THE AIR QUALITY DISPLAY MODEL ANALYSIS FOR SUSPENDED PARTICULATES IN CEDAR RAPIDS, IOWA

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Abstract

The Iowa Department of Environmental Quality (DEQ) is currently examining possible revisions of the State Implementation Plan. These air pollution control srategy revisions are being evaluated so that the National Ambient Air Quality Standards can eventually be attained and maintained in all parts of Iowa as required by the Clean Air Act Amendments of 1977. To accomplish this, it is necessary to analyze current air quality attainment problems.

To examine these current air quality attainment problems, a dispersion model is used. The dispersion model is a computer program that predicts what the ambient air quality will be at a certain point within an air basin. The Air Quality Display Model (AQDM) is the major tool DEQ used to model each air basin. AQDM is a computer model that combines point source emissions (industrial plants), area source emissions (residential heating, fugitive dust, solid waste disposal, transportation, etc.) and meteorological factors (wind speed, wind direction, average temperature, pressure, and mixing height) over a specified area to predict the annual distribution of pollutants for that area. From the results obtained by using AQDM, a reliable estimation of source contribution is found.

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Introduction

Total suspended particulate (TSP) is one of the six pollutants for which the federal EPA has declared national air quality standards for the protection of human health and welfare. A set of strategies to control TSP emissions, and thereby reduce ambient concentrations of this pollutant to acceptable levels, was developed by the Iowa Air Pollution Control Commission in 1971 and 1972. These strategies became part of a federally approved State Implementation Plan on May 31, 1972 (40 CFR, Part 52). Since that time most air pollution sources have reached compliance with State particulate emission standards, yet air monitoring has shown portions of Iowa are still plagued with unacceptably high TSP concentrations. The Clean Air Act Amendments of 1977 required each state to identify those areas with unacceptably high TSP concentrations and devise a control strategy to reduce these high concentrations.

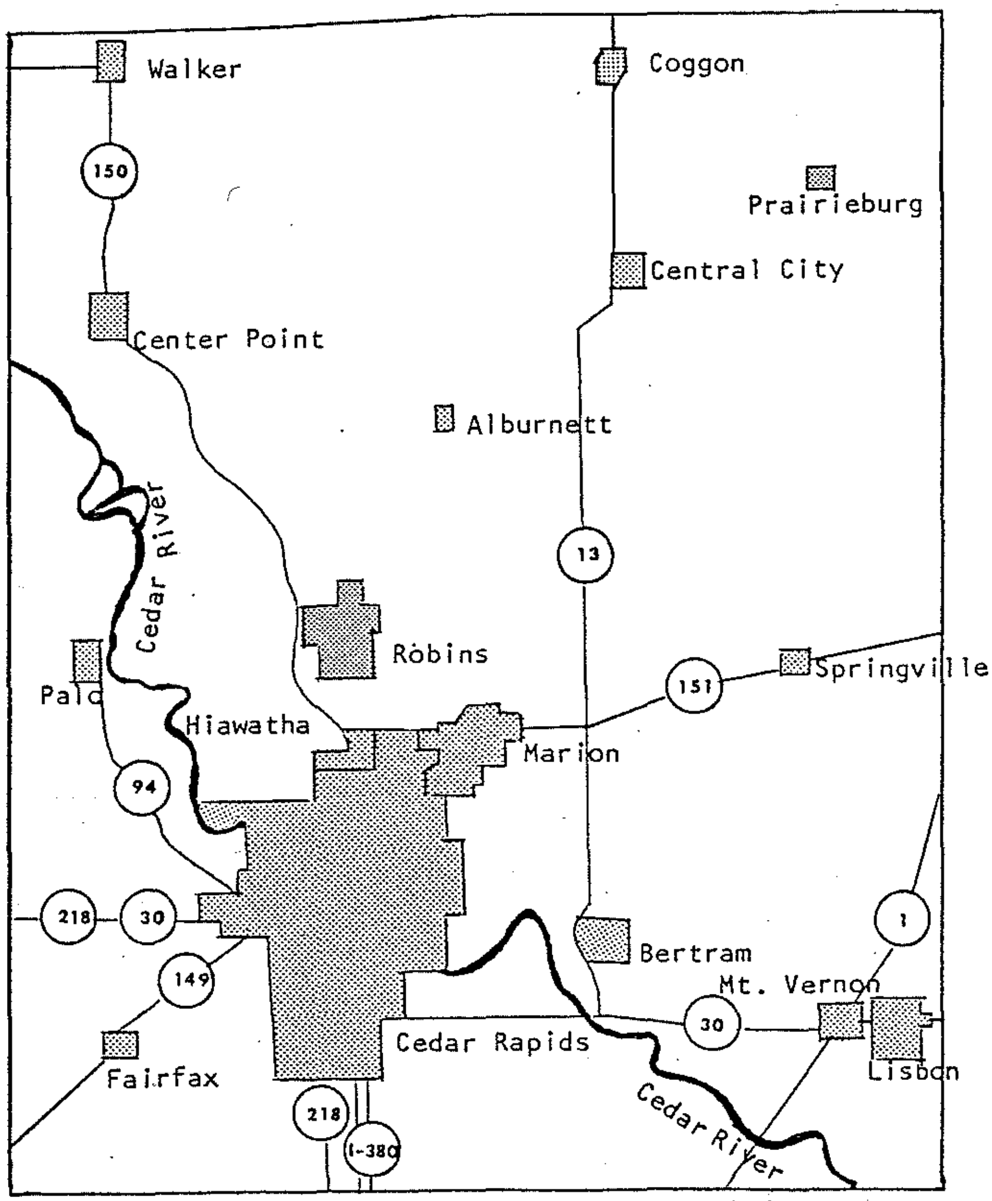
The purpose of this analysis is to explore the causes of these high TSP concentrations to aid in the future development of necessary control strategies which will lead to reducing TSP to an acceptable level.

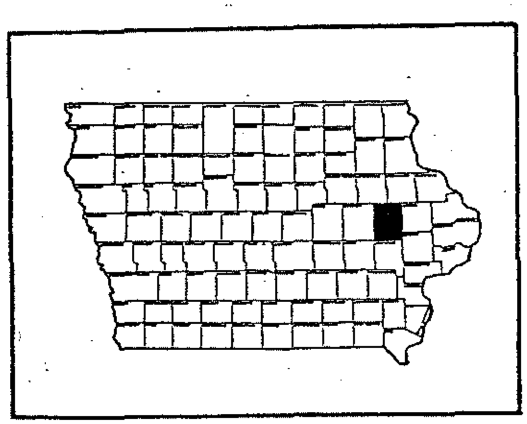
County Statistics

Linn County is located in the gently rolling terrain of east central Iowa. Cedar Rapids is the urban center located in the southwest quarter of the county and is bisected by the Cedar River. (See Figure 1) The 1970 population for the Cedar Rapids metropolitan area was 110,642; the 1970 population for Linn County was 163,213. The major industrial processes in Linn County are wet corn milling, grain processing, meat processing, general manufacturing, and electrical generation.

Figure 1

Illustration of Linn County
and Location in Iowa





Major sources of fugitive dust and fugitive emissions include construction, agricultural tilling, roads (both paved and unpaved), and grain transferring.

Linn County is situated in a temperate climate in the middle of a large land mass. The area is largely influenced by pressure systems moving in a general west-east direction. The winds are dominant from the north to northwest and south to southeast. The mean annual temperature is 49 degrees Fahrenheit, the mean annual precipitation is 33 inches. Neutral atmospheric stability is dominant for this area, with slightly unstable and stable conditions occurring less frequently.

Background

Because of large-scale natural suspended particulate emissions (such as volcanoes and dust storms) and large-scale man-made suspended particulate sources (such as agricultural activities) which cannot be accurately modeled, a natural background estimate must be developed for Iowa to include in any modeling.

To develop a numerical value for background, extensive monitoring of an isolated rural area must be conducted. The background of suspended particulates in Iowa was estimated from monitoring conducted from 1959 to 1965 at Backbone State Park in northeast Iowa. This site appears to be the most isolated area monitored in the State and is located away from any localized agricultural and urban sources. However, because of the large amount of agricultural activity in the State, an additional contribution from soil erosion, tilling, and travel on unpaved surfaces is inevitable and thus a true background measurement not influenced by any man-made sources is unlikely. Therefore the background recorded at Backbone

State Park is expected to include not only a natural worldwide background but a local and statewide background. To estimate the contribution of all sources to the background site, a study of rural sources was conducted.

The background figure monitored at Backbone State Park averaged 44 micrograms per cubic meter annual arithmetic mean. An estimated breakdown of sources accounting for this monitored value is shown in Table 1 below.

TABLE 1

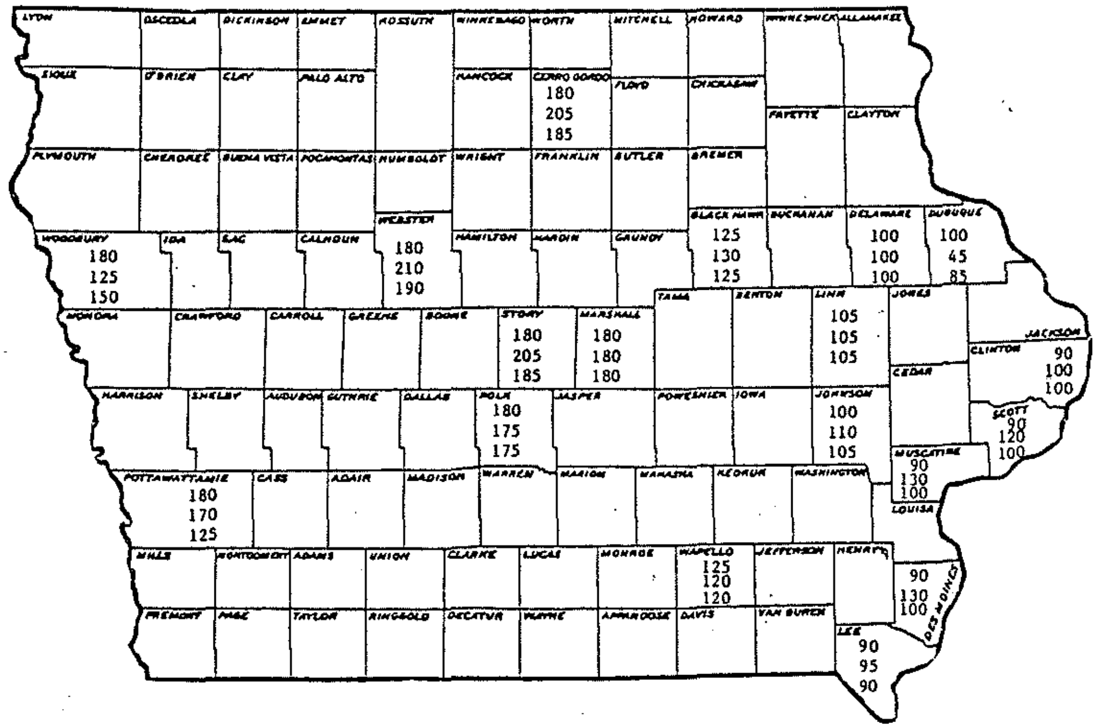
Source Contributions to the Recorded
Background level at Backbone State Park
(Values shown are in micrograms per cubic meter [ug/m^3])

Worldwide Concentration	15 ug/m^3
Continental Concentration	10 ug/m^3
Unpaved Roads	6 ug/m^3
Agriculture (soil erosion)	13 ug/m^3
Total Background	44 ug/m^3

The worldwide and continental values were obtained from studies conducted by GCA Corporation for DEQ[1]. This natural background that is not influenced by man is approximately 25 ug/m^3. The unpaved road estimate of 6 ug/m^3 was established by computer modeling of all rural unpaved roads in a five county area. The remaining 13 ug/m^3 was assumed to be from agricultural processes such as tilling and soil erosion.

Since the contribution from agricultural processes could easily be larger or smaller in other areas of the state depending on the farming practices, an investigation of these farming practices throughout the state was conducted. By comparing climatic factors, soil types, crops planted, and tilling frequencies in other areas of the state with the area around Backbone State Park, an index of soil erodibility was developed as shown in Figure 2. Using this index to increase or decrease the contribution of agricultural sources, an estimation of background throughout the State has been developed as shown in Figure 3.

Figure 2
Agricultural Index For Selected
Counties in Iowa



100 The first number represents the climatic factor for the county using the Federal Soil Conservation's climatic factors for Iowa. Deleware County is the reference county and has been given a value of 100. Numbers greater than 100 represent drier conditions while numbers less than 100 represent wetter conditions.

100 The second number represents the proportion of tilled land in soybeans or row crops. Deleware County is the reference county and has been given a value of 100. A county registering 200 would have twice the amount of land in soybeans or row crops.

100 The third number represents the agricultural index for the county. Deleware County is the reference county and has been given a value of 100. This index was based on the climatic factor, proportion of tilled land, and county size. Numbers greater than 100 represent areas of more severe wind erosion than Deleware County while numbers less than 100 represent areas of less severe soil erosion.

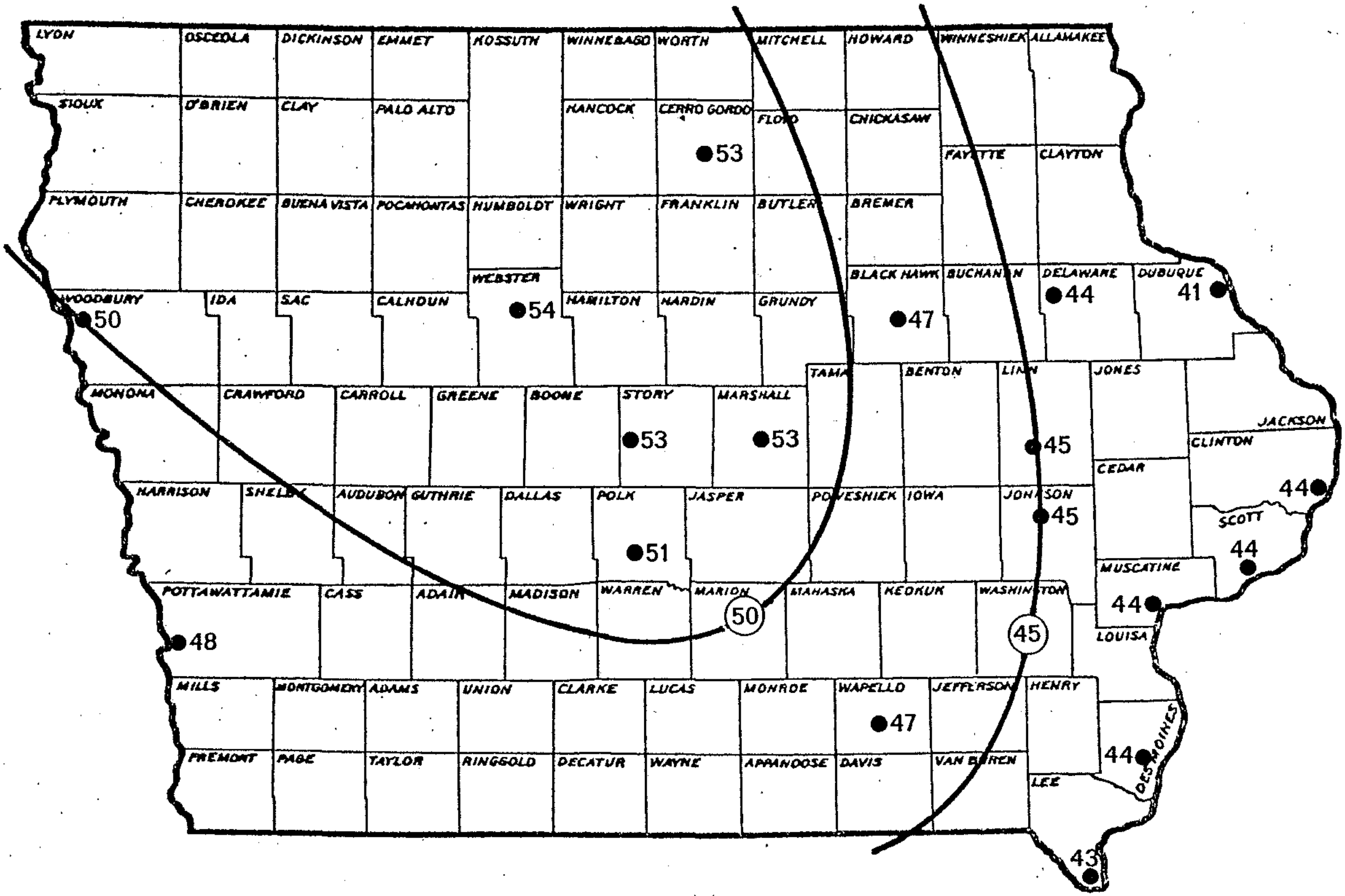


Figure 3
Estimations of Rural Background levels in Iowa
(Values shown are arithmetic means in micrograms per cubic meter)

