

# EDMS - Microcomputer Pollution Model for Civilian Airports and Air Force Bases: USER'S GUIDE

2



US Department of Transportation  
**Federal Aviation Administration**  
Office of Environment and Energy  
Washington, D.C. 20591



**United States Air Force**  
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Tyndall Air Force Base, Florida 32403

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H.M. Segal

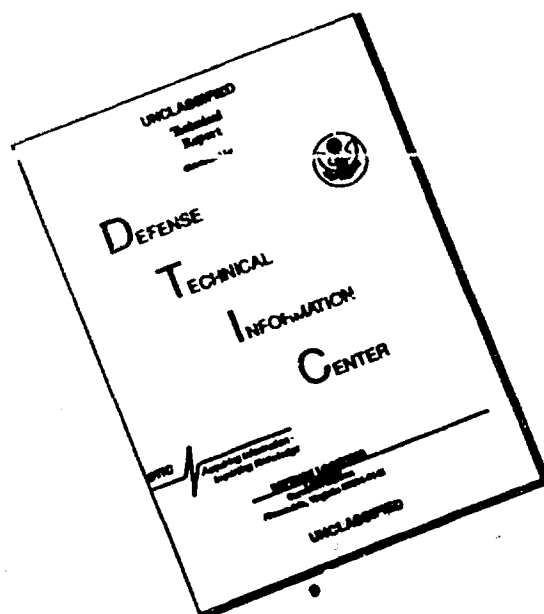
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| 16. Abstract<br><p>This report represents the final release of the User's Guide for the Emissions and Dispersion Modeling System (EDMS). It provides special instruction for performing air quality assessments at airports and airbases and contains a 94 step example problem to familiarize the user with the model.</p> <p>This report supersedes the August 1988 release of the "Beta" User's Guide (report number FAA-EE-88-6/ESL-TR-88-54) and incorporates the following model improvements suggested by "Beta" users:</p> <ol style="list-style-type: none"> <li>1. A more detailed description on how to use the temporal files.</li> <li>2. A separate explanation on how to calculate the length of aircraft queues.</li> <li>3. Data on how long it will take to run a scenario on EDMS.</li> <li>4. Explicit instructions on how to access stored emission rate data.</li> <li>5. Enhanced screen displays.</li> <li>6. A simplified file processing system that is menu driven.</li> </ol> <p>This document is one of 3 EDMS reports with the same main title but different sub-titles. These sub-titles are:</p> <ol style="list-style-type: none"> <li>1. USER'S GUIDE (FAA-EE-91-3/ESL-TR-91-31)</li> <li>2. MODEL DESCRIPTION (FAA-EE-88-4/ESL-TR-88-53)</li> <li>3. MODEL APPLICATION AND BACKGROUND (FAA-EE-88-5/ESL-TR-88-55)</li> </ol> <p>All reports can be obtained either from the National Technical Information Service (NTIS) or from the Defense Technical Information Center (DTIC).</p> |  |                                                          |                                                                                                                                                                                                    |                                                                 |  |
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## 1 - INTRODUCTION

Before starting an airfield improvement project or changing the numbers, types, or activity of aircraft at an airfield, an air quality assessment is usually required. This assessment is usually made with an emissions/dispersion model.

Two emissions/dispersion models were developed in the early 1970s for use at airports and airbases. The United States Air Force (USAF) developed the Air Quality Assessment Model (AQAM) (Rote, et al., 1975), and the Federal Aviation Administration (FAA) developed the Airport Vicinity Air Pollution model (AVAP) (Wang, et al., 1973). However, these models are obsolete -- they are expensive to operate, tedious to enter data into, and since they were not approved by the Environmental Protection Agency (EPA), had to be "sold" for each application.

Both the FAA and the USAF noticed that microcomputer advances of the 1980s' could significantly improve airfield modeling. They also noticed that the FAA's and the USAF's modeling requirements were quite similar. It was therefore concluded that the FAA and the USAF should join forces to develop a single modeling system that both agencies could use.

This single modeling system is called the Emissions and Dispersion Modeling System (EDMS). It compensates for AQAM and AVAP limitations by employing the new modeling concepts developed in the "Simplex A" (Segal, 1981) and "GIMM" (Segal, 1983) microcomputer models and uses a commercial database for data entry. These enhancements permit a qualified technician to perform a modeling task that had been previously reserved for a highly skilled scientist or engineer.

EDMS is a refined model designed for use on a microcomputer. It employs special table lookup and numerical integration procedures to permit a microcomputer to perform the tasks that had previously been done on a mainframe computer. These special procedures, along with other features of EDMS, are described in the model description report (Segal and Hamilton, 1988).

Figures 1, 1A, and 2 show the system flow and menu structure of EDMS.

# System Flow - Emissions Model

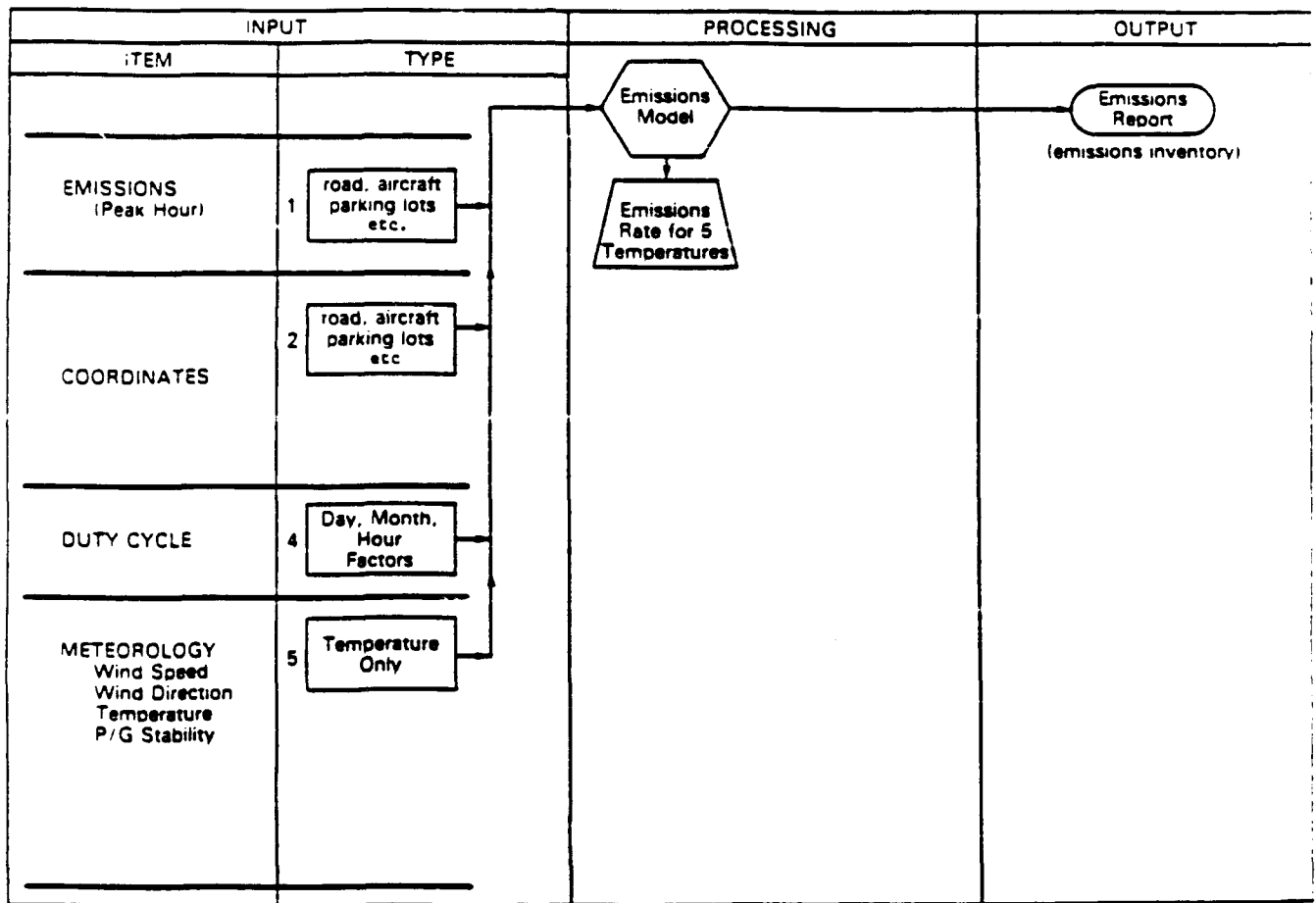
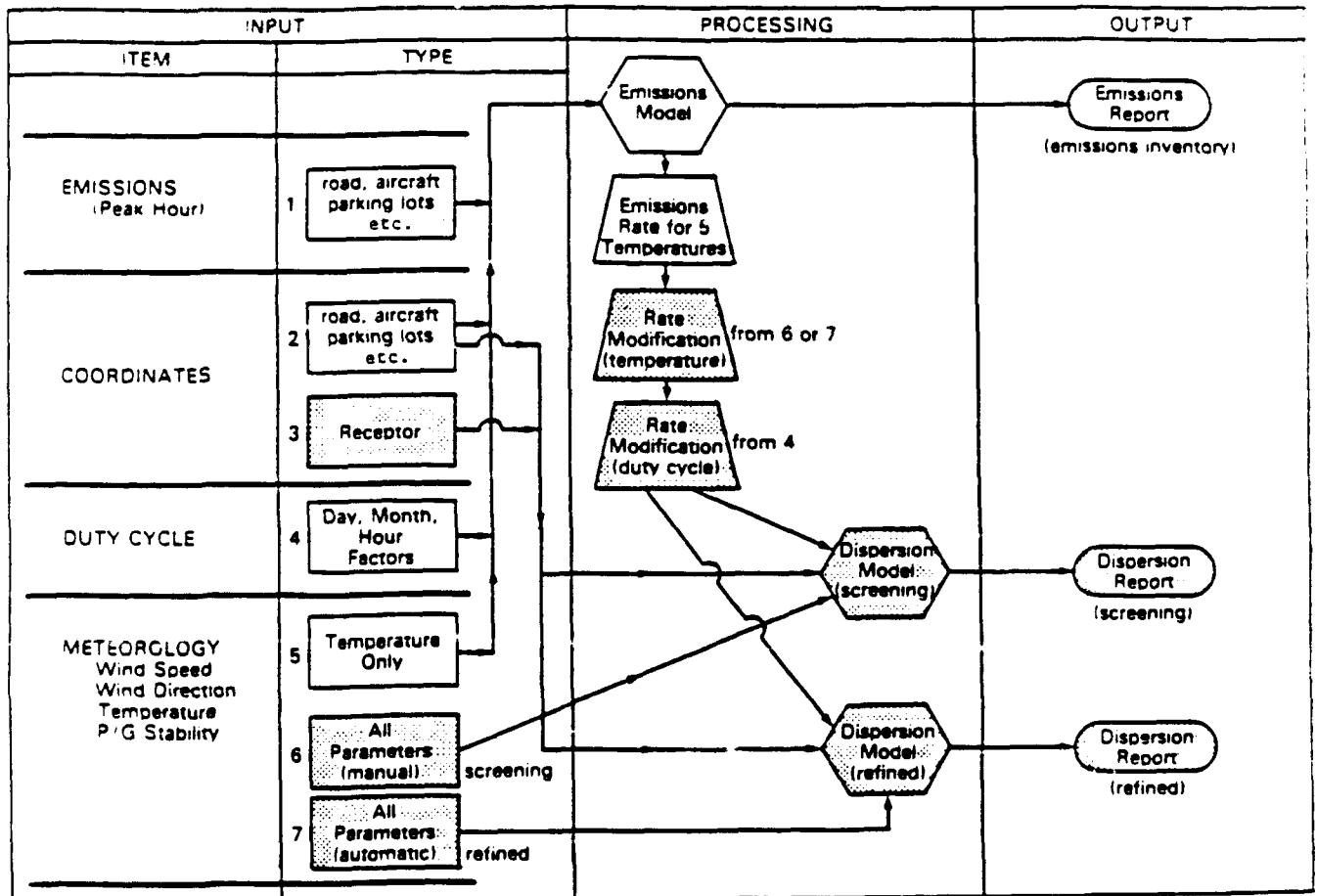


