on manufacturer and rated horsepower.

Computation of fuel use and emissions for each grid was accomplished by deriving fuel consumption and pollutant emission factors as a function of engine type and applying these factors to railroad activity.

The following sections describe the methods developed to accomplish each of these tasks and the results obtained.

---

* Horsepower-hour is a unit of work which represents generation of one horsepower for one hour.

A. ALLOCATION OF RAILROAD ACTIVITY

1. Data Collection and Preparation

As part of the development of the emission inventory for the Regional Air Pollution Study the U.S. Department of Transportation, Transportation Systems Center, supplied a complete inventory of railroad activity including:

- Routing, runtime and locomotive information for each train in the study area
- Total active and idle hours and locomotive information for each rail yard in the AQCR
- Interyard transfer routing and runtime

These data were compiled based on a one day sample taken on Wednesday July 17, 1974. The data were assumed to represent annual average 24-hour activity [2]. Also required were U.S.G.S. topographic maps of the area with the grid system overlaid.

These data were put into a computer-compatible format. A total of seven information files were created; the information included in these files is presented in Table 3-1.

The basis for simulating the rail network is a system of links comprised of straight segments which connect node points in the study area. The "nodes" are defined to be the significant checkpoints of the system such as the points were rail lines cross the study area boundary, control towers, and railroad yards. The movement of a train between two nodes takes place along a rail line which is defined as a "link". A link is defined by its origin node and destination node and is comprised of a series of straight line "segments" which simulate the geometry of the actual rail system as seen on a map.

Appendix B presents a manual for coding the information indicated in Table 3-1.

2. Locomotive Classification

As noted above, the goal of the allocation task is to determine, by engine class and grid, the total number of horsepower-hours expended. One

TABLE 3-1

RAIL ACTIVITY ALLOCATION FILES

File	Contents
Grid	Coordinates (UTM) of southwest corner, size, and identification number
Rail Segments	Coordinates (UTM) of straight rail segments keyed sequentially and by the link (org-des) they comprise. (See text for further information).
Road Train Activity	Two-card entry for each road train in study area: Card 1 - locomotive information; Card 2 - routing and runtimes
Transfer Hours	Number of hours of transfer engine activity between each rail yard
Yard Activity	Number of switch engine active and idle hours in each yard plus an indication of typical engine types for that yard
Road Train Idling	Number of road locomotive idling hours for each yard including locomotive information
Yard Location	The grids which contain each yard and an estimate of the portion of the yard in each grid

Note: Locomotive information includes number of engines and the manufacturer and horsepower of each.

important task was to investigate the locomotives in operation in the St. Louis AQCR to determine engine type and typical operating factors. Three tasks were performed to achieve this objective:

- Classification of locomotives into the five engine categories specified in AP-42 [3].
- Derivation of active and idle load factors for switch and road locomotives
- Characterization of a "typical" transfer engine used in the St. Louis AQCR

a. Engine Types

The public relations departments of General Motors, Montreal Locomotive Works, and General Electric, the three locomotive manufacturers with engines operating in the St. Louis area, were contacted [4,5,6] to obtain the information necessary to categorize each locomotive operating in the St. Louis AQCR into the five "AP-42" categories. These categories are:

- 2 - Stroke Supercharged Road
- 2 - Stroke Turbocharged Road
- 4 - Stroke Road
- 2 - Stroke Supercharged Switch
- 4 - Stroke Switch

Table 3-2 presents the results of this categorization.

b. Load Factors

The portion of the available locomotive horsepower which is utilized during normal operation is the load factor. This factor is defined as the average horsepower produced during operation divided by the available power. AP-42 [3] suggests a typical load factor of 0.4 for a line haul (road) locomotive and 0.06 for a switch engine. These numbers are based on data in a recent EPA - sponsored research study [7]. However, it was decided not to use these load factors directly as they implicitly assume a mix of both active and idle time. In the St. Louis railroad activity information base, the hours of active and idling time are explicitly recorded.

TABLE 3-2

CATEGORIZATION OF LOCOMOTIVE TYPES IN ST. LOUIS RAIL ACTIVITY INVENTORY

Maker	Horsepower Range	Engine Type
ALCO (Montreal Locomotive)	1,000	4-Stroke Switch
ALCO (Montreal Locomotive)	1,600-2,000	4-Stroke Road
General Electric	600	4-Stroke Switch
General Electric	2,500-3,300	4-Stroke Road
General Motors (EMD)	600-1,500	2-Stroke Supercharged Switch
General Motors (EMD)	1,600-2,300,2,500	2-Stroke Supercharged Road
General Motors (EMD)	2,400,2,750-3,600	2-Stroke Turbocharged Road

Thus, four load factors, corresponding to active road locomotive, idling road locomotive, active switch engine, and idling switch engine, were derived for this study.

The data required for constructing the four load factors was obtained from the Southwest Research Institute (SWRI) report [7] and from telephone conversations with General Motors personnel [4]. The SWRI study gives the following duty cycles for a switch locomotive and a road locomotive.

LOCOMOTIVE DUTY CYCLES

Throttle Setting (Notch)	Percent of Operating Time in Notch	
	Switch	Road
Idle	77	41
Dynamic Brake	--	8
1	10	3
2	5	3
3	4	3
4	2	3
5	1	3
6	1	3
7	0	3
8	0	30

The duty cycle gives the percent of operating time in each throttle position or notch. General Motors Electro-Motive Division provided data on the horsepower produced at each throttle position for both a typical switch and a typical road locomotive.

ENGINE HORSEPOWER BY THROTTLE SETTING

Throttle Setting (Notch)	Engine Horsepower	
	Switch	Road
Idle	24	50
Dynamic Brake	--	100
1	100	100
2	210	345
3	375	645
4	575	980
5	785	1400
6	1015	1890
7	1250	2640
8	1500	3050

To calculate load factors at idle, the ratio of horsepower produced at idle to total available horsepower was used.

For a switch engine, idle load factor $= \frac{24}{1500} = 0.016$

For a road locomotive, idle load factor $= \frac{50}{3050} = 0.016$

To calculate load factors for an active locomotive, the percentage of operating time in each running throttle position (i.e., other than the idle portion) was normalized and the average horsepower calculated.

The active load factors were 0.19 and 0.65 for switch and road locomotives, respectively.

As a check, composite load factors for both switch and road engine types were calculated and compared to those from AP-42. The results are tabulated below and indicate no significant difference.

COMPOSITE LOAD FACTOR COMPUTATION

Engine	Time Idling (percent)	Idle Load Factor	Time Running (percent)	Running Load Factor	Composite Load Factor	AP-42 Load Factor
Switch	77	0.016	23	0.19	0.056	0.06
Road	41	0.016	59	0.65	0.39	0.4

c. Characterization of a Typical Transfer Engine

The final task in the classification of St. Louis locomotives was the characterization of the typical transfer engine operating between area yards. Since specific information on the type of engines transferring rolling stock between yards was not specified in the rail inventory, switching engines active inside the area yards were used to derive a typical transfer engine in terms of horsepower and mix of engine types. An average locomotive horsepower weighted by active operating hours for each of the switch engine categories was calculated. The average engines are as follows:

Type	Average Horsepower	Active Hours	Percent of Total Active Hours
2-Stroke Supercharged	1300	1157	85
4-Stroke	1030	205	15

In allocating transfer activity to grids, the above factors were used in conjunction with the active yard engine load factor to compute horsepower-hours. The equation to be used is:

$$\text{Work (switch engine type}_i\text{, transfer)} = HP_i * LF * PCT_i * THR$$

where:

Work (switch engine type$_i$, transfer) = Work output (hphr) in transfer activities of engine type$_i$

HP_i = average locomotive horsepower for engine type$_i$

LF = active yard engine load factor (0.19)

PCT_i = portion of total transfer hours represented by engine type$_i$

THR = total transfer hours in grid

3. Software Development

A battery of computer programs was developed to perform the railroad activity allocation. Included was a program to preprocess the grid information, several programs to provide a quality assurance of the data, and the actual allocation programs. The methodology used in developing these computer programs is briefly described in this section. A complete description of these programs including flow charts and run streams is presented in Appendix A.

a. Overview of Computer Processing

Figure 3-1 presents an overview of the methodology to be employed. The center column lists seven computer programs (identified by rectangles) which were developed. The relationship of these programs to the various input files and the purpose and subsequent use of the output data sets are generally indicated along the left and right sides, respectively, of the diagram. Each of the computer programs is described in the following subsections.

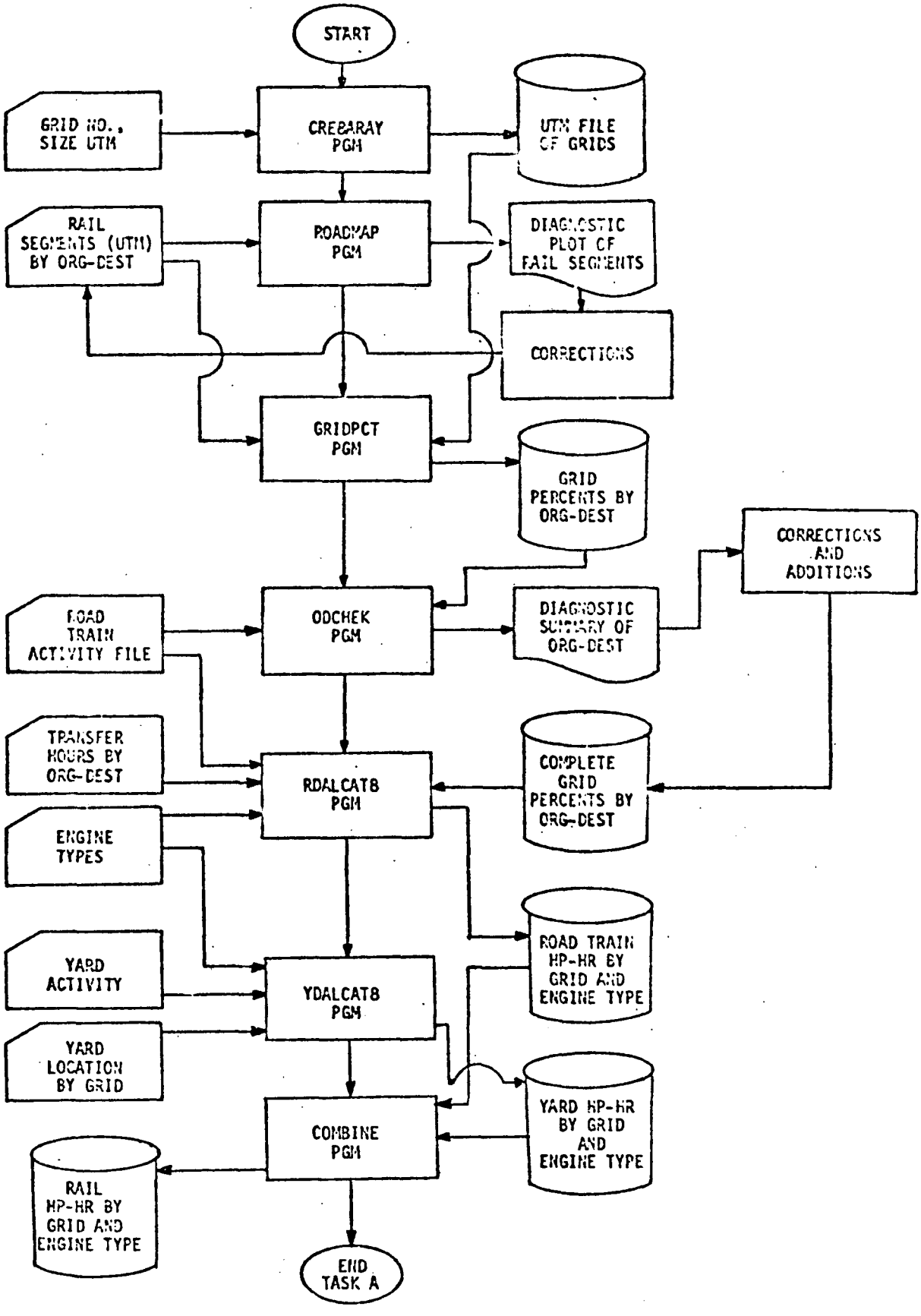

FIGURE 3-1

OVERVIEW OF COMPUTER PROCESSING METHODOLOGY

b. Grid Preprocessing Program (CRE8ARAY)

The purpose of this program is to provide a cross-reference of grid number and boundary location as a function of UTM coordinate. The input to the program is the RAPS grid system including grid number, southwest corner coordinates, and grid size (area). The program assigns to each integral UTM coordinate pair within each grid and to the west and south boundaries of that grid, a location indicator and the grid number. The location codes are:

Code	Condition
0	Not in AQCR
1	Corner of a grid
2	"X" boundary but not a "Y" boundary
3	No boundary
4	"Y" boundary but not an "X" boundary

This program builds an array of codes and grid numbers which are output to disk for use by the subsequent programs.

c. Link Plotting Program (ROADMAP)

The purpose of this program is to provide a plot of the rail node and link network as coded from the U.S.G.S. maps in order to identify coding and keypunching.

ROADMAP is an existing Walden computer program which displays a set of highway or rail links on a Calcomp plotter. The output of this program provides a visual check of the accuracy of rail link coding and will thus serve as the basis for correcting input link data. Figures 3-2 and 3-3 present the St. Louis AQCR rail network as used in this study.

d. Links-to-Grids Program (GRIDPCT)

This program determines the length of each link between each origin and destination (node) and the percent of this length which is included in each grid. The inputs to the program include the cross-reference