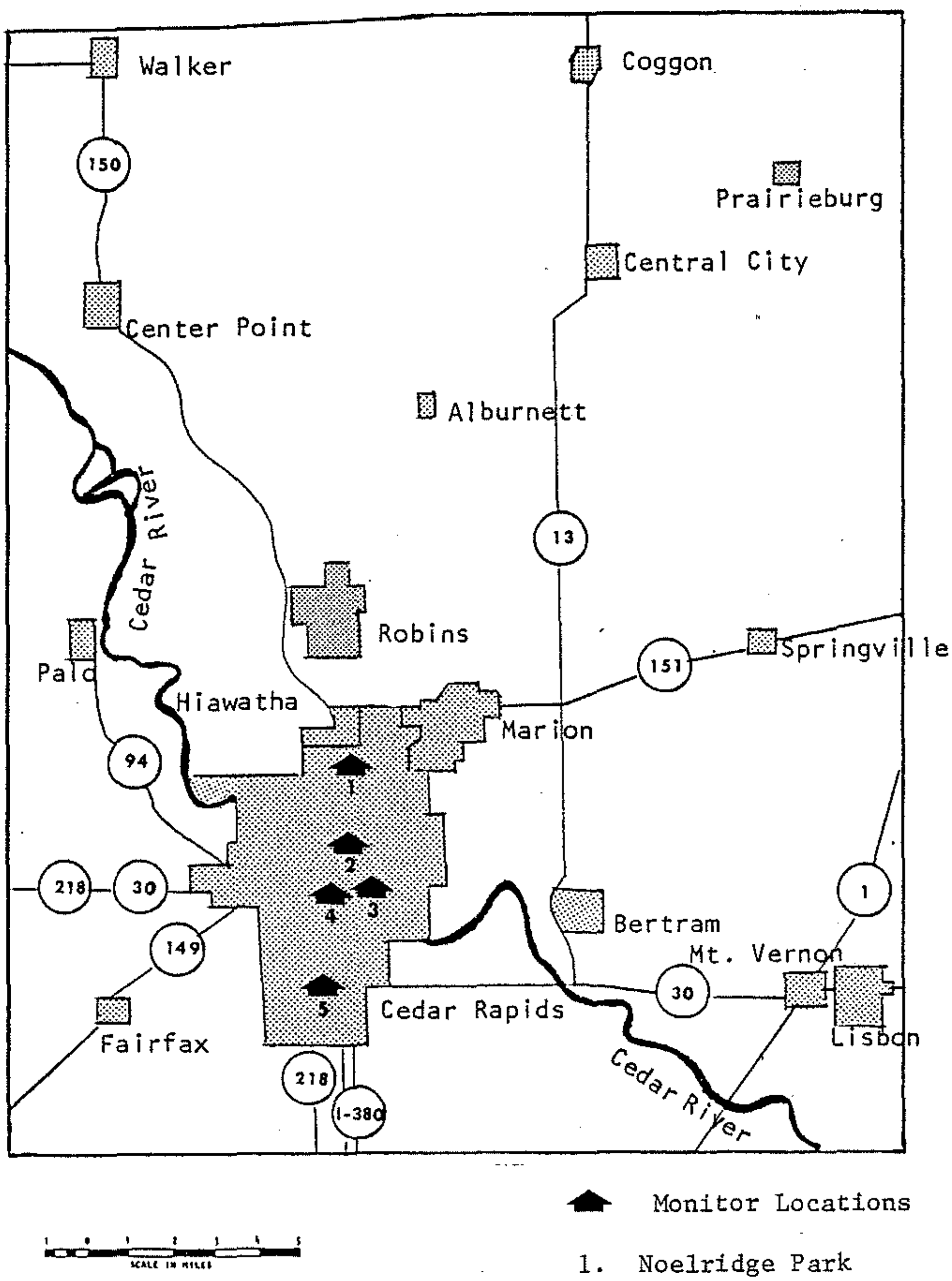
Air Monitoring

The most accurate measurement of suspended particulate levels in an area is obtained by monitoring the air. Air quality data for suspended particulate are obtained using the high volume sampler. The sampler draws a known quantity of ambient air through a preweighed glass fiber filter for a twenty-four-hour period once every six days. After each twenty-four-hour period the sample filter is sent to the laboratory where it is weighed again. The weight difference measured in micrograms is the amount of particulate. Combined with the volume of air that passed through the filter during the twenty-four-hour period, the sampling results are calculated and recorded as the average micrograms of particulate matter per cubic meter of air for a twenty-four-hour period. Five County owned high volume samplers are currently located in Cedar Rapids. These monitors are located at (1) Noelridge Park, 4426 Council St. NE; (2) Linn County Health Department, 751 Center Point Road NE (3) Jane Boyd Community Center, 14th Ave. & 10th St. SE; (4) Cedar Rapids City Garage, 445 - First St. SW; and (5) Grant Wood Building, 4401 Sixth St. SW. (See Figure 4) Table 2 shows the monitored values at these sites. An asterik after the year indicates insufficient data for that year to calculate a valid annual mean.

The National Ambient Air Quality Standards were developed in 1971. The standards for suspended particulates were developed for a twenty-four-hour and annual time periods. These time periods were also divided into two categories: primary, to protect the public's health; and secondary to protect the public's welfare. The national twenty-four-hour primary standard, not to be exceeded more than once per year, is 260 micrograms per cubic meter; the secondary standard is 150 micro-

Figure 4

Location of Suspended Particulate Air Monitoring Equipment in Cedar Rapids



Monitor Locations

1. Noelridge Park
2. Linn County Health Department
3. Jane Boyd Community Center
4. Cedar Rapids City Garage
5. Grantwood Building

grams per cubic meter. The primary annual standard is 75 micrograms per cubic meter as an annual gemetric mean; the secondary standard is 60 micrograms per cubic meter as an annual geometric mean.

The air monitoring data are an essential tool in calibrating the computer model. The annual means that are predicted by the model are correlated with the monitoring data to estimate the accuracy of the projections. Large variances between the monitored values and the projections indicates poor correlation and revisions to the model inputs must be made. Small variances indicate good correlation and correct model inputs.

TABLE 2

Air monitoring data for Cedar Rapids

Location	Year	Number of Samples	Maximum 24-Hour Value	2nd Max. 24-Hour Value	Arithmetic Mean	Geometric Mean	Standard Geometric Deviation
1. Noelridge	1975	58	173.0	163.5	71	62	1.73
Park	1976	55	400.7	395.7	84	70	1.75
	1977	54	135.9	133.0	64	60	1.48
2. Linn	1975	45	314.8	305.0	139	126	1.54
County	1976	59	269.6	209.5	108	99	1.56
Health	1977	57	446.0	361.5	125	109	1.70
Dept.							
3. Jane Boyd	1975	55	211.9	208.0	112	101	1.62
Comm.	1976	60	449.7	311.1	119	106	1.61
Center	1977	59	371.0	175.2	94	85	1.54
4. Cedar	1975	55	365.0	219.7	114	104	1.56
Rapids	1976	58	353.8	289.5	116	98	1.81
City	1977	62	267.0	265.3	95	84	1.65
Garage							
5. Grantwood	1976*	24	333.7	173.3	105	94	1.59
Building	1977	47	434.0	230.5	87	74	1.70

* These years do not have a sufficient number of samples to calculate a valid annual mean.

The Model (Annual Average Estimation)

A dispersion model is a compter program that predicts what the ambient air quality will be at a certain point within an air basin. The Air Quality Display Model (AQDM)[2] is the model DEQ used in each air basin. AQDM is a computer model that combines point source emissions (industrial plants), area source emissions (residential heating, fugitive dust, solid waste disposal, transportation, etc.) and meteorological factors (wind speed, wind direction, average temperature, pressure, and mixing height) over a specified area to predict the annual distribution of pollutants for that area. The annual particulate concentrations predicted by the model for each year are plotted as isopleths over the air basin. Five designated receptors are also broken down into specific source contribution percentages.

The computer algorithm and the program inputs reflect several assumptions. Assumptions used in the computer algorithm are:

(a) Total reflection of the pollutant plume takes place at the earth's surface.

(b) Conditions describing the plume are averaged over a time period of several minutes.

(c) All effluent gases and particulates have diameters less than 20 microns and have neutral buoyancy in the atmosphere. Zero fallout is assumed.

(d) The plume exhibits a Gaussian concentration distribution and the spread in both directions is considered to be a function of downwind distance and atmospheric stability only.

(e) The plume is a steady-state phenomenon resulting from a constant, continuous emission.

Assumptions used in the program input are:

(a) Point source data from plant emission inventory forms, from stack tests, and from permit information are accurate and complete.

(b) Sources not reporting stack parameters were given parameters of similar sources (this was true in interstate air basins where other states occasionally were not able to provide stack parameters).

(c) Area source data from the National Emissions Data System (NEDS) are accurate and complete.

(d) Population distribution and area source emissions are directly related.

(e) Fugitive emissions from paved and unpaved roads are accurately calculated.

Source of Suspended Particulates (Point)

All Cedar Rapids point sources were acquired from DEQ's current emission inventory. Stack emissions, diameters, emission velocities and temperatures were taken from values supplied by the plant operators on emission inventory forms, permit applications, or stack tests performed at the plant. Emissions for the modeled year were taken from the 1975 emission inventory and updated by permit applications, compliance schedules, or stack tests. All plant emission controls were assumed to be working the entire year unless breakdown or maintenance reports were submitted to the County or the Department. The emissions during periods of emission control device breakdown or maintenance were added to the plant totals. All industrial point source estimates calculated were verified by the appropriate plant officials. Fugitive dust point sources were given plume heights of 6.0 meters. All source emissions were calculated in tons per year and divided by 365 days to obtain the necessary model input of tons per day. No consideration was given to seasonal operation or weekend shutdowns.

Sources of Suspended Particulates (Area)

Residential Emissions

Total residential emissions for fuel use in Linn County were taken from the National Emissions Data System (NEDS) estimates of area source emissions supplied by EPA. Solid waste emissions were calculated using an estimated tonage of solid waste and an appropriate emission factor. The emissions were distributed by housing population calculated from the population projections provided by the Cedar Rapids Planning and Redevelopment Commission. The 1977 Cedar Rapids population growth was estimated at 1.093 times the 1970 census figure.

The Linn County census population was broken down into designated area sources in the model region as shown in Figure 5. Area housing populations were divided by the total county housing population and multiplied by the county emission totals to obtain area emissions for residential fuel use and solid waste.

All housing emissions were assumed to be uniform for the county. Total particulate emissions for the modeled year obtained from NEDS were:

	1977
Residential Fuel	74 tons per year
Residential Solid Waste	225 tons per year

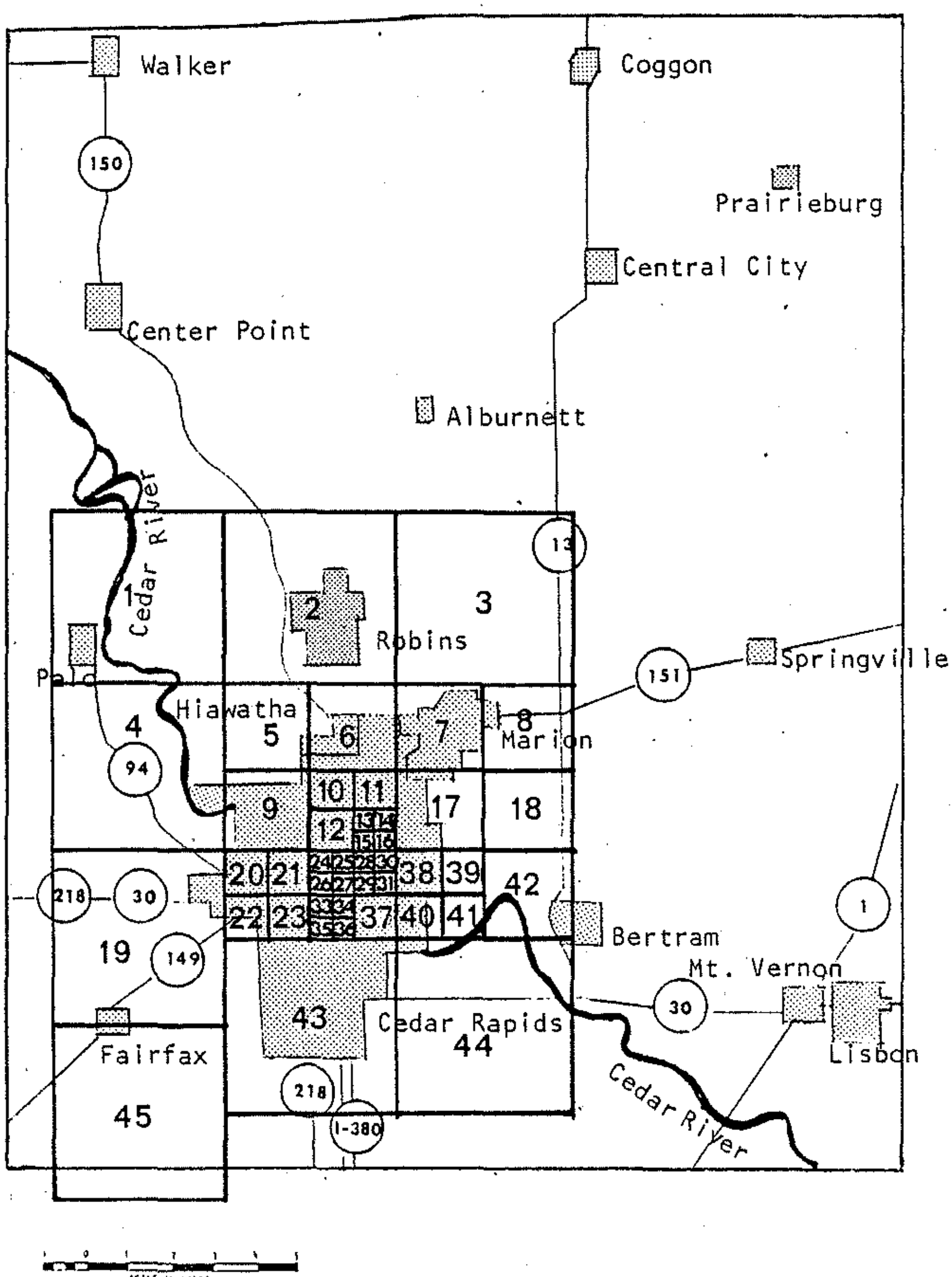
Commercial-Institutional Emissions

Total commercial-institutional emissions for fuel use and solid waste disposal in Linn County were taken from the NEDS data supplied by EPA. Ninety percent of the county emissions was assumed to be in the major urban center, while ten percent was assumed to be in the smaller cities. The commercial-institutional emissions were distributed by land use area.