FIGURE 1

# System Flow

## Emissions and Dispersion Model



NOTE: Shading represents dispersion model elements.

FIGURE 1A

## Menu Flow

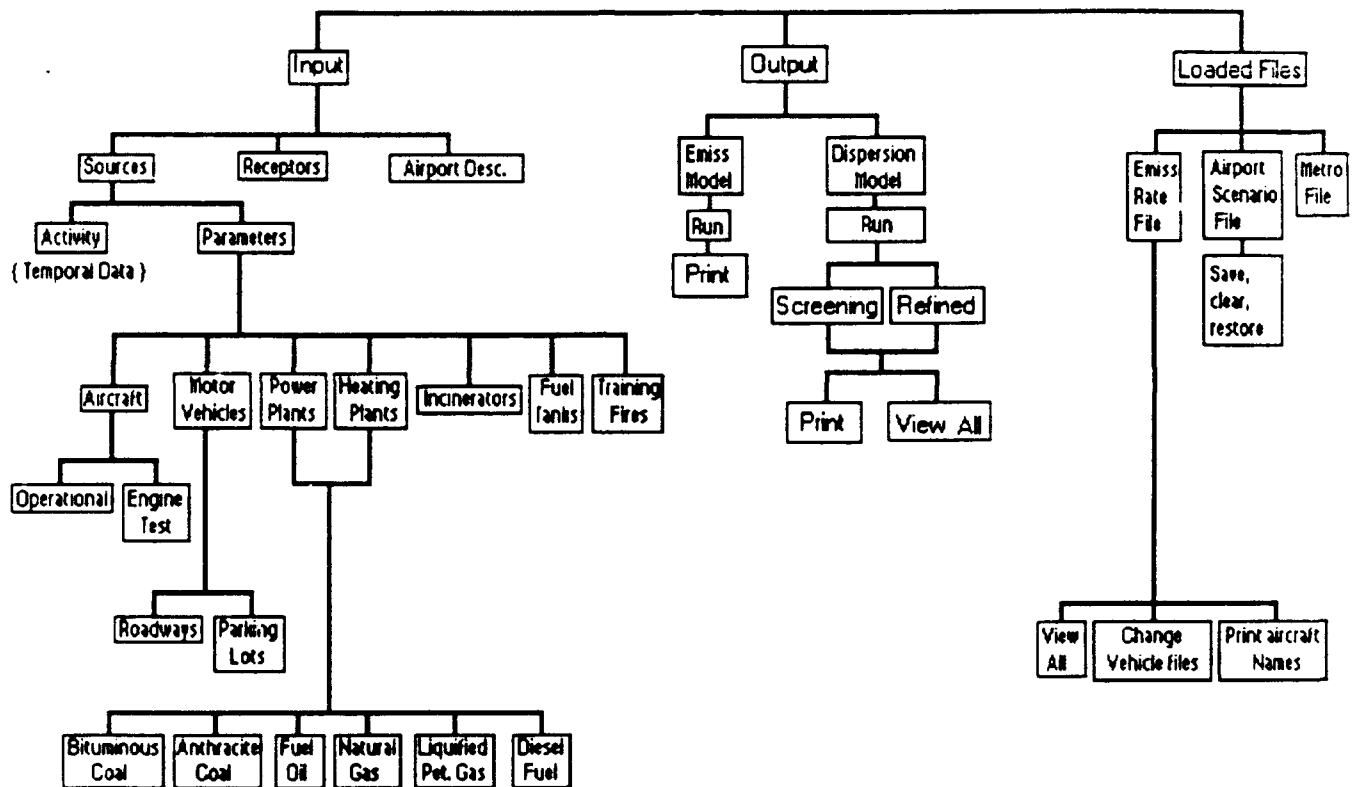


FIGURE 2

## 2 - APPROACH

A "hands on" example problem is used to demonstrate EDMS. The user has only to read two short sections before starting this "hands on" learning experience. The first section describes hardware and software requirements and the second explains how to load the model.

After running the example problem, the user can check his or her results with a master solution of the example problem appearing in Appendix A.

The last two sections provide answers to questions that a user may ask when he is performing a formalized air quality assessment.

Since yearly supplements to this Guide are planned, we welcome recommendations for model improvements. Contacts are Mr. Howard Segal of the FAA (202-267 3494) and Captain Michael Moss of the USAF (904-283 6034). Mailing addresses are listed in items 9 and 12 of the Technical Report Documentation Page, the second page in this report.

### 3 - SYSTEM SET-UP

#### 3.1 HARDWARE

EDMS requires the following hardware:

1. An IBM PC/XT/AT or compatible computer.
2. At least 400 kilobytes of free memory.
3. One floppy disk drive.
4. One hard drive with at least 5 megabytes free. (This hard drive must be designated as the "C" drive.)

In addition the following items should enhance model performance:

1. A computer with an 80386 processor and an 80387 coprocessor.
2. An additional 10 megabytes on the hard drive.

#### 3.2 SOFTWARE

EDMS requires the following software:

- 1) MS-DOS version 2.1 or higher
- 2) 2 diskettes containing the EDMS code

Note: These diskettes can be purchased for \$40 from the :

Federal Aviation Administration  
800 Independence Avenue, SW.  
AEE-120  
Washington, D.C. 20591  
Attn: Howard M. Segal  
Telephone: (202) 267-3494

### 3.3 INSTALLATION OF CODE

Loading instructions are as follows:

1. The CONFIG.SYS file of the computer must have its FILE and BUFFER commands set at 30 or above.

Note: Reboot the computer if you change these settings.

2. Clear old versions of EDMS from the hard drive.
3. Create a subdirectory called "EDMS".
4. Insert disk #1 into the "A" drive.
5. Type "COPY A:\*. \* C:\EDMS\\*. \*"
6. Repeat Steps #4 and #5 for second disk.

## 4 - EXAMPLE PROBLEM

### 4.1 INTRODUCTION

This section is in 3 parts. The first, AIRPORT SCENARIO, shows the layout of the airport and the location of its sources and receptors. The second, GIVEN INFORMATION, lists the emission values assigned to these sources. The third, INSTRUCTION TO RUN MODEL, provides instructions for running the model.

### 4.2 AIRPORT SCENARIO

This "hands on" example problem is set at Washington National Airport (DCA) and uses 6 of the 19 possible sources shown in Figure 3. The sources are:

- One power plant (source G)
- One runway (source C)
- Two roadways (sources D and E)
- One parking lot (source F)
- One takeoff queue (source B)

Note: The user enters the locations of possible queues at both ends of the runway. The model selects the appropriate queue after processing wind direction information since the model assumes takeoff into the wind.

The origin of the airport coordinate system is located in the lower left hand corner of the map (Figure 3) and north is assumed to be at the top of the map.

### 4.3 GIVEN INFORMATION

#### 4.3.1 SOURCES

##### 4.3.1.1 Hourly Changes in Source Activity

In the model, source activity factors ranging from "1" (for 100 percent activity) to "0" (for 0 percent activity) are entered into the duty cycle (or temporal screen). These factors are entered into 43 fields — 24 "hour" fields, 7 "day" fields, and 12 "month" fields. These data are processed to produce emission rates for every hour of the year (8760 hours).

A more detailed description of the temporal files is contained in section 6.2.



#### 4.3.1.2 Source inputs

Table 1 lists source characteristics.