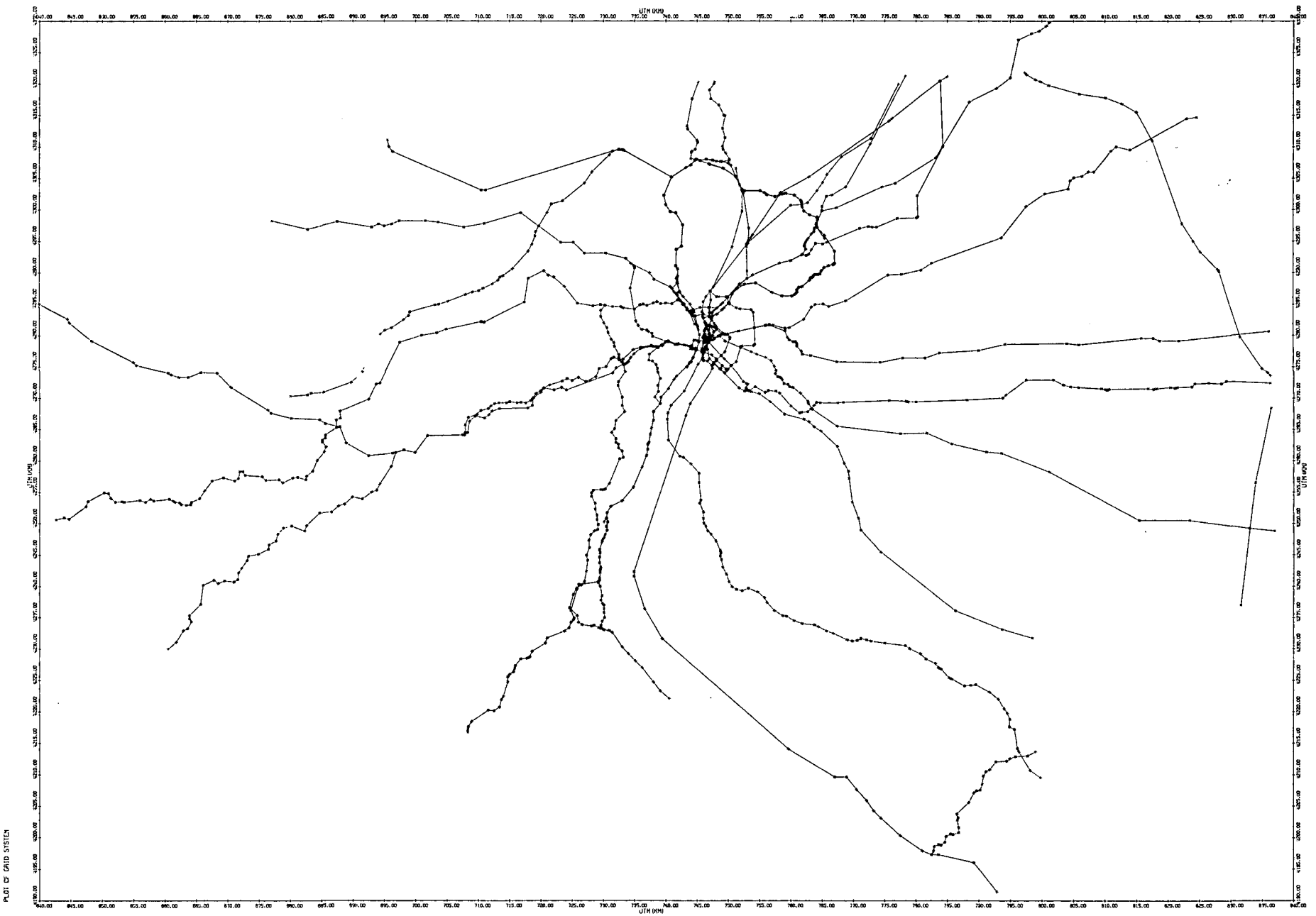

FIGURE 3-2 ST. LOUIS AQCR RAIL NETWORK

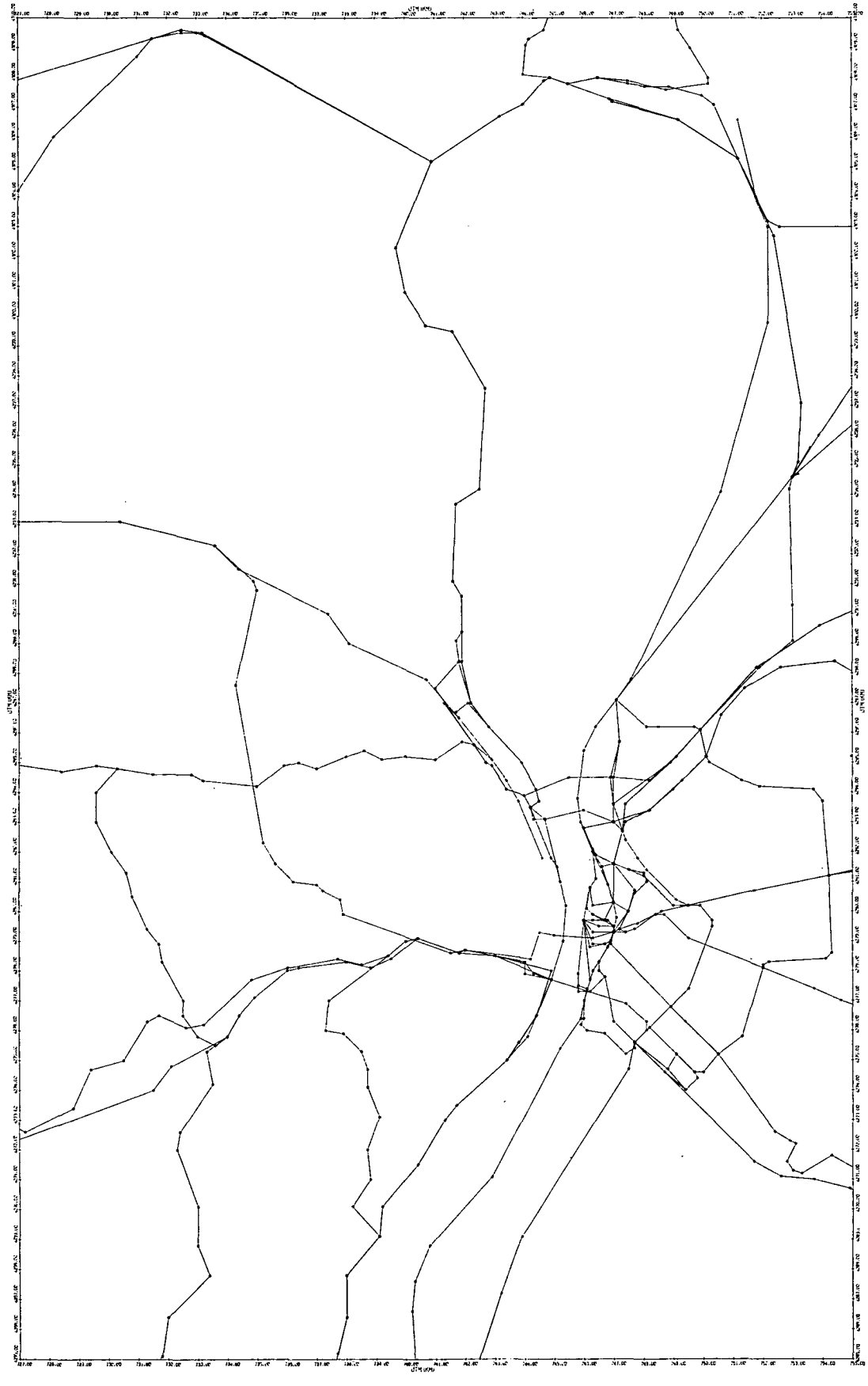

FIGURE 3.3 EXPANDED VIEW OF ST. LOUIS/E. ST. LOUIS RAIL NETWORK

file output by CRE8ARAY plus the card file of coded rail segments corrected by means of the ROADMAP plot.

This program determines for each rail segment comprising a rail link between a given origin and destination:

- the grid(s) containing each end of the segment,
- the grids not containing the end points but which are intersected by the segment,
- the length of the segment in each grid
- a running total

After processing all links and segments the length of rail by grid is normalized and three files are output to disk. These are:

- The length of each link connecting an origin-destination
- A file of grids containing the percent of each link the grid contains
- A cross-reference key for these files

e. Rail Activity Quality Control Program (ODCHEK)

This program provides a quality assurance check on the routing of road trains. The inputs include the card file of rail routing plus the cross-reference key created by the GRIDPCT program. This program provides a printout of origin-destinations which were not represented by the first coding of rail links. Two conditions cause an origin-destination to be flagged. These are:

- The TSC study [2] skipped certain intermediate nodes in providing the routing or,
- A keypunch or coding error occurred.

Corrections and additions to the input files were made as a result of the processing.

f. Allocation of Road and Transfer Train Activity (RDALCAT8)

The purpose of this program is to allocate non-yard activity to grids. The inputs include the road and transfer train activity*, the outputs of GRIDPCT, and a file of engine types. This program determines for each rail activity, the horsepower-hours by engine type used between two nodes and then allocates this to the grids containing the link which connects the two nodes. The output of this program is total horsepower-hours from non-yard activity by grid and engine type.

g. Allocation of Yard Activity (YDALCAT8)

This program allocates locomotive activity in yards to the grid system. The program uses switch engine activity (idle and active) and road engine idling by yard, plus a file of grid number and percent by yard coded from the U.S.G.S. maps and an identification of engine types. Activity in the yards is summed by grid number and engine type.

h. Program to Merge Files (COMBINE)

This program combines the road and yard activity files into a master file which summarizes all locomotive activity (horsepower-hours) by grid and engine type. The program uses the output files of RDALCAT8 and YDALCAT8. The results of this program are the total AQCR locomotive activity measured in horsepower-hours and summarized by RAPS grid and engine type.

B. COMPUTATION OF FUEL USE AND EMISSIONS

The second phase of the analysis was conversion of the rail activity file to estimates of annual fuel use and emissions for each grid. To achieve this, a computer program was prepared. The input to this program was the file of total daily horsepower-hours by grid and engine type (created by the program COMBINE). The output includes a card file of annual fuel use by

---

* Activity includes routing (origin and destination) and runtime

engine type, grid fuel use, and total grid emissions of five pollutants; a print file presenting total annual fuel use and emissions by grid; and an AQCR summary file which is the summation of computed grid fuel use and emissions.

The program computes fuel use per horsepower-hour using factors derived from AP-42. These fuel use rates are as follows:

Engine Category	Fuel Consumption (gallons/hp-hr)
2 Stroke Supercharged Switch	0.097
4 Stroke Switch	0.076
2 Stroke Supercharged Road	0.059
2 Stroke Turbo-Charged Road	0.055
4 Stroke Road	0.047

Fuel consumption in each grid was computed by the equation:

$$F_i = \sum_{j=1}^{5} (U_j)(P_{ij})\ (365)$$

where:

F_i = Annual fuel use in $Grid_i$ (gallons)

U_i = Fuel Consumption by $Engine\ Category_i$ (gallons/hp-hr)

$P_{i,j}$ = Work by locomotives of $engine\ category_j$ in $grid_i$ (hp-hr)

365 = Factor to convert daily to annual consumption [2]

Emissions of the five criteria pollutants* in each grid were computed using the following:

$$Q_{i,k} = \sum_{j=1}^{5} (E_{j,k})(P_{i,j})(0.000403)$$

* Sulfur dioxide, particulates, nitrogen oxides, hydrocarbons, and carbon monoxide

where:

$Q_{i,k}$ = Emissions of $pollutant_k$ in $grid_i$ (tons/year)

$E_{j,k}$ = Emission factor for $pollutant_k$ resulting from operation of $engine\ category_j$ (grams/hp-hr)

0.000403 = Factor to convert grams/day to tons/year

Table 3-3 presents the emission factors, $E_{j,k}$, used in this study [3].

TABLE 3-3

LOCOMOTIVE EMISSION FACTORS
(grams/horsepower-hour)

Engine Category	Pollutant: Carbon Monoxide	Hydrocarbon	Nitrogen Oxides	Sulfur Oxides	Particulates
2-Stroke Supercharged Switch	3.9	8.9	11.	2.5	1.1
4-Stroke Switch	13.	5.0	17.	2.0	0.9
2-Stroke Supercharged Road	1.8	4.0	9.4	1.5	0.7
2-Stroke Turbocharged Road	4.0	0.7	8.2	1.4	0.6
4-Stroke Road	4.1	2.2	10.	1.2	0.5

IV. RESULTS

Appendix C presents the annual fuel use and emissions for each grid in the RAPS study area which contains railroad activity. Annual locomotive fuel use in the AQCR was calculated to be 70,070 thousand gallons.

Total AQCR emissions of five criteria pollutants emitted by railroads were derived through summation of the grid emissions. The results are as follows:

Pollutant	Emissions (tons/yr)
Particulates	876
Sulfur Oxides	1,997
Carbon Monoxide	4,350
Hydrocarbons	4,220
Nitrogen Oxides	11,935

The average emission factor for each pollutant was then calculated for the AQCR by dividing total emissions by total fuel use. These emission factors based on the AQCR engine mix are present below along with the factors based on a "national mix" [3].

Pollutant	AQCR-70 Emission Factor ($lb/10^3$ gallon)	Nationwide Emission Factor ($lb/10^3$ gallon)
Particulates	25.	25.
Sulfur Oxides	57.	57.
Carbon Monoxide	124.	130.
Hydrocarbons	121.	94.
Nitrogen Oxides	340.	370.

As there is no differentiation in emission factors by engine type for particulates and sulfur oxides in AP-42, the AQCR factor exactly equals the nationwide mix factor. The derived carbon monoxide and nitrogen oxide

emission factors are also not significantly different from nationwide averages. The hydrocarbon emission factor for the AQCR, however, is approximately thirty percent greater than the national average. This results from the high concentration of switch engine (yard) activity in the St. Louis area. Switch engines tend to emit a greater amount of hydrocarbons than line haul locomotives.

As verification of the results of this analysis, a 1973 estimate of railroad fuel use in the St. Louis AQCR was obtained from the National Emissions Data System (NEDS) [1]. This estimate, based on a different allocation procedure, indicated total annual fuel use by railroads to be 62,700,000 gallons, twelve percent less than estimated through the present methodology. This difference is less than the variance associated with the two different allocation procedures, indicating that the methodology presented in this report provides an accurate estimation of railroad fuel use.

V. REFERENCES

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APPENDIX A

COMPUTER PROGRAM DESCRIPTIONS AND RUNSTREAMS

NAME: CRE8ARAY (GRID PREPROCESSING PROGRAM)

1. RUN DESCRIPTION

CRE8ARAY is used to provide a cross-reference of grid number and boundary location as a function of UTM coordinates. The input to the program is RAPS grid system, which includes for each grid, the grid number, its southwest corner coordinate and the grid size (area). The program assigns to each integral UTM coordinate pair within the grid and to the west and south boundaries, a location indicator and the grid number. The location codes are:

Code	Condition
0	Not in AQCR
1	Corner of a grid
2	"X" boundary but not a "Y" boundary
3	Inside the grid but not on any boundary
4	"Y" boundary but not a "X" boundary

The program builds an array of codes and grid numbers which are output to disk for use by the subsequent programs. The flow chart for this program is illustrated in Figure A-1.

2. INPUT-OUTPUT DESCRIPTION

2.1 INPUT

a. Card or Tape or Disk Input:

Title: GRIDS

Record Format: Card Format

Description: This file contains the RAPS grid system. The record description is given in Table A-1.

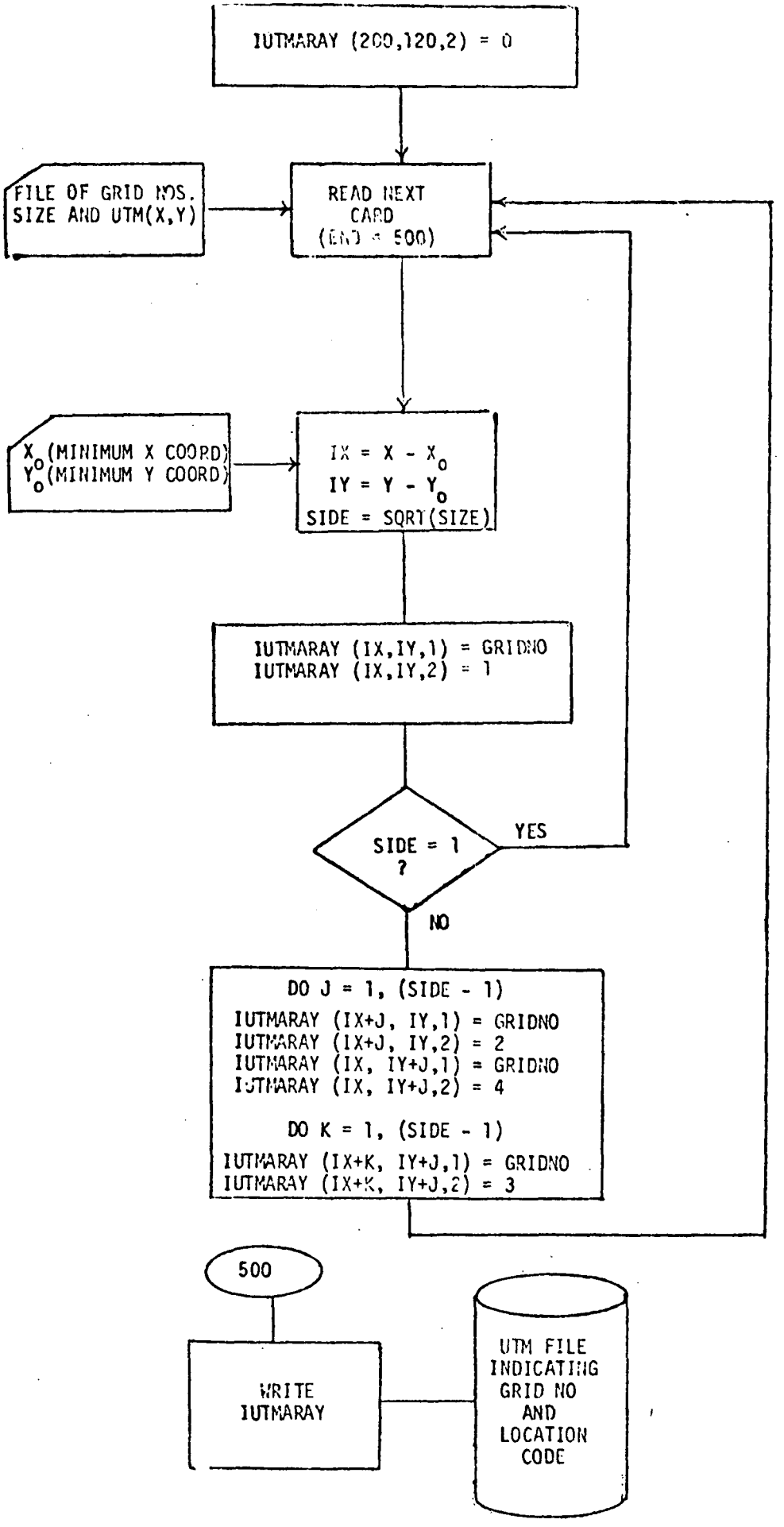


FIGURE A-1 CRE8ARAY PROGRAM FLOW CHART

TABLE A-1

RECORD DESCRIPTION

Record Position		Length	Data Item Picture	Data Item Name	Description
First	Last				
1	4	4	I4	IGNO	RAPS grid number
5	9	5	I5	ISIZE	SIZE of the grid
10	18	9	F9.1	X	X UTM Coordinate of the south-west corner of the grid
19	26	8	F8.1	Y	Y UTM coordinate of the south-west corner of the grid

2.2 OUTPUT

a. Disk Output

Title: PPR02

Record Format: Unformatted

Description: The dimensioned array IUTM (210,150,2) is output. This array stores the grid number and the location code for each pair of integral UTM coordinates within the grid system.

b. Printed Output

Selected values of the array IUTM are printed to check the results. At the end of the processing message "ALL RECORDS HAVE BEEN PROCESSED" is printed.

3. RUNSTREAM

The runstream for executing program CRE8ARAY on the UNIVAC computer is illustrated in Figure A-2. This program has a large array and therefore it requires a large amount of core. To get around this difficulty on UNIVAC the following statement was used as the first statement in the source code:

```
COMPILER (XM=1)
```

In addition the array was placed in a labeled COMMON statement.

```
@RUN, accounting information
@ASG,A GRIDS
@ASG,CP PPRO2
@USE 5, GRIDS
@USE 8, PPRO2
@FOR, IS CRE8
         CRE8ARAY source statements with the arrays in a
         common statement labeled ABC.
@MAP,E CRE8
       IN CRE8
       IN ABC
END
@XQT CRE8
@FIN
```

FIGURE A-2

RUNSTREAM FOR PROGRAM CRE8ARAY

NAME: GRIDPCT (LINK-TO-GRIDS PROGRAM)

1. RUN DESCRIPTION

GRIDPCT program determines the length of the link between each origin and destination and the percent of this length which is included in each grid. The inputs to the program are the cross-reference file output by CRE8ARAY and the card file of coded rail segments corrected by means of the ROADMAP plot.

This program determines for each rail segment comprising a rail link between a given origin and destination.

- the grid(s) containing each end of the segment,
- the grids not containing the end points but which are intersected by the segment,
- the length of the segment in each grid
- a running total of link length

After processing all links and segments the length of rail by grid is normalized and three files are output to disk. These are:

- The length of each link connecting an origin-destination
- A file of grids containing the percent of each link the grid contains
- A cross-reference key for these files

The flow chart of this program is illustrated in Figure A-3.

2. INPUT-OUTPUT DESCRIPTION

2.1 INPUT

a. Card, or Tape or Disk Input:

Title: LINK

Record Format: Card Format

Description: This file contains the coded rail segments corrected by means of the ROADMAP plot. The record description is given in Table A-2.