All commercial-institutional building emissions were assumed to be uniform for the county. Total particulate emissions for the modeled year were:

Figure 5

Area Source Grid Pattern for Linn County



		1977
Commercial-Institutional Fuel		194 tons per year
Commercial-Institutional Solid Waste		106 tons per year

Transportation-Motor Vehicle

Total emissions from transportation sources, excluding fugitive emissions, were taken from the NEDS data supplied by EPA. Emissions from major highway line sources and rural paved and unpaved roads were individually calculated.

Major access street and highway line source emissions were calculated by multiplying the emission factor for vehicles (0.66 grams per vehicle mile)[3] by the product of the length of the road segment and the traffic flow count. Each line source emission was assigned to the appropriate designated area and was assumed to disperse equally over the area. All car and truck emissions were assumed to be approximately the same. After all major access highway emissions were calculated, the total line source emissions assigned to each area was subtracted from the NEDS county total and distributed by the population proportion in each area.

Fugitive dust from vehicle travel on paved and unpaved roads was calculated from emission factors found in two recent reports.[4,5] Fugitive dust from unpaved roads was calculated by multiplying the emission factor (1179 grams per vehicle mile) by the product of the length of the road segment and the traffic flow count. Thirty percent of these emissions was assumed to actually become suspended. Paved road emissions were also calculated by multiplying the emission factor (11 grams per vehicle mile) by the product of the length of the road segment and the traffic flow count. These emission factors were derived from an emission formula that combines conditions of the road, vehicle speeds, and climatological factors to obtain grams of particulate per vehicle mile. Thirty percent of these emissions was assumed to actually become suspended. Emissions from each road segment are assumed to disperse equally over the designated areas.

Total estimated particulate emissions for the modeled year were:

	1977
Vehicles	549 tons per year
Fugitive (paved roads)	9150 tons per year
Fugitive (unpaved roads)	12200 tons per year

Transportation - Railroads

Total railroad fuel use emissions for railroads in Linn County were taken from the NEDS data supplied by EPA. Approximate track mileage was estimated for each designated area. Emissons were distributed by the portion of track miles in each area.

Transportation - Off Highway

Off highway transportation was considered to be any fuel burning machine not operated on a road (i.e., farm tractor, lawnmowers, motorized boats, etc.). Because of the difficulty in estimating the concentration of off-highway transportation, it was assumed that the NEDS emissions were distributed equally over the entire county.

Transportation - Aircraft

The Cedar Rapids Airport emissions were distributed as a four square kilometer area source. Emissions were based on projections from the State airport system plan.[5]

Area Source Totals

A listing of area sources and total emissions used in the model is given in Appendix A.

Model Meteorology Parameters

To accurately model the suspended particulate emission sources, detailed meterological parameters are necessary.

Meteorological wind data consists of five stability classes and sixteen wind directions. These data were not available for the Cedar Rapids, therefore the windrose data for Waterloo, Iowa, were chosen because the topography and river orientations are similar for both cities.

Other necessary meteorological parameters that were obtained for Cedar Rapids are shown below:

Average daily mixing depth:	1190 meters
Average ambient temperature	282 degrees Kelvin (9 degrees Celsius)
Average ambient pressure	988 millibars

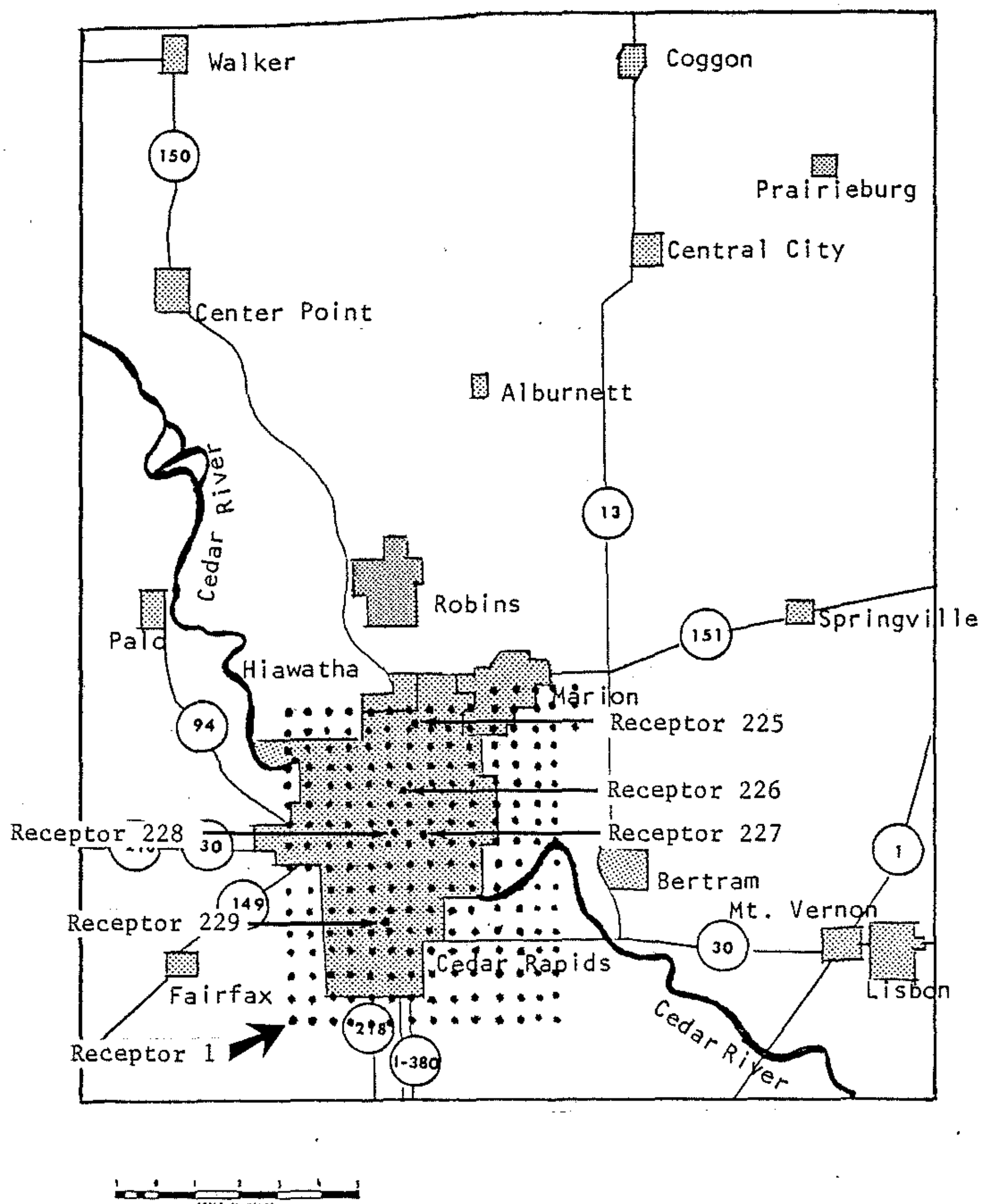
Results

A grid area of 14 kilometers by 16 kilometers was set up around Cedar Rapids with receptors placed at one kilometer intervals as shown in Figure 6. Twelve additional receptors located throughout the county were also included in the total receptor count.

Expected concentrations at each receptor are given in Appendix B. Graphical displays of these results are illustrated in Figure 7 for Linn County and Figure 8 for Cedar Rapids. Each line represents an isopleth of suspended particulate concentration as an annual arithmetic mean. The highest concentration expected was 147 micrograms per cubic meter at receptor 90. Figure 9 illus-

Figure 6

Receptor Locations for the Cedar Rapids AQDM Model



NOTE: Except for Receptors 225-236, grid numbering runs bottom to top and left to right.

Figure 7

Linn County
1977 Suspended Particulate Isopleth Map
(values shown are arithmetic means in micrograms per cubic meter)

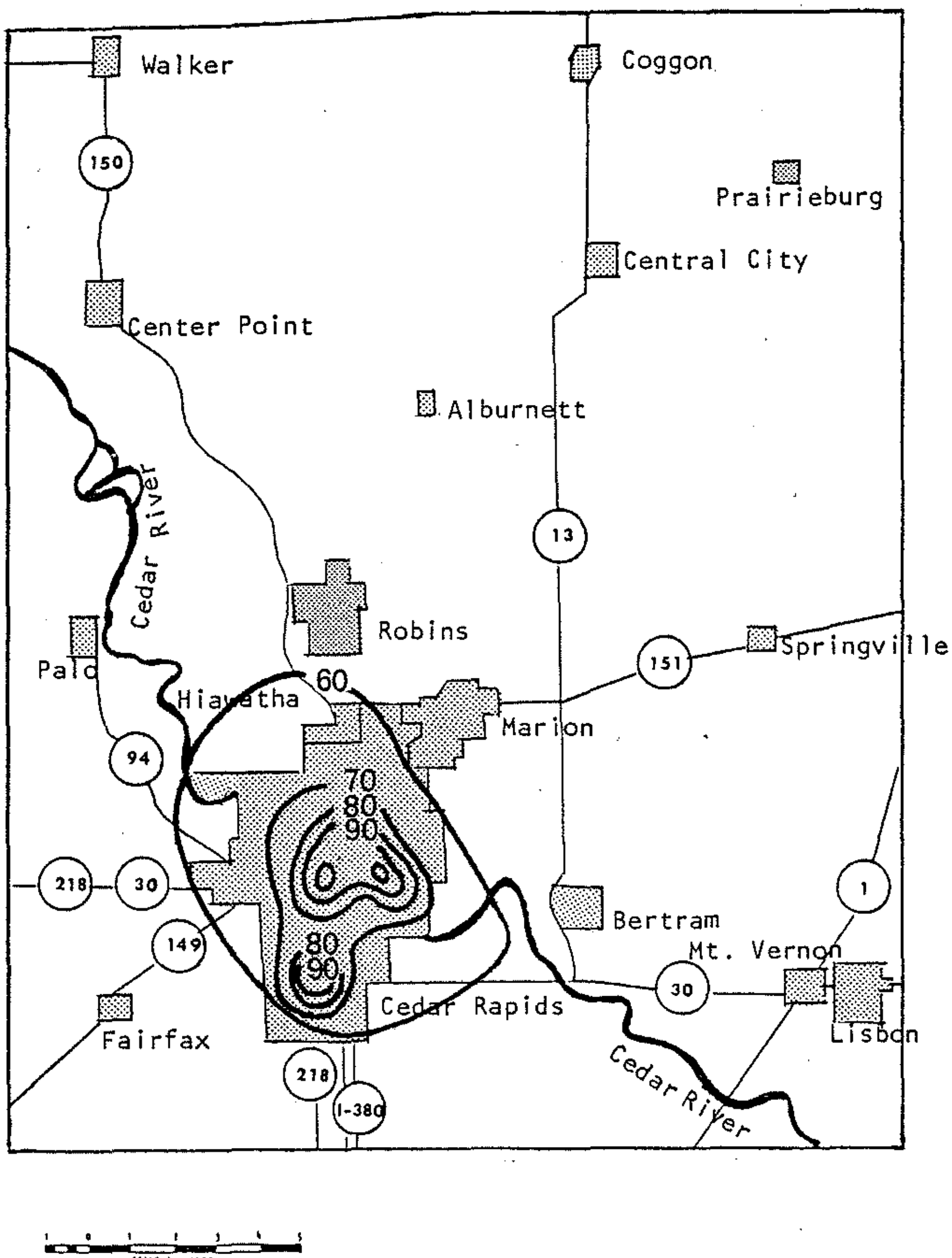


Figure 8
Suspended Particulate Isopleth Map for Cedar Rapids
(values shown are arithmetic means in micrograms per cubic meter)

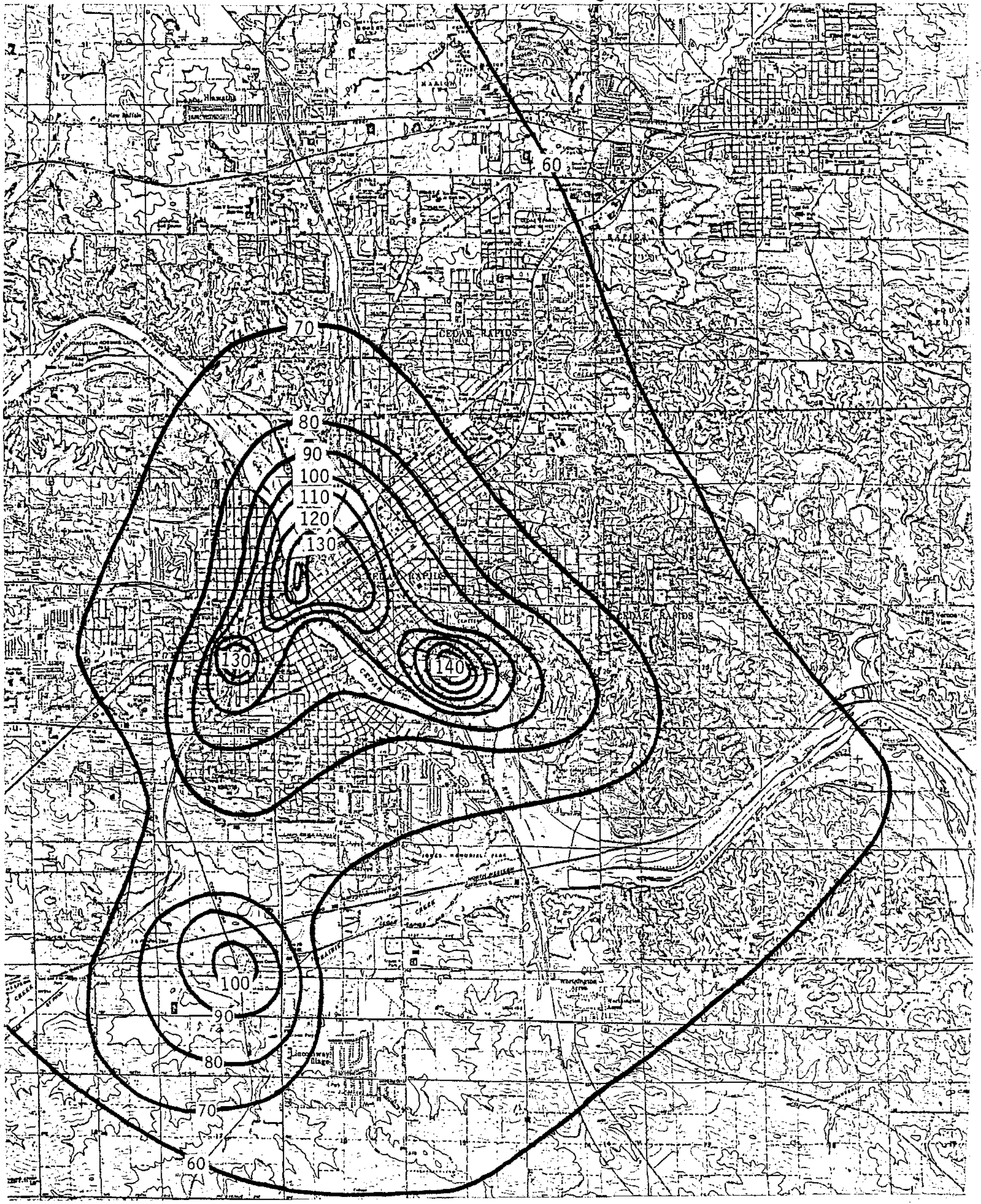
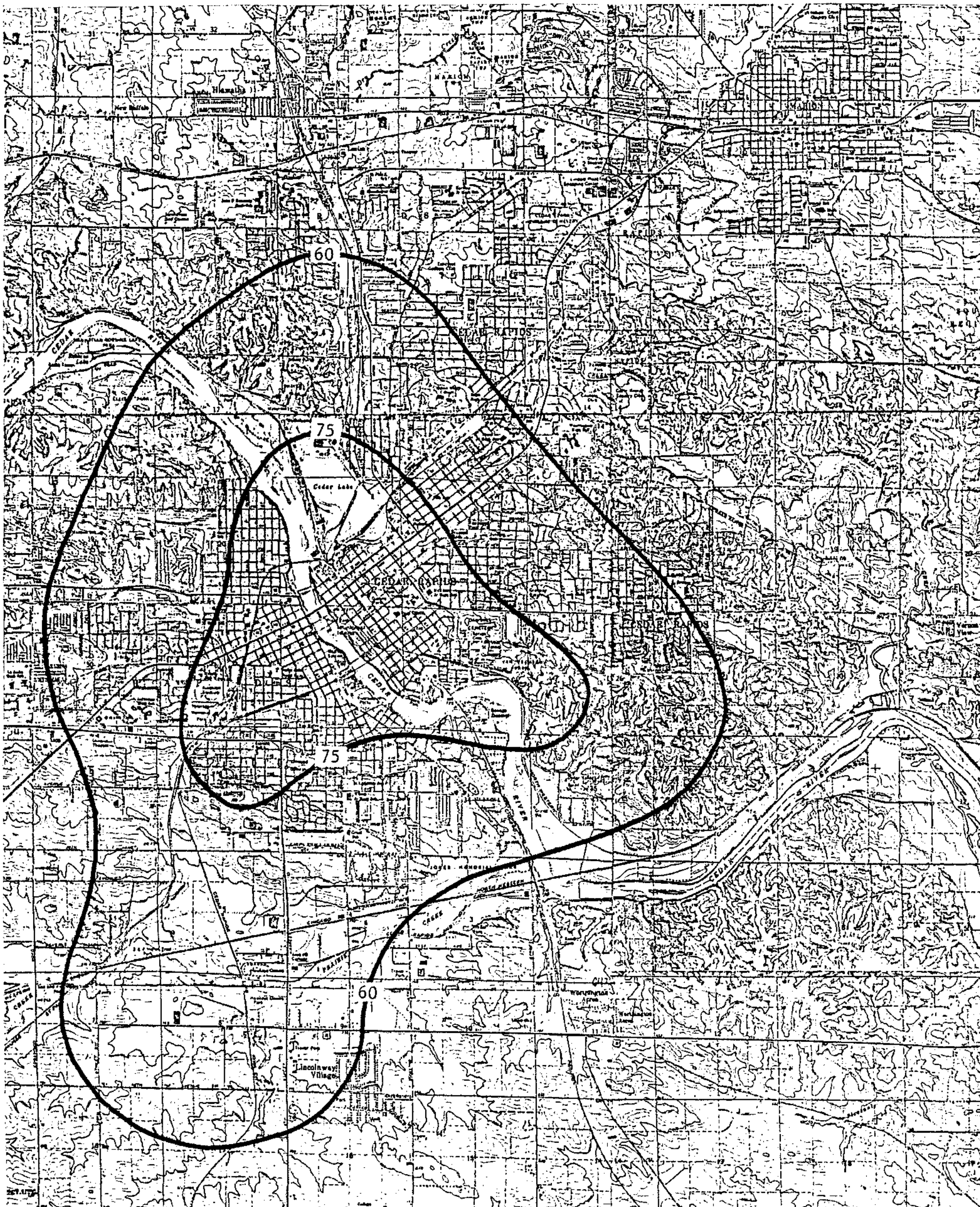