TABLE 1

SOURCE INPUTS  
(refer to Figure 3)

| Source        | Coordinates (M) |            |            |            | Source *<br>Activity               | Duty Cycle     |                                                                                                   |
|---------------|-----------------|------------|------------|------------|------------------------------------|----------------|---------------------------------------------------------------------------------------------------|
|               | x1              | y1         | x2         | y2         |                                    | Record<br>Name | % Activity<br>(Temporal Factor)                                                                   |
| Power Plant G | 800             | 400        |            |            | 4 m tons/hr<br>bituminous<br>coal  | POWER          | 100% activity for<br>all days, months &<br>hours                                                  |
| Runway C      | 1600            | 1050       | 000        | 900        | 10 DC9s/hr.<br>12 727s/hr.         | SCENARIO       | 0800 - 90% activity<br>0900 - 60% activity<br>Aug - 60% activity<br>all other activity<br>is 100% |
| Queue B       | 150             | 760        | 1500       | 820        | 10 DC9s/hr.<br>12 727s/hr.         | SCENARIO       | same as "runway"                                                                                  |
| Roadway E     | 320             | 500        | 770        | 660        | 340 veh/hr<br>15 mi/hr<br>20% cold | SCENARIO       | same as "runway"                                                                                  |
| Roadway D     | 880             | 530        | 910        | 610        | 1500 veh/hr<br>5 mi/hr<br>20% cold | SCENARIO       | same as "runway"                                                                                  |
| Parking Lot F | 870<br>830      | 520<br>660 | 910<br>770 | 620<br>580 | 150 veh/hr<br>5 mi/hr<br>80% cold  | SCENARIO       | same as "runway"                                                                                  |

\* Source activity for the peak hour of the year.

#### 4.3.2 RECEPTORS

Receptor coordinates are listed below.

| Receptor Name             | "X" Location (meters) | "Y" Location (meters) |
|---------------------------|-----------------------|-----------------------|
| #1 Main Terminal          | 920                   | 600                   |
| #2 South of Main Terminal | 1000                  | 600                   |
| #3 Runway - North End     | 1650                  | 1100                  |
| #4 North Terminal         | 550                   | 610                   |

#### 4.3.3 METEOROLOGICAL DATA

Meteorological inputs are required in both the screening and refined runs.

##### SCREENING RUN

| Parameter                        | Hourly averaged values |
|----------------------------------|------------------------|
| Wind speed (meters/second)       | 1                      |
| Wind direction (degrees)         | 225                    |
| Air temperature (degrees F.)     | 70                     |
| Pasquill/Gifford stability (1-6) | 2                      |

Note: Stability classes 1 - 6 corresponds to Pasquill/Gifford stability classes A - F.

##### REFINED RUN

Meteorological data must be loaded into EDMS before starting a refined run. However, the user will not have to load a meteorological file before running the example problem because one such file has already been loaded into the model.

To further reduce run time, only two hours of meteorological data are scheduled to be processed; one for 0800 hours and the other for 0900 hours.

#### 4.4 INSTRUCTIONS TO RUN MODEL

The example problem instructions incorporate some special notations. The word ENTER in the text means that the carriage return key (↵) should be pressed. Text entries must all be in upper (or lower) case since the data base distinguishes between upper and lower case characters. Quotes around numbers, characters, or words are for identification only. They are not to be typed in.

The 94 step example problem is listed below. The flow chart of Figure 2 should prove helpful if the user gets lost while running the example problem.

##### PREPARE FOR DATA ENTRY

| <u>ACTION</u>                           | <u>PURPOSE</u>                                 |
|-----------------------------------------|------------------------------------------------|
| 1 turn on computer, monitor and printer | activate system                                |
| 2 type "C:" ENTER                       | make sure the system is in the "C" drive       |
| 3 press CAPS LOCK key                   | set for upper case entry *                     |
| 4 type "CD\EDMS" ENTER                  | change to the EDMS directory                   |
| 5 type "EDMS" ENTER                     | execute EDMS program within the EDMS directory |

NOTE:- Because EDMS is delivered with empty input screens, the user will not have to empty these screens before running the example problem. However, before a new scenario can be started, all its input screens must be empty. Option 8 of the main menu shows how to empty these screens.

\* Case can be either upper or lower.

ENTER FACILITY DATA

- |   |                |                                                 |
|---|----------------|-------------------------------------------------|
| 6 | type "4" ENTER | select airport description / temperature screen |
| 7 | type "R"       | select revise (R) option                        |

NOTE: The letters "R" for revise, "E" for End (or save), "C" for Continue, and "Q" for Quit are noted at the bottom of the screen.

- |    |                         |                                                                                                                  |
|----|-------------------------|------------------------------------------------------------------------------------------------------------------|
| 8  | press ENTER eight times | bypass airport description fields which are for user convenience only. These fields are not read into the model. |
| 9  | intentionally blank     |                                                                                                                  |
| 10 | intentionally blank     |                                                                                                                  |
| 11 | intentionally blank     |                                                                                                                  |
| 12 | press "70" 12 times     | enter 70 degrees 12 times                                                                                        |
| 13 | type "E"                | save data                                                                                                        |
| 14 | press ENTER             | return to main input menu                                                                                        |

ENTER TEMPORAL DATA

|    |                       |                                          |
|----|-----------------------|------------------------------------------|
| 15 | type "2" ENTER        | select TEMPORAL option                   |
| 16 | type "1" ENTER        | select "add" option                      |
| 17 | type "POWER" ENTER    | enter temporal record name               |
| 18 | type ENTER 43 times   | enter 1.0 for 100%                       |
| 19 | type "C"              | save first record "POWER"; then continue |
| 20 | type "SCENARIO" ENTER | start the second record (see Table 2)    |
| 21 | press ENTER 8 times   | enter default (1.0)                      |
| 22 | type ".9" ENTER       | enter 90% (for 0800 hours)               |
| 23 | type ".6" ENTER       | enter 60% (for 0900 hours)               |
| 24 | press enter 28 times  | enter 100%                               |
| 25 | type ".6" ENTER       | enter 60% (for August)                   |
| 26 | press ENTER 4 times   | enter 1.0 into remaining fields          |
| 27 | type "E"              | save                                     |
| 28 | type "11" ENTER       | return to the main menu                  |

TABLE 2

| T E M P O R A L   A C T I V I T Y |                 |                 |                 |                 |                 |
|-----------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Temporal name <u>SCENARIO</u>     |                 |                 |                 |                 |                 |
| Hourly factors:                   |                 |                 |                 |                 |                 |
| 0 <u>1.00</u>                     | 1 <u>1.00</u>   | 2 <u>1.00</u>   | 3 <u>1.00</u>   | 4 <u>1.00</u>   | 5 <u>1.00</u>   |
| 6 <u>1.00</u>                     | 7 <u>1.00</u>   | 8 <u>0.90</u>   | 9 <u>0.60</u>   | 10 <u>1.00</u>  | 11 <u>1.00</u>  |
| 12 <u>1.00</u>                    | 13 <u>1.00</u>  | 14 <u>1.00</u>  | 15 <u>1.00</u>  | 16 <u>1.00</u>  | 17 <u>1.00</u>  |
| 18 <u>1.00</u>                    | 19 <u>1.00</u>  | 20 <u>1.00</u>  | 21 <u>1.00</u>  | 22 <u>1.00</u>  | 23 <u>1.00</u>  |
| Daily factors:                    |                 |                 |                 |                 |                 |
| Sun <u>1.00</u>                   | Mon <u>1.00</u> | Tue <u>1.00</u> | Wed <u>1.00</u> |                 |                 |
| Thu <u>1.00</u>                   | Fri <u>1.00</u> | Sat <u>1.00</u> |                 |                 |                 |
| Monthly factors:                  |                 |                 |                 |                 |                 |
| Jan <u>1.00</u>                   | Feb <u>1.00</u> | Mar <u>1.00</u> | Apr <u>1.00</u> | May <u>1.00</u> | Jun <u>1.00</u> |
| Jul <u>1.00</u>                   | Aug <u>0.60</u> | Sep <u>1.00</u> | Oct <u>1.00</u> | Nov <u>1.00</u> | Dec <u>1.00</u> |

ENTER SOURCE DATA - POWER PLANTS

|    |                             |                                            |
|----|-----------------------------|--------------------------------------------|
| 29 | type "1" ENTER              | select sources — data menu                 |
| 30 | type "3" ENTER              | select power plants                        |
| 31 | type "1" ENTER              | select bituminous                          |
| 32 | type "1" ENTER              | display data entry screen                  |
| 33 | type "POWER" enter          | enter temporal name                        |
| 34 | type "PUGET POWER #1" ENTER | enter the name of the power plant          |
| 35 | type "800" ENTER            | enter X coordinate (meters<br>from origin) |
| 36 | type "400" ENTER            | enter Y coordinate                         |
| 37 | press ENTER 5 times         | enter defaults                             |
| 38 | type "2" ENTER              | enter plant class                          |
| 39 | type "35040" ENTER          | enter fuel burned per year                 |
| 40 | press ENTER 7 times         | enter defaults                             |
| 41 | type "E"                    | save                                       |
| 42 | type "10" ENTER             | return to power plant menus                |
| 43 | type "10" ENTER             | return to source menu                      |

ENTER SOURCE DATA - AIRCRAFT OPERATIONS

- 44 type "1" ENTER select new source (aircraft)
- 45 type "1" ENTER prepare to input 1st aircraft and runway information
- 46 type "1" ENTER display input screen
- 47 enter values listed in Table 3. Press ENTER after each entry. When finished proceed to step 48.
- 48 type "C" save data, display screen for 2nd aircraft entry.
- 49 enter data from Table 4 enter data for second aircraft

