IOWA DEPARTMENT OF ENVIRONMENTAL QUALITY

AIR QUALITY MANAGEMENT DIVISION

THE

AIR QUALITY DISPLAY MODEL

ANALYSIS

FOR

SUSPENDED PARTICULATES

IN

FORT DODGE, IOWA

DRAFT

August 1, 1978

The Air Quality Display Model Analysis for Fort Dodge, Iowa

Report on
Methods, Procedures, and Results

Prepared by the
Air and Land Quality Management Division
of the Iowa Department of Environmental Quality

July, 1978

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.

TABLE OF CONTENTS

Introduction