Figure 9
Suspended Particulate Isopleth Map for Cedar Rapids
(values shown are geometric means in micrograms per cubic meter)



trates these results as annual geometric means which can be compared to the national standards described on Page 7 of this report.

To estimate the impact of each source on a receptor, a special audit was requested for receptors 225, 226, 227, 228 and 229. Results for each source are given in Appendix B and a summary is shown in Table 3.

Grain handling facilities are projected to contribute the largest amount of particulates from the point sources. Most of this contribution is the result of grain transferring, especially near the grain elevator locations in Cedar Rapids. Since the model assumes a general particle size of 20 microns or less and no particulate fallout, the grain handling sources may be projected to contribute more particulate than is actually occurring. Any significant reductions in projected emissions because of particle size would be at receptors on or very near the plant.

An estimate of particulate generation from the freeway construction in Cedar Rapids was included in the model and is shown in Table 3. Because this dust is generated near the ground, the impact is very localized. The largest contribution is shown to be at Receptor 226.

Area sources also contribute a large quantity of particulates in urban areas. This contribution ranged from ten to twenty micrograms per cubic meter.

To estimate the accuracy of the modeling results, a comparison of expected concentrations and monitoring data is necessary. This comparison is shown in Table 4. Both Monitor 1 and Monitor 4 agree closely with the projected concentrations. Monitor 2 is projected thirty micrograms per cubic meter low. How-

TABLE 3
Source Contributions to Five
Selected Receptors
(values shown are in micrograms per cubic meter)

Source	Receptor 225 Noelridge Park	Receptor 226 Linn County Health Dept.	Receptor 227 Jane Bond Comm. Center	Receptor 228 Cedar Rapids City Garage	Receptor 229 Grantwood Building
<u>Point Sources</u>					
Cargill (6th St.)	0.80	4.51	2.86	2.25	0.34
Iowa Electric Light & Power (6th St.)	0.07	0.04	0.09	0.05	0.03
Prairie Creek	0.04	0.03	0.05	0.03	0.01
Quaker Oats	1.10	3.32	3.04	4.56	0.55
Diamond V. Mills	0.04	0.14	0.21	0.92	0.05
City Water Pollution Control Plant	0.02	0.03	0.02	0.03	0.01
Cargill (16th St)	2.03	4.36	52.62	7.21	1.25
Wilson & Company	0.63	1.76	9.42	2.07	0.24
Iowa Manufacturing	0.13	0.53	0.39	1.02	0.16
Penick & Ford	0.20	0.53	0.39	1.02	0.16
FMC	0.01	0.05	0.08	0.18	1.30
Cargill (10th Ave)	0.65	1.15	1.57	3.59	1.30
Cedar Rapids Asphalt	0.01	0.02	0.03	0.03	0.02
Hubbard Milling	0.13	0.24	0.23	0.43	9.30

TABLE 3 (Continued)
Source Contributions to Five
Selected Receptors
(values shown are in micrograms per cubic meter)

Source	Receptor 225 Noelridge Park	Receptor 226 Linn County Health Dept.	Receptor 227 Jane Bond Comm. Center	Receptor 228 Cedar Rapids City Garage	Receptor 229 Grantwood Building
Point Sources					
Cornsweeteners	0.92	1.24	1.24	1.81	8.49
National Oats	0 .26	0.97	0.20	0.14	0.05
Freeway Construction	0 .95	13.28	4.11	8.77	0.45
Area Sources	10.91	17.16	16.10	20.47	8.96
Background	45.00	45.00	45.00	45.00	45.00
Total Concentration	63.82	94.15	139.89	99.46	76.36

TABLE 4

Comparison of Air Monitoring Data

with Projected Concentrations

Monitor Location	1977 Arithmetic Mean	Projected Concentration
1. Noelridge Park	64	64
2. Linn County Health Department	126	94
3. Jane Boyd Comm. Center	97	140
4. Cedar Rapids City Garage	95	99
5. Grantwood Building	87	76

ever this site is located near the freeway construction and appears to be affected by the fugitive dust from the construction more than the model predicts. Monitor three is projected to be much higher than the actual monitored value. This monitor is located close to a grain elevator and, as stated earlier, may have been projected too high because of the model's technique of dispersing fugitive emissions from grain handling sources. The projected concentration at Monitor 5 is close to the observed value. However the discrepancy of eleven micrograms per cubic meter is believed to be caused by localized fugitive sources that were not included in the model or were not accurately distributed by the model.

Although the calculated concentrations are not always exactly the same as the actual monitored values, the projected concentrations represent averages that do not reflect changing weather conditions. Therefore, these projections should be used more as a guideline for locating and interpreting high concentration areas than as an exact calculation of suspended particulate levels at each receptor.

An estimated breakdown of the annual suspended particulate concentrations by source types using this model is shown in Table 5 for receptors located at three monitoring sites in Cedar Rapids. A graphical display of the estimated contributions by various suspended particulate source types is shown in Figure 10.

The industrial sources located in central Cedar Rapids account for ten to thirty percent of the total projected concentration in this part of the city. Even with required control equipment, the industrial contribution remains relatively high in this area. However, a large percentage of the particulates contributed from these sources are fugitive and may be overpredicted by the model. Also some fluctuations in annual averages may be possible when breakdown or maintenance of air pollution control equipment occurs.

Other significant sources of particulates shown in Table 5 are transportation oriented sources. These fugitive dust emissions are estimated to contribute nearly ten to fifteen percent of the total calculated particulate concentration while the emissions from the transportation source itself (i.e., from engine exhaust and tire wear) accounts for less than three percent. As would be expected, the largest amount of fugitive dust is from paved roads in the urban center with an increasingly larger contribution from unpaved roads in rural areas.

Summary

The AQDM results for Cedar Rapids indicate a large area of high particulate potential. This area encompasses most of the central Cedar Rapids area and extends into the northern, southern, and eastern residential areas.

TABLE 5

Breakdown of Annual Suspended Particulate Concentration for Three Selected Sites in Cedar Rapids

Sources of Particulate	Expected Concentrations (ug/m^3)		
	Noelridge Park	City Garages	Grant-wood Bldg.
Point Sources	7.04	25.13	21.91
Area Sources			
Fuel use (Residential and Commercial)	0.52	0.85	0.24
Solid Waste Disposal (Open Burning)	1.07	2.04	.53
Transportation			
Exhaust, Tire Wear	1.40	3.34	.79
Fugitive Dust from Paved Roads	3.77	11.64	2.62
Fugitive Dust from Unpaved Roads	4.08	1.81	4.68
Miscellaneous (structural fire, construction)	0.07	0.78	0.10
Freeway Construction	0.95	8.77	0.45
Background	45.00	45.00	45.00
TOTAL	63.82	99.46	76.36

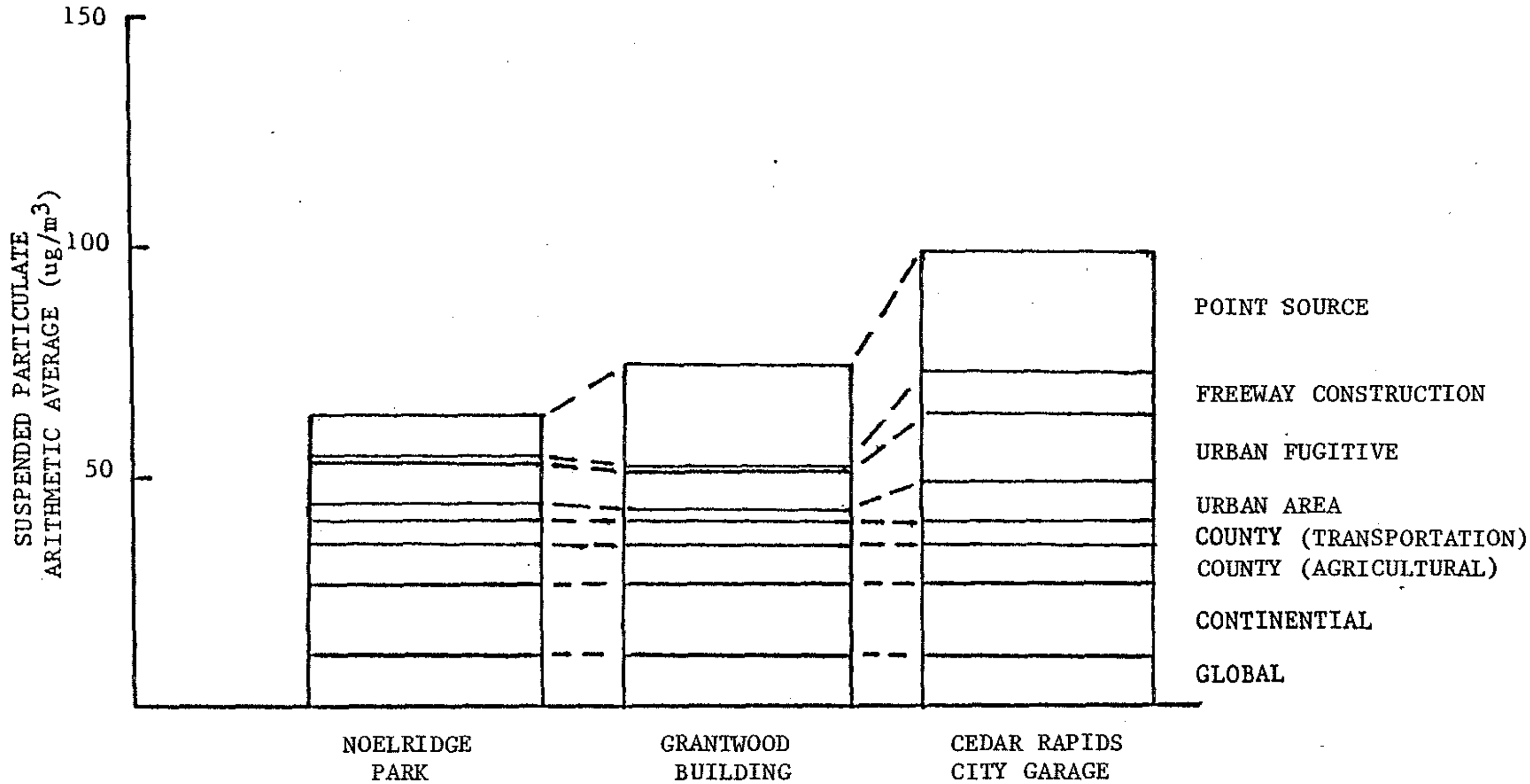


Figure 10 Estimated contributions of various suspended particulate source types

Both industrial point sources and area sources contribute to the high particulate levels. Industrial sources are projected to contribute ten to thirty micrograms per cubic meter of particulate matter to the annual arithmetic mean. In most cases fugitive emissions from industrial sources contribute more to the annual particulate projections than the stack emissions.

Area sources account for ten to twenty percent of the annual particulate concentrations in this area. The majority of area source particulates are generated by travel on both paved and unpaved roads, and accounts for over seventy-five percent of the area source contribution.

Another significant source appears to be the freeway construction in Cedar Rapids. This temporary source of particulate adds from one to fifteen micrograms per cubic meter of particulate to the area with possibly greater amounts near the construction.

Four of the five particulate monitors in Cedar Rapids exceeded the secondary standard in 1977. These values support the general pattern of annual concentrations shown by the model. Three sites are calculated incorrectly; however, two of these sites have a localized source that has elevated the particulate levels while the other site was modeled incorrectly.

References

1. GCA/Technology Division, "Assessment of Particulate Attainment and Maintenance Problem", Volume 1 and 4, DEQ Contract No. 76-2000-06, September, 1976.

2. Air Quality Display Model prepared for Department of Health Education and Welfare Public Health Service by TRW Systems Group, November 1969, Contract No. PH-22-68-60.

3. AP-42, "Compilation of Air Pollutant Emission Factors, Second Edition", U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, February 1976.

4. Amick, R. S., Axetell, K., and Wells, D. M., "Fugitive Dust Emissions Inventory Techniques", Presented at the 67th Annual APCA meeting, #74-58, Page 7.

5. Cowherd, C. Jr., and Mann, C. O., "Quantification of Dust Entrainment from Paved Roads", Presented at the 69th Annual APCA meeting, #76-5.4, Page 13.