TABLE 3

| OPERATIONAL AIRCRAFT SOURCES (1) |                    |               |                 |
|----------------------------------|--------------------|---------------|-----------------|
| <u>TEMPORAL SCENARIO</u>         |                    |               |                 |
| Name                             | DATA32 <u>MAIN</u> |               |                 |
| Runway:                          |                    |               |                 |
| Location:                        | Point 1 X1         | <u>1600</u>   | Y1 <u>1050</u>  |
|                                  | Point 2 X2         | <u>0</u>      | Y2 <u>900</u>   |
| Aircraft type                    | AIRCFT             | <u>DC9</u>    |                 |
| Takeoffs(peak hour)              |                    | <u>10.00</u>  |                 |
|                                  |                    | <u>100.00</u> |                 |
| Queue:                           |                    |               |                 |
| Time in Mode:                    | QTIM               | <u>12.00</u>  |                 |
| End point of queue #1:           | Q1X1               | <u>1500</u>   | Q1Y1 <u>820</u> |
| End point of queue #2:           | Q2X1               | <u>150</u>    | Q2Y1 <u>760</u> |
| QUENUM <u>1</u> (use default)    |                    |               |                 |
| Hourly touch and go:             | HTGO               | <u>0.00</u>   |                 |

(Q1X1, Q1Y1) (Q2X1, Q2Y1)

Queue 1 / \ Queue 2

(X1, Y1) Runway (X2, Y2)

TABLE 4

| OPERATIONAL AIRCRAFT SOURCES (2) |                    |                |                 |
|----------------------------------|--------------------|----------------|-----------------|
| <u>TEMPORAL SCENARIO</u>         |                    |                |                 |
| Name                             | DATA32 <u>MAIN</u> |                |                 |
| Runway:                          |                    |                |                 |
| Location:                        | Point 1            | X1 <u>1600</u> | Y1 <u>1050</u>  |
|                                  | Point 2            | X2 <u>0</u>    | Y2 <u>900</u>   |
| Aircraft type                    | AIRCFT             | <u>727</u>     |                 |
| Takeoffs(peak hour)              |                    | <u>12.00</u>   |                 |
|                                  |                    | <u>100.00</u>  |                 |
| Queue:                           |                    |                |                 |
| Time in Mode:                    | QTIM               | <u>12.00</u>   |                 |
| End point of queue #1:           | Q1X1               | <u>1500</u>    | Q1Y1 <u>820</u> |
| End point of queue #2:           | Q2X1               | <u>150</u>     | Q2Y1 <u>760</u> |
| QUENUM <u>1</u> (use default)    |                    |                |                 |
| Hourly touch and go:             | HTGO               | <u>0.00</u>    |                 |

Diagram illustrating the layout of the aircraft sources. Two queues, Queue 1 and Queue 2, are shown. Queue 1 starts at point (X1, Y1) and ends at point (Q1X1, Q1Y1). Queue 2 starts at point (X2, Y2) and ends at point (Q2X1, Q2Y1). The runway is represented by a horizontal line segment between (X1, Y1) and (X2, Y2).

50 type "E"

save

51 type "10" ENTER

return to aircraft menu

ENTER SOURCE DATA - AUTO ROADWAYS

|    |                         |                                          |
|----|-------------------------|------------------------------------------|
| 53 | type "2" ENTER          | select motor vehicle source              |
| 54 | type "1" ENTER          | select roadway mode                      |
| 55 | type "1" ENTER          | display screen for roadway #1            |
| 56 | input data from Table 5 |                                          |
| 57 | type "C"                | save data, display screen for roadway #2 |
| 58 | enter data from Table 6 | enter values for 2nd roadway             |

TABLE 5

| R O A D W A Y S (1) |                          |                       |               |
|---------------------|--------------------------|-----------------------|---------------|
| Temporal name       | TEMPORAL <u>SCENARIO</u> |                       |               |
| Roadway name        | DATA32                   | <u>NORTH TERMINAL</u> |               |
| Vehicles/hour       | CAUT                     | <u>340.00</u>         |               |
| Speed (mph)         | CVAS                     | <u>15.00</u>          |               |
| Cold starts (%)     | OCLD                     | <u>20.00</u>          |               |
| End points of road: |                          |                       |               |
| point 1             | X1                       | <u>320</u>            | Y1 <u>500</u> |
| point 2             | X2                       | <u>770</u>            | Y2 <u>660</u> |

ENTER SOURCE DATA - AUTO ROADWAYS

TABLE 6

| R O A D W A Y S (2) |                          |                      |               |
|---------------------|--------------------------|----------------------|---------------|
| Temporal name       | TEMPORAL <u>SCENARIO</u> |                      |               |
| Roadway name        | DATA32                   | <u>MAIN TERMINAL</u> |               |
| Vehicles/hour       | CAUT                     | <u>1500.00</u>       |               |
| Speed (mph)         | CVAS                     | <u>5.00</u>          |               |
| Cold starts (%)     | OCLD                     | <u>20.00</u>         |               |
| End points of road: |                          |                      |               |
| point 1             | X1                       | <u>880</u>           | Y1 <u>530</u> |
| point 2             | X2                       | <u>910</u>           | Y2 <u>610</u> |

59 type "E"

save

60 type "10 ENTER

return to motor vehicle menu

ENTER SOURCE DATA - AUTO PARKING

- 61 type "2" ENTER                      select parking lot option  
62 type "1" ENTER                      display screen  
63 input data from Table 7

TABLE 7

| VEHICLE PARKING FACILITIES (lots)           |                                 |              |               |
|---------------------------------------------|---------------------------------|--------------|---------------|
| Temporal name                               | <u>TEMPORAL SCENARIO</u>        |              |               |
| Parking facility                            | <u>DATA32 MAIN TERMINAL LOT</u> |              |               |
| Average distance from gate to parking space | AVED <u>300</u> (feet)          |              |               |
| Vehicles entering/hr                        | VINP                            | <u>150</u>   |               |
| Vehicles exiting/hr                         | VOUT                            | <u>150</u>   |               |
| Speed (mph)                                 | CVAS                            | <u>5.00</u>  |               |
| Cold starts on exit (%)                     | OCLD                            | <u>80.00</u> |               |
| Four corners of Lot:                        | X1                              | <u>870</u>   | Y1 <u>520</u> |
|                                             | X2                              | <u>910</u>   | Y2 <u>620</u> |
|                                             | X3                              | <u>770</u>   | Y3 <u>580</u> |
|                                             | X4                              | <u>830</u>   | Y4 <u>660</u> |

- 64 type "E"                              save  
65 type "11" ENTER                      return to main menu

ENTER RECEPTORS

- 66 type "3" ENTER                      prepare to enter receptor coordinates  
67 type "1" ENTER                      display receptor screen  
68 enter data from Table 8              enter receptors 1 through 4

Note: After entering the first receptor, press "C" to enter the next receptor. After entering the last receptor, press "E" to end.

- 69 type "11" ENTER                      return to main menu

TABLE 8

RECEPTORS

| NAME        | X    | Y    |
|-------------|------|------|
| RECEPTOR #1 | 920  | 600  |
| RECEPTOR #2 | 1000 | 600  |
| RECEPTOR #3 | 1650 | 1100 |
| RECEPTOR #4 | 550  | 610  |

You have now entered all sources and receptors. The remaining tasks are:

1. run emissions model — print results;
2. run dispersion model — print results (screening mode);
3. run dispersion model — print results (refined mode);
4. save data to diskette;
5. erase data from hard disk;

#### RUN EMISSIONS MODEL

- |    |                |                                          |
|----|----------------|------------------------------------------|
| 70 | type "5" ENTER | select emissions model menu              |
| 71 | type "1" ENTER | run emissions model and check for errors |

NOTE: If no errors were made, the main menu will reappear on the screen. When this happens, proceed to step 72 (print emission report).

If errors were made, an error message will appear. To correct these errors, identify the flow path to the appropriate screen. (Refer to Fig. 2.) Next access the screen with the error and correct it using the Revise (R) command. Finally, rerun the emissions model. (Return to steps 70 and 71.)

#### PRINT EMISSION OUTPUT

- |    |                 |                       |
|----|-----------------|-----------------------|
| 72 | type "2" ENTER  | print emission report |
| 73 | type "11" ENTER | return to main menu   |

RUN DISPERSION MODEL IN SCREENING MODE -- PRINT RESULTS

|    |                  |                                       |
|----|------------------|---------------------------------------|
| 74 | type "6" ENTER   | initiate dispersion modeling sequence |
| 75 | type "1" ENTER   | run dispersion model for all sources  |
| 76 | type "S" ENTER   | select screening mode                 |
| 77 | type "1" ENTER   | enter one hour                        |
| 78 | type "70" ENTER  | enter temperature in degrees F        |
| 79 | type "1" ENTER   | enter wind speed                      |
| 80 | type "225" ENTER | enter wind direction                  |
| 81 | type "2" ENTER   | enter stability class                 |
| 82 | type "Y" ENTER   | initiate dispersion model calculation |
| 83 | type "3" ENTER   | print screening dispersion report     |

RUN DISPERSION MODEL IN REFINED MODE -- PRINT RESULTS

|    |                        |                                        |
|----|------------------------|----------------------------------------|
| 84 | type "1" ENTER         | run dispersion model for all sources   |
| 85 | type "R" ENTER         | select refined mode                    |
| 86 | type "8, 11, 08" ENTER | enter starting time (Aug 11 - 8:00 am) |
| 87 | type "8, 11, 09" ENTER | enter ending time (Aug 11 - 9:00 am)   |
| 88 | type "4" ENTER         | print refined dispersion report        |
| 89 | type "11" ENTER        | return to main menu                    |

SAVE AND ERASE DATA

- |    |                                                |                                                                                                        |
|----|------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| 90 | type "8" ENTER                                 | display save, delete, and<br>restore options                                                           |
| 91 | type "1" ENTER<br>(follow screen instructions) | save airport scenario on<br>floppy diskette                                                            |
| 92 | type "2" ENTER<br>type "Y" ENTER               | erase saved scenario from hard disk<br>This action clears the hard disk to<br>accept new scenario data |
| 93 | type "11" ENTER                                | return to main menu                                                                                    |
| 94 | type "10" ENTER                                | leave the EDMS program and<br>return to DOS                                                            |

## 5. - GENERAL TASKS

### 5.1 ENTERING AIRCRAFT QUEUES

The user must enter two possible queue locations, one at each end of a runway. This is necessary because the model automatically selects the queue location associated with takeoff into the wind.