GRIDPCT

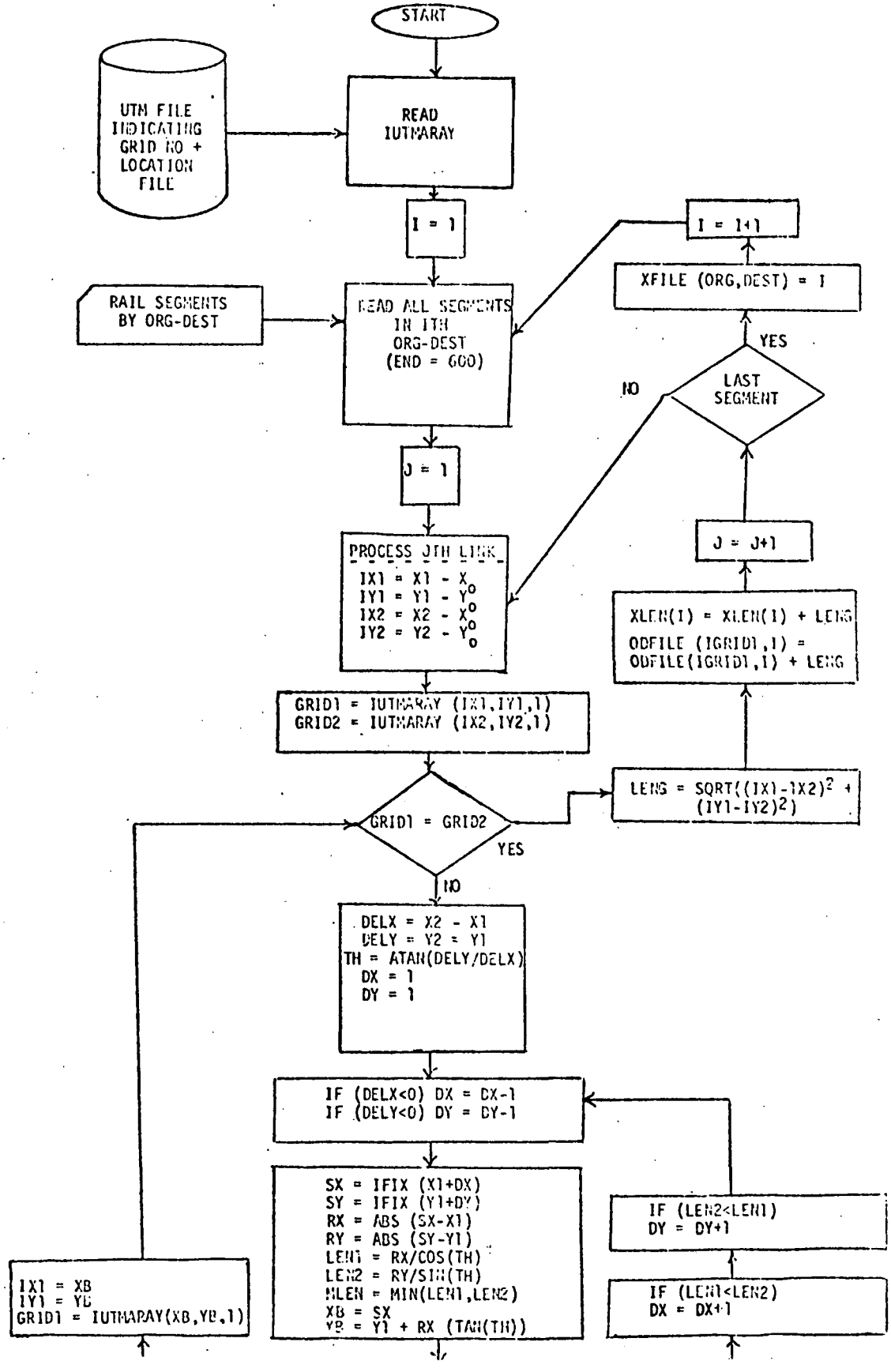


FIGURE A-3

GRIDPCT PROGRAM FLOW CHART

GRIDPCT (CONTINUED)

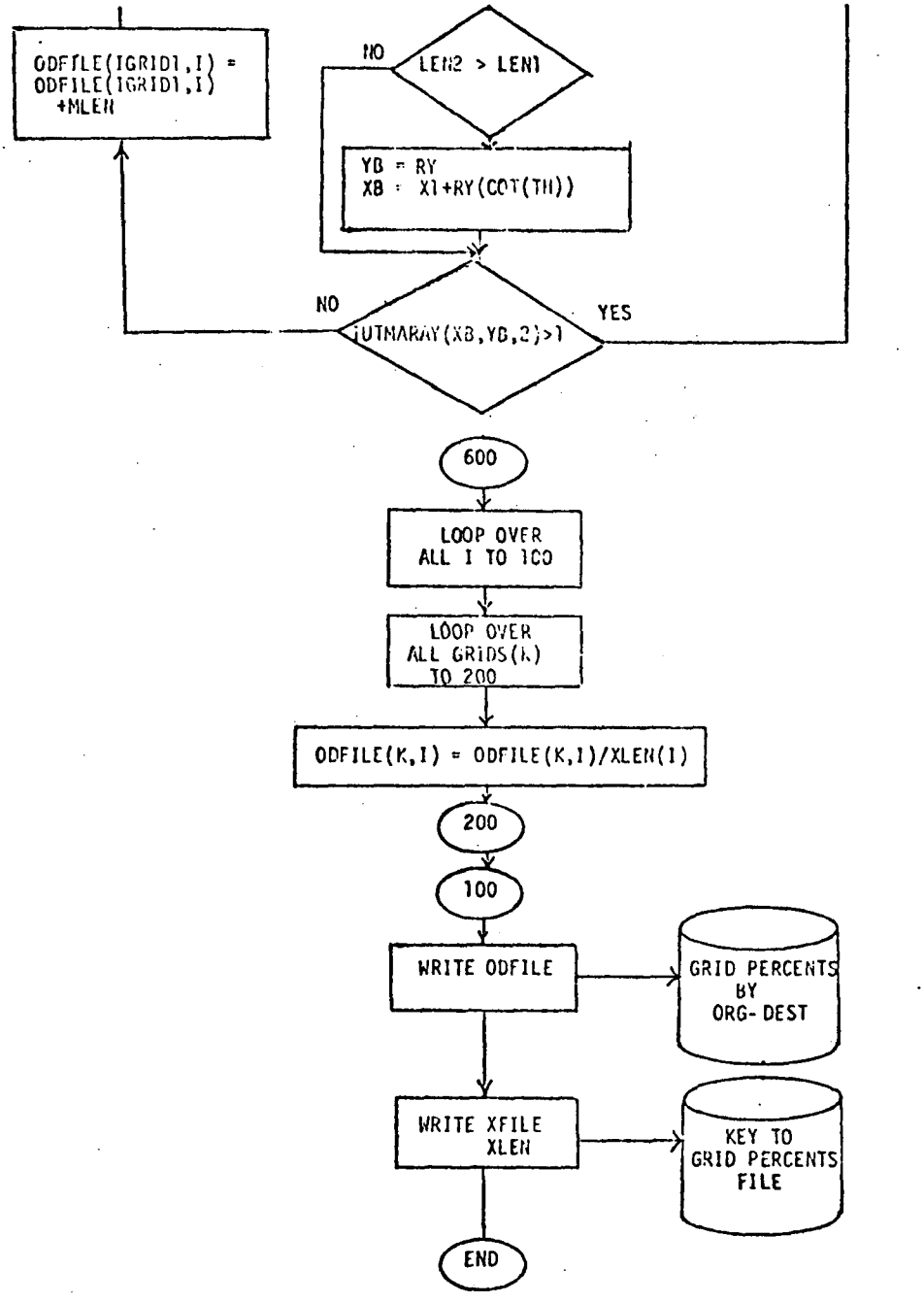


FIGURE A-3

GRIDPCT PROGRAM FLOW CHART (CONTINUED)

TABLE A-2

RECORD DESCRIPTION

Record Position		Length	Data Item Picture	Data Item Name	Description
First	Last				
1	3	3	I3	OR	Origin number of the Link
4	6	3	I3	DT	Destination number of the link
9	10	2	I2	JSEG	Segment number of the link
11	16	6	F6.1	X1	X coordinate of the beginning of the segment
17	22	6	F6.1	Y1	Y coordinate of the beginning of the segment
23	28	6	F6.1	X2	X coordinate of the end point of the segment
29	34	6	F6.1	Y2	Y coordinate of the end point of the segment

b. Disk Input

Title: PPRO2

Record Format: Unformatted

Description: This is the output file generated by the CRE8ARAY program consisting of location codes and grid numbers.

2.2 OUTPUT

a. Disk Output

1. Title: ODFILE

Record Format: Unformatted

Description: This is a file of grids containing the percent of each link the grids contain.

2. Title: IXFILE

Record Format: Unformatted

Description: This file has the identifying key for each link by its origin and destination. In other words, it is a cross-reference key file for the files ODFILE, and XLEN.

3. Title: XLEN

Record Format: Unformatted

Description: This file has the length of each link by its identifying key.

b. Printed Output

At the end of each segment in every link the grid number in which this end was lying, the length of the link up to this point and the length of the segment in the last grid are printed. When all the segments for any link have been processed then its identifying key, origin and destination numbers, length of link in the last grid and its total length are printed. At the end of the run a message "ALL RECORDS HAVE BEEN PROCESSED" is printed.

3. RUNSTREAM

The runstream for executing program GRIDPCT on the UNIVAC computer is illustrated in Figure A-4. All the big arrays of this program are placed in a labeled COMMON statement so that additional core for the COMMON statement can be obtained.

```
@RUN, accounting information
@ASG,A PPRO2
@ASG,A LINK
@ASG,CP ODFILE
@ASG,CP IXFILE
@ASG,CP XLEN
@USE 5, LINK
@USE 8, PPRO2
@USE 9, ODFILE
@USE 10, IXFILE
@USE 11, XLEN
@FOR, IS PCT
        GRIDPCT source statements with the arrays in a
        common statement labeled ABC.
@MAP,E PCT
       IN PCT
       IN ABC
END
@XQT PCT
@FIN
```

FIGURE A-4

RUNSTREAM FOR PROGRAM GRIDPCT

NAME: ODCHEK (RAIL ACTIVITY QUALITY CONTROL PROGRAM)

1. RUN DESCRIPTION

This program provides a quality assurance check on the routing of road trains. The inputs include the card file of rail routing plus the cross-reference key created by the GRIDPCT program. This program provides a printout of origin destinations which were not represented by the first coding of rail links. Two conditions cause an origin-destination to be flagged. These are:

- The Railroad inventory study [2] skipped certain intermediate nodes in providing the routing or,
- A keypunch or coding error occurred.

Corrections and additions to the input files will be made as a result of the processing. The flow chart for this program is illustrated in Figure A-5.

2. INPUT-OUTPUT DESCRIPTION

2.1 INPUT

a. Card or Tape or Disk Input

Title: RD8

Record Format: Card Format

Description: This file contains the Road train activity data.

b. Disk Input

Title: IXFILE

Record Format: Unformatted

Description: This file was created by the GRIDPCT program and contains the cross-reference keys for the origin and destination of the links input to GRIDPCT program.

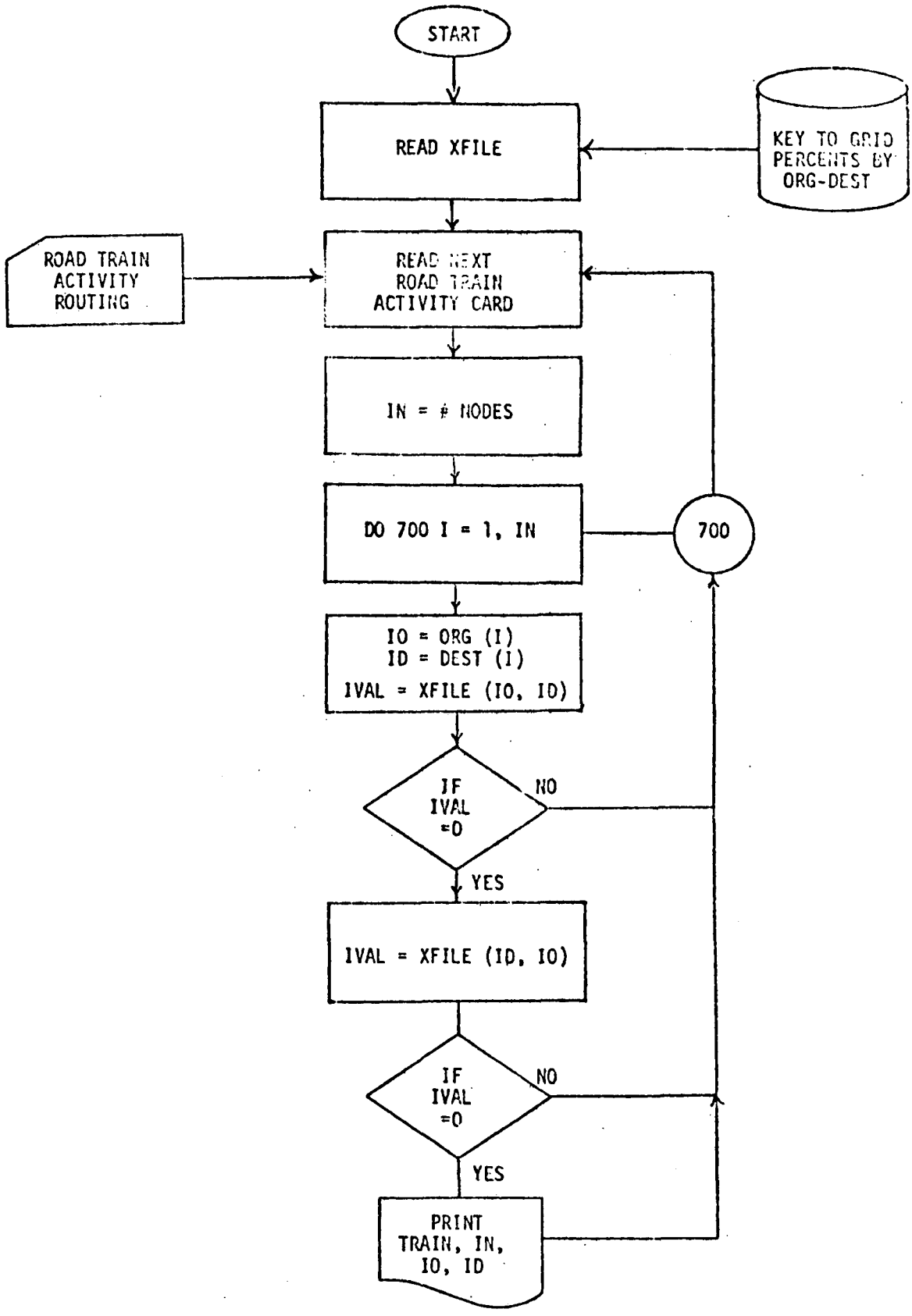


FIGURE A-5 ODCHEK PROGRAM FLOW CHART

2.2 OUTPUT

a. Printed Output

This program flags out any records which have origin destinations not present in the file IXFILE. In addition, it also flags out records which have total run time less than the total link time or if the horse power of any engine is out of range.

3. RUNSTREAM

The runstream for executing program ODCHEK on the UNIVAC computer is illustrated in Figure A-6.

```
@RUN, accounting information
@ASG,A RD8
@ASG,A IXFILE
@USE 5, RD8
@USE 8, IXFILE
@FOR, IS ODCH
         ODCHEK source statements
@MAP, ODCH
      IN ODCH
END
@XQT  ODCH
@FIN
```

FIGURE A-6
RUNSTREAM FOR PROGRAM ODCHEK

NAME: RDALC8 (Allocation of Road and Transfer Train Activity Program)

1. RUN DESCRIPTION

The purpose of this program is to allocate non-yard activity to grids. The inputs include the road and transfer train activity and the outputs of GRIDPCT program. This program determines for each rail activity, the horsepower-hours, by engine type, used between two nodes and then allocates this to grid. The output of this program is written to disk in the form of the total horsepower-hours by grid and engine type. The flow chart for this program is illustrated in Figure A-7.

2. INPUT-OUTPUT DESCRIPTION

2.1 INPUT

a. Card or Tape or Disk Input

Title: RD8
Record Format: Card Format
Description: This file contains the Road train activity data and transfer hour data separated by a blank card.

b. Disk Input

1. Title: IXFILE
Record Format: Unformatted
Description: This file contains the cross-reference keys generated by the GRIDPCT program.

2. Title: ODFILE
Record Format: Unformatted
DescriptionL This is the grids file containing the percentage of each link in the grids, generated by the GRIDPCT program.