6. Iowa Airport System Plan, 1972, Department of Transportaton, Table 41.

APPENDIX A

Cedar Rapids Sources and

Corresponding Source Numbers Used

In the AQDM Program

Source Number	Source
1	Alpha Asphalt
2-21	Cargill Inc. (Sixth St.)
22-23	Iowa Electric Light & Power (6th Street)
24-26	Iowa Electric Light & Power (Prairie Crk)
27-85	Quaker Oats Company
86	Diamond V. Mills
87	Cedar Rapids Water Pollution Pollution Control Plant
88-110	Cargill, Inc. (16th Street)
111-115	Wilson & Company
116-118	Iowa Manufacturing Company
119-121	Penick and Ford
122-124	FMC (6th Street)
125-143	Cargill, Inc. (10th Avenue)
144	Cedar Rapids Asphalt & Paving
145-148	Hubbard Milling Company
149-160, 164	Corn Sweetners
161-164	National Oats
165-170	Freeway Construction
171	Cedar Rapids Municipal Airport
172-215	Area Sources

SOURCE DATA

SOURCE NUMBER	SOURCE LOCATION (KILOMETERS) HORIZONTAL	VERTICAL	SOURCE AREA SQUARE KILOMETERS	ANNUAL SOURCE EMISSION RATE (TONS/DAY) SO2	PART	STACK DATA HT (M)	DIAM (M)	VEL (M/SEC)	TEMP (DEG.K)
1	618.4	4653.8	0.0	0.0	0.013	10.9	0.8	23.6	394.
2	610.5	4648.7	0.0	0.0	0.108	6.0	0.0	0.0	294.
3	610.5	4648.7	0.0	0.0	0.006	9.1	0.8	10.6	294.
4	610.5	4648.7	0.0	0.0	0.009	9.1	0.9	9.6	294.
5	610.5	4648.7	0.0	0.0	0.017	40.9	0.8	9.6	294.
6	610.5	4648.7	0.0	0.0	0.004	18.2	0.4	25.2	294.
7	610.5	4648.7	0.0	0.0	0.159	12.2	4.5	3.3	310.
8	610.5	4648.7	0.0	0.0	0.018	9.1	1.3	7.0	294.
9	610.5	4648.7	0.0	0.0	0.005	6.0	0.8	5.2	325.
10	610.5	4648.7	0.0	0.0	0.011	15.2	0.8	13.6	316.
11	610.5	4648.7	0.0	0.0	0.030	15.2	0.6	10.6	333.
12	610.5	4648.7	0.0	0.0	0.005	12.1	0.8	22.7	322.
13	610.5	4648.7	0.0	0.0	0.030	12.1	0.9	12.7	311.
14	610.5	4648.7	0.0	0.0	0.005	12.1	0.6	15.8	325.
15	610.5	4648.7	0.0	0.0	0.023	9.1	0.7	18.8	294.
16	610.5	4648.7	0.0	0.0	0.023	10.6	0.8	12.7	294.
17	610.5	4648.7	0.0	0.0	0.011	18.2	0.2	15.8	325.
18	610.5	4648.7	0.0	0.0	0.025	12.1	0.9	9.7	311.
19	610.5	4648.7	0.0	0.0	0.018	20.0	0.9	10.3	311.
20	610.5	4648.7	0.0	0.0	0.018	20.0	0.8	22.2	325.
21	610.5	4648.7	0.0	0.0	0.009	3.0	0.3	16.2	325.
22	610.3	4648.7	0.0	0.0	0.483	60.0	3.0	7.3	451.
23	610.3	4648.7	0.0	0.0	0.130	60.0	3.0	9.1	439.
24	612.9	4644.3	0.0	0.0	0.349	60.6	3.9	17.0	413.
25	612.9	4644.3	0.0	0.0	0.130	54.5	4.8	4.8	446.
26	612.9	4644.3	0.0	0.0	0.220	54.8	3.8	8.2	450.
27	610.2	4648.5	0.0	0.0	0.005	36.4	1.0	10.3	294.
28	610.2	4648.5	0.0	0.0	0.003	37.2	0.6	21.3	295.
29	610.2	4648.5	0.0	0.0	0.013	15.2	1.2	10.3	294.
30	610.2	4648.5	0.0	0.0	0.004	35.2	1.1	8.8	297.
31	610.2	4648.5	0.0	0.0	0.006	28.8	0.8	13.9	294.
32	610.2	4648.5	0.0	0.0	0.004	7.6	0.6	14.2	294.
33	610.2	4648.5	0.0	0.0	0.014	25.8	0.5	21.5	294.
34	610.2	4648.5	0.0	0.0	0.012	54.8	0.5	21.2	297.
35	610.2	4648.5	0.0	0.0	0.003	51.5	0.9	23.0	294.
36	610.2	4648.5	0.0	0.0	0.028	35.2	0.7	8.5	311.
37	610.2	4648.5	0.0	0.0	0.054	34.8	0.8	16.4	305.
38	610.2	4648.5	0.0	0.0	0.029	35.2	0.4	17.9	316.
39	610.2	4648.5	0.0	0.0	0.004	35.5	0.6	9.1	316.
40	610.2	4648.5	0.0	0.0	0.006	42.4	0.6	22.1	300.
41	610.2	4648.5	0.0	0.0	0.013	42.4	1.1	10.6	308.
42	610.2	4648.5	0.0	0.0	0.004	25.9	0.6	4.3	316.
43	610.2	4648.5	0.0	0.0	0.004	25.8	0.6	4.2	317.
44	610.2	4648.5	0.0	0.0	0.004	25.8	0.4	10.9	306.
45	610.2	4648.5	0.0	0.0	0.005	38.4	0.5	22.0	347.
46	610.2	4648.5	0.0	0.0	0.014	13.3	0.7	23.6	316.
47	610.2	4648.5	0.0	0.0	0.031	51.5	0.7	23.6	314.
48	610.2	4648.5	0.0	0.0	0.013	27.3	0.8	10.6	313.
49	610.2	4648.5	0.0	0.0	0.020	56.1	0.6	15.5	300.
50	610.2	4648.5	0.0	0.0	0.004	27.3	0.8	17.9	313.
51	610.2	4648.5	0.0	0.0	0.003	55.8	0.5	18.2	323.
52	610.2	4648.5	0.0	0.0	0.003	55.8	0.5	16.1	324.
53	610.2	4648.5	0.0	0.0	0.004	55.8	0.5	18.5	322.
54	610.2	4648.5	0.0	0.0	0.004	29.7	0.8	17.0	300.
55	610.2	4648.5	0.0	0.0	0.009	47.3	0.9	11.5	306.
56	610.2	4648.5	0.0	0.0	0.004	47.3	0.8	18.2	300.
57	610.2	4648.5	0.0	0.0	0.025	51.5	0.6	12.1	319.
58	610.2	4648.5	0.0	0.0	0.009	51.5	0.7	24.2	319.
59	610.2	4648.5	0.0	0.0	0.008	33.6	0.7	24.8	306.
60	610.2	4648.5	0.0	0.0	0.011	36.9	0.7	12.0	313.
61	610.2	4648.5	0.0	0.0	0.006	36.9	0.7	9.7	313.
62	610.2	4648.5	0.0	0.0	0.003	30.5	0.3	14.9	315.
63	610.2	4648.5	0.0	0.0	0.017	54.5	1.2	7.3	326.
64	610.2	4648.5	0.0	0.0	0.010	26.5	0.4	21.9	305.
65	610.2	4648.5	0.0	0.0	0.003	46.7	0.5	6.7	316.
66	610.2	4648.5	0.0	0.0	0.003	46.7	0.5	6.7	312.
67	610.2	4648.5	0.0	0.0	0.003	46.7	0.5	6.7	311.
68	610.2	4648.5	0.0	0.0	0.004	46.7	0.5	6.7	311.
69	610.2	4648.5	0.0	0.0	0.003	54.6	0.5	14.9	370.
70	610.2	4648.5	0.0	0.0	0.007	37.9	0.7	6.4	321.
71	610.2	4648.5	0.0	0.0	0.009	47.6	0.2	19.1	302.
72	610.2	4648.5	0.0	0.0	0.005	47.6	0.5	16.1	322.
73	610.2	4648.5	0.0	0.0	0.013	47.3	0.5	17.6	322.
74	610.2	4648.5	0.0	0.0	0.014	51.5	0.6	8.2	294.
75	610.2	4648.5	0.0	0.0	0.006	58.5	0.7	12.7	317.
76	610.2	4648.5	0.0	0.0	0.005	39.1	0.5	12.1	334.
77	610.2	4648.5	0.0	0.0	0.006	36.6	0.5	19.8	302.
78	610.2	4648.5	0.0	0.0	0.014	39.6	0.5	19.8	302.
79	610.2	4648.5	0.0	0.0	0.013	36.4	0.3	19.4	402.
80	610.1	4648.5	0.0	0.0	0.083	6.0	0.0	0.0	294.
81	610.1	4648.6	0.0	0.0	0.048	6.0	0.0	0.0	294.
82	610.2	4648.4	0.0	0.0	0.017	6.0	0.0	0.0	294.
83	610.2	4648.4	0.0	0.0	0.039	6.0	0.0	0.0	294.
84	610.3	4648.6	0.0	0.0	0.037	6.0	0.0	0.0	294.
85	610.2	4648.5	0.0	0.0	0.003	36.6	0.3	5.2	361.
86	609.3	4648.2	0.0	0.0	0.048	6.0	0.0	0.0	294.
87	612.1	4646.7	0.0	0.0	0.029	51.8	0.6	25.9	422.

88	612.2	4647.1	0.0	0.0	0.017	15.2	1.5	16.4	339.
89	612.2	4647.1	0.0	0.0	0.146	6.0	0.0	0.0	294.
90	612.2	4647.1	0.0	0.0	0.045	16.7	0.1	14.2	294.
91	612.2	4647.1	0.0	0.0	0.015	16.7	0.1	25.2	294.
92	612.2	4647.1	0.0	0.0	0.143	13.6	0.8	20.0	372.
93	612.2	4647.1	0.0	0.0	0.142	13.7	0.2	7.6	294.
94	612.2	4647.1	0.0	0.0	0.043	12.1	1.1	9.2	339.
95	612.2	4647.1	0.0	0.0	0.022	12.1	0.9	7.0	366.
96	612.2	4647.1	0.0	0.0	0.121	12.1	0.3	22.4	294.
97	612.2	4647.1	0.0	0.0	0.055	12.1	0.5	18.2	327.
98	612.2	4647.1	0.0	0.0	0.089	4.5	0.3	18.2	294.
99	612.2	4647.1	0.0	0.0	0.121	12.1	0.8	3.6	316.
100	612.2	4647.1	0.0	0.0	0.010	6.0	0.1	24.2	294.
101	612.2	4647.1	0.0	0.0	0.087	0.3	0.6	16.1	294.
102	612.2	4647.1	0.0	0.0	0.180	13.6	0.7	18.2	319.
103	612.2	4647.1	0.0	0.0	0.034	13.5	0.1	25.2	319.
104	612.2	4647.1	0.0	0.0	0.040	12.2	0.1	25.3	294.
105	612.2	4647.1	0.0	0.0	0.008	13.7	0.1	25.3	294.
106	612.2	4647.1	0.0	0.0	0.013	13.6	0.1	10.0	294.
107	612.2	4647.1	0.0	0.0	0.152	12.1	0.7	12.4	322.
108	612.2	4647.1	0.0	0.0	0.042	12.1	0.7	23.9	294.
109	612.2	4647.1	0.0	0.0	0.063	12.1	1.2	7.0	477.
110	612.2	4647.1	0.0	0.0	0.096	68.6	4.5	2.8	422.
111	611.6	4647.8	0.0	0.0	0.169	13.3	1.8	2.4	561.
112	611.6	4647.8	0.0	0.0	0.018	59.7	3.0	1.2	589.
113	611.6	4647.8	0.0	0.0	0.144	15.2	0.3	0.5	294.
114	611.6	4647.8	0.0	0.0	0.012	15.2	1.0	6.6	322.
115	611.6	4647.8	0.0	0.0	0.120	15.2	0.5	0.6	294.
116	611.3	4647.2	0.0	0.0	0.050	25.8	2.1	1.2	311.
117	611.3	4647.2	0.0	0.0	0.003	10.6	1.2	8.2	300.
118	611.3	4647.2	0.0	0.0	0.026	3.5	0.0	0.0	300.
119	610.5	4647.0	0.0	0.0	0.180	30.7	1.4	15.6	311.
120	610.5	4647.0	0.0	0.0	0.080	30.7	1.4	35.0	311.
121	610.5	4647.0	0.0	0.0	0.012	6.0	0.0	0.0	294.
122	609.8	4646.5	0.0	0.0	0.003	10.6	1.6	4.5	294.
123	609.8	4646.5	0.0	0.0	0.016	7.9	1.4	4.8	294.
124	609.8	4646.5	0.0	0.0	0.003	13.6	0.7	7.6	294.
125	609.0	4646.6	0.0	0.0	0.038	12.1	1.1	6.1	533.
126	609.0	4646.6	0.0	0.0	0.044	13.7	0.3	10.1	355.
127	609.0	4646.6	0.0	0.0	0.003	24.4	0.2	10.6	305.
128	609.0	4646.6	0.0	0.0	0.016	10.7	0.3	17.7	294.
129	609.0	4646.6	0.0	0.0	0.047	13.7	0.6	15.2	294.
130	609.0	4646.6	0.0	0.0	0.047	7.6	0.4	11.6	294.
131	609.0	4646.6	0.0	0.0	0.047	7.6	0.5	14.0	322.
132	609.0	4646.6	0.0	0.0	0.090	30.5	0.5	9.8	294.
133	609.0	4646.6	0.0	0.0	0.208	10.0	5.0	1.0	347.
134	609.0	4646.6	0.0	0.0	0.008	21.3	0.4	16.2	294.
135	609.0	4646.6	0.0	0.0	0.049	6.0	0.0	0.0	294.
136	609.0	4646.6	0.0	0.0	0.183	15.2	0.5	13.1	294.
137	609.0	4646.6	0.0	0.0	0.005	15.2	0.2	3.6	366.
138	609.0	4646.6	0.0	0.0	0.003	3.0	0.1	10.0	294.
139	609.0	4646.6	0.0	0.0	0.019	9.1	0.2	7.6	322.
140	609.0	4646.6	0.0	0.0	0.005	10.7	0.6	17.7	294.
141	609.0	4646.6	0.0	0.0	0.022	13.7	0.8	19.8	294.
142	609.0	4646.6	0.0	0.0	0.008	9.1	0.2	18.8	311.
143	609.0	4646.6	0.0	0.0	0.131	6.0	0.0	0.0	294.
144	610.5	4643.7	0.0	0.0	0.029	7.0	1.0	30.3	380.
145	610.2	4643.3	0.0	0.0	0.138	6.0	0.0	0.0	294.
146	610.2	4643.3	0.0	0.0	0.004	27.3	0.6	3.3	294.
147	610.2	4643.3	0.0	0.0	0.021	10.4	1.1	3.4	305.
148	610.2	4643.3	0.0	0.0	0.021	16.5	1.1	3.7	305.
149	608.8	4642.6	0.0	0.0	1.200	49.4	2.7	14.6	349.
150	608.7	4642.6	0.0	0.0	0.024	10.3	1.5	6.6	330.
151	608.7	4642.5	0.0	0.0	0.012	10.3	1.5	6.6	330.
152	608.7	4642.5	0.0	0.0	0.024	10.3	1.5	6.6	330.
153	608.7	4642.5	0.0	0.0	0.088	11.0	0.7	11.8	344.
154	608.7	4642.6	0.0	0.0	0.016	13.6	1.1	7.6	433.
155	608.7	4642.6	0.0	0.0	0.030	13.6	1.4	9.7	433.
156	608.7	4642.6	0.0	0.0	0.105	13.6	1.4	10.4	433.
157	608.7	4642.6	0.0	0.0	0.090	11.9	0.6	24.5	305.
158	608.7	4642.6	0.0	0.0	0.010	11.6	0.5	36.6	305.
159	608.7	4642.7	0.0	0.0	0.588	6.0	0.0	0.0	294.
160	608.7	4642.7	0.0	0.0	0.196	20.0	0.0	0.0	294.
161	611.2	4649.8	0.0	0.0	0.059	33.5	0.6	5.5	311.
162	611.2	4649.8	0.0	0.0	0.010	33.5	0.6	5.5	322.
163	611.2	4649.8	0.0	0.0	0.016	6.0	0.0	0.0	294.
164	608.5	4642.3	0.16	0.0	0.403	0.0	0.0	0.0	0.
165	610.0	4648.0	0.09	0.0	0.093	0.0	0.0	0.0	0.
166	610.3	4648.1	0.09	0.0	0.093	0.0	0.0	0.0	0.
167	610.6	4648.4	0.09	0.0	0.093	0.0	0.0	0.0	0.
168	610.7	4648.7	0.09	0.0	0.093	0.0	0.0	0.0	0.
169	610.6	4649.0	0.09	0.0	0.093	0.0	0.0	0.0	0.
170	610.6	4649.3	0.09	0.0	0.093	0.0	0.0	0.0	0.
171	606.0	4637.0	4.00	0.0	0.112	3.0	0.0	0.0	0.
172	597.0	4657.0	64.00	0.0	1.521	0.0	0.0	0.0	0.
173	605.0	4657.0	64.00	0.0	1.301	0.0	0.0	0.0	0.
174	613.0	4657.0	64.00	0.0	0.590	0.0	0.0	0.0	0.
175	597.0	4649.0	64.00	0.0	1.072	0.0	0.0	0.0	0.
176	605.0	4653.0	16.00	0.0	0.452	0.0	0.0	0.0	0.
177	609.0	4653.0	16.00	0.0	0.541	0.0	0.0	0.0	0.
178	613.0	4653.0	16.00	0.0	0.572	0.0	0.0	0.0	0.
179	617.0	4653.0	16.00	0.0	0.309	0.0	0.0	0.0	0.
180	605.0	4649.0	16.00	0.0	0.267	0.0	0.0	0.0	0.