The number of queueing aircraft is determined either by observing queue length at peak hour or by multiplying estimated peak hour Time In Mode (TIM) —in minutes — by the estimated peak hour departure rate — in airplanes per minute. Having calculated the number of queueing aircraft, queue length is determined by adding up the length of all aircraft and the spacing between them.

The queue line extends from the end of the runway where aircraft first start their takeoff roll to the location on the taxiway where the last aircraft is queueing. This queueing approximation will have an insignificant effect on model results.

### 5.2 ENTERING LONG-TERM METEOROLOGICAL DATA

The National Climatic Data Center (NCDC) distributes AIRWAY SURFACE OBSERVATION files for each weather station in the United States. Before a refined run can start, these files must be entered into EDMS. (Files can be obtained by contacting the NCDC in Ashville, North Carolina 28801). The procedure for entering these files is as follows:

- 1- Enter EDMS (follow steps noted on page 13)
- 2- Execute item 9 of the main menu and follow instructions.

After entering a new weather station file, the weather station default file, which is for 1982 hourly weather observations at Stapleton International Airport (DEN), will be overwritten.

### 5.3 CHANGING THE MOTOR VEHICLE FLEET MIX YEAR

Emission rate (standards) files for 1990, 1995, 2000, and 2010 fleet mixes have been loaded into EDMS in accordance with Mobile 4 information provided by the EPA in June 1988. The user can select emission information for any one of these 4 years by selecting option 7 of the main menu and following the instructions that appear on the screen. When this is done, the file default, 1990 - high altitude, is overwritten.

As new issues of Mobile 4 are released, they will be incorporated into EDMS. The user should check with the model issuer to determine what version of Mobile 4 has been loaded into his version of the model.

### 5.4 VIEWING EMISSION RATE FILES

Exercising option 7 of the main menu will provide access to all emission rate information.

### 5.5 PRINTING OUT AIRCRAFT IDENTIFIERS

Explicit aircraft names (i.e. 737; not B737) must be entered into EDMS to avoid an error message. Option 7 of the main menu permits access to the specific aircraft names that EDMS will accept.

### 5.6 RESTORING AN OLD SCENARIO

Option 7 can also be used to restore previously saved scenarios. However, make sure that the scenario being restored was saved on same version of EDMS that you are using.

### 5.7 RETRIEVING DISPERSION RESULTS

Dispersion results are written to a text file called DISPERSE.OUT. Option 6 of the main menu initiates access to this file.

## 6. - GENERAL INFORMATION

### 6.1 OPERATIONAL CONSTRAINTS IN ENTERING DATA AND RUNNING THE MODEL

#### 6.1.1 DATA INPUT LIMITS

| <u>FILE NAME</u> | <u>FILE DESCRIPTION</u> | <u>RECORD LIMIT</u> |
|------------------|-------------------------|---------------------|
|------------------|-------------------------|---------------------|

##### STANDARDS:

|      |                |                               |
|------|----------------|-------------------------------|
| AIRZ | Aircraft       | 648 (81 acft * 8 geomodes)    |
| MVEM | Motor Vehicles | 60                            |
| TFEM | Training Fires | 13                            |
| PPEF | Power Plants   | 22                            |
| INEF | Incinerators   | 5                             |
| TNEF | Tank Farms     | 117 (13 fuel types * 9 temp.) |

##### SOURCES:

|      |                   |                               |
|------|-------------------|-------------------------------|
| ACTH | Temporal          | 30                            |
| RUNW | Aircraft Takeoffs | 162 (ie. 4 runways * 41 acft) |
| VTES | Engine Tests      | 10                            |
| ROAD | Roadways          | 300                           |
| VPRL | Car Parking       | 30                            |
| TANK | Tank Farms        | 20                            |
| FTRE | Training Fires    | 20                            |
| PLAN | Power Plants      | 20                            |
| HEAT | Heating Plants    | 20                            |
| INCI | Incinerators      | 20                            |

##### RECEPTORS:

|      |           |     |
|------|-----------|-----|
| RECP | Receptors | 200 |
|------|-----------|-----|

#### 6.1.2 DATA PROCESSING CONSTRAINTS

This section provides information on the time it takes to run the model and the amount of disk storage space needed to store modeling results. Table 9 lists the characteristics of 7 scenarios that were run during model development. These scenarios were run on a 386 — 25 Mhz computer with an 80387 math coprocessor

TABLE 9

MODEL PROCESSING CHARACTERISTICS

| NUMBER OF SOURCES                                                                                                                    | RECEPTORS | WEATHER<br>HOURS | RUNTIME<br>HOURS | DISK STORAGE<br>(megabytes) |
|--------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------|------------------|-----------------------------|
| <u>Scenario #1</u><br>Roadways: 2<br>Parking lots: 1<br>Power Plants: 1<br>Aircraft Types: 2                                         | 4         | 1                | <.1              | <.1                         |
| <u>Scenario #2</u><br>Roadways: 5<br>Parking lots: 1<br>Heating Plants: 1<br>Training Fires: 1<br>Fuel Tanks: 2<br>Aircraft Types: 7 | 7         | 5                | <.1              | <.1                         |
| <u>Scenario #3</u><br>Roadways: 27<br>Aircraft Types: 9                                                                              | 7         | 5                | <.1              | <.1                         |
| <u>Scenario #4</u><br>Roadways: 11<br>Parking lots: 6<br>Power Plants: 3<br>Incinerators: 1<br>Fuel Tanks: 15<br>Aircraft Types 14   | 7         | 5                | .1               | <.1                         |
| <u>Scenario #5</u><br>Roadways: 5<br>Parking lots: 1<br>Heating Plants: 1<br>Training Fires: 1<br>Fuel Tanks: 2<br>Aircraft Types 7  | 200       | 5                | 1.7              | .7                          |
| <u>Scenario #6</u><br>Roadways: 27<br>Aircraft Type 9                                                                                | 200       | 5                | 2.0              | .3                          |
| <u>Scenario #7</u><br>Roadways: 11<br>Parking lots: 6<br>Power Plants: 3<br>Incinerators: 1<br>Fuel Tanks: 15<br>Aircraft Type:14    | 200       | 5                | 4.5              | .8                          |

TABLE 9-cont.

MODEL PROCESSING CHARACTERISTICS

| NUMBER OF SOURCES                                                                                                                   | RECEPTORS | HOURS RUN | MODEL RUNTIME (hours) | DISK STORAGE (megabytes) |
|-------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------------------|--------------------------|
| <u>Scenario #8</u><br>Aircraft Type 14                                                                                              | 1         | 8760      | 8                     | 1                        |
| <u>Scenario #9</u><br>Aircraft Type 14                                                                                              | 2         | 8760      | 23                    | 3                        |
| <u>Scenario #10</u><br>Roadways: 11<br>Parking lots: 6<br>Power Plants: 3<br>Incinerators: 1<br>Fuel Tanks: 15<br>Aircraft Types 14 | 1         | 8760      | 13                    | 9                        |
| <u>Scenario #11</u><br>Roadways: 11<br>Parking lots: 6<br>Power Plants: 3<br>Incinerators: 1<br>Fuel Tanks: 15<br>Aircraft Types 14 | 3         | 8760      | 48                    | 26                       |

## 6.2 TEMPORAL FACTORS

### 6.2.1 DESCRIPTION OF TEMPORAL FACTORS

All sources are related to a set of temporal factors that can range from 0 (for 0 percent activity) to 1 (for 100 percent activity). Factors within this range are entered into the month, day, and hour fields of the temporal screen. By multiplying the nested month, day, and hour field values together, activity for any hour of the year can be determined.

### 6.2.2 RELATIONSHIP BETWEEN PEAK AND ANNUAL ACTIVITY

The user may want to determine peak hour activity knowing only annual activity or may want to determine annual activity knowing only peak hour activity. The mathematical relationship between peak hour and annual activity is stated below.

- (1) 
$$\text{peak hour activity} = \frac{\text{annual activity}}{\text{hours in year}} \div \frac{\text{factor average (month)}}{\text{factor average (week)}} \div \frac{\text{factor average (week)}}{\text{factor average (hour)}}$$
- (2) 
$$\text{annual activity} = \text{peak hour activity} * \text{hours in year} * \frac{\text{factor average (month)}}{\text{factor average (week)}} * \frac{\text{factor average (week)}}{\text{factor average (hour)}}$$

Calculated peak hour values can vary substantially when different temporal factors are used. This difference is emphasized when constant (or non-variable) factors are compared to variable factors. A listing of variable and non-variable factors is tabulated below.