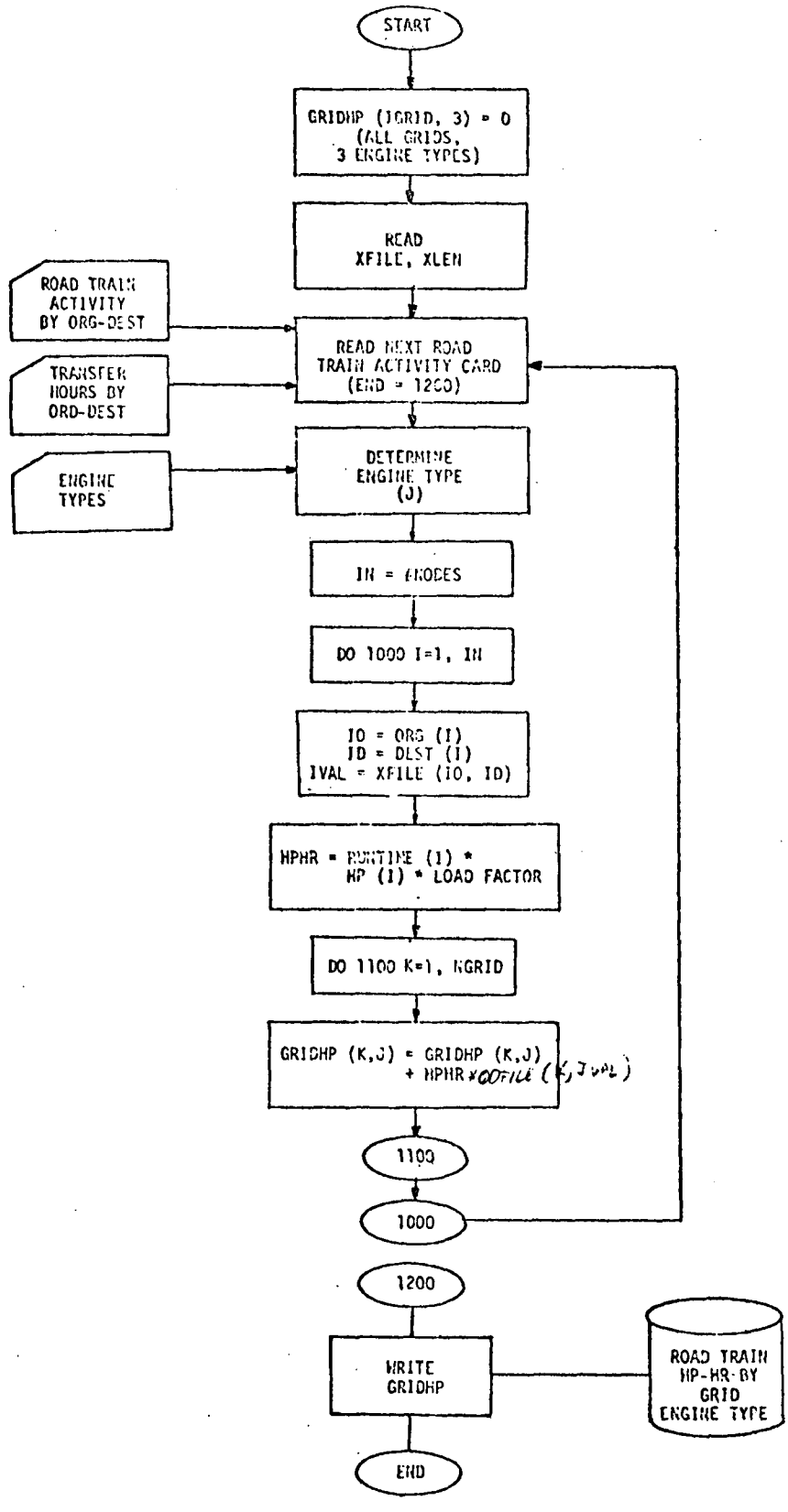


FIGURE A-7

RDALC8 PROGRAM FLOW CHART

2.2 OUTPUT

a. Disk Output

Title: GRIDHP

Record Format: Unformatted

Description: This file contains the total horsepower-hours for non-yard activity by grid and engine type.

b. Printed Output

The program produces a listing of each train type and its origin and destination. At the end of the processing it prints the message "ALL RECORDS HAVE BEEN PROCESSED".

3. RUN STREAM

The runstream for executing RDALC8 on the UNIVAC computer is illustrated in Figure A-8. Note, that all the big arrays are placed in a labeled COMMON statement.

```
@RUN, accounting information
@ASG,A RD8
@ASG,A IXFILE
@ASG,A ODFILE
@ASG,CP GRIDHP
@USE 5, RD8
@USE 8, IXFILE
@USE 9, ODFILE
@USE 10, GRIDHP
@FOR, IS ROAD
         RDALC8 source statements with the arrays in a
         common statement labeled ABC
@MAP,E ROAD
       IN ROAD
       IN ABC
END
@XQT ROAD
@FIN
```

FIGURE A-8

RUNSTREAM FOR PROGRAM RDALC8

NAME: YDALC8 (Allocation of Yard Activity Program)

1. RUN DESCRIPTION

This program allocates locomotive activity in yards to the grid system. The program reads coded switch engine activity (idle and active) and road engine idling by yard, plus a file or frid number and percent by yard coded from the U.S.G.S. maps and an identification of engine types. These are then stored in an array referenced by grid number and engine type. After processing all yards, this array is then written to disk. The flow chart for this program is illustrated in Figure A-9.

2. INPUT - OUTPUT DESCRIPTION

2.1 INPUT

a. Card or Tape or Disk Input

Title: YD8

Record Format: Card Format

Description: This file contains the coded cards for three types of data separated by blank cards. The first type of cards contain the yard numbers and yard percentage in different grids by grid number. The second type of cards have the yard activity and the third type of cards have the Road Engine Idling line.

2.2 OUTPUT

a. Disk Output

Title: YDHP

Record Format: Unformatted

Description: This file contains the horsepower-hours for yard activity by grid and engine type.

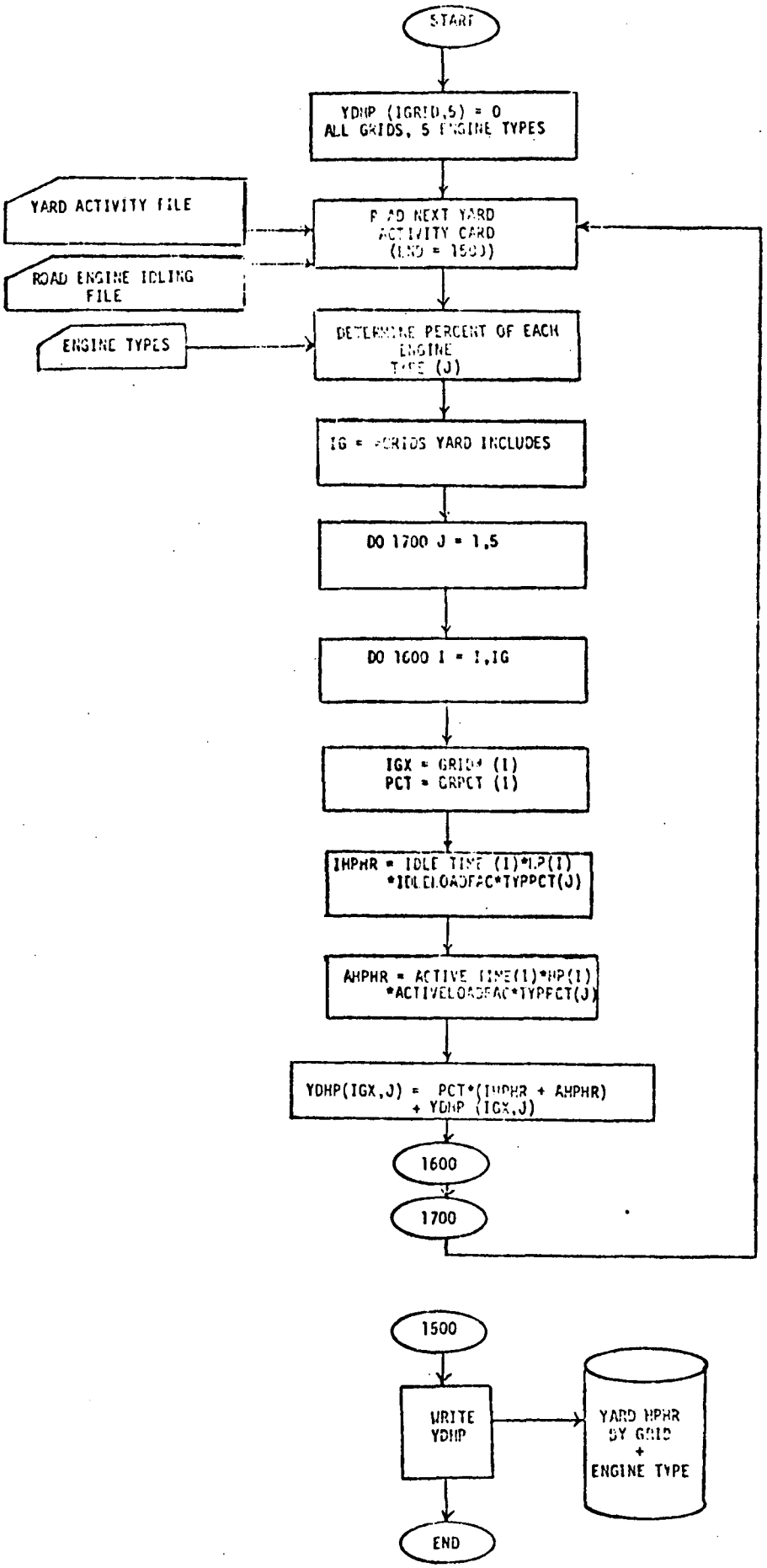


FIGURE A-9

YDALC8 PROGRAM FLOW CHART

b. Printed Output

A list of horsepower hour and engine type is produced for the Switch Engine yard data. At the end of the processing a message "ALL RECORDS HAVE BEEN PROCESSED" is produced.

3. RUNSTREAM

The runstream for executing YDALC8 on the UNIVAC computer is illustrated in Figure A-10.

```
@RUN, accounting information
@ASG,A YD8
@ASG,CP YDHP
@USE 5, YD8
@USE 8, YDHP
@FOR, IS YARD
        YDALC8 source statements
@MAP, YARD
      IN YARD
END
@XQT YARD
@FIN
```

FIGURE A-10

RUNSTREAM FOR PROGRAM YDALC8

NAME: COMBINE (Program to Merge Files)

1. RUN DESCRIPTION

This program combines the road and yard activity files into a master file which summarizes all locomotive activity (horsepower-hours) by grid and engine type. The program uses the output files of RDALC8 and YDALC8 and writes the output to a disk file. The flow chart for this program is illustrated in Figure A-11.

2. INPUT-OUTPUT DESCRIPTION

2.1 INPUT

a. Disk Input

1. Title: GRIDHP
Record Format: Unformatted
Description: This file has the non-yard activity by grid and engine type generated by RDALC8 program.

2. Title: YDHP
Record Format: Unformatted
Description: This file has the yard activity by grid and engine type generated by YDALC8 program.

2.2 OUTPUT

a. Disk Output

Title: THPHR
Record Format: Unformatted
Description: This file contains the total horsepower-hours for all locomotive activity by grid and engine type.

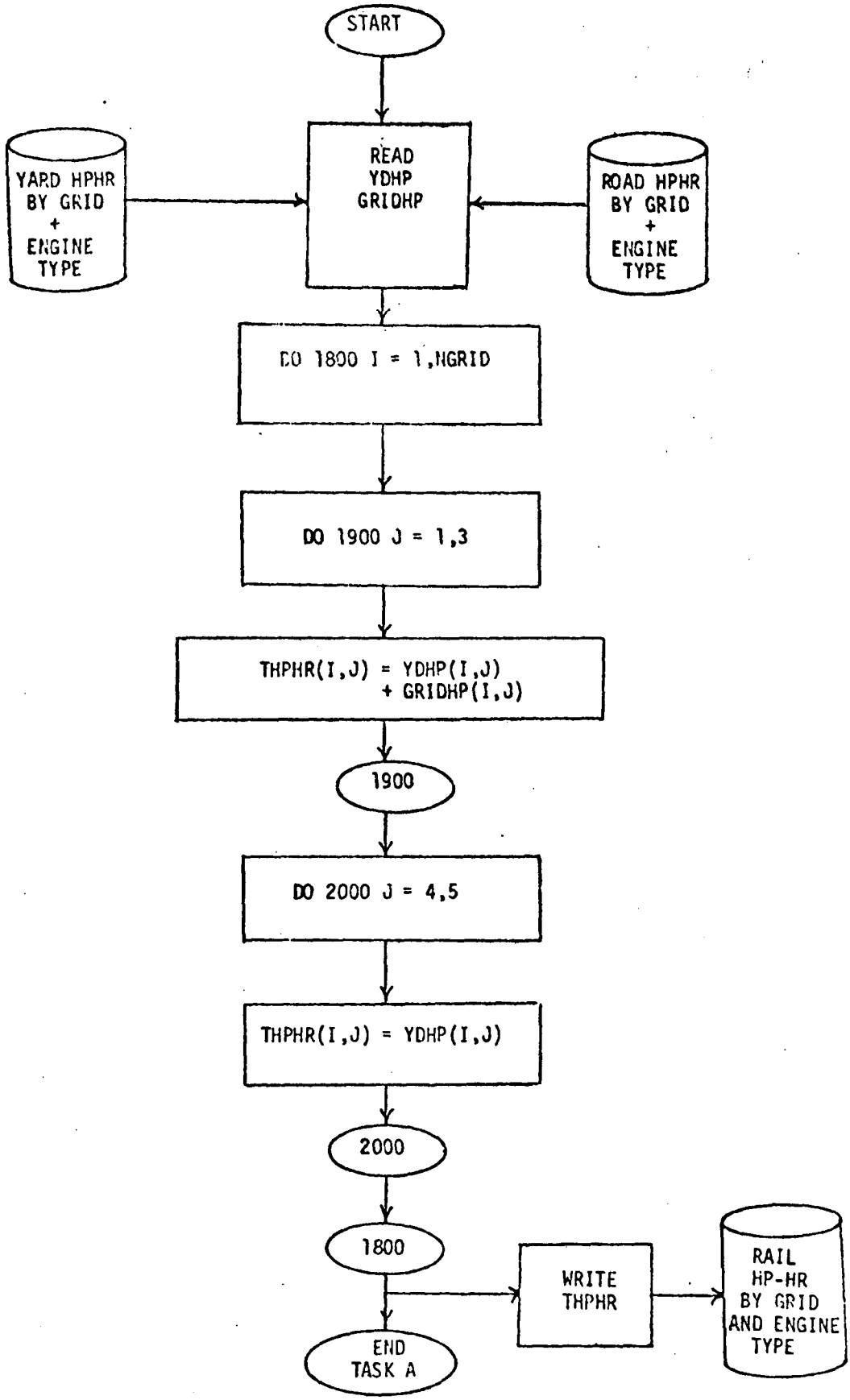


FIGURE A-11

COMBINE PROGRAM FLOW CHART

b. Printed Output

This program lists the yard activity and non-yard activity horse-power-hours by grid number and engine type. At the end of the processing sum of all the emissions is printed as well as the message "ALL RECORDS HAVE BEEN PROCESSED".

3. RUNSTREAM

The runstream for executing COMBINE program on the UNIVAC computer is illustrated in Figure A-12.

```
@RUN, accounting information
@ASG,A GRIDHP
@ASG,A YDHP
@ASG,CP THPHR
@USE 8, GRIDHP
@USE 9, YDHP
@USE 10, THPHR
@FOR, IS CMBN
         COMBINE source statements with the arrays in a
         common statement labeled ABC.
@MAP,E CMBN
       IN CMBN
       IN ABC
END
@XQT CMBN
@FIN
```

FIGURE A-12

RUNSTREAM FOR PROGRAM COMBINE

NAME: EMISSION (Program to Compute Fuel Use and Emissions)

1. RUN DESCRIPTION

This program computes fuel use and emissions by grid. The input to this program is the file of total horsepower-hours by grid and engine type created by the COMBINE program. The output includes a card file of annual fuel use by engine type, grid fuel use, and total grid emissions of five pollutants; a print file presenting total annual fuel use and emissions by grid; and an AQCR summary file which is the summation of computed grid fuel use and emissions.

2. INPUT-OUTPUT DESCRIPTION

2.1 INPUT

1. Disk Input

Title: THPHR
Record Format: Unformatted
Description: This file has the horsepower-hours for all locomotive activity by grid and engine type generated by the COMBINE program.

2.2 OUTPUT

a. Disk Output

Title: EMISSION
Record Format: Card Format
Description: This file contains annual fuel use by engine type grid fuel use, and total grid emissions of five pollutants.

b. Printed Output

This program produces a listing of total annual fuel use and emissions by grid, and an AQCR summary file.