181	609.0	4651.0	4.00	0.0	0.220	0.0	0.0	0.0	0.
182	611.0	4651.0	4.00	0.0	0.273	0.0	0.0	0.0	0.
183	605.0	4649.0	4.00	0.0	0.086	0.0	0.0	0.0	0.
184	611.0	4650.0	1.00	0.0	0.068	0.0	0.0	0.0	0.
185	612.0	4650.0	1.00	0.0	0.055	0.0	0.0	0.0	0.
186	611.0	4649.0	1.00	0.0	0.154	0.0	0.0	0.0	0.
187	612.0	4649.0	1.00	0.0	0.093	0.0	0.0	0.0	0.
188	613.0	4649.0	16.00	0.0	0.304	0.0	0.0	0.0	0.
189	617.0	4649.0	16.00	0.0	0.496	0.0	0.0	0.0	0.
190	597.0	4641.0	64.00	0.0	1.483	0.0	0.0	0.0	0.
191	605.0	4647.0	4.00	0.0	0.183	0.0	0.0	0.0	0.
192	607.0	4647.0	4.00	0.0	0.208	0.0	0.0	0.0	0.
193	605.0	4645.0	4.00	0.0	0.213	0.0	0.0	0.0	0.
194	607.0	4645.0	4.00	0.0	0.213	0.0	0.0	0.0	0.
195	609.0	4648.0	1.00	0.0	0.077	0.0	0.0	0.0	0.
196	610.0	4648.0	1.00	0.0	0.165	0.0	0.0	0.0	0.
197	609.0	4647.0	1.00	0.0	0.136	0.0	0.0	0.0	0.
198	610.0	4647.0	1.00	0.0	0.149	0.0	0.0	0.0	0.
199	611.0	4648.0	1.00	0.0	0.162	0.0	0.0	0.0	0.
200	611.0	4647.0	1.00	0.0	0.097	0.0	0.0	0.0	0.
201	612.0	4648.0	1.00	0.0	0.090	0.0	0.0	0.0	0.
202	612.0	4647.0	1.00	0.0	0.040	0.0	0.0	0.0	0.
203	609.0	4646.0	1.00	0.0	0.119	0.0	0.0	0.0	0.
204	610.0	4646.0	1.00	0.0	0.089	0.0	0.0	0.0	0.
205	609.0	4645.0	1.00	0.0	0.071	0.0	0.0	0.0	0.
206	610.0	4645.0	1.00	0.0	0.058	0.0	0.0	0.0	0.
207	611.0	4645.0	4.00	0.0	0.109	0.0	0.0	0.0	0.
208	613.0	4647.0	4.00	0.0	0.163	0.0	0.0	0.0	0.
209	615.0	4647.0	4.00	0.0	0.156	0.0	0.0	0.0	0.
210	613.0	4645.0	4.00	0.0	0.025	0.0	0.0	0.0	0.
211	615.0	4645.0	4.00	0.0	0.210	0.0	0.0	0.0	0.
212	617.0	4645.0	16.00	0.0	0.448	0.0	0.0	0.0	0.
213	605.0	4637.0	64.00	0.0	1.140	0.0	0.0	0.0	0.
214	613.0	4637.0	64.00	0.0	1.033	0.0	0.0	0.0	0.
215	597.0	4633.0	64.00	0.0	1.089	0.0	0.0	0.0	0.

APPENDIX B

RECEPTOR CONCENTRATION DATA

RECEPTOR NUMBER	RECEPTOR LOCATION (KILOMETERS)		EXPECTED ARITHMETIC MEAN (MICROGRAMS/CU. METER)	
	HORIZ	VERT	SO2	PARTICULATES
1	605.0	4639.0	0.	55.
2	605.0	4640.0	0.	55.
3	605.0	4641.0	0.	56.
4	605.0	4642.0	0.	57.
5	605.0	4643.0	0.	58.
6	605.0	4644.0	0.	60.
7	605.0	4645.0	0.	62.
8	605.0	4646.0	0.	63.
9	605.0	4647.0	0.	64.
10	605.0	4648.0	0.	64.
11	605.0	4649.0	0.	64.
12	605.0	4650.0	0.	63.
13	605.0	4651.0	0.	63.
14	605.0	4652.0	0.	62.
15	605.0	4653.0	0.	62.
16	605.0	4654.0	0.	61.
17	606.0	4639.0	0.	55.
18	606.0	4640.0	0.	56.
19	606.0	4641.0	0.	57.
20	606.0	4642.0	0.	58.
21	606.0	4643.0	0.	60.
22	606.0	4644.0	0.	62.
23	606.0	4645.0	0.	64.
24	606.0	4646.0	0.	63.
25	606.0	4647.0	0.	66.
26	606.0	4648.0	0.	65.
27	606.0	4649.0	0.	66.
28	606.0	4650.0	0.	65.
29	606.0	4651.0	0.	64.
30	606.0	4652.0	0.	63.
31	606.0	4653.0	0.	62.
32	606.0	4654.0	0.	61.
33	607.0	4639.0	0.	55.
34	607.0	4640.0	0.	56.
35	607.0	4641.0	0.	58.
36	607.0	4642.0	0.	62.
37	607.0	4643.0	0.	67.
38	607.0	4644.0	0.	67.
39	607.0	4645.0	0.	67.
40	607.0	4646.0	0.	68.
41	607.0	4647.0	0.	70.
42	607.0	4648.0	0.	70.
43	607.0	4649.0	0.	69.
44	607.0	4650.0	0.	68.
45	607.0	4651.0	0.	65.
46	607.0	4652.0	0.	64.
47	607.0	4653.0	0.	64.
48	607.0	4654.0	0.	62.
49	608.0	4639.0	0.	56.
50	608.0	4640.0	0.	57.
51	608.0	4641.0	0.	61.
52	608.0	4642.0	0.	75.
53	608.0	4643.0	0.	96.
54	608.0	4644.0	0.	71.
55	608.0	4645.0	0.	70.
56	608.0	4646.0	0.	72.
57	608.0	4647.0	0.	81.
58	608.0	4648.0	0.	75.
59	608.0	4649.0	0.	74.
60	608.0	4650.0	0.	71.
61	608.0	4651.0	0.	69.
62	608.0	4652.0	0.	66.
63	608.0	4653.0	0.	64.
64	608.0	4654.0	0.	62.
65	609.0	4639.0	0.	56.
66	609.0	4640.0	0.	58.
67	609.0	4641.0	0.	64.
68	609.0	4642.0	0.	90.
69	609.0	4643.0	0.	101.
70	609.0	4644.0	0.	75.
71	609.0	4645.0	0.	75.
72	609.0	4646.0	0.	90.
73	609.0	4647.0	0.	131.
74	609.0	4648.0	0.	94.
75	609.0	4649.0	0.	88.
76	609.0	4650.0	0.	79.
77	609.0	4651.0	0.	73.
78	609.0	4652.0	0.	69.
79	609.0	4653.0	0.	65.
80	609.0	4654.0	0.	63.

RECEPTOR CONCENTRATION DATA

RECEPTOR NUMBER	RECEPTOR LOCATION (KILOMETERS) HORIZ	VERT	EXPECTED ARITHMETIC MEAN (MICROGRAMS/CU. METER) SO2	PARTICULATES
81	610.0	4639.0	0.	57.
82	610.0	4640.0	0.	59.
83	610.0	4641.0	0.	65.
84	610.0	4642.0	0.	72.
85	610.0	4643.0	0.	76.
86	610.0	4644.0	0.	71.
87	610.0	4645.0	0.	75.
88	610.0	4646.0	0.	87.
89	610.0	4647.0	0.	91.
90	610.0	4648.0	0.	147.
91	610.0	4649.0	0.	121.
92	610.0	4650.0	0.	84.
93	610.0	4651.0	0.	75.
94	610.0	4652.0	0.	68.
95	610.0	4653.0	0.	65.
96	610.0	4654.0	0.	63.
97	611.0	4639.0	0.	57.
98	611.0	4640.0	0.	60.
99	611.0	4641.0	0.	62.
100	611.0	4642.0	0.	64.
101	611.0	4643.0	0.	67.
102	611.0	4644.0	0.	67.
103	611.0	4645.0	0.	72.
104	611.0	4646.0	0.	78.
105	611.0	4647.0	0.	95.
106	611.0	4648.0	0.	127.
107	611.0	4649.0	0.	110.
108	611.0	4650.0	0.	85.
109	611.0	4651.0	0.	73.
110	611.0	4652.0	0.	68.
111	611.0	4653.0	0.	65.
112	611.0	4654.0	0.	62.
113	612.0	4639.0	0.	58.
114	612.0	4640.0	0.	59.
115	612.0	4641.0	0.	61.
116	612.0	4642.0	0.	62.
117	612.0	4643.0	0.	63.
118	612.0	4644.0	0.	65.
119	612.0	4645.0	0.	70.
120	612.0	4646.0	0.	75.
121	612.0	4647.0	0.	143.
122	612.0	4648.0	0.	113.
123	612.0	4649.0	0.	87.
124	612.0	4650.0	0.	75.
125	612.0	4651.0	0.	68.
126	612.0	4652.0	0.	64.
127	612.0	4653.0	0.	62.
128	612.0	4654.0	0.	61.
129	613.0	4639.0	0.	57.
130	613.0	4640.0	0.	59.
131	613.0	4641.0	0.	60.
132	613.0	4642.0	0.	61.
133	613.0	4643.0	0.	62.
134	613.0	4644.0	0.	64.
135	613.0	4645.0	0.	68.
136	613.0	4646.0	0.	82.
137	613.0	4647.0	0.	93.
138	613.0	4648.0	0.	77.
139	613.0	4649.0	0.	70.
140	613.0	4650.0	0.	66.
141	613.0	4651.0	0.	63.
142	613.0	4652.0	0.	61.
143	613.0	4653.0	0.	61.
144	613.0	4654.0	0.	59.
145	614.0	4639.0	0.	57.
146	614.0	4640.0	0.	58.
147	614.0	4641.0	0.	59.
148	614.0	4642.0	0.	60.
149	614.0	4643.0	0.	61.
150	614.0	4644.0	0.	64.
151	614.0	4645.0	0.	69.
152	614.0	4646.0	0.	73.
153	614.0	4647.0	0.	71.
154	614.0	4648.0	0.	67.
155	614.0	4649.0	0.	63.
156	614.0	4650.0	0.	61.
157	614.0	4651.0	0.	60.
158	614.0	4652.0	0.	59.
159	614.0	4653.0	0.	58.
160	614.0	4654.0	0.	57.

CEDAR RAPIDS, IOWA 1977 PARTICULATES JULY 1978

RECEPTOR CONCENTRATION DATA

RECEPTOR NUMBER	RECEPTOR LOCATION (KILOMETERS) HORIZ	VERT	EXPECTED ARITHMETIC MEAN (MICROGRAMS/CU. METER) SO2	PARTICULATES
161	615.0	4639.0	0.	57.
162	615.0	4640.0	0.	58.
163	615.0	4641.0	0.	59.
164	615.0	4642.0	0.	60.
165	615.0	4643.0	0.	61.
166	615.0	4644.0	0.	65.
167	615.0	4645.0	0.	68.
168	615.0	4646.0	0.	68.
169	615.0	4647.0	0.	65.
170	615.0	4648.0	0.	63.
171	615.0	4649.0	0.	61.
172	615.0	4650.0	0.	59.
173	615.0	4651.0	0.	58.
174	615.0	4652.0	0.	57.
175	615.0	4653.0	0.	57.
176	615.0	4654.0	0.	56.
177	616.0	4639.0	0.	57.
178	616.0	4640.0	0.	58.
179	616.0	4641.0	0.	59.
180	616.0	4642.0	0.	59.
181	616.0	4643.0	0.	61.
182	616.0	4644.0	0.	63.
183	616.0	4645.0	0.	65.
184	616.0	4646.0	0.	63.
185	616.0	4647.0	0.	62.
186	616.0	4648.0	0.	60.
187	616.0	4649.0	0.	59.
188	616.0	4650.0	0.	58.
189	616.0	4651.0	0.	57.
190	616.0	4652.0	0.	56.
191	616.0	4653.0	0.	56.
192	616.0	4654.0	0.	55.
193	617.0	4639.0	0.	57.
194	617.0	4640.0	0.	57.
195	617.0	4641.0	0.	58.
196	617.0	4642.0	0.	59.
197	617.0	4643.0	0.	60.
198	617.0	4644.0	0.	61.
199	617.0	4645.0	0.	62.
200	617.0	4646.0	0.	61.
201	617.0	4647.0	0.	60.
202	617.0	4648.0	0.	59.
203	617.0	4649.0	0.	58.
204	617.0	4650.0	0.	57.
205	617.0	4651.0	0.	56.
206	617.0	4652.0	0.	55.
207	617.0	4653.0	0.	55.
208	617.0	4654.0	0.	54.
209	618.0	4639.0	0.	56.
210	618.0	4640.0	0.	57.
211	618.0	4641.0	0.	58.
212	618.0	4642.0	0.	58.
213	618.0	4643.0	0.	59.
214	618.0	4644.0	0.	60.
215	618.0	4645.0	0.	60.
216	618.0	4646.0	0.	59.
217	618.0	4647.0	0.	57.
218	618.0	4648.0	0.	57.
219	618.0	4649.0	0.	57.
220	618.0	4650.0	0.	56.
221	618.0	4651.0	0.	55.
222	618.0	4652.0	0.	55.
223	618.0	4653.0	0.	54.
224	618.0	4654.0	0.	54.
225	611.2	4653.1	0.	64.
226	610.8	4649.6	0.	94.
227	611.7	4647.3	0.	140.
228	610.2	4647.5	0.	95.
229	609.8	4643.2	0.	76.
230	615.0	4655.0	0.	55.
231	616.0	4655.0	0.	54.
232	617.0	4655.0	0.	54.
233	618.0	4655.0	0.	53.
234	619.0	4655.0	0.	52.
235	619.0	4654.0	0.	53.
236	619.0	4653.0	0.	53.