MONTHLY TEMPORAL FACTORS AND THEIR AVERAGES

| MONTH          | NON-VARIABLE FACTORS | VARIABLE FACTORS |
|----------------|----------------------|------------------|
| JANUARY        | 1.0                  | 0.3 (30%)        |
| FEBRUARY       | 1.0                  | 0.3              |
| MARCH          | 1.0                  | 0.4              |
| APRIL          | 1.0                  | 0.3              |
| MAY            | 1.0                  | 0.3              |
| JUNE           | 1.0                  | 0.4              |
| JULY           | 1.0                  | 0.5              |
| AUGUST         | 1.0                  | 0.5              |
| SEPTEMBER      | 1.0                  | 0.6              |
| OCTOBER        | 1.0                  | 0.6              |
| NOVEMBER       | 1.0                  | 0.8              |
| DECEMBER       | <u>1.0</u>           | <u>1.0</u>       |
| TOTAL          | 12.0                 | 6.0              |
| FACTOR AVERAGE | 1.0                  | 0.5              |

Let us assume that the variable and non-variable factor averages (1.0 and 0.5 from the table) apply weekly and hourly as well. Values to be entered into equation (1) are therefore:

|                        |                | VARIABLE | NON-VARIABLE |
|------------------------|----------------|----------|--------------|
| FACTOR AVERAGE - MONTH | (from table)   | 0.5      | 1.0          |
| FACTOR AVERAGE - WEEK  | (assumed same) | 0.5      | 1.0          |
| FACTOR AVERAGE - HOUR  | (assumed same) | 0.5      | 1.0          |
| ANNUAL OPERATIONS      | (assumed)      | 17,520   | 17,520       |
| HOURS IN A YEAR —      | 8760           |          |              |

THEN:

#### NON-VARIABLE FACTOR CALCULATION

$$17,520 / 8760 / 1 / 1 / 1 = 2 \text{ peak hour departures.}$$

#### VARIABLE FACTOR CALCULATION

$$17,520 / 8760 / .5 / .5 / .5 = 16 \text{ peak hour departures}$$

Notice that the peak hour departures are quite different even though the annual operations are the same — 17,520 departures.

### 6.3 FUEL CODES

Fuel code names are listed in Table 10.

TABLE 10

#### FUEL CODES

| FUEL CODE | NAME                 | USAGE         |                |
|-----------|----------------------|---------------|----------------|
|           |                      | STORAGE TANKS | TRAINING FIRES |
| 1         | Anthracite Coal      | *             | *              |
| 2         | Bituminous Coal      | *             | *              |
| 3         | Fuel Oil             | 3             |                |
| 4         | Natural Gas          | 4             |                |
| 5         | Liquid Petroleum Gas |               | 5              |
| 6         | Diesel               | 6             |                |
| 7         | Waste                | *             | *              |
| 8         | Automobile Gasoline  | 8             |                |
| 9         | Aviation Gasoline    | 9             |                |
| 10        | JP4                  | 10            | 10             |
| 11        | JP5                  | 11            |                |
| 12        | JP8                  | 12            |                |
| 13        | JET A                | 13            |                |

\* Fuel codes are not used with incinerators or power/heating plants.

#### 6.4 AIRCRAFT MODES AND TIMES IN MODE

The model refers to eight Geomodes, each of which has a different TIME IN MODE (TIM). (A Geomode is the title given to an aircraft operation such as taxi or takeoff.) The relationship of EDMS Geomodes to EPA TIMES IN MODE are listed in Table 11.

TABLE 11

#### EDMS MODES ASSIGNED TO CIVIL AIRCRAFT

| EDMS MODES           | EPA MODES       | EPA TIMES IN MODE (MIN) |                |          |
|----------------------|-----------------|-------------------------|----------------|----------|
|                      |                 | TURBO FAN*<br>TURBO JET | TURBO*<br>PROP | PISTON** |
| 1 - RUNWAY TAKEOFF   | TAKEOFF         | 0.7                     | 0.5            | 0.3      |
| 2 - RUNWAY QUEUE     | ***RUNWAY QUEUE | 12.0                    | 12.0           | 4.0      |
| 3 - TOUCH AND GO     |                 |                         |                |          |
| 4 - TAXIWAY CYCLE    | ***TAXI OUT     | 7.0                     | 7.0            | 8.0      |
|                      | ***TAXI IN      | 7.0                     | 7.0            | 4.0      |
| 5 - AIRCRAFT PARKING |                 |                         |                |          |
| 6 - ENGINE TESTING   |                 |                         |                |          |
| 7 - CLIMB            | CLIMB           | 2.2                     | 2.5            | 6.0      |
| 8 - APPROACH         | APPROACH        | 4.0                     | 4.5            | 6.0      |

\* Page 58473, Federal Register, December 30, 1982 (Final Engine Emission Standards)

\*\* Page 19101, Federal Register, July 17, 1973 (Initial Engine Emission Standards)

\*\*\* 26 minute EPA taxi-idle time in mode breakdown (estimated)

#### 6.5 HARD DRIVE DESIGNATION

EDMS will operate properly only when it is loaded into the "C" drive. Future versions of the model will be modified to permit operation with other drives (i.e. D,E,F,)

#### 6.6 TEXT CHARACTERS

All data fields should contain only numeric and/or alphabetic characters. The introduction of other characters, such as semicolons or commas, will distort file writing procedures and will cause an error message to appear.

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APPENDIX A

PRINTOUT OF EXAMPLE PROBLEM RESULTS

OVERVIEW

In this appendix, the first page of the emissions inventory report and all pages of the dispersion reports are printed out.

EMISSION REPORT  
(all values are in grams)

## ROADWAYS

## NORTH TERMINAL

|           | CARBON<br>MONOXIDE | HYDROCARBONS | NITROGEN<br>OXIDES | SULPHUR<br>OXIDES | PARTICULATES |
|-----------|--------------------|--------------|--------------------|-------------------|--------------|
| JANUARY   | 3.057E+06          | 2.241E+05    | 1.597E+05          | 1.347E+02         | 8.943E+02    |
| FEBRUARY  | 2.786E+06          | 2.042E+05    | 1.456E+05          | 1.228E+02         | 8.150E+02    |
| MARCH     | 3.057E+06          | 2.241E+05    | 1.597E+05          | 1.347E+02         | 8.943E+02    |
| APRIL     | 2.959E+06          | 2.168E+05    | 1.546E+05          | 1.304E+02         | 8.655E+02    |
| MAY       | 3.057E+06          | 2.241E+05    | 1.597E+05          | 1.347E+02         | 8.943E+02    |
| JUNE      | 2.959E+06          | 2.168E+05    | 1.546E+05          | 1.304E+02         | 8.655E+02    |
| JULY      | 3.057E+06          | 2.241E+05    | 1.597E+05          | 1.347E+02         | 8.943E+02    |
| AUGUST    | 1.834E+06          | 1.344E+05    | 9.585E+04          | 8.084E+01         | 5.366E+02    |
| SEPTEMBER | 2.959E+06          | 2.168E+05    | 1.546E+05          | 1.304E+02         | 8.655E+02    |
| OCTOBER   | 3.057E+06          | 2.241E+05    | 1.597E+05          | 1.347E+02         | 8.943E+02    |
| NOVEMBER  | 2.959E+06          | 2.168E+05    | 1.546E+05          | 1.304E+02         | 8.655E+02    |
| DECEMBER  | 3.057E+06          | 2.241E+05    | 1.597E+05          | 1.347E+02         | 8.943E+02    |
| ANNUAL    | 3.480E+07          | 2.550E+06    | 1.818E+06          | 1.534E+03         | 1.018E+04    |

## MAIN TERMINAL

|           | CARBON<br>MONOXIDE | HYDROCARBONS | NITROGEN<br>OXIDES | SULPHUR<br>OXIDES | PARTICULATES |
|-----------|--------------------|--------------|--------------------|-------------------|--------------|
| JANUARY   | 6.322E+06          | 4.836E+05    | 1.611E+05          | 1.063E+02         | 7.059E+02    |
| FEBRUARY  | 5.761E+06          | 4.407E+05    | 1.468E+05          | 9.691E+01         | 6.432E+02    |
| MARCH     | 6.322E+06          | 4.836E+05    | 1.611E+05          | 1.063E+02         | 7.059E+02    |
| APRIL     | 6.118E+06          | 4.680E+05    | 1.559E+05          | 1.029E+02         | 6.831E+02    |
| MAY       | 6.322E+06          | 4.836E+05    | 1.611E+05          | 1.063E+02         | 7.059E+02    |
| JUNE      | 6.118E+06          | 4.680E+05    | 1.559E+05          | 1.029E+02         | 6.831E+02    |
| JULY      | 6.322E+06          | 4.836E+05    | 1.611E+05          | 1.063E+02         | 7.059E+02    |
| AUGUST    | 3.793E+06          | 2.902E+05    | 9.666E+04          | 6.380E+01         | 4.235E+02    |
| SEPTEMBER | 6.118E+06          | 4.680E+05    | 1.559E+05          | 1.029E+02         | 6.831E+02    |
| OCTOBER   | 6.322E+06          | 4.836E+05    | 1.611E+05          | 1.063E+02         | 7.059E+02    |
| NOVEMBER  | 6.118E+06          | 4.680E+05    | 1.559E+05          | 1.029E+02         | 6.831E+02    |
| DECEMBER  | 6.322E+06          | 4.836E+05    | 1.611E+05          | 1.063E+02         | 7.059E+02    |
| ANNUAL    | 7.196E+07          | 5.505E+06    | 1.834E+06          | 1.210E+03         | 8.034E+03    |

## DISPERSION REPORT

(Screening Mode)