3. RUN STREAM

The runstream for executing EMISSION program on the UNIVAC computer is illustrated in Figure A-13.

```
@RUN,       accounting information
@ASG,A      THPHR
@ASG,CP     EMISSION
@USE      11,THPHR
@USE       8,EMISSION
@FOR,IS     EMSN
            EMISSION source statements
@MAP,       EMSN
          IN EMSN
END
@XQT        EMSN
@FIN
```

FIGURE A-13
RUNSTREAM FOR PROGRAM EMISSION

APPENDIX B

INPUT DATA CODING FORMATS

COORDINATES OF LINE SEGMENTS DEFINING LINKS

Columns	Format	Units	Description
1-3	XXX	-	Origin of Link in Which Segment Occurs
4-6	XXX	-	Destination of Link in Which Segment Occurs
7-10	1XXX	-	Segment Number
11-16	XXXX.X	UTM*	X-Coordinate of Beginning of Segment
17-22	XXXX.X	UTM	Y-Coordinate of Beginning of Segment
23-28	XXXX.X	UTM	X-Coordinate of End Point of Segment
29-34	XXXX.X	UTM	Y-Coordinate of End Point of Segment
35-80	Blank	-	Unused

* Note UTM in kilometers, common zone

Origin	Destination	Series	UTM Start X	UTM Start Y	UTM End X	UTM End Y	Coordinates of Line Segments Defining Links
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					
		10					

ROAD TRAIN ACTIVITY CARD TYPE 1

#1 Columns	Format	Units	Description
1	A	-	Inbound (I) or Outbound (O) Train
2-4	XXX	-	Origin of Train
5-7	XXX	-	Destination of Train
8-13	AAAAAA	-	Destination Yard if Inbound Train Origin Yard if Outbound Train
15-20	AAAAAA	-	Train Name
22	X	-	Number of Engine Types
24-26	AAA	-	Make of First Engine Type
28-31	XXXX	hp	Horsepower of First Engine Type
33-36	XXXX	hrs/mins	Run Time (Hours in Columns 33,34; Minutes in Columns 35,36)
38	X	-	Number of Type 1 Engines
40-42	AAA	-	Make of Second Engine Type
44-47	XXXX	hp	Horsepower of Second Engine Type
49-52	XXXX	hrs/mins	Run Time (Hours in Columns 49,50; Minutes in Columns 51,52)
54	X	-	Number of Type 2 Engines
56-58	AAA	-	Make of Third Engine Type
60-63	XXXX	hp	Horsepower of Third Engine Type
65-68	XXXX	hrs/mins	Run Time (Hours in Columns 65;66; Minutes in Columns 67,68)
70	X	-	Number of Type 3 Engines
72-76	AAAAA	-	Name of Railroad
77-78	XX	-	Reference Number (Arbitrary)
80	1	-	Card Type (#)
14,21,23,27,32 37,39,43,48,53 55,59,64,69,71,79	BLANK	-	Unused

ROAD TRAIN ACTIVITY CARD TYPE 2

#2 Columns	Format	Units	Description
1	A	-	Inbound (I) or Outbound (O) Train
2-4	XXX	-	Origin of Train
5-7	XXX	-	Destination of Train
8-13	AAAAAA	-	Destination Yard if Inbound Train Origin Yard if Outbound Train
15-20	AAAAA	-	Train Name
22	X	-	Number of Nodes
24-26	XXX	-	Entry Node if Inbound Train Exit Node if Outbound Train
27-30	XXXX	hrs/mins	Link Time - Time Between Nodes (Hours in Columns 27,28; minutes in columns 29,30)
32-34	XXX	-	Node 2
35-38	XXXX	hrs/mins	Link Time (Hours in Columns 35,36; Minutes in Columns 37,38)
40-42	XXX	-	Node 3
43-46	XXXX	hrs/mins	Link Time (Hours in Columns 43,44; Minutes in Columns 45,46)
48-50	XXX	-	Node 4
51-54	XXXX	hrs/mins	Link Time (Hours in Columns 51,52; Minutes in Columns 53,54)
56-58	XXX	-	Node 5
59-62	XXXX	hrs/mins	Link Time (Hours in Columns 59,60; Minutes in Columns 61,62)
64-66	XXX	-	Node 6
72-76	AAAAA	-	Name of Railroad
77-78		-	Reference Number (Arbitrary)
80	X		Card Type (#)

Road Train Activity Card Type 2

Direction	
Origin	
Destination	
Origin or Destination Yard	
Train Name	
Number of Nodes	
Entry or Exit Node	
Link Time	
Node 2	
Link Time	
Node 3	
Link Time	
Node 4	
Link Time	
Node 5	
Link Time	
Node 6	
Railroad	
Reference #	
Card Type	

Road Train Activity Card Type One

Direction	
Origin	
Destination	
Origin or Destination Yard	
Train Name	
Number of Engine Types	
Type 1	Make
	Horsepower
	Run Time
	# of Units
Type 2	Make
	Horsepower
	Run Time
	# of Units
Type 3	Make
	Horsepower
	Run Time
	# of Units
Railroad	
Reference #	
Card Type	

ROAD TRAIN UNITS IDLING IN YARDS

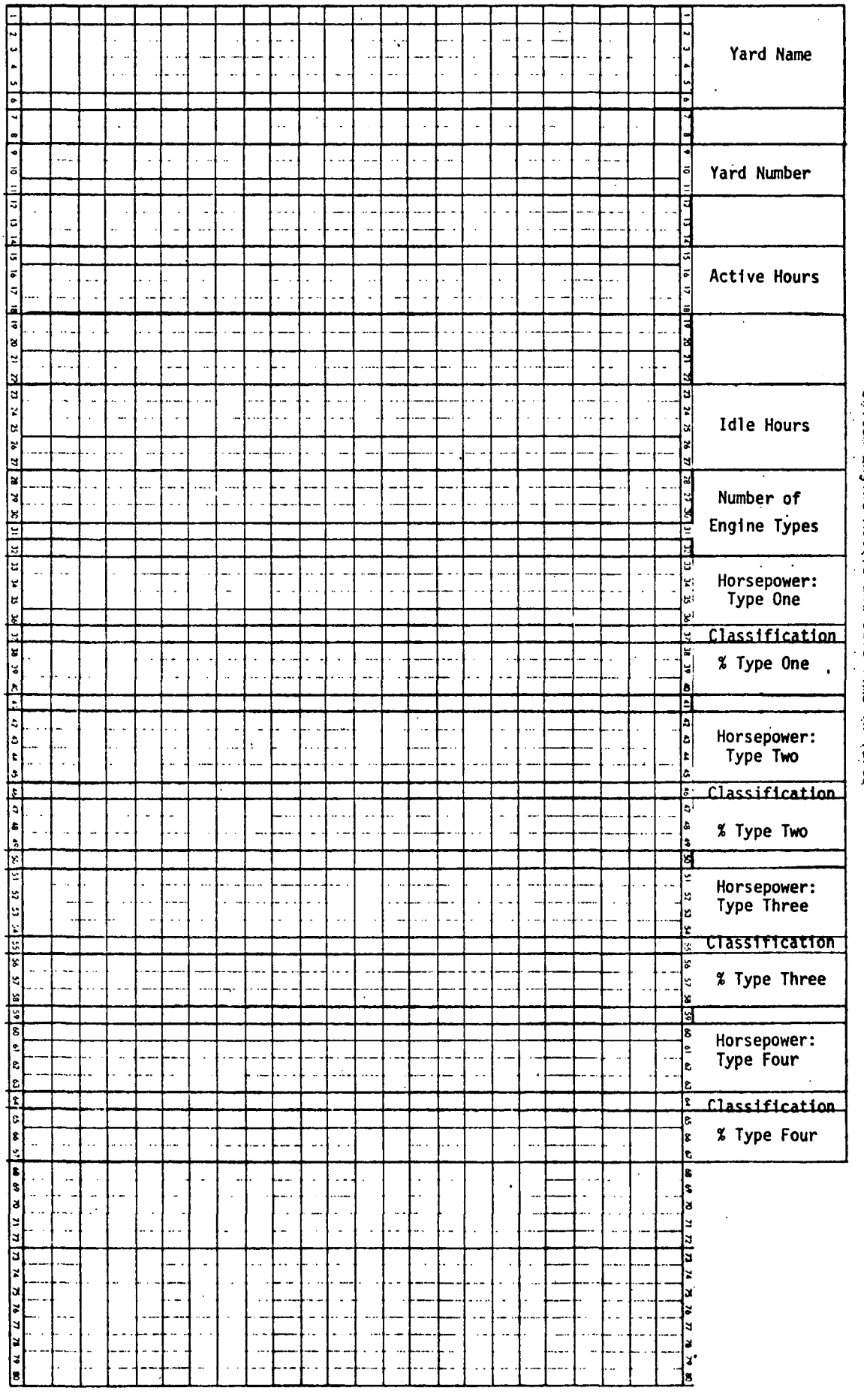
#3 Columns	Format	Units	Description
1-6	AAAAAA	-	Yard Name
8-10	XXX	-	Yard Name
12-17	AAAAAA	-	Train Name
19	X	-	Number of Engine Types
21-23	AAA	-	Make a First Type
25-28	XXXX	hp	Horsepower of First Type
30-33	XXXX	hrs/mins	Idle Time (Hours in Columns 30,31; Minutes in Columns 32,33)
35	X	-	Number of Engines in First Type
37-39	AAA	-	Make of Second Type
41-44	XXXX	hp	Horsepower of Second Type
46-49	XXXX	hrs/mins	Idle Time (Hours in Columns 46,47; Minutes in Columns 48,49)
51	X	-	Number of Engines in Second Type
53-55	AAA	-	Make of Third Type
57-60	XXXX	hp	Horsepower of Third Type
62-65	XXXX	hrs/mins	Idle Time (Hours in Columns 62,63; Minutes in Columns 64,65)
67	X	-	Number of Engines in Third Type

Yard Name
Yard Number
Train Name
Number of Engine Types
Make: Type 1
Horsepower: Type 1
Idle Time: Type 1
# of Units
Make: Type 2
Horsepower: Type 2
Idle Time: Type 2
# of Units
Make: Type 3
Horsepower: Type 3
Idle Time: Type 3
# of Units
Road Train Units Idling in Yards

SWITCH ENGINE ACTIVE AND IDLE TIME IN YARDS

#4 Columns	Format	Units	Description
1-6	AAAAAA	-	Yard Name
9-11	XXX	-	Yard Numbers
15-18	XXXX	hrs/mins	Active Hours (Hours in Columns 15,16; Minutes in Columns 17,18)
23-27	XXXXX	hrs/mins	Idle Hours (Hours in Columns 23-25; Minutes in Columns 26/27)
31	X	-	Numbers of Engine Types
33-36	XXXX	hp	Horsepower of First Engine Type
37	X	-	Engine Classification
38-40	XXX	percent	Percent of Engine Type Operating in Yard
42-45	XXXX	hp	Horsepower of Second Engine Type
46	X	-	Engine Classification
47-49	XXX	percent	Percent of Engine Type Operating in Yard
51-54	XXXX	hp	Horsepower of Third Engine Type
55	X	-	Engine Classification
56-58	XXX	percent	Percent of Engine Type Operating in Yard
60-63	XXXX	hp	Horsepower of Fourth Engine Type
64	X	-	Engine Classification
65-67	XXX	percent	Percent of Engine Type Operating in Yard

Switch Engine Active and Idle Time in Yards



TRANSFER ENGINE UNIT HOURS ON LINKS

#5 Columns	Format	Units	Description
1-3	XXX	-	Origin of Transfer Operation
4	Blank	-	Unused
5-7	XXX	-	Distination of Transfer Operation
8	Blank	-	Unused
9-12	XX.X	hours	Transfer Hours
13-80	Blank	-	Unused

Origin

Destination

Transfer Hours

Transfer Engine Unit Hours on Links

LOCATION OF AREA YARDS

#6 Columns	Format	Units	Description
1-6	AAAAAA	-	Yard Name
7-10	XXXX	-	Yard Number
11-13	XXX	-	Total Number of Grid Squares in Which Yard is Located
14-17	XXXX	-	Grid Number
18-20	XXX	percent	Percent of Yard in Grid
21-24	XXXX	-	Grid Number
25-27	XXX	percent	Percent of Yard in Grid
28-31	XXXX	-	Grid Number
32-34	XXX	percent	Percent of Yard in Grid
35-38	XXXX	-	Grid Number
39-41	XXX	percent	Percent of Yard in Grid
42-45	XXXX	-	Grid Number
46-48	XXX	percent	Percent of Yard in Grid
49-52	XXXX	-	Grid Number
53-55	XXX	percent	Percent of Yard in Grid
56-59	XXXX	-	Grid Number
60-62	XXX	percent	Percent of Yard in Grid
63-66	XXXX	-	Grid Number
67-69	XXX	percent	Percent of Yard in Grid
70-73	XXXX	-	Grid Number
74-76	XXX	percent	Percent of Yard in Grid
77-80	Blank	-	Unused

Location of Area Yards

Yard Name	Yard #	No. of Grids	Grid Number and Percent of Yard in Grid																				
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	

ENGINE CLASSIFICATION

#7 Columns	Format	Units	Description
1-3	AAA	-	Make of Engine
4-6	Blank	-	Unused
7-10	XXXX	hp	Engine Horsepower
11-14	Blank	-	Unused
15	X	-	Engine Classification
16-80	Blank	-	Unused

Engine Classification by Make and Horsepower

Make of Engine	Horsepower	Engine Classification

APPENDIX C

FUEL USE AND EMISSIONS BY GRID

GRID NO	FUEL USE 1000 GALLONS	EMISSIONS ***** PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
2	97.567	1108.720	2527.581	6556.274	2391.820	14067.170
4	207.451	2357.653	5375.905	11337.871	10774.972	35751.442
8	117.597	1336.326	3046.923	6425.799	6106.773	20262.321
9	103.219	1172.948	2674.322	5640.189	5360.166	17785.074
12	120.392	1368.090	3119.246	8190.330	2951.356	17358.004
14	186.618	2143.385	4886.919	10306.592	9794.893	32499.532
15	198.940	2260.687	5154.367	10870.643	10330.941	34278.144
19	173.278	1969.067	4489.472	9311.642	7457.392	28263.171
20	80.645	916.422	2089.443	5419.148	1976.981	11627.548
21	52.500	596.593	1360.232	3527.877	1237.019	7569.430
22	389.954	4430.163	10100.772	21302.693	20245.063	67173.279
27	117.992	1340.615	3057.057	6340.662	5078.031	19245.501
28	11.016	125.187	285.426	592.004	474.117	1796.880
51	3.953	35.145	80.130	168.994	160.604	532.886
52	38.158	433.614	988.641	2085.060	1981.541	6574.770
57	60.534	687.829	1568.326	4067.743	1463.969	5727.767
59	194.971	2215.583	5051.530	10653.758	10124.824	33594.245
61	111.164	1263.223	2880.149	3544.304	7966.869	15521.823
66	209.851	2384.675	5437.059	11277.038	9031.414	34228.642
67	640.736	5000.414	11400.944	30494.676	17613.568	79013.705
68	179.243	2036.848	4644.014	9794.301	9304.037	30884.140
69	13.135	149.262	340.318	955.278	167.174	1970.260
73	321.454	3652.691	8328.591	21976.987	14021.219	59081.509
74	13.948	158.504	361.389	1014.426	177.524	2092.253
75	16.076	182.705	439.224	1234.593	216.054	2546.348
77	70.030	795.796	1814.416	2232.315	5018.911	10408.299
85	445.777	5065.652	11549.536	31330.465	21371.260	87613.125
86	31.798	361.344	823.865	2136.764	779.521	4584.650
87	58.416	663.817	1513.503	3967.602	1342.083	8466.779
88	71.173	808.781	1844.021	2269.246	5100.604	10578.131
95	195.178	2217.930	5056.851	13705.000	7330.679	35639.226
104	14.259	162.035	369.439	958.172	349.555	2055.859
105	75.556	859.728	1960.120	5083.893	1854.675	10908.023
106	15.953	181.285	413.329	1160.221	203.039	2392.957
110	42.962	488.274	1113.105	1369.784	3078.993	6385.266
118	27.391	311.256	709.664	873.311	1963.024	4070.952
131	627.947	7135.762	16269.537	42331.054	29585.169	119640.741
134	11.382	129.342	294.900	764.848	279.027	1641.061
135	59.775	679.402	1445.069	3807.092	1241.134	8103.828
136	2.726	30.972	70.616	198.221	34.689	406.830
141	429.235	4877.675	11121.101	30140.358	16121.641	78487.803
144	32.885	373.691	852.015	1393.376	1692.690	5145.112
156	363.744	4133.451	9424.268	24720.350	17188.081	69643.345
160	55.524	630.955	1438.578	3731.075	1361.148	8005.411
177	16.181	183.874	419.232	685.608	832.583	2531.642
180	10.357	117.689	266.329	436.822	533.169	1623.371
189	552.205	6275.062	14307.141	37271.140	26017.262	105213.915
192	59.649	677.831	1545.454	4008.266	1462.271	8600.153
195	1.920	11.592	26.430	74.189	12.993	153.014
196	71.006	806.882	1839.690	2263.918	5038.823	10553.285
197	205.759	2338.167	5331.022	14447.968	7728.086	37623.991

GRID NO	FUEL USE 1000 GALLONS	EMISSIONS ***** PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
213	66.155	751.761	1714.716	2803.782	3495.620	10350.524
214	9.162	104.140	237.495	388.051	472.679	1436.590
240	25.287	330.536	753.621	927.404	2024.614	4323.107
241	100.045	1136.879	2592.785	7124.997	3757.601	18293.787
242	312.295	3548.806	8091.278	21928.728	11725.475	57104.657
251	47.926	534.391	1218.411	3235.507	2233.875	9062.545
259	8.821	100.236	228.539	281.239	632.169	1311.001
260	8.171	92.851	211.701	260.519	585.594	1214.414
277	1.496	16.998	38.756	108.789	19.038	224.378
279	2.675	30.397	69.304	85.286	191.705	397.561
280	14.317	162.691	370.934	456.471	1026.053	2127.846
281	253.472	2880.361	6567.222	17085.184	11935.578	48249.320
286	1.243	14.121	32.195	90.373	15.815	166.394
287	2.785	31.644	72.149	202.523	35.441	417.703
288	19.648	223.277	509.072	734.974	1251.569	2923.914
291	70.193	797.642	1818.625	2974.159	3613.479	10982.232
292	56.394	640.840	1461.115	2995.793	2343.403	8751.588
308	56.103	637.534	1453.577	2048.428	3646.073	8347.101
309	12.398	140.899	321.227	901.689	157.796	1859.734
310	77.588	881.680	2010.230	4099.690	4479.401	12069.188
311	157.117	1785.419	4070.756	11042.609	7532.428	30809.278
328	18.501	210.240	479.348	994.218	796.237	3017.701
329	90.291	1026.038	2339.366	6345.922	4328.706	17705.352
338	18.013	204.690	466.692	967.960	775.215	2938.030
339	47.268	537.131	1224.660	3322.095	2266.081	9268.766
340	42.160	479.096	1092.338	2963.152	2021.237	8267.300
352	24.061	273.423	623.404	1246.027	1024.153	3737.099
353	33.606	381.891	870.710	1787.867	1386.444	5214.234
354	87.447	993.721	2265.683	4422.919	3828.120	13595.584
355	229.654	2609.701	5950.119	10805.900	10965.731	35843.720
367	17.922	203.661	464.347	963.105	771.320	2923.265
368	37.101	421.601	961.250	2607.552	1779.674	7275.164
369	55.646	632.337	1441.728	3910.930	2667.739	10911.635
381	13.450	153.185	349.262	905.841	330.463	1943.576
382	3.537	40.195	91.646	237.691	86.713	509.991
389	36.647	416.444	949.492	1168.443	2626.420	5446.712
392	9.108	103.499	235.979	662.396	115.919	1366.191
393	215.743	2451.621	5589.695	15173.037	7365.370	39135.093
396	15.727	178.710	407.460	881.105	608.316	2434.718
399	7.421	84.329	192.270	415.773	286.907	1148.879
402	.333	3.782	8.622	17.393	14.322	54.279
403	64.240	729.994	1664.391	4223.929	2993.433	12016.698
404	49.388	561.226	1279.595	3471.116	2367.732	9684.540
415	5.224	59.363	135.348	351.035	129.063	753.183
416	5.772	65.596	149.559	387.894	141.509	832.268
417	53.938	611.793	1394.900	2055.643	4649.668	6117.584
427	20.764	235.959	537.967	1163.316	802.760	3214.546
432	111.329	1265.104	2884.436	7528.004	5249.394	21239.570
444	10.996	124.959	284.907	738.931	269.572	1585.453
446	53.838	611.798	1394.900	2055.643	4649.668	6117.584
453	13.696	155.638	354.854	436.682	931.572	2035.600