Cedar Rapids Sources and

Corresponding Source Numbers Used

In the AQDM Program

Source Number	Source
1	Alpha Asphalt
2-21	Cargill Inc. (Sixth St.)
22-23	Iowa Electric Light & Power (6th Street)
24-26	Iowa Electric Light & Power (Prairie Crk)
27-85	Quaker Oats Company
86	Diamond V. Mills
87	Cedar Rapids Water Pollution Pollution Control Plant
88-110	Cargill, Inc. (16th Street)
111-115	Wilson & Company
116-118	Iowa Manufacturing Company
119-121	Penick and Ford
122-124	FMC (6th Street)
125-143	Cargill, Inc. (10th Avenue)
144	Cedar Rapids Asphalt & Paving
145-148	Hubbard Milling Company
149-160, 164	Corn Sweetners
161-164	National Oats
165-170	Freeway Construction
171	Cedar Rapids Municipal Airport
172-215	Area Sources

CEDAR RAPIDS, IOWA 1977 PARTICULATES JULY 1978

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 225	RECEPTOR 226	RECEPTOR 227	RECEPTOR 228	RECEPTOR 229
1	0.01 %	0.00 %	0.00 %	0.00 %	0.00 %
	0.0036	0.0022	0.0020	0.0019	0.0014
2	0.30 %	1.80 %	0.61 %	0.80 %	0.11 %
	0.1921	1.6892	0.8491	0.7999	0.0970
3	0.02 %	0.08 %	0.03 %	0.04 %	0.01 %
	0.0106	0.0747	0.0431	0.0370	0.0048
4	0.03 %	0.12 %	0.05 %	0.05 %	0.01 %
	0.0160	0.1087	0.0637	0.0540	0.0072
5	0.05 %	0.09 %	0.06 %	0.05 %	0.02 %
	0.0295	0.0826	0.0835	0.0521	0.0135
6	0.01 %	0.05 %	0.02 %	0.02 %	0.00 %
	0.0071	0.0452	0.0277	0.0232	0.0032
7	0.24 %	0.46 %	0.30 %	0.22 %	0.08 %
	0.1544	0.4326	0.4186	0.2208	0.0604
8	0.05 %	0.21 %	0.09 %	0.10 %	0.02 %
	0.0319	0.1931	0.1203	0.0968	0.0144
9	0.01 %	0.06 %	0.02 %	0.03 %	0.01 %
	0.0089	0.0581	0.0346	0.0287	0.0040
10	0.03 %	0.08 %	0.04 %	0.04 %	0.01 %
	0.0193	0.0784	0.0575	0.0390	0.0088
11	0.08 %	0.27 %	0.13 %	0.13 %	0.03 %
	0.0529	0.2567	0.1795	0.1320	0.0240
12	0.01 %	0.03 %	0.01 %	0.01 %	0.00 %
	0.0051	0.0300	0.0186	0.0136	0.0020
13	0.08 %	0.24 %	0.12 %	0.11 %	0.03 %
	0.0528	0.2291	0.1619	0.1124	0.0240
14	0.01 %	0.04 %	0.02 %	0.02 %	0.01 %
	0.0088	0.0419	0.0291	0.0210	0.0040
15	0.06 %	0.28 %	0.11 %	0.13 %	0.02 %
	0.0408	0.2662	0.1596	0.1328	0.0185
16	0.06 %	0.28 %	0.11 %	0.13 %	0.02 %
	0.0408	0.2668	0.1601	0.1337	0.0185
17	0.03 %	0.14 %	0.06 %	0.07 %	0.01 %
	0.0195	0.1345	0.0788	0.0681	0.0088
18	0.07 %	0.23 %	0.10 %	0.11 %	0.03 %
	0.0441	0.2123	0.1436	0.1066	0.0200
19	0.05 %	0.13 %	0.07 %	0.06 %	0.02 %
	0.0316	0.1211	0.0959	0.0628	0.0143
20	0.03 %	0.09 %	0.04 %	0.04 %	0.01 %
	0.0182	0.0845	0.0610	0.0410	0.0071
21	0.03 %	0.14 %	0.05 %	0.06 %	0.01 %
	0.0160	0.1295	0.0685	0.0622	0.0072
22	0.09 %	0.03 %	0.05 %	0.03 %	0.04 %
	0.0578	0.0296	0.0781	0.0285	0.0275
23	0.02 %	0.01 %	0.01 %	0.01 %	0.01 %
	0.0140	0.0060	0.0153	0.0060	0.0067
24	0.02 %	0.01 %	0.01 %	0.01 %	0.01 %
	0.0115	0.0101	0.0107	0.0103	0.0040
25	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0073	0.0073	0.0092	0.0091	0.0032
26	0.02 %	0.01 %	0.01 %	0.01 %	0.01 %
	0.0118	0.0117	0.0143	0.0127	0.0049
27	0.01 %	0.02 %	0.02 %	0.02 %	0.01 %
	0.0074	0.0174	0.0250	0.0208	0.0042
28	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0045	0.0109	0.0134	0.0131	0.0025
29	0.03 %	0.07 %	0.06 %	0.09 %	0.01 %
	0.0196	0.0656	0.0757	0.0900	0.0111
30	0.01 %	0.01 %	0.01 %	0.02 %	0.00 %
	0.0059	0.0132	0.0191	0.0157	0.0034
31	0.01 %	0.03 %	0.02 %	0.03 %	0.01 %
	0.0090	0.0265	0.0345	0.0341	0.0051
32	0.01 %	0.03 %	0.02 %	0.04 %	0.00 %
	0.0061	0.0285	0.0302	0.0434	0.0034
33	0.03 %	0.08 %	0.06 %	0.10 %	0.02 %
	0.0210	0.0741	0.0897	0.1010	0.0120
34	0.03 %	0.03 %	0.03 %	0.03 %	0.01 %
	0.0175	0.0272	0.0472	0.0277	0.0100
35	0.00 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0025	0.0051	0.0073	0.0053	0.0013
36	0.07 %	0.11 %	0.10 %	0.12 %	0.03 %
	0.0416	0.1024	0.1439	0.1238	0.0237
37	0.13 %	0.16 %	0.16 %	0.18 %	0.06 %
	0.0799	0.1548	0.2305	0.1829	0.0456
38	0.07 %	0.12 %	0.11 %	0.14 %	0.03 %
	0.0432	0.1131	0.1557	0.1398	0.0246
39	0.01 %	0.02 %	0.01 %	0.02 %	0.00 %
	0.0059	0.0149	0.0209	0.0181	0.0034
40	0.01 %	0.02 %	0.02 %	0.02 %	0.01 %
	0.0088	0.0168	0.0262	0.0198	0.0051
41	0.02 %	0.03 %	0.02 %	0.03 %	0.01 %
	0.0109	0.0257	0.0349	0.0288	0.0055
42	0.01 %	0.02 %	0.02 %	0.03 %	0.00 %
	0.0060	0.0220	0.0262	0.0303	0.0034

CEDAR RAPIDS, IOWA 1977 PARTICULATES JULY 1978

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 225	RECEPTOR 226	RECEPTOR 227	RECEPTOR 228	RECEPTOR 229
43	0.01 %	0.02 %	0.02 %	0.03 %	0.00 %
	0.0060	0.0220	0.0262	0.0304	0.0034
44	0.01 %	0.02 %	0.02 %	0.03 %	0.00 %
	0.0060	0.0226	0.0267	0.0315	0.0034
45	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0042	0.0111	0.0144	0.0130	0.0021
46	0.03 %	0.06 %	0.05 %	0.07 %	0.02 %
	0.0259	0.0543	0.0689	0.0739	0.0119
47	0.04 %	0.05 %	0.05 %	0.05 %	0.02 %
	0.0254	0.0457	0.0699	0.0465	0.0130
48	0.03 %	0.05 %	0.05 %	0.06 %	0.01 %
	0.0194	0.0480	0.0656	0.0604	0.0110
49	0.05 %	0.04 %	0.05 %	0.04 %	0.02 %
	0.0291	0.0408	0.0732	0.0406	0.0167
50	0.01 %	0.01 %	0.01 %	0.02 %	0.00 %
	0.0059	0.0120	0.0168	0.0149	0.0034
51	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0044	0.0051	0.0096	0.0050	0.0025
52	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0044	0.0053	0.0098	0.0052	0.0025
53	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0058	0.0069	0.0128	0.0057	0.0033
54	0.01 %	0.02 %	0.01 %	0.02 %	0.00 %
	0.0060	0.0142	0.0197	0.0175	0.0034
55	0.02 %	0.02 %	0.02 %	0.02 %	0.01 %
	0.0132	0.0185	0.0276	0.0196	0.0075
56	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0058	0.0084	0.0143	0.0089	0.0033
57	0.06 %	0.05 %	0.06 %	0.05 %	0.03 %
	0.0365	0.0515	0.0902	0.0529	0.0209
58	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0073	0.0126	0.0196	0.0126	0.0037
59	0.02 %	0.02 %	0.02 %	0.03 %	0.01 %
	0.0118	0.0220	0.0326	0.0261	0.0067
60	0.03 %	0.04 %	0.04 %	0.04 %	0.01 %
	0.0163	0.0334	0.0499	0.0391	0.0093
61	0.01 %	0.02 %	0.02 %	0.02 %	0.01 %
	0.0089	0.0197	0.0287	0.0232	0.0051
62	0.01 %	0.02 %	0.01 %	0.02 %	0.00 %
	0.0045	0.0153	0.0189	0.0205	0.0026
63	0.02 %	0.02 %	0.02 %	0.02 %	0.01 %
	0.0138	0.0213	0.0349	0.0207	0.0070
64	0.02 %	0.05 %	0.04 %	0.07 %	0.01 %
	0.0150	0.0500	0.0670	0.0669	0.0085
65	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0044	0.0096	0.0145	0.0109	0.0025
66	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0044	0.0098	0.0147	0.0111	0.0025
67	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0044	0.0099	0.0149	0.0112	0.0025
68	0.01 %	0.01 %	0.01 %	0.02 %	0.00 %
	0.0059	0.0131	0.0197	0.0150	0.0034
69	0.00 %	0.00 %	0.00 %	0.00 %	0.00 %
	0.0025	0.0044	0.0067	0.0044	0.0013
70	0.02 %	0.03 %	0.02 %	0.03 %	0.01 %
	0.0104	0.0239	0.0366	0.0282	0.0059
71	0.02 %	0.04 %	0.03 %	0.04 %	0.01 %
	0.0133	0.0322	0.0475	0.0391	0.0076
72	0.01 %	0.01 %	0.01 %	0.01 %	0.01 %
	0.0073	0.0117	0.0195	0.0124	0.0042
73	0.03 %	0.03 %	0.04 %	0.03 %	0.01 %
	0.0191	0.0297	0.0497	0.0316	0.0109
74	0.03 %	0.04 %	0.05 %	0.05 %	0.02 %
	0.0206	0.0417	0.0653	0.0457	0.0118
75	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0049	0.0084	0.0130	0.0083	0.0025
76	0.01 %	0.02 %	0.02 %	0.02 %	0.01 %
	0.0074	0.0154	0.0230	0.0177	0.0042
77	0.01 %	0.02 %	0.02 %	0.03 %	0.01 %
	0.0089	0.0223	0.0313	0.0269	0.0051
78	0.03 %	0.05 %	0.05 %	0.06 %	0.02 %
	0.0207	0.0478	0.0595	0.0561	0.0118
79	0.03 %	0.04 %	0.04 %	0.05 %	0.01 %
	0.0193	0.0415	0.0609	0.0489	0.0110
80	0.19 %	0.64 %	0.45 %	1.05 %	0.09 %
	0.1201	0.6000	0.6256	1.0429	0.0720
81	0.11 %	0.40 %	0.25 %	0.51 %	0.05 %
	0.0704	0.3803	0.3443	0.5098	0.0408
82	0.04 %	0.13 %	0.10 %	0.26 %	0.02 %
	0.0254	0.1193	0.1435	0.2583	0.0150
83	0.09 %	0.29 %	0.24 %	0.60 %	0.04 %
	0.0582	0.2727	0.3251	0.5926	0.0343
84	0.09 %	0.38 %	0.21 %	0.37 %	0.04 %
	0.0595	0.3574	0.2938	0.3689	0.0310

CEDAR RAPIDS, IOWA . 1977 PARTICULATES JULY 1978

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 225	RECEPTOR 226	RECEPTOR 227	RECEPTOR 228	RECEPTOR 229
85	0.01 %	0.01 %	0.01 %	0.02 %	0.00 %
	0.0045	0.0138	0.0179	0.0177	0.0026
86	0.07 %	0.15 %	0.15 %	0.92 %	0.06 %
	0.0416	0.1398	0.2051	0.9187	0.0468
87	0.03 %	0.03 %	0.01 %	0.04 %	0.01 %
	0.0199	0.0326	0.0179	0.0355	0.0104
88	0.02 %	0.03 %	0.02 %	0.02 %	0.01 %
	0.0130	0.0242	0.0272	0.0224	0.0058
89	0.31 %	0.48 %	6.69 %	0.85 %	0.17 %
	0.1985	0.4516	9.3545	0.8480	0.1265
90	0.10 %	0.15 %	1.50 %	0.25 %	0.05 %
	0.0611	0.1371	2.0977	0.2510	0.0389
91	0.03 %	0.05 %	0.49 %	0.08 %	0.02 %
	0.0204	0.0457	0.6865	0.0835	0.0130
92	0.18 %	0.24 %	0.51 %	0.27 %	0.07 %
	0.1118	0.2289	0.7069	0.2662	0.0519
93	0.30 %	0.46 %	5.19 %	0.81 %	0.16 %
	0.1928	0.4345	7.2420	0.8010	0.1229
94	0.05 %	0.08 %	0.29 %	0.09 %	0.02 %
	0.0341	0.0726	0.4032	0.0923	0.0161
95	0.05 %	0.06 %	0.20 %	0.07 %	0.02 %
	0.0297	0.0594	0.2754	0.0738	0.0187
96	0.26 %	0.39 %	3.92 %	0.68 %	0.14 %
	0.1643	0.3687	5.4779	0.6709	0.1047
97	0.12 %	0.17 %	0.75 %	0.25 %	0.06 %
	0.0745	0.1578	1.0493	0.2444	0.0472
98	0.19 %	0.29 %	3.78 %	0.51 %	0.10 %
	0.1210	0.2745	5.2900	0.5116	0.0771
99	0.26 %	0.39 %	2.71 %	0.63 %	0.14 %
	0.1641	0.3624	3.7986	0.6304	0.1044
100	0.02 %	0.03 %	0.45 %	0.06 %	0.01 %
	0.0136	0.0309	0.6282	0.0579	0.0087
101	0.19 %	0.28 %	3.19 %	0.49 %	0.10 %
	0.1182	0.2669	4.4557	0.4899	0.0753
102	0.38 %	0.52 %	1.72 %	0.66 %	0.20 %
	0.2430	0.4897	2.4093	0.6606	0.1535
103	0.07 %	0.11 %	1.19 %	0.19 %	0.04 %
	0.0462	0.1039	1.6581	0.1906	0.0294
104	0.09 %	0.13 %	1.54 %	0.23 %	0.05 %
	0.0542	0.1227	2.1589	0.2273	0.0346
105	0.02 %	0.03 %	0.29 %	0.05 %	0.01 %
	0.0109	0.0245	0.4108	0.0452	0.0069
106	0.03 %	0.04 %	0.49 %	0.07 %	0.01 %
	0.0177	0.0398	0.6937	0.0736	0.0113
107	0.32 %	0.46 %	1.87 %	0.64 %	0.17 %
	0.2056	0.4295	2.6202	0.6392	0.1303
108	0.09 %	0.13 %	0.67 %	0.20 %	0.05 %
	0.0569	0.1228	0.9411	0.2005	0.0362
109	0.08 %	0.10 %	0.17 %	0.11 %	0.03 %
	0.0489	0.0979	0.2392	0.1074	0.0224
110	0.02 %	0.01 %	0.00 %	0.01 %	0.00 %
	0.0101	0.0107	0.0006	0.0062	0.0037
111	0.25 %	0.42 %	0.49 %	0.24 %	0.07 %
	0.1611	0.3906	0.6913	0.2392	0.0518
112	0.01 %	0.01 %	0.00 %	0.00 %	0.00 %
	0.0094	0.0121	0.0017	0.0039	0.0027
113	0.38 %	0.76 %	3.38 %	0.98 %	0.14 %
	0.2424	0.7163	4.7302	0.9796	0.1031
114	0.03 %	0.05 %	0.10 %	0.04 %	0.01 %
	0.0201	0.0463	0.1407	0.0426	0.0085
115	0.32 %	0.63 %	2.77 %	0.82 %	0.11 %
	0.2020	0.5957	3.8726	0.9116	0.0859
116	0.12 %	0.20 %	0.18 %	0.35 %	0.06 %
	0.0767	0.1923	0.2545	0.3465	0.0425
117	0.01 %	0.01 %	0.03 %	0.03 %	0.00 %
	0.0046	0.0122	0.0397	0.0261	0.0026
118	0.06 %	0.13 %	1.05 %	0.42 %	0.03 %
	0.0403	0.1217	1.4738	0.4202	0.0225
119	0.20 %	0.37 %	0.18 %	0.38 %	0.13 %
	0.1295	0.3480	0.2455	0.3767	0.0998
120	0.09 %	0.14 %	0.04 %	0.06 %	0.05 %
	0.0560	0.1274	0.0562	0.0567	0.0417
121	0.02 %	0.05 %	0.07 %	0.60 %	0.02 %
	0.0158	0.0507	0.0936	0.5927	0.0141
122	0.00 %	0.01 %	0.01 %	0.02 %	0.01 %
	0.0030	0.0056	0.0079	0.0224	0.0047
123	0.03 %	0.03 %	0.03 %	0.13 %	0.03 %
	0.0162	0.0299	0.0445	0.1319	0.0253
124	0.00 %	0.01 %	0.01 %	0.03 %	0.01 %
	0.0030	0.0056	0.0087	0.0263	0.0047
125	0.02 %	0.03 %	0.02 %	0.06 %	0.04 %
	0.0152	0.0270	0.0257	0.0596	0.0311
126	0.05 %	0.06 %	0.06 %	0.19 %	0.09 %
	0.0329	0.0590	0.0836	0.1936	0.0664