## ROADWAYS

| EMISSION INFORMATION   |      |      |      |      |            |     |       |      |       |                         |          |          |          |          |
|------------------------|------|------|------|------|------------|-----|-------|------|-------|-------------------------|----------|----------|----------|----------|
| INPUT                  |      |      |      |      |            |     |       |      |       | OUTPUT                  |          |          |          |          |
| SOURCE COORDINATES (m) |      |      |      |      | (MOBILE 4) |     |       |      |       | EMISSION RATES (gm/sec) |          |          |          |          |
| ROAD#                  | X1   | Y1   | X2   | Y2   | CARS/HR    | MPH | XCOLD | TEMP | YEAR  | CO                      | HC       | NOx      | SOx      | PART     |
| 1                      | 320, | 500, | 770, | 660, | 340,       | 15, | 20,   | 70,  | 1990, | 1.17E+00                | 8.54E-02 | 6.09E-02 | 5.14E-05 | 3.41E-04 |
| 2                      | 880, | 530, | 910, | 610, | 1500,      | 5,  | 20,   | 70,  | 1990, | 2.41E+00                | 1.84E-01 | 6.14E-02 | 4.05E-05 | 2.69E-04 |

| DISPERSION REPORT |           |     |     |     |     |      |                                     |          |          |          |          |          |  |
|-------------------|-----------|-----|-----|-----|-----|------|-------------------------------------|----------|----------|----------|----------|----------|--|
| INPUT             |           |     |     |     |     |      | OUTPUT                              |          |          |          |          |          |  |
| RECEPTORS (m)     |           |     |     |     |     |      | CONCENTRATIONS (gm/m <sup>3</sup> ) |          |          |          |          |          |  |
| HR                | DATE      | W/S | WD  | P/G | NO. | X    | Y                                   | CO       | HC       | NOx      | SOx      | PART     |  |
|                   |           | m/s | DEG | A=1 |     |      |                                     |          |          |          |          |          |  |
| 0                 | JAN- 1-00 | 1   | 225 | 2   | 1   | 920  | 600                                 | 6.31E-03 | 4.83E-04 | 1.61E-04 | 1.06E-07 | 7.05E-07 |  |
| 0                 | JAN- 1-00 | 1   | 225 | 2   | 2   | 1000 | 600                                 | 1.19E-04 | 9.12E-06 | 3.04E-06 | 2.01E-09 | 1.33E-08 |  |
| 0                 | JAN- 1-00 | 1   | 225 | 2   | 3   | 1650 | 1100                                | 1.98E-05 | 1.51E-06 | 5.24E-07 | 3.53E-10 | 2.34E-09 |  |
| 0                 | JAN- 1-00 | 1   | 225 | 2   | 4   | 550  | 610                                 | 3.42E-04 | 2.51E-05 | 1.79E-05 | 1.51E-08 | 1.00E-07 |  |

## P A R K I N G   L O T S

| EMISSION INFORMATION   |     |     |     |     |     |     |     |     |            |      |      |      |                         |         |         |         |         |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------------|------|------|------|-------------------------|---------|---------|---------|---------|
| INPUT                  |     |     |     |     |     |     |     |     | OUTPUT     |      |      |      |                         |         |         |         |         |
| SOURCE COORDINATES (m) |     |     |     |     |     |     |     |     | (MOBILE 4) |      |      |      | EMISSION RATES (gm/sec) |         |         |         |         |
| LOT                    |     |     |     |     |     |     |     |     | CARS/      | MIN/ | TEMP | YEAR |                         |         |         |         |         |
| #                      | X1  | Y1  | X2  | Y2  | X3  | Y3  | X4  | Y4  | HR         | CAR  | (F)  |      | CO                      | HC      | NOx     | SOx     | PART    |
| 1                      | 870 | 520 | 910 | 620 | 770 | 580 | 830 | 660 | 150        | .681 | 70   | 1990 | 4.6E-01                 | 3.6E-02 | 8.2E-03 | 4.3E-06 | 2.9E-05 |

| DISPERSION REPORT |           |     |     |     |     |      |      |                                     |          |          |          |          |  |  |
|-------------------|-----------|-----|-----|-----|-----|------|------|-------------------------------------|----------|----------|----------|----------|--|--|
| INPUT             |           |     |     |     |     |      |      | OUTPUT                              |          |          |          |          |  |  |
| RECEPTORS (m)     |           |     |     |     |     |      |      | CONCENTRATIONS (gm/m <sup>3</sup> ) |          |          |          |          |  |  |
| HR                | DATE      | W/S | WD  | P/G | NO. | X    | Y    | CO                                  | HC       | NOx      | SOx      | PART     |  |  |
|                   |           | m/s | DEG | A=1 |     |      |      |                                     |          |          |          |          |  |  |
| 0                 | JAN- 1-00 | 1   | 225 | 2   | 1   | 920  | 600  | 2.49E-04                            | 1.95E-05 | 4.45E-06 | 2.35E-09 | 1.56E-08 |  |  |
| 0                 | JAN- 1-00 | 1   | 225 | 2   | 2   | 1000 | 600  | 4.88E-06                            | 3.82E-07 | 8.73E-08 | 4.60E-11 | 3.05E-10 |  |  |
| 0                 | JAN- 1-00 | 1   | 225 | 2   | 3   | 1650 | 1100 | 3.54E-06                            | 2.78E-07 | 6.34E-08 | 3.34E-11 | 2.21E-10 |  |  |
| 0                 | JAN- 1-00 | 1   | 225 | 2   | 4   | 550  | 610  | 0.00E+00                            | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |  |  |

## P O W E R   P L A N T S

| EMISSION INFORMATION |     |     |                |  |  |  |  |                         |          |          |          |          |  |  |
|----------------------|-----|-----|----------------|--|--|--|--|-------------------------|----------|----------|----------|----------|--|--|
| INPUT                |     |     |                |  |  |  |  | OUTPUT                  |          |          |          |          |  |  |
| SOURCE COORDS(m)     |     |     |                |  |  |  |  | EMISSION RATES (gm/sec) |          |          |          |          |  |  |
| REC#                 | X1  | Y1  | NAME           |  |  |  |  | CO                      | HC       | NOx      | SOx      | PART     |  |  |
| 1                    | 800 | 400 | PUGET POWER #1 |  |  |  |  | 3.33E-01                | 6.11E-02 | 8.33E+00 | 4.33E+01 | 8.67E+01 |  |  |

| DISPERSION REPORT |           |     |     |     |     |      |                                     |          |          |          |          |          |
|-------------------|-----------|-----|-----|-----|-----|------|-------------------------------------|----------|----------|----------|----------|----------|
| INPUT             |           |     |     |     |     |      | OUTPUT                              |          |          |          |          |          |
| RECEPTORS (m)     |           |     |     |     |     |      | CONCENTRATIONS (gm/m <sup>3</sup> ) |          |          |          |          |          |
| HR                | DATE      | W/S | WD  | P/G | NO. | X    | Y                                   | CO       | HC       | NOx      | SOx      | PART     |
|                   |           | m/s | DEG | A=1 |     |      |                                     |          |          |          |          |          |
| 0                 | JAN- 1-00 | 1   | 225 | 2   | 1   | 920  | 600                                 | 5.11E-08 | 9.38E-09 | 1.28E-06 | 6.65E-06 | 1.33E-05 |
| 0                 | JAN- 1-00 | 1   | 225 | 2   | 2   | 1000 | 600                                 | 1.18E-06 | 2.17E-07 | 2.96E-05 | 1.54E-04 | 3.08E-04 |
| 0                 | JAN- 1-00 | 1   | 225 | 2   | 3   | 1650 | 1100                                | 3.51E-06 | 6.44E-07 | 8.78E-05 | 4.56E-04 | 9.13E-04 |
| 0                 | JAN- 1-00 | 1   | 225 | 2   | 4   | 550  | 610                                 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

No heating plant sources were entered

No incinerator sources were entered

No training fire sources were entered

No fuel tank sources were entered

No surface coating sources were entered

#### AIRCRAFT - QUEUES

| EMISSION INFORMATION   |      |     |      |      |         |               |                         |          |          |          |          |          |
|------------------------|------|-----|------|------|---------|---------------|-------------------------|----------|----------|----------|----------|----------|
| INPUT                  |      |     |      |      |         |               | OUTPUT                  |          |          |          |          |          |
| SOURCE COORDINATES (m) |      |     |      |      |         |               | EMISSION RATES (gm/sec) |          |          |          |          |          |
| REC#                   | X1   | Y1  | X2   | Y2   | ACFT/HR | AIRCRAFT TYPE | TIME IN MODE            | CO       | HC       | NOx      | SOx      | PART     |
| 1                      | 1500 | 820 | 1600 | 1050 | 10      | DC9           | 12.00                   | 1.97E+01 | 5.09E+00 | 1.97E+00 | 5.78E-01 | 1.78E-01 |
| 2                      | 1500 | 820 | 1600 | 1050 | 12      | 727           | 12.00                   | 3.55E+01 | 9.16E+00 | 3.54E+00 | 1.04E+00 | 3.20E-01 |

| DISPERSION REPORT |             |     |     |     |      |      |                         |          |          |          |          |          |
|-------------------|-------------|-----|-----|-----|------|------|-------------------------|----------|----------|----------|----------|----------|
| INPUT             |             |     |     |     |      |      | OUTPUT                  |          |          |          |          |          |
| RECEPTORS (m)     |             |     |     |     |      |      | CONCENTRATIONS (gm/m^3) |          |          |          |          |          |
| HR                | DATE        | W/S | WD  | P/G |      |      |                         |          |          |          |          |          |
|                   |             | m/s | DEG | A=1 | NO.  | X    | Y                       | CO       | HC       | NOx      | SOx      | PART     |
| 0                 | JAN- 1-00:1 | 225 | 2   | 1   | 920  | 600  |                         | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 0                 | JAN- 1-00:1 | 225 | 2   | 2   | 1000 | 600  |                         | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 0                 | JAN- 1-00:1 | 225 | 2   | 3   | 1650 | 1100 |                         | 1.54E-02 | 3.97E-03 | 1.53E-03 | 4.50E-04 | 1.39E-04 |
| 0                 | JAN- 1-00:1 | 225 | 2   | 4   | 550  | 610  |                         | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