GRID NO	FUEL USE 1000 GALLONS	EMISSIONS ***** PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
459	22.968	250.777	571.772	1236.420	853.205	3415.545
473	13.608	154.636	352.571	731.270	505.651	2219.589
474	118.103	1342.079	3059.940	6229.224	5640.831	23016.684
485	11.003	125.039	285.090	739.405	269.745	1586.471
487	53.338	611.798	1394.900	2055.643	4649.668	6117.984
494	52.908	601.224	1370.791	1933.858	4368.042	6491.436
495	16.805	190.970	435.411	641.458	1451.370	1909.697
497	30.433	345.827	788.485	1493.185	1409.485	4746.281
498	5.462	62.077	141.520	163.856	367.456	868.985
501	7.176	81.548	185.929	215.236	482.763	1141.659
502	7.244	82.319	187.687	217.322	487.328	1152.466
503	7.175	81.511	185.846	215.190	482.546	1141.157
505	33.151	376.719	858.920	2033.451	1511.428	5909.570
506	115.546	1313.027	2993.702	8120.920	5539.474	22657.658
514	.365	4.147	9.455	18.810	30.792	45.423
515	.408	4.636	10.571	21.030	34.426	50.784
516	11.240	127.737	291.223	751.433	280.385	1615.718
518	53.338	611.798	1394.900	2055.643	4649.668	6117.984
525	125.731	1428.760	3257.572	4714.378	10657.312	14766.791
526	140.044	1591.414	3628.425	5347.153	12094.750	15914.144
527	278.331	3162.647	7211.291	13748.860	12789.051	43393.104
528	132.556	1506.337	3434.447	6498.837	6144.985	20674.466
529	15.106	171.658	391.390	453.177	1016.215	2403.211
530	81.046	920.979	2099.832	5211.561	2998.158	13938.556
542	17.922	203.641	464.347	963.105	771.320	2923.265
543	42.993	488.562	1113.922	3021.701	2061.174	8430.654
544	79.141	899.326	2050.464	5562.227	3794.128	15516.815
549	.407	4.630	10.557	21.033	34.381	50.718
550	.477	5.422	12.362	24.594	40.260	59.390
551	.091	1.037	2.364	4.703	7.698	11.356
552	17.749	201.698	459.948	677.671	1532.627	2016.878
553	13.726	155.979	355.633	902.177	410.447	1954.006
555	17.749	201.698	459.948	677.671	1532.627	2016.878
561	3.809	43.290	98.700	139.335	282.770	548.850
562	125.127	1421.901	3241.933	4730.357	10633.545	14642.430
563	140.044	1591.414	3628.425	5347.153	12094.750	15914.144
569	227.661	2587.054	5898.482	16024.474	8168.795	41123.575
572	8.961	101.830	232.173	481.552	385.660	1461.633
573	14.030	159.436	363.515	753.958	603.829	2288.484
574	14.269	207.600	473.327	1283.979	875.833	3582.348
575	93.552	1063.094	2423.355	6575.113	4485.042	18344.804
576	.033	.376	.858	1.706	2.793	4.120
577	.439	4.994	11.385	22.651	37.079	54.698
578	.478	5.431	12.382	24.653	40.324	59.484
579	17.775	201.994	460.546	679.058	1535.098	2020.228
583	14.543	165.260	376.792	952.727	445.653	2066.470
589	23.665	268.917	613.131	903.561	2043.770	2689.171
591	19.038	216.344	493.265	696.343	1413.175	2742.942
597	19.741	224.323	511.469	1106.018	763.220	3056.211
598	21.934	249.247	568.284	1228.376	847.999	3395.699
599	22.510	255.794	583.210	1261.153	870.272	3484.888

GRID NO	FUEL USE 1000 GALLONS	EMISSIONS PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
600	11.807	134.167	305.901	661.492	456.469	1827.871
601	10.037	114.054	260.044	539.358	431.555	1637.088
602	9.993	113.562	256.921	536.810	434.236	1626.146
603	106.313	1208.098	2754.464	6893.683	5795.297	19350.983
604	.430	4.890	11.149	22.179	36.307	53.559
611	14.784	167.999	383.036	968.522	453.046	2100.729
619	19.038	216.345	493.266	696.344	1413.177	2742.946
635	2.058	23.382	53.312	115.283	79.552	316.556
638	13.169	149.652	341.207	737.337	509.152	2038.632
639	21.730	246.935	563.013	1217.478	840.134	3364.204
640	67.149	763.057	1739.770	3294.161	3830.039	9564.529
641	107.786	1224.661	2792.563	7575.623	5167.514	21136.262
549	14.855	168.807	384.881	973.180	455.225	2110.834
556	2.572	29.229	66.641	93.475	190.514	371.365
557	19.277	219.060	499.456	705.361	1431.104	2777.016
570	90.041	1023.196	2332.288	3957.935	6548.365	11325.347
671	737.571	8384.900	19117.575	31936.393	55417.255	91335.076
672	204.362	2322.520	5295.346	11287.522	13298.870	32028.572
678	.542	6.157	14.038	27.927	45.716	67.439
679	15.569	176.925	403.390	1005.492	532.859	2196.063
680	1.037	11.788	26.877	53.471	87.531	129.123
681	1.037	11.788	26.877	53.471	87.531	129.123
682	1.041	11.832	26.976	53.668	87.853	129.595
683	1.047	11.897	27.125	53.963	88.336	130.311
684	1.047	11.897	27.125	53.963	88.336	130.311
685	1.053	11.963	27.286	54.284	88.862	131.086
686	22.934	260.616	594.204	840.273	1703.332	3302.363
695	284.886	3237.655	7381.191	18318.984	10538.963	48995.890
696	327.576	3722.458	8487.203	21063.936	12118.142	56337.530
697	554.925	6305.953	14377.596	35682.985	20528.523	95437.589
698	319.228	3627.593	8270.912	20527.133	11809.318	54901.799
699	236.722	2690.027	6133.262	13316.902	10233.425	39689.586
714	139.032	1579.909	3602.191	7324.170	9647.306	20887.556
715	26.228	298.046	679.546	1843.392	1257.415	5143.101
718	1.050	11.929	27.198	54.108	88.574	130.662
719	8.762	99.573	227.026	348.991	754.611	1007.427
720	15.861	180.243	410.953	612.237	1368.659	1807.795
721	36.233	411.734	938.753	2121.066	1702.372	4876.051
727	11.704	132.995	303.229	417.799	861.769	1699.638
726	7.803	88.670	202.169	278.555	574.558	1133.183
737	55.859	634.759	1447.250	3693.312	2480.043	10396.861
738	240.627	2734.399	6234.428	16933.415	8670.938	43514.565
754	93.950	1067.617	2434.166	6331.151	4871.392	17654.276
756	.825	9.379	21.383	42.501	69.574	102.633
757	.289	3.287	7.495	14.911	24.409	36.007
760	23.912	271.729	619.539	1530.823	870.099	3352.747
761	.000	.002	.005	.011	.006	.025
766	19.507	221.665	505.396	696.352	1436.324	2832.814
776	17.887	203.262	463.438	666.397	1035.076	2817.630
777	7.171	81.483	185.782	267.945	414.939	1129.524
786	2.248	25.547	58.247	165.499	26.612	337.217

		EMISSIONS				
GRID NO	FUEL USE 1000 GALLONS	PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
787	3.014	34.245	78.079	219.169	38.355	452.035
788	2.249	25.556	58.268	163.560	28.623	337.343
789	121.224	1377.551	3140.815	7384.433	7212.267	20784.825
790	.213	2.421	5.519	10.930	17.973	26.514
791	1.393	15.825	36.080	71.779	117.501	173.335
795	12.377	140.651	320.684	792.381	450.378	1735.440
796	222.621	2529.779	5767.696	11497.730	18209.687	27797.973
797	7.683	87.306	199.057	293.346	653.522	873.055
800	18.254	207.437	472.957	651.657	1344.134	2650.991
801	7.803	88.667	202.161	278.544	574.536	1133.139
813	10.435	118.575	270.352	389.917	603.824	1643.699
814	38.929	442.379	1008.624	1471.357	2835.607	5234.300
815	53.057	602.926	1374.671	2007.620	3944.698	7010.814
816	3.183	36.157	82.461	231.471	40.507	477.408
817	3.647	41.442	94.488	265.229	46.415	547.034
818	3.014	34.245	78.079	219.170	38.355	452.039
819	2.632	29.913	68.201	191.440	33.502	394.845
820	2.099	23.858	54.396	152.691	26.721	314.525
821	3.070	34.891	79.551	223.310	39.077	460.556
822	3.069	34.871	79.505	223.173	39.055	460.293
824	2.749	31.237	71.221	199.919	34.986	412.334
825	127.547	1449.395	3304.622	7721.318	7613.141	21693.826
826	1.087	12.357	28.173	56.049	91.750	135.346
831	30.732	349.222	796.226	1173.236	2654.087	3492.220
832	265.542	3017.518	6879.942	13832.756	20599.907	33387.810
835	17.294	196.525	448.077	617.377	1273.426	2511.536
836	3.043	34.577	78.835	108.622	224.049	441.884
847	.416	4.723	10.769	15.532	24.053	65.476
848	46.434	527.664	1203.074	1680.077	3663.841	5984.567
849	38.967	442.804	1009.592	1336.412	3012.021	5269.193
850	.632	7.178	16.366	18.950	42.494	100.493
851	.559	6.347	14.471	40.620	7.108	83.779
852	1.126	12.800	29.183	81.918	14.336	168.957
854	20.189	229.424	523.088	770.866	1743.625	2294.244
857	107.063	1216.624	2773.904	7469.349	5123.340	20569.699
858	24.136	274.273	625.343	936.089	2082.316	2754.514
864	38.089	432.835	986.863	2423.444	1443.695	5321.655
867	19.216	218.363	497.868	685.930	1414.529	2790.619
877	683.758	7769.977	17715.548	43676.217	25457.353	117302.321
878	109.000	1238.640	2824.099	7008.981	4032.287	18746.197
882	25.540	290.225	661.713	1642.270	944.803	4392.410
883	127.691	1451.037	3308.364	8210.851	4723.726	21963.713
886	514.940	5851.592	13341.629	24146.805	34491.574	69845.343
887	44.162	501.841	1144.197	2534.474	2682.180	7196.205
888	57.516	654.725	1492.774	2058.346	4646.839	7330.759
889	48.770	554.279	1263.593	1793.479	4051.775	5923.511
895	31.379	362.266	825.966	2193.099	1589.615	6013.329
896	98.320	1117.277	2547.391	5740.797	6069.531	16122.784
902	37.170	422.395	963.038	2364.938	1408.641	5193.180
904	16.430	186.699	425.674	586.509	1209.757	2385.964
905	5.125	58.237	132.781	182.951	377.362	744.259

GRID NO	FUEL USE 1000 GALLONS	PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
	EMISSIONS					
914	90.343	1026.630	2340.716	5400.228	4374.098	16386.362
915	179.965	2044.150	4660.461	12470.562	5596.303	30356.261
924	8.342	95.367	217.438	251.770	564.575	1335.143
925	14.973	170.145	387.921	449.184	1007.260	2382.034
930	584.266	6639.383	15137.793	28475.358	43970.845	79797.346
931	13.656	155.184	353.819	709.073	1151.503	1703.992
937	69.474	789.423	1800.021	4120.100	3824.161	9323.395
938	597.575	6790.628	15482.631	27776.554	46060.025	79353.897
939	58.745	667.551	1522.017	4693.132	4333.285	9108.267
940	137.953	1567.645	3574.231	6502.014	9855.044	18007.836
941	31.119	353.623	806.261	1900.290	1594.025	5325.692
942	25.740	292.504	666.910	1701.921	1142.032	4790.993
943	24.553	279.009	636.142	1623.402	1090.108	4569.960
944	24.154	274.473	625.798	1597.005	1072.382	4495.650
945	25.446	289.165	659.295	1682.489	1129.784	4736.291
953	3.989	45.333	103.360	228.949	242.292	649.881
955	5.119	58.172	132.633	153.575	344.380	814.413
956	40.993	465.830	1062.093	1450.039	3271.626	5298.028
960	724.494	8232.881	18770.969	31703.326	56981.413	90359.404
961	.128	1.455	3.317	9.310	1.629	19.202
966	34.272	389.449	887.945	1841.741	2449.661	5092.642
967	484.605	5506.670	12555.662	24773.546	32490.790	63955.770
968	232.702	2644.339	6029.093	10990.011	17315.041	31238.630
969	23.506	267.115	609.023	1495.104	1239.153	4283.305
975	5.123	58.213	132.725	338.707	227.441	953.479
976	28.450	323.297	737.117	1891.086	1263.141	5295.352
993	8.969	101.918	232.372	514.721	544.718	1461.055
994	133.500	1517.049	3458.872	6098.195	9113.785	17703.053
995	711.479	8084.991	18433.780	35023.261	48119.327	98721.844
996	254.980	2897.497	6606.293	16436.657	13719.089	42752.749
997	45.574	522.428	1191.137	2183.884	3398.707	6323.416
998	182.980	2079.314	4740.835	21678.220	12187.483	35287.564
999	477.250	5423.293	12365.108	72185.561	32870.514	98819.410
1002	907.533	9176.514	20922.451	36590.685	63828.993	105423.897
1003	.128	1.455	3.317	9.310	1.629	19.202
1007	25.067	284.849	649.456	1347.891	1776.263	3752.746
1008	83.596	949.555	2165.900	4454.895	5912.567	12513.068
1009	108.441	1232.297	2809.614	4907.449	8641.444	13609.535
1018	47.454	541.528	1234.683	3293.275	1379.978	7819.742
1019	11.713	133.099	303.465	809.433	339.176	1921.964
1024	16.087	182.811	416.810	598.595	1169.165	2201.718
1025	16.626	188.928	430.756	618.623	1228.954	2275.386
1028	9.936	112.909	257.433	570.232	603.464	1618.626
1029	7.598	86.339	196.854	436.045	461.457	1237.731
1030	38.896	442.003	1007.767	1511.944	3246.671	4699.022
1031	422.958	4806.343	10956.463	16128.445	36153.396	49015.879
1032	256.497	2914.741	6645.609	13339.442	18893.554	37168.816
1033	170.000	1931.621	4404.551	8285.529	12891.991	23661.693
1034	.371	4.212	9.603	19.105	31.274	46.135
1036	61.562	699.572	1595.023	2819.068	5009.075	7925.674
1037	195.465	2221.191	5064.316	8779.318	16036.323	24779.112

GRID NO	FUEL USE 1000 GALLONS	EMISSIONS PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
1038	414.275	4707.674	10733.497	20705.575	3262 6.278	56454.400
1039	123.686	1405.527	3204.602	6124.365	8925.866	18232.186
1048	74.652	848.313	1934.154	5104.063	2239.165	12202.891
1049	29.563	335.942	765.949	1100.018	2185.247	4045.990
1050	21.768	247.367	563.998	809.977	1609.095	2979.211
1051	7.387	83.947	191.384	274.853	546.022	1010.950
1052	21.260	241.591	550.928	791.062	1571.520	2909.642
1053	4.252	48.321	110.172	158.222	314.323	581.963
1057	118.539	1347.033	3071.235	6802.997	7199.466	19310.576
1059	39.180	445.230	1015.123	2249.568	2379.611	6382.649
1060	59.430	675.343	1539.781	3410.721	3609.493	9681.467
1061	39.809	452.372	1031.408	2284.639	2417.785	6485.039
1063	23.665	268.917	613.131	903.561	2043.771	2689.171
1066	65.341	742.513	1692.929	3013.915	4279.505	10391.139
1067	47.532	540.136	1231.511	1994.178	3683.569	6066.772
1068	131.989	1499.875	3419.715	6107.942	8936.933	20751.078
1069	116.069	1318.967	3007.244	5208.465	9296.415	15234.433
1070	111.424	1266.181	2886.893	4967.839	8911.667	14648.415
1071	102.895	1169.254	2665.904	4543.135	8179.617	13612.955
1072	101.275	1150.853	2623.944	4668.414	8213.074	13115.798
1073	190.826	2168.476	4944.125	28007.010	12362.155	39001.632
1074	276.140	3137.957	7154.542	41273.175	18676.306	57186.564
1075	164.351	1867.630	4258.196	8206.538	11361.174	24919.092
1076	16.677	189.519	432.053	794.915	1194.467	2329.991
1079	33.649	382.374	871.813	1284.777	2906.042	3823.740
1087	71.824	816.177	1860.384	4423.711	2841.970	11323.971
1090	9.944	113.597	257.634	359.997	735.035	1360.904
1091	.001	.011	.026	.037	.074	.136
1094	158.072	1796.275	4095.506	10656.973	4596.640	25969.167
1095	24.440	277.726	633.215	1659.077	1542.752	4218.222
1096	40.227	457.130	1042.257	2554.714	2695.705	6363.716
1097	150.691	1712.395	3904.261	9134.168	10083.759	23780.425
1098	95.992	1090.822	2487.073	4832.301	7234.862	12605.027
1099	405.983	4612.302	10516.048	20202.118	27141.717	54790.805
1100	299.114	3399.027	7749.782	14881.250	22139.625	39221.633
1101	201.912	2294.457	5231.362	10160.747	15420.238	26766.086
1102	116.150	1319.834	3009.336	6159.254	8027.064	16028.993
1103	213.424	2425.277	5529.631	12062.396	15572.764	29080.127
1104	351.746	3997.112	9113.416	19737.767	23202.649	52600.841
1105	62.530	711.708	1622.695	2654.512	4999.972	7840.717
1106	84.560	960.909	2190.870	3699.811	6577.658	10904.582
1107	20.189	229.424	523.088	770.366	1743.625	2294.244
1110	74.442	845.927	1928.714	4526.521	3023.263	11697.246
1111	.000	.004	.008	.018	.015	.049
1118	191.253	2173.332	4955.196	12638.248	10224.485	30944.496
1119	94.181	1070.244	2440.156	6519.541	5737.935	16590.708
1120	7.131	81.034	184.758	500.467	428.828	1279.042
1121	1.127	12.819	29.202	58.996	95.102	140.292
1122	993.680	11291.029	25745.351	49187.565	66543.400	131811.709
1123	1534.420	17436.585	39755.415	96966.396	93670.633	220947.508
1124	484.958	5511.346	12565.869	28244.550	30534.046	67577.977