CEDAR RAPIDS, IOWA 1977 PARTICULATES JULY 1978

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 225	RECEPTOR 226	RECEPTOR 227	RECEPTOR 228	RECEPTOR 229
127	0.00 %	0.00 %	0.00 %	0.01 %	0.01 %
	0.0022	0.0040	0.0057	0.0129	0.0045
128	0.02 %	0.02 %	0.02 %	0.08 %	0.03 %
	0.0120	0.0215	0.0312	0.0774	0.0243
129	0.06 %	0.07 %	0.06 %	0.20 %	0.09 %
	0.0351	0.0630	0.0889	0.2035	0.0711
130	0.06 %	0.07 %	0.07 %	0.23 %	0.09 %
	0.0352	0.0633	0.0919	0.2312	0.0714
131	0.06 %	0.07 %	0.06 %	0.19 %	0.09 %
	0.0351	0.0630	0.0977	0.1936	0.0711
132	0.10 %	0.13 %	0.12 %	0.34 %	0.18 %
	0.0669	0.1190	0.1635	0.3345	0.1344
133	0.13 %	0.15 %	0.11 %	0.29 %	0.22 %
	0.0828	0.1452	0.1581	0.2870	0.1679
134	0.01 %	0.01 %	0.01 %	0.03 %	0.02 %
	0.0060	0.0107	0.0150	0.0339	0.0121
135	0.06 %	0.07 %	0.07 %	0.25 %	0.10 %
	0.0367	0.0661	0.0967	0.2496	0.0745
136	0.21 %	0.26 %	0.25 %	0.80 %	0.36 %
	0.1367	0.2451	0.3462	0.7924	0.2766
137	0.01 %	0.01 %	0.01 %	0.02 %	0.01 %
	0.0037	0.0067	0.0097	0.0237	0.0076
138	0.00 %	0.00 %	0.00 %	0.02 %	0.01 %
	0.0022	0.0040	0.0059	0.0154	0.0046
139	0.02 %	0.03 %	0.03 %	0.09 %	0.04 %
	0.0142	0.0256	0.0372	0.0940	0.0289
140	0.01 %	0.01 %	0.01 %	0.02 %	0.01 %
	0.0037	0.0067	0.0095	0.0220	0.0076
141	0.03 %	0.03 %	0.03 %	0.08 %	0.04 %
	0.0164	0.0294	0.0397	0.0804	0.0331
142	0.01 %	0.01 %	0.01 %	0.04 %	0.02 %
	0.0060	0.0108	0.0156	0.0390	0.0122
143	0.15 %	0.19 %	0.18 %	0.67 %	0.26 %
	0.0981	0.1767	0.2586	0.6673	0.1993
144	0.02 %	0.02 %	0.02 %	0.04 %	0.03 %
	0.0134	0.0235	0.0230	0.0395	0.0253
145	0.17 %	0.19 %	0.11 %	0.33 %	11.25 %
	0.1095	0.1800	0.1592	0.3280	8.5836
146	0.00 %	0.01 %	0.00 %	0.01 %	0.06 %
	0.0032	0.0052	0.0046	0.0094	0.0462
147	0.03 %	0.03 %	0.02 %	0.05 %	0.54 %
	0.0166	0.0273	0.0241	0.0497	0.4116
148	0.03 %	0.03 %	0.02 %	0.05 %	0.32 %
	0.0166	0.0273	0.0250	0.0496	0.2464
149	0.11 %	0.11 %	0.07 %	0.15 %	0.15 %
	0.0717	0.1017	0.0985	0.1454	0.1147
150	0.01 %	0.01 %	0.01 %	0.02 %	0.08 %
	0.0074	0.0101	0.0096	0.0153	0.0580
151	0.01 %	0.01 %	0.00 %	0.01 %	0.04 %
	0.0037	0.0050	0.0057	0.0076	0.0282
152	0.01 %	0.01 %	0.01 %	0.02 %	0.07 %
	0.0074	0.0101	0.0095	0.0152	0.0563
153	0.08 %	0.07 %	0.05 %	0.10 %	0.38 %
	0.0503	0.0674	0.0664	0.0987	0.2931
154	0.01 %	0.01 %	0.00 %	0.01 %	0.04 %
	0.0049	0.0067	0.0063	0.0100	0.0301
155	0.01 %	0.01 %	0.01 %	0.02 %	0.04 %
	0.0091	0.0122	0.0113	0.0181	0.0323
156	0.05 %	0.05 %	0.03 %	0.06 %	0.14 %
	0.0317	0.0425	0.0394	0.0630	0.1055
157	0.08 %	0.07 %	0.05 %	0.10 %	0.50 %
	0.0518	0.0693	0.0690	0.1018	0.3820
158	0.01 %	0.01 %	0.01 %	0.01 %	0.06 %
	0.0058	0.0077	0.0077	0.0113	0.0420
159	0.53 %	0.48 %	0.33 %	0.68 %	5.62 %
	0.3408	0.4561	0.4550	0.6731	4.2922
160	0.18 %	0.16 %	0.11 %	0.22 %	1.67 %
	0.1135	0.1517	0.1525	0.2235	1.2744
161	0.28 %	0.21 %	0.10 %	0.10 %	0.05 %
	0.1813	0.2010	0.1354	0.0957	0.0360
162	0.05 %	0.03 %	0.02 %	0.02 %	0.01 %
	0.0307	0.0292	0.0226	0.0159	0.0061
163	0.08 %	0.79 %	0.03 %	0.03 %	0.01 %
	0.0504	0.7412	0.0430	0.0307	0.0098
164	0.35 %	0.32 %	0.20 %	0.44 %	2.31 %
	0.2221	0.3003	0.2927	0.4336	1.7653
165	0.19 %	0.48 %	0.53 %	3.95 %	0.12 %
	0.1210	0.4499	0.7425	3.9305	0.0883
166	0.21 %	0.74 %	0.64 %	2.31 %	0.11 %
	0.1347	0.6981	0.8955	2.2936	0.0844
167	0.24 %	1.25 %	0.76 %	1.10 %	0.10 %
	0.1546	1.1773	1.0687	1.0925	0.0769
168	0.26 %	2.28 %	0.45 %	0.70 %	0.09 %
	0.1690	2.1498	0.6322	0.6921	0.0719

CEDAR RAPIDS, IOWA 1977 PARTICULATES JULY 1978

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 225	RECEPTOR 226	RECEPTOR 227	RECEPTOR 228	RECEPTOR 229
169	0.28 %	3.23 %	0.32 %	0.45 %	0.09 %
	0.1756	3.0356	0.4513	0.4488	0.0689
170	0.29 %	6.14 %	0.24 %	0.32 %	0.09 %
	0.1882	5.7724	0.3319	0.3190	0.0655
171	0.06 %	0.05 %	0.03 %	0.06 %	0.09 %
	0.0355	0.0456	0.0382	0.0556	0.0667
172	0.87 %	0.63 %	0.41 %	0.59 %	0.71 %
	0.5539	0.5927	0.5719	0.5883	0.5454
173	0.97 %	0.64 %	0.38 %	0.52 %	0.52 %
	0.6215	0.6015	0.5250	0.5184	0.3980
174	0.44 %	0.18 %	0.13 %	0.17 %	0.17 %
	0.2775	0.1725	0.1837	0.1719	0.1292
175	0.40 %	0.35 %	0.25 %	0.38 %	0.58 %
	0.2578	0.3309	0.3509	0.3737	0.4424
176	0.51 %	0.41 %	0.25 %	0.38 %	0.31 %
	0.3244	0.3904	0.3549	0.3790	0.2404
177	1.05 %	0.55 %	0.30 %	0.39 %	0.31 %
	0.6719	0.5135	0.4183	0.3868	0.2359
178	2.03 %	0.41 %	0.21 %	0.29 %	0.28 %
	1.2961	0.3860	0.2954	0.2915	0.2103
179	0.40 %	0.17 %	0.10 %	0.13 %	0.12 %
	0.2545	0.1586	0.1375	0.1307	0.0947
180	0.18 %	0.19 %	0.15 %	0.24 %	0.28 %
	0.1165	0.1834	0.2062	0.2379	0.2124
181	0.44 %	0.55 %	0.24 %	0.31 %	0.17 %
	0.2825	0.5152	0.3291	0.3071	0.1262
182	0.95 %	0.47 %	0.24 %	0.28 %	0.18 %
	0.6042	0.4446	0.3367	0.2757	0.1359
183	0.14 %	0.16 %	0.12 %	0.21 %	0.09 %
	0.0918	0.1495	0.1640	0.2044	0.0705
184	0.28 %	1.90 %	0.11 %	0.12 %	0.05 %
	0.1816	1.7824	0.1478	0.1177	0.0386
185	0.23 %	0.36 %	0.07 %	0.08 %	0.04 %
	0.1438	0.3385	0.0952	0.0768	0.0301
186	0.50 %	2.47 %	0.41 %	0.45 %	0.13 %
	0.3165	2.3233	0.5685	0.4424	0.1005
187	0.26 %	0.81 %	0.19 %	0.18 %	0.08 %
	0.1654	0.7586	0.2626	0.1754	0.0637
188	0.53 %	0.43 %	0.26 %	0.23 %	0.19 %
	0.3360	0.4059	0.3578	0.2311	0.1454
189	0.67 %	0.43 %	0.24 %	0.31 %	0.27 %
	0.4288	0.4008	0.3376	0.3036	0.2037
190	0.42 %	0.31 %	0.23 %	0.33 %	0.54 %
	0.2672	0.2931	0.3204	0.3277	0.4120
191	0.14 %	0.13 %	0.11 %	0.18 %	0.32 %
	0.0879	0.1221	0.1581	0.1797	0.2460
192	0.17 %	0.18 %	0.16 %	0.27 %	0.40 %
	0.1104	0.1739	0.2225	0.2707	0.3069
193	0.12 %	0.12 %	0.09 %	0.15 %	0.42 %
	0.0762	0.1086	0.1266	0.1520	0.3195
194	0.17 %	0.15 %	0.12 %	0.19 %	0.52 %
	0.1116	0.1427	0.1686	0.1935	0.3966
195	0.13 %	0.15 %	0.15 %	0.63 %	0.09 %
	0.0815	0.1423	0.2142	0.6279	0.0712
196	0.31 %	0.59 %	0.50 %	3.11 %	0.22 %
	0.1985	0.5507	0.7020	3.0862	0.1697
197	0.20 %	0.23 %	0.20 %	0.77 %	0.23 %
	0.1253	0.2135	0.2816	0.7637	0.1737
198	0.25 %	0.40 %	0.36 %	2.87 %	0.26 %
	0.1563	0.3780	0.4994	2.8479	0.1952
199	0.42 %	0.89 %	1.20 %	1.33 %	0.17 %
	0.2691	0.8378	1.6751	1.3213	0.1287
200	0.21 %	0.33 %	0.60 %	1.19 %	0.14 %
	0.1348	0.3132	0.8356	1.1854	0.1057
201	0.21 %	0.39 %	0.48 %	0.27 %	0.10 %
	0.1310	0.3631	0.6705	0.2697	0.0729
202	0.08 %	0.13 %	0.88 %	0.16 %	0.05 %
	0.0495	0.1227	1.2262	0.1552	0.0355
203	0.15 %	0.18 %	0.13 %	0.33 %	0.33 %
	0.0940	0.1667	0.1826	0.3316	0.2526
204	0.13 %	0.17 %	0.13 %	0.57 %	0.21 %
	0.0828	0.1633	0.1808	0.5652	0.1565
205	0.08 %	0.10 %	0.06 %	0.16 %	0.32 %
	0.0507	0.0898	0.0878	0.1577	0.2462
206	0.08 %	0.09 %	0.07 %	0.18 %	0.20 %
	0.0485	0.0833	0.1019	0.1825	0.1506
207	0.17 %	0.18 %	0.16 %	0.25 %	0.23 %
	0.1073	0.1668	0.2188	0.2457	0.1749
208	0.31 %	0.35 %	0.29 %	0.31 %	0.17 %
	0.1962	0.3288	0.4112	0.3100	0.1287
209	0.24 %	0.26 %	0.19 %	0.21 %	0.13 %
	0.1558	0.2473	0.2613	0.2075	0.1005
210	0.03 %	0.04 %	0.04 %	0.05 %	0.03 %
	0.0210	0.0372	0.0570	0.0470	0.0262

CEDAR RAPIDS, IOWA 1977 PARTICULATES JULY 1979

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 225	RECEPTOR 226	RECEPTOR 227	RECEPTOR 228	RECEPTOR 229
211	0.28 %	0.30 %	0.26 %	0.32 %	0.24 %
	0.1816	0.2793	0.3696	0.3149	0.1945
212	0.51 %	0.40 %	0.31 %	0.39 %	0.34 %
	0.3279	0.3754	0.4356	0.3830	0.2620
213	0.48 %	0.36 %	0.23 %	0.37 %	0.50 %
	0.3037	0.3371	0.3180	0.3637	0.3949
214	0.59 %	0.44 %	0.34 %	0.47 %	0.73 %
	0.3742	0.4158	0.4722	0.4713	0.5543
215	0.27 %	0.20 %	0.13 %	0.20 %	0.29 %
	0.1728	0.1872	0.1880	0.1943	0.2120
BACK-GROUND	70.54 %	47.83 %	32.19 %	45.28 %	58.97 %
	45.	45.	45.	45.	45.
TOTAL	100.0 %	100.1 %	100.1 %	100.1 %	100.1 %
	63.8135	94.1498	139.8976	99.4593	76.3558