## AIRCRAFT - TAKEOFFS

| EMISSION INFORMATION   |       |      |    |     |    |                         |          |          |          |          |          |
|------------------------|-------|------|----|-----|----|-------------------------|----------|----------|----------|----------|----------|
| INPUT                  |       |      |    |     |    | OUTPUT                  |          |          |          |          |          |
| SOURCE COORDINATES (m) |       |      |    |     |    | EMISSION RATES (gm/sec) |          |          |          |          |          |
| REC                    |       |      |    |     |    | ACFT/AIRCRAFT           |          |          |          |          |          |
| #                      | X1    | Y1   | X2 | Y2  | HR | TYPE                    | CO       | HC       | NOx      | SOx      | PART     |
| 1                      | 1600, | 1050 | 0, | 900 | 10 | DC9                     | 2.05E-01 | 1.43E-02 | 5.96E+00 | 2.94E-01 | 1.10E-01 |
| 2                      | 1600, | 1050 | 0, | 900 | 12 | 727                     | 3.70E-01 | 2.57E-02 | 1.07E+01 | 5.29E-01 | 1.98E-01 |

| DISPERSION REPORT |             |     |     |     |      |      |   |                         |          |          |          |          |
|-------------------|-------------|-----|-----|-----|------|------|---|-------------------------|----------|----------|----------|----------|
| INPUT             |             |     |     |     |      |      |   | OUTPUT                  |          |          |          |          |
| RECEPTORS (m)     |             |     |     |     |      |      |   | CONCENTRATIONS (gm/m^3) |          |          |          |          |
| HR                | DATE        | W/S | WD  | P/G |      |      |   |                         |          |          |          |          |
|                   |             | m/s | DEG | A=1 | NO.  | X    | Y | CO                      | HC       | NOx      | SOx      | PART     |
| 0                 | JAN- 1-00:1 | 225 | 2   | 1   | 920  | 600  |   | 0.00E+00                | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 0                 | JAN- 1-00:1 | 225 | 2   | 2   | 1000 | 600  |   | 0.00E+00                | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 0                 | JAN- 1-00:1 | 225 | 2   | 3   | 1650 | 1100 |   | 1.23E-04                | 8.51E-06 | 3.55E-03 | 1.75E-04 | 6.57E-05 |
| 0                 | JAN- 1-00:1 | 225 | 2   | 4   | 550  | 610  |   | 0.00E+00                | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

| INPUT         |     |     |     |     |     |      |      | OUTPUT                  |          |          |          |          |  |  |
|---------------|-----|-----|-----|-----|-----|------|------|-------------------------|----------|----------|----------|----------|--|--|
| RECEPTORS (m) |     |     |     |     |     |      |      | CONCENTRATIONS (gm/m^3) |          |          |          |          |  |  |
| DATE          | HR  | W/S | WD  | P/G |     |      |      |                         |          |          |          |          |  |  |
|               |     | m/s | DEG | A=1 | NO. | X    | Y    | CO                      | HC       | NOx      | SOx      | PART     |  |  |
| JAN-1-00      | 0:1 | 225 | 2   |     | 1   | 920  | 600  | 6.56E-03                | 5.02E-04 | 1.67E-04 | 6.76E-06 | 1.40E-05 |  |  |
| JAN-1-00      | 0:1 | 225 | 2   |     | 2   | 1000 | 600  | 1.25E-04                | 9.72E-06 | 3.27E-05 | 1.54E-04 | 3.08E-04 |  |  |
| JAN-1-00      | 0:1 | 225 | 2   |     | 3   | 1650 | 1100 | 1.55E-02                | 3.98E-03 | 5.17E-03 | 1.08E-03 | 1.12E-03 |  |  |
| JAN-1-00      | 0:1 | 225 | 2   |     | 4   | 550  | 610  | 3.42E-04                | 2.51E-05 | 1.79E-05 | 1.51E-08 | 1.00E-07 |  |  |

### CONCENTRATION - BY SOURCE TYPE

[illegible][illegible]

AVERAGE CONCENTRATION FOR 1 HOURS (gm/m<sup>3</sup>)

| SOURCE          | RECP | CO       | HC       | NOx      | SOx      | PART     |
|-----------------|------|----------|----------|----------|----------|----------|
| ROADWAYS        | 1    | 6.31E-03 | 4.83E-04 | 1.61E-04 | 1.06E-07 | 7.05E-07 |
|                 | 2    | 1.19E-04 | 9.12E-06 | 3.04E-06 | 2.01E-09 | 1.33E-08 |
|                 | 3    | 1.98E-05 | 1.51E-06 | 5.24E-07 | 3.53E-10 | 2.34E-09 |
|                 | 4    | 3.42E-04 | 2.51E-05 | 1.79E-05 | 1.51E-06 | 1.00E-07 |
| PARKING LOTS    | 1    | 2.49E-04 | 1.95E-05 | 4.45E-06 | 2.35E-09 | 1.56E-08 |
|                 | 2    | 4.88E-06 | 3.82E-07 | 8.73E-08 | 4.60E-11 | 3.05E-10 |
|                 | 3    | 3.54E-06 | 2.78E-07 | 6.34E-08 | 3.34E-11 | 2.21E-10 |
|                 | 4    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| POWER PLANTS    | 1    | 5.11E-08 | 9.38E-09 | 1.28E-06 | 6.65E-06 | 1.33E-05 |
|                 | 2    | 1.18E-06 | 2.17E-07 | 2.96E-05 | 1.54E-04 | 3.08E-04 |
|                 | 3    | 3.51E-06 | 6.44E-07 | 8.78E-05 | 4.56E-04 | 9.13E-04 |
|                 | 4    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HEATING PLANTS  | 1    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 2    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 3    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 4    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| INCINERATORS    | 1    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 2    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 3    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 4    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TRAINING FIRES  | 1    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 2    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 3    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 4    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FUEL FACILITIES | 1    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 2    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 3    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 4    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

|                   |   |          |          |          |          |          |
|-------------------|---|----------|----------|----------|----------|----------|
| SURFACE COATING   | 1 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                   | 2 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                   | 3 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                   | 4 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AIRCRAFT-QUEUES   | 1 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                   | 2 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                   | 3 | 1.54E-02 | 3.97E-03 | 1.53E-03 | 4.50E-04 | 1.39E-04 |
|                   | 4 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AIRCRAFT-TAKEOFFS | 1 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                   | 2 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                   | 3 | 1.23E-04 | 8.51E-06 | 3.55E-03 | 1.75E-04 | 6.57E-05 |
|                   | 4 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TOTAL-ALL SOURCES | 1 | 6.56E-03 | 5.02E-04 | 1.67E-04 | 6.76E-06 | 1.40E-05 |
|                   | 2 | 1.25E-04 | 9.72E-06 | 3.27E-05 | 1.54E-04 | 3.08E-04 |
|                   | 3 | 1.55E-02 | 3.98E-03 | 5.17E-03 | 1.08E-03 | 1.12E-03 |
|                   | 4 | 3.42E-04 | 2.51E-05 | 1.79E-05 | 1.51E-08 | 1.00E-07 |

# DISPERSION REPORT

(Refined Mode)

AVERAGE CONCENTRATION FOR 2 HOURS (gm/m<sup>3</sup>)

| SOURCE          | RECP | CO       | HC       | NOx      | SOx      | PART     |
|-----------------|------|----------|----------|----------|----------|----------|
| ROADWAYS        | 1    | 1.32E-03 | 1.02E-04 | 2.95E-05 | 1.87E-08 | 1.24E-07 |
|                 | 2    | 7.69E-05 | 5.93E-06 | 1.73E-06 | 1.10E-09 | 7.28E-09 |
|                 | 3    | 6.45E-06 | 4.93E-07 | 1.69E-07 | 1.15E-10 | 7.62E-10 |
|                 | 4    | 4.68E-05 | 3.42E-06 | 2.16E-06 | 1.75E-09 | 1.16E-08 |
| PARKING LOTS    | 1    | 6.19E-05 | 5.03E-06 | 8.97E-07 | 4.57E-10 | 3.03E-09 |
|                 | 2    | 2.87E-06 | 2.33E-07 | 4.15E-08 | 2.11E-11 | 1.40E-10 |
|                 | 3    | 2.61E-06 | 2.12E-07 | 3.78E-08 | 1.92E-11 | 1.28E-10 |
|                 | 4    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| POWER PLANTS    | 1    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 2    | 1.01E-07 | 1.86E-08 | 2.54E-06 | 1.32E-05 | 2.64E-05 |
|                 | 3    | 1.57E-06 | 2.89E-07 | 3.94E-05 | 2.05E-04 | 4.09E-04 |
|                 | 4    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| HEATING PLANTS  | 1    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 2    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 3    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 4    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| INCINERATORS    | 1    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 2    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 3    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 4    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TRAINING FIRES  | 1    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 2    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 3    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 4    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FUEL FACILITIES | 1    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 2    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 3    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                 | 4    | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

|                   |   |          |          |          |          |          |
|-------------------|---|----------|----------|----------|----------|----------|
| SURFACE COATING   | 1 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                   | 2 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                   | 3 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                   | 4 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AIRCRAFT-QUEUES   | 1 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                   | 2 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
|                   | 3 | 1.57E-03 | 4.05E-04 | 1.56E-04 | 4.60E-05 | 1.41E-05 |
|                   | 4 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| AIRCRAFT-TAKEOFFS | 1 | 3.88E-06 | 2.69E-07 | 1.13E-04 | 5.55E-06 | 2.08E-06 |
|                   | 2 | 4.06E-06 | 2.82E-07 | 1.18E-04 | 5.80E-06 | 2.18E-06 |
|                   | 3 | 1.84E-05 | 1.27E-06 | 5.32E-04 | 2.62E-05 | 9.85E-06 |
|                   | 4 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| TOTAL-ALL SOURCES | 1 | 1.39E-03 | 1.07E-04 | 1.43E-04 | 5.57E-06 | 2.21E-06 |
|                   | 2 | 8.40E-05 | 6.46E-06 | 1.22E-04 | 1.90E-05 | 2.86E-05 |
|                   | 3 | 1.60E-03 | 4.07E-04 | 7.28E-04 | 2.77E-04 | 4.33E-04 |
|                   | 4 | 4.68E-05 | 3.42E-06 | 2.16E-06 | 1.75E-09 | 1.16E-08 |