GRID NO	FUEL USE 1000 GALLONS	EMISSIONS PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
1125	232.366	2637.117	6012.526	13186.297	13525.678	33967.160
1126	214.343	2435.718	5553.438	13798.721	8668.917	36217.958
1127	252.141	2865.223	6532.732	15242.414	12029.630	40428.206
1128	145.629	1654.670	3773.105	7517.628	8993.365	21312.863
1129	37.427	425.319	969.706	1793.832	2545.132	5189.286
1130	6.730	76.475	174.363	256.955	581.208	764.748
1134	40.504	460.271	1049.417	1767.165	3052.267	5040.261
1135	145.546	1653.628	3770.955	6969.922	9458.474	19829.658
1140	82.006	931.891	2124.689	5606.314	2277.366	13538.058
1145	12.050	136.927	312.194	691.531	731.832	1962.938
1146	12.672	144.002	326.325	727.263	769.646	2064.363
1147	2.535	28.803	65.670	145.463	153.941	412.903
1150	1485.111	16876.256	38477.863	63896.513	118472.727	181765.084
1151	99.596	1131.773	2580.441	6095.466	5761.622	15280.801
1152	13.505	153.461	349.892	529.744	1164.208	1546.057
1154	142.287	1616.898	3686.527	7996.268	6498.241	21268.642
1155	218.110	2478.521	5651.027	8483.545	18670.973	25277.335
1156	268.832	3054.979	6965.193	11205.290	19061.000	37753.780
1157	54.291	614.948	1402.642	2213.978	3021.244	8566.403
1158	37.156	422.226	962.675	1449.078	3204.398	4246.906
1160	53.368	606.687	1383.246	3166.295	2482.548	6966.397
1161	70.039	795.896	1814.643	3444.301	4598.164	9935.298
1168	113.088	1285.090	2930.096	5080.540	7943.742	14851.810
1169	149.524	1702.546	3881.805	6599.827	11131.674	18851.178
1179	531.874	6044.028	13780.383	24407.504	38020.676	67882.677
1180	363.447	4357.349	9934.756	16841.214	27793.191	47373.950
1181	35.198	399.976	911.945	1963.524	2394.577	4820.293
1182	29.554	339.250	773.491	1620.059	1967.844	4290.554
1183	27.668	314.404	716.842	1379.036	1653.258	4521.575
1185	270.549	3074.424	7009.636	10309.150	22940.395	31825.996
1186	237.991	2704.446	6166.136	10602.755	13135.042	37652.777
1187	70.246	798.251	1820.013	2986.454	5414.140	8832.292
1188	34.581	396.375	903.735	1331.820	3012.450	3963.750
1190	34.236	389.043	887.019	2031.690	1591.956	5749.781
1191	55.542	631.159	1439.042	3296.033	2582.636	9328.074
1197	73.800	838.633	1912.084	3673.231	4333.015	10623.523
1198	74.467	846.212	1929.363	3727.236	4627.048	10296.451
1199	19.957	226.785	517.070	1364.367	554.225	3296.656
1200	28.982	329.338	750.891	1981.340	804.849	4764.516
1201	26.789	304.422	694.082	1831.440	743.957	4422.538
1202	26.683	303.212	691.324	1824.164	741.002	4404.969
1203	774.571	8801.943	20068.431	49806.766	28653.973	133213.002
1211	33.532	381.047	868.738	1597.650	1654.263	5362.940
1212	36.525	415.057	946.329	1740.246	1801.888	5841.593
1213	98.465	1121.197	2556.328	3997.692	7563.440	12413.921
1214	50.028	568.698	1296.176	3390.332	1756.974	8289.869
1215	247.950	2817.619	6424.171	14595.776	9889.997	37201.797
1216	12.448	141.459	322.527	475.302	1075.089	1414.591
1218	39.490	448.744	1023.137	2021.564	2433.899	6216.150
1219	32.619	370.670	845.127	1819.658	2219.129	4647.115
1220	278.583	3165.717	7217.834	14171.256	16927.167	36[illegible]1.30

		EMISSIONS				
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GRID NO	FUEL USE 1000 GALLONS	PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
	**********	**********	**********	**********	**********	**********
1222	45.975	522.448	1191.181	2936.722	2599.437	7483.920
1223	40.006	454.617	1036.528	1769.370	2878.213	5725.469
1224	97.502	1107.976	2526.184	4296.033	6521.297	13632.771
1225	15.072	171.279	390.495	830.672	663.773	2454.394
1228	15.065	171.416	390.828	895.179	701.429	2533.490
1229	70.625	802.555	1829.926	4191.162	3284.036	11861.190
1230	4.069	46.241	105.429	241.483	189.217	683.406
1233	446.111	5069.448	11558.342	23925.166	25669.161	66308.807
1238	57.601	654.560	1492.397	2996.539	3062.321	8691.258
1239	26.680	303.179	691.247	1233.793	1745.534	3842.545
1240	21.052	239.225	545.433	1174.957	1045.949	3217.331
1241	9.979	113.402	258.555	482.238	277.135	1647.460
1246	15.651	177.848	405.494	745.680	772.094	2503.074
1247	10.672	121.275	276.507	612.733	379.196	1584.087
1248	6.456	73.361	167.264	370.682	229.382	956.240
1249	32.062	364.343	830.702	2146.060	1326.711	5210.107
1250	57.378	652.024	1486.614	3840.600	2374.265	9323.945
1251	57.378	652.025	1486.617	3840.607	2374.270	9323.961
1252	36.258	412.027	939.422	1905.276	2061.188	5920.222
1254	337.004	3829.815	8754.778	17230.544	20189.801	44080.893
1256	61.318	696.791	1588.583	2823.289	3560.656	9382.738
1259	16.070	182.615	416.361	924.638	647.851	2659.290
1263	66.556	756.322	1724.414	3949.720	3094.851	11177.896
1264	23.221	263.677	601.640	1378.0 9	1079.779	3899.916
1267	40.683	464.584	1059.251	1951.531	2577.625	5749.834
1268	116.347	1322.125	3014.446	5299.375	7921.864	15779.411
1269	60.323	685.486	1562.909	3370.581	2940.554	9252.411
1270	15.109	171.697	391.470	1079.497	381.854	2516.844
1274	162.934	1851.527	4221.481	8219.259	7393.793	25521.820
1275	1.844	20.959	47.786	105.970	65.532	273.759
1279	11.166	127.119	289.832	534.593	624.215	1925.188
1280	67.634	768.572	1752.343	4422.082	2951.912	10935.228
1282	413.439	4700.442	10717.909	21465.900	23640.991	54180.318
1283	105.866	1203.025	2742.897	4698.037	7720.368	12641.995
1286	7.074	80.387	183.283	237.802	535.573	983.313
1287	24.502	278.429	634.819	1079.516	1652.323	3750.295
1288	33.993	386.278	880.715	1866.554	1375.925	5485.409
1289	3.399	38.621	88.057	272.221	132.164	685.114
1290	4.855	55.172	125.793	388.881	188.802	978.717
1291	4.855	55.172	125.793	388.881	188.802	978.717
1292	52.260	593.660	1354.000	3202.053	2393.097	8940.128
1293	45.345	515.288	1174.356	2752.650	2085.918	7715.550
1294	42.666	485.096	1106.019	2555.625	1890.085	6655.428
1295	42.688	485.096	1106.019	2555.625	1890.085	6655.428
1296	60.632	689.074	1570.930	3265.034	3392.674	8741.835
1297	89.792	1020.360	2326.422	3856.477	6315.502	12106.698
1298	129.191	1468.084	3347.232	4932.763	11157.641	14680.863
1312	14.927	168.484	384.143	708.550	827.334	2551.642
1313	57.020	647.952	1477.330	3784.262	2449.821	9185.774
1315	51.570	586.019	1336.120	2822.008	2647.760	6946.968
1316	245.790	2793.063	6368.184	13079.657	13389.711	32626.146

GRID NO	FUEL USE 1000 GALLONS	EMISSIONS ***** PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
1318	5.772	65.598	149.540	368.673	326.331	939.524
1319	12.714	144.476	329.405	812.110	718.638	2069.575
1323	23.911	271.712	619.503	803.795	1810.247	3323.653
1324	37.294	423.793	966.248	2140.715	1503.212	6163.262
1325	1.456	16.546	37.724	116.621	56.620	293.507
1329	44.612	506.956	1155.859	2691.150	2284.695	7243.571
1331	16.824	191.187	435.906	642.388	1453.021	1911.870
1332	33.649	382.374	871.813	1284.777	2906.042	3823.740
1333	23.764	270.041	615.694	796.836	1799.141	3303.197
1343	5.803	65.939	150.340	277.301	323.789	998.622
1344	8.970	101.930	232.401	428.663	500.526	1543.708
1345	44.600	506.820	1155.549	2960.032	1916.219	7184.996
1346	56.983	647.534	1476.377	3781.822	2448.241	9179.249
1347	56.983	647.534	1476.377	3781.822	2448.242	9179.851
1348	71.695	814.719	1857.560	4757.483	2361.113	11176.543
1349	15.440	175.458	400.043	986.261	872.938	2513.381
1350	10.809	122.833	280.060	690.455	611.156	1759.550
1355	26.025	295.742	674.291	874.864	1970.371	3617.572
1356	24.339	276.576	630.593	1323.789	986.056	3904.986
1357	5.986	66.899	152.510	320.160	238.479	944.426
1363	8.412	95.593	217.953	321.194	726.511	955.935
1364	25.237	286.750	653.860	963.582	2179.532	2867.805
1365	49.000	556.622	1269.553	1762.419	3978.673	6171.002
1373	4.748	53.959	123.027	272.514	288.395	773.540
1374	71.528	812.822	1853.234	4105.739	4344.276	11652.317
1378	89.955	1022.221	2330.663	4285.955	4437.774	14386.949
1379	5.953	67.650	154.241	283.641	293.648	952.116
1380	42.795	486.310	1108.787	2070.654	2046.513	6807.168
1381	8.374	95.143	216.973	480.345	297.552	1243.019
1386	14.506	164.842	375.840	693.236	809.453	2496.493
1391	128.746	1463.025	3335.697	4327.925	9747.366	17696.022
1392	147.695	1678.358	3826.656	8033.215	5983.732	23695.816
1393	177.771	2020.126	4605.882	11098.557	8432.790	32513.052
1396	49.275	559.944	1276.677	1771.562	3999.490	6209.222
1397	19.201	218.191	497.475	722.271	1632.933	2242.185
1410	46.524	528.677	1205.384	2216.432	2295.150	7440.716
1411	.785	8.924	20.346	45.090	27.902	116.562
1412	10.013	113.786	259.432	574.942	355.780	1486.266
1416	2.514	31.973	72.898	134.460	157.002	484.220
1417	14.065	159.825	364.409	672.150	784.833	2420.560
1419	227.334	2583.340	5890.016	10276.234	13907.983	36050.835
1431	7.824	88.905	202.705	372.758	385.962	1251.263
1432	2.260	25.687	58.565	129.790	80.315	335.516
1433	8.343	94.812	216.172	479.071	296.654	1236.433
1435	11.627	132.127	301.232	555.622	648.769	2000.916
1436	14.903	169.317	383.534	707.427	826.024	2547.600
1437	12.738	144.752	330.034	608.745	710.798	2192.225
1449	1.775	20.171	45.989	101.920	63.069	263.469
1450	12.907	146.675	334.419	741.125	458.616	1915.[illegible]
1452	11.769	133.966	305.443	563.387	657.236	2028.[illegible]
1453	10.020	113.868	259.619	478.347	559.146	1724.503

GRID NO	FUEL USE 1000 GALLONS	EMISSIONS PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
1461	38.101	432.971	987.174	1815.356	1879.661	6093.727
1462	3.893	45.373	103.451	229.263	141.871	592.662
1463	11.535	131.083	298.970	662.342	479.864	1712.202
1465	6.202	70.479	160.682	296.378	346.064	1067.322
1466	10.340	117.522	267.904	494.147	576.989	1779.533
1469	11.218	127.474	290.640	722.364	290.656	1745.226
1475	503.327	5719.629	13040.753	32365.148	18619.761	86563.711
1484	30.656	348.369	794.262	1460.611	1512.339	4902.595
1486	17.154	194.934	444.450	817.318	846.269	2743.546
1487	22.350	253.978	579.071	1076.586	1083.240	3558.412
1488	11.450	130.109	296.649	657.420	406.818	1699.478
1494	68.772	781.495	1781.908	4750.531	1383.050	10656.519
1498	28.692	326.044	743.380	964.504	2172.259	3988.236
1499	68.248	775.545	1768.243	2294.221	5167.051	9486.630
1500	135.571	1540.581	3512.526	7135.237	5896.646	21505.354
1505	61.584	699.823	1595.597	3152.495	3130.190	10495.925
1509	38.101	432.969	987.169	1815.347	1879.651	6093.697
1510	11.383	129.358	294.936	653.623	404.469	1669.661
1516	2.376	26.998	61.554	79.864	179.870	330.239
1518	42.025	477.560	1088.838	2002.309	2073.236	6721.284
1519	9.968	113.267	258.249	572.321	354.158	1479.490
1520	4.713	53.562	122.122	239.020	234.040	777.354
1521	16.570	188.297	429.318	791.875	924.628	2851.714
1523	26.775	304.265	693.724	1849.559	540.420	4148.980
1539	44.422	504.795	1150.932	2116.498	2191.469	7104.569
1540	5.218	59.300	135.203	248.631	257.433	834.597
1541	5.006	56.884	129.695	239.222	279.327	861.492
1542	27.327	310.533	708.015	1427.186	1269.619	4404.898
1543	2.265	25.742	58.691	130.069	80.488	336.237
1547	.000	.004	.009	.024	.007	.053
1546	32.247	366.445	835.495	2227.539	650.661	4996.876
1552	5.314	60.397	137.682	178.636	402.325	738.662
1553	29.087	330.533	753.614	977.793	2202.165	4043.143
1559	14.770	163.290	372.302	684.641	708.893	2298.181
1561	16.482	187.296	427.034	787.662	919.709	2836.543
1563	10.796	122.686	279.724	619.912	383.608	1602.518
1566	23.028	261.676	596.622	1590.673	464.776	3568.240
1573	22.746	258.523	571.193	741.099	1669.105	3064.453
1579	719.854	8180.153	18650.771	46288.351	26629.819	123802.663
1582	62.105	705.740	1609.087	3564.237	3771.956	10117.229
1584	385.484	4380.504	9987.550	18366.525	19017.112	61652.136
1585	212.121	2410.466	5495.863	10106.574	10464.573	33925.408
1586	125.923	1430.945	3262.555	6504.992	6001.013	20473.726
1590	56.261	639.333	1457.679	3836.362	1135.550	8717.992
1591	68.603	779.580	1777.443	4738.894	1384.650	10630.416
1592	146.120	1660.457	3785.842	4911.969	11062.750	20311.049
1595	769.876	8748.587	19946.778	44798.725	34823.182	133226.461
1616	59.091	671.488	1530.992	3391.252	3588.890	9626.203
1617	238.239	2707.263	6172.560	11350.931	11753.060	38102.591
1618	240.393	2731.742	6226.371	11453.612	11859.327	38447.102
1619	46.662	530.255	1208.981	2229.959	2603.800	8030.569

GRID NO	FUEL USE 1000 GALLONS	EMISSIONS ***** PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
	**********	**********	**********	**********	**********	**********
1620	72.694	826.071	1883.441	3960.944	3031.342	11313.699
1622	53.729	610.562	1392.061	3459.912	1392.155	8359.121
1624	134.587	1529.401	3487.034	9296.335	2716.442	20855.024
1627	43.133	490.146	1117.532	2509.813	2010.875	7591.644
1628	14.377	163.374	372.493	977.931	657.747	2718.508
1633	134.352	1526.725	3480.934	7710.507	8159.865	21886.560
1637	242.049	2750.569	6271.276	12542.597	11453.637	39259.391
1639	54.166	615.524	1403.394	3480.029	1403.469	8427.052
1641	244.491	2778.306	6334.539	16888.704	4934.683	37885.196
1642	25.793	293.103	668.275	1500.851	1202.467	4539.742
1643	131.533	1494.689	3407.890	7279.482	6273.646	22726.327
1644	294.761	3349.557	7636.989	17007.703	13057.820	50378.343
1664	402.992	4579.458	10441.163	19200.693	19880.829	64452.245
1668	55.059	625.672	1426.533	3545.540	1426.609	8565.998
1670	85.981	977.054	2227.683	4401.341	4370.196	14653.822
1685	476.449	5414.194	12344.363	28144.853	16436.344	76015.109
1686	93.913	1067.194	2433.202	7683.796	4226.088	20063.245
1687	48.439	550.440	1255.004	3963.171	2179.744	10348.279
1694	39.260	446.367	1017.717	1871.523	1937.817	6282.265
1695	70.752	803.994	1833.197	3381.157	3947.990	12176.287
1701	10.113	114.916	262.008	580.651	359.313	1501.023
1707	53.695	610.175	1391.198	3457.717	1391.272	8353.220
1709	176.020	2000.232	4560.530	12158.965	3552.708	27275.319
1710	86.126	978.773	2231.443	5949.517	1738.321	13345.668
1712	34.199	388.629	886.074	1989.997	1594.392	6019.300
1713	32.651	371.037	845.965	1899.917	1522.220	5746.830
1715	10.113	114.916	262.008	580.651	359.313	1501.023
1718	10.113	114.916	262.008	580.650	359.313	1501.023
1724	10.119	114.989	262.173	581.017	359.539	1501.970
1726	10.120	114.996	262.191	581.056	359.564	1502.072
1728	48.848	555.088	1265.600	3753.422	2354.811	9930.554
1729	74.309	844.423	1925.284	6079.345	3343.915	15875.151
1730	31.586	358.935	818.372	1812.750	1918.394	5145.561
1735	197.251	2241.489	5110.596	9396.090	9730.993	31547.193
1739	70.307	798.941	1821.585	3359.905	3923.175	12099.751
1740	38.455	436.985	996.326	2206.013	1366.341	5707.872
1741	15.988	181.686	414.244	918.029	568.086	2373.169
1742	54.843	623.212	1420.923	3531.597	1420.999	8532.313
1746	33.366	379.157	864.477	1941.493	1555.531	5872.586
1751	128.419	1459.305	3327.215	8806.539	6674.139	23903.436
1752	33.315	378.580	863.163	1911.955	2023.392	5427.189
1755	134.503	1528.442	3484.848	6408.434	6635.437	21511.617
1756	150.018	1704.748	3886.325	7169.231	8371.114	25817.966
1758	56.844	645.969	1472.789	3263.928	2019.752	8437.487
1759	53.587	608.941	1388.385	3450.725	1388.459	8336.926
1762	308.001	3500.007	7980.015	21275.758	6216.529	47726.353
1763	.598	6.791	15.483	41.276	12.061	92.597
1764	236.865	2691.677	6137.464	12353.137	9595.995	37104.740
1766	44.331	503.764	1148.583	2118.556	2473.720	7629.[illegible]
1768	52.358	600.658	1369.501	3035.025	1878.105	784
1771	10.717	121.798	277.677	690.145	277.692	166.[illegible]

GRID NO	FUEL USE 1000 GALLONS	EMISSIONS ***** PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
1776	10.717	121.788	277.677	690.145	277.692	1667.385
1781	10.717	121.788	277.677	690.145	277.692	1667.385
1785	10.717	121.788	277.677	690.145	277.692	1667.385
1788	10.776	122.455	279.197	693.923	279.212	1676.514
1790	33.247	377.805	861.396	1588.842	1855.202	5721.765
1791	113.655	1291.533	2944.694	6525.896	4038.293	16869.909
1792	107.718	1224.063	2790.864	6936.432	2791.014	16758.489
1795	282.243	3207.312	7312.671	19496.532	5696.660	43735.146
1796	299.997	3409.059	7772.654	15644.355	12152.634	46990.469
1799	146.810	1668.299	3803.722	7015.947	8192.134	25265.960
1803	50.761	576.833	1315.180	2914.641	1803.610	7534.555
1808	10.760	122.278	278.793	692.918	278.808	1674.056
1814	46.836	532.245	1213.518	2442.500	1897.349	7336.401
1815	310.701	3530.688	8049.968	16202.516	12586.217	48667.801
1816	557.001	6329.558	14431.395	33230.439	17540.357	86831.197
1817	16.171	183.758	418.947	843.274	655.060	2532.910
1819	10.717	121.782	277.662	690.109	277.677	1667.293
1822	10.965	124.599	284.085	706.072	284.100	1705.864
1824	11.295	128.349	292.637	727.326	292.652	1757.214
1826	10.717	121.782	277.662	690.109	277.677	1667.298
1829	137.438	1561.793	3560.987	6568.039	7669.136	23652.944
1832	52.864	600.723	1369.647	3035.350	1878.306	7846.597
1833	123.276	1400.664	3193.870	7747.005	3422.259	19195.583
1835	51.530	585.570	1335.099	2958.784	1830.926	7648.669
1836	286.651	3257.402	7426.876	14948.393	11612.006	44900.028
1837	94.404	1118.228	2549.560	5252.670	4078.738	15276.528
1838	164.007	1863.713	4249.266	8754.448	6797.896	25461.376
1839	231.471	2630.354	5997.207	11976.516	10562.462	37071.951
1840	164.007	1863.713	4249.266	8754.448	6797.896	25461.376
1841	332.138	3774.301	8605.405	17729.081	13766.766	51563.136
1842	235.515	2676.307	6101.980	12756.789	9329.651	36209.971
1843	369.366	4197.337	9569.928	20066.797	14003.105	57786.529
2001	35.129	399.191	910.156	1887.760	1511.846	5729.826
2007	33.333	378.783	863.626	1791.252	1434.555	5436.298
2008	42.829	486.697	1109.669	2301.572	1843.254	6985.849
2009	12.028	136.686	311.645	808.278	294.671	1734.246
2010	35.775	406.529	926.887	2403.960	876.598	5157.947
2011	169.848	1930.028	4400.599	9290.936	8820.159	29265.356
2015	10.888	123.728	282.100	731.651	266.916	1569.833
2017	10.888	123.728	282.100	731.651	266.916	1569.833
2018	18.824	213.910	487.714	1011.570	810.134	3070.370
2022	35.381	402.055	916.696	1901.335	1522.694	5770.939
2024	67.886	771.434	1758.370	3646.084	2921.632	11072.850
2026	57.012	647.866	1477.133	3063.732	2453.644	9299.196
2027	55.003	625.036	1425.081	2955.770	2367.180	8971.503
2029	50.150	569.699	1299.350	2694.990	2158.330	8179.572
2030	510.051	5796.037	13214.964	34528.515	24061.567	97386.597
2034	27.416	311.567	710.372	874.182	1964.583	4075.013
2035	5.581	63.425	144.610	177.957	400.010	829.547
2036	22.022	250.247	570.564	702.134	1578.254	3273.038
2037	41.861	475.690	1084.573	1334.673	3000.071	6221.596

GRID NO	FUEL USE 1000 GALLONS	EMISSIONS ***** PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
2043	199.614	2269.344	5171.824	13472.259	9404.650	38031.874
2045	8.323	94.580	215.642	605.310	195.929	1266.451
2052	162.676	1848.591	4214.768	10890.884	7638.145	30817.999
2054	41.783	474.807	1082.560	1332.196	2994.503	6210.049
2055	8.318	94.523	215.512	604.947	195.866	1247.703
2063	7.902	89.799	204.740	334.829	406.803	1236.374
2069	2.486	28.253	64.416	180.822	31.644	372.946
2070	3.398	38.613	88.038	247.123	43.247	509.691
2071	30.430	345.795	788.414	1289.363	1565.518	4761.036
2072	4.831	54.901	125.175	204.709	248.713	755.899
2078	5.707	64.858	147.875	415.089	72.641	856.121
2080	6.496	73.813	168.294	275.227	334.388	1016.289
2081	10.925	123.015	280.475	458.686	557.283	1693.721
2082	10.655	121.414	276.830	452.724	550.039	1671.706
2095	201.760	2292.952	5227.934	13624.402	9508.453	38456.405
2101	21.852	248.222	566.174	1466.422	535.701	3150.052
2102	2.428	27.587	62.899	163.134	59.513	350.020
2104	2.990	33.973	77.459	217.428	38.050	442.445
2105	4.437	50.415	114.947	322.659	56.465	665.484
2119	215.048	2443.730	5571.704	14299.979	10068.389	40545.955
2123	23.544	267.545	610.004	1582.096	577.171	3394.553
2124	21.986	249.837	569.629	1477.380	538.969	3169.873
2125	13.143	149.357	340.535	883.206	322.206	1895.011
2126	2.496	28.359	64.659	181.530	31.762	374.344
2127	6.011	68.308	155.741	437.169	76.505	901.660
2141	48.434	550.387	1254.892	1849.310	4182.940	5503.868
2147	25.745	292.555	667.025	1729.926	631.123	3711.865
2161	169.519	1926.354	4392.087	6472.549	14640.289	19263.538
2166	8.110	92.154	210.111	544.942	198.802	1169.229
2167	18.296	207.905	474.023	1229.420	448.509	2637.849
2169	1.224	13.971	31.854	39.200	88.113	182.731
2183	10.219	116.124	264.764	686.687	250.513	1473.359
2184	22.590	256.701	585.278	1517.968	553.776	3256.959
2185	53.838	611.798	1394.900	2055.643	4649.648	6117.984
2187	28.050	318.751	726.753	894.340	2010.296	4168.960
2203	110.935	1260.623	2874.233	5348.823	5180.651	17300.295
2204	30.670	348.518	794.622	1718.318	1185.744	4748.152
2205	15.042	170.927	389.715	842.732	581.537	2328.685
2206	43.725	496.874	1132.872	2449.752	1690.484	6769.318
2207	42.064	478.004	1089.850	2356.729	1626.286	6512.246
2218	59.664	677.998	1545.835	2659.645	3009.835	9336.031
2219	63.583	722.529	1647.366	2882.254	3158.197	9942.273
2220	7.436	84.506	192.673	277.334	430.330	1171.422
2221	40.169	456.470	1040.752	2250.558	1553.022	6216.863
2222	10.430	118.524	270.235	584.355	403.247	1614.751
2233	8.754	99.479	226.809	327.117	506.572	1378.965
2237	50.745	576.650	1314.762	1896.226	2936.486	7993.551
2239	35.593	404.469	922.190	1994.176	1376.103	5510.418
2240	44.452	505.595	1152.756	2492.759	1720.155	6886.131
2241	31.426	357.116	814.223	1760.705	1214.993	4865.27
2242	47.549	540.334	1231.963	2664.038	1838.348	7361.[illegible]

GRID NO	FUEL USE 1000 GALLONS	EMISSIONS ***** PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
2243	47.377	538.390	1227.505	2654.403	1831.697	7334.785
2244	37.436	425.410	969.935	2097.420	1447.347	5795.708
2248	44.240	502.731	1146.227	1653.156	2560.069	6968.887
2249	4.881	55.463	126.456	182.383	282.437	768.836
2251	25.328	287.820	656.230	1419.054	979.234	3921.210
2254	16.077	182.689	416.531	900.721	621.552	2488.922
2255	42.431	482.173	1099.354	2377.281	1640.469	6569.037
2256	23.794	270.366	616.490	889.123	1376.692	3746.105
2260	53.764	610.960	1392.988	2009.048	3111.202	8469.154
2261	12.346	140.301	319.835	461.357	714.455	1944.853
2262	38.308	435.332	992.533	2463.315	1417.152	6586.374
2263	139.868	1589.404	3623.842	8733.140	6069.571	23712.470
2266	50.103	569.356	1298.133	3312.771	2224.511	9325.618
2270	117.795	1338.574	3051.949	7378.106	5032.095	20000.751
2273	89.385	1015.743	2315.393	5747.691	3306.663	15372.754
2274	24.177	274.744	626.416	1598.534	1073.442	4500.095
2275	24.177	274.744	626.416	1598.534	1073.442	4500.094
2276	48.226	548.027	1249.500	3188.664	2141.174	8976.251
2279	5.979	67.946	154.916	343.149	363.147	974.043
2281	33.225	377.541	860.839	1236.281	2455.489	4547.221
2282	33.596	381.769	870.433	1250.059	2483.360	4597.697
2283	28.841	327.740	747.248	1073.149	2131.912	3947.198
2284	117.082	1330.472	3033.476	8784.432	5011.683	22083.500
2285	36.108	410.323	935.536	2709.154	1545.623	6810.641
2286	138.148	1569.869	3579.391	8621.125	7975.055	22502.308
2289	62.372	708.777	1616.011	4679.695	2669.854	11764.453
2293	7.663	87.055	198.553	574.975	328.034	1445.451
2294	107.583	1222.539	2787.369	8161.312	4634.037	20621.893
2295	9.893	112.422	256.322	809.437	445.191	2113.531
2296	1929.401	21925.015	49969.034	80212.801	153421.547	236527.578
2323	34.384	390.739	890.864	2324.291	756.215	5334.784
2327	69.390	788.525	1797.936	4688.086	1529.193	10766.369
2331	68.235	775.393	1767.896	4616.953	1495.239	10586.151
2336	24.950	283.520	646.425	1431.877	1515.324	4064.438
2337	34.742	394.792	900.126	1660.279	1938.615	5979.026
2340	13.976	158.814	362.097	859.964	362.116	2174.306
2341	21.502	244.343	557.102	1384.635	557.132	3345.268
2344	66.991	761.260	1735.673	3729.692	3785.067	11463.137
2345	57.512	653.549	1490.091	1933.329	4354.250	7994.340
2346	47.447	539.173	1229.313	2426.814	2411.627	8086.491
2347	11.541	131.144	299.008	662.323	700.922	1880.031
2349	4.803	54.576	124.433	229.515	267.992	826.534
2352	21.825	248.007	565.456	1405.398	565.486	3395.430
2354	67.340	765.223	1744.731	3662.675	2728.231	10804.359
2355	24.056	273.369	623.280	1100.281	1327.282	3644.863
2356	30.575	350.654	799.947	1037.897	2337.555	4291.717
2357	9.857	112.009	255.378	640.817	476.758	1820.629
2358	17.072	194.091	442.323	1161.260	781.053	3228.137
2360	12.910	146.673	331.206	655.762	651.122	2183.294
2363	24.761	281.378	641.542	1421.060	1503.877	4033.734
2364	15.029	170.790	389.400	535.230	1137.881	2039.133

GRID NO	FUEL USE 1000 GALLONS	PARTICULATES KILOGRAMS/YR	SULFUR DIOXIDE KILOGRAMS/YR	CARBON MONOXIDE KILOGRAMS/YR	HYDROCARBONS KILOGRAMS/YR	NITROGEN OXIDES KILOGRAMS/YR
		EMISSIONS				
2366	14.132	160.591	366.147	961.268	646.540	2672.189
2367	20.293	230.598	525.764	1380.322	928.392	3837.099
2372	22.033	250.373	570.849	1418.873	570.880	3427.617
2374	60.967	692.803	1579.590	2049.451	4615.780	8474.505
2375	42.164	479.136	1092.430	1750.648	2627.611	6204.854
2376	55.174	626.975	1429.503	2479.572	3113.583	8314.200
2377	24.062	273.432	623.424	1308.740	974.846	3860.593
2380	6.885	78.235	178.376	468.303	314.976	1301.816
2381	50.685	575.966	1313.203	3447.634	2318.848	9583.934
2384	11.282	128.246	294.910	641.326	496.591	1917.335
2385	21.302	242.074	551.928	1129.754	816.535	3299.439
2386	21.560	244.999	558.596	1139.931	820.864	3325.067
2387	8.226	93.477	213.127	434.927	313.191	1268.641
2389	15.665	178.239	406.386	1010.041	406.408	2440.253
2390	6.109	70.098	159.824	397.230	159.832	959.705
2395	8.076	91.797	209.297	470.051	376.606	1421.799
2396	39.320	445.815	1018.739	2078.940	1497.044	6064.065
2397	4.941	56.148	128.017	261.245	188.123	762.027
2399	8.487	96.449	219.903	493.871	395.691	1493.851
2400	21.436	243.589	555.393	1380.363	555.413	3334.947
2405	7.350	83.525	190.437	427.694	342.670	1293.679
2406	9.976	113.358	258.457	580.457	465.064	1755.754
2407	50.233	570.834	1301.502	2655.974	1912.565	7747.214
2409	22.447	255.084	581.592	1443.422	830.405	3860.573
2410	140.790	1599.685	3647.737	9053.125	5208.288	24213.455
2413	4.595	52.218	119.056	295.480	169.690	790.289
2414	72.936	828.822	1889.714	4689.781	2698.159	12543.837
2417	73.441	834.560	1902.797	4722.451	2716.840	12630.651
2419	117.811	1338.761	3052.375	7575.526	4358.221	20261.474
2420	29.072	330.360	753.222	1869.381	1075.460	4999.839
2430	141.861	1612.291	3676.011	9363.983	5353.675	24973.493
2437	5.161	58.652	133.727	304.895	178.597	823.475
2436	109.045	1239.144	2825.253	6877.909	3972.710	18435.349
2439	22.576	256.547	584.911	1847.037	1015.898	4822.949
2448	27.236	309.497	705.653	1563.071	1654.164	4435.838
2449	24.186	274.846	626.650	1388.173	1468.968	3940.099
2453	12.427	141.221	321.984	713.218	754.783	2024.496
2454	12.980	147.530	336.299	744.925	788.339	2114.503
2458	26.141	319.789	729.119	1615.049	1709.172	4584.360
2462	27.144	308.459	703.265	1557.721	1648.566	4421.922
2463	1.460	16.596	37.839	83.816	38.730	237.914
69790.368	793972.141	1808204.531	3933687.375	3831639.469	1960487.750	

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

A methodology has been developed for calculating and reporting fuel use and air pollutant emissions from railroad locomotive activity. The procedure utilizes automated techniques to report rail activity on a variable-sized grid system. Separate methodologies were developed for the two major types of rail activity - road or line-haul operation and activity within switch yards. The methodology for road locomotives utilizes a line source concept and synthesizes the rail network by a series of links connecting a system of node points within the study area. The methodology for switch yard operation utilizes an area source concept. Both methodologies use as a basic unit locomotive horsepower-hours and were programmed to provide an analysis of fuel use and emissions for five criteria pollutants on a grid-by-grid basis as well as for the entire study area.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Regional Air Pollution Fuel Use Emissions Air Pollution Emission Inventory		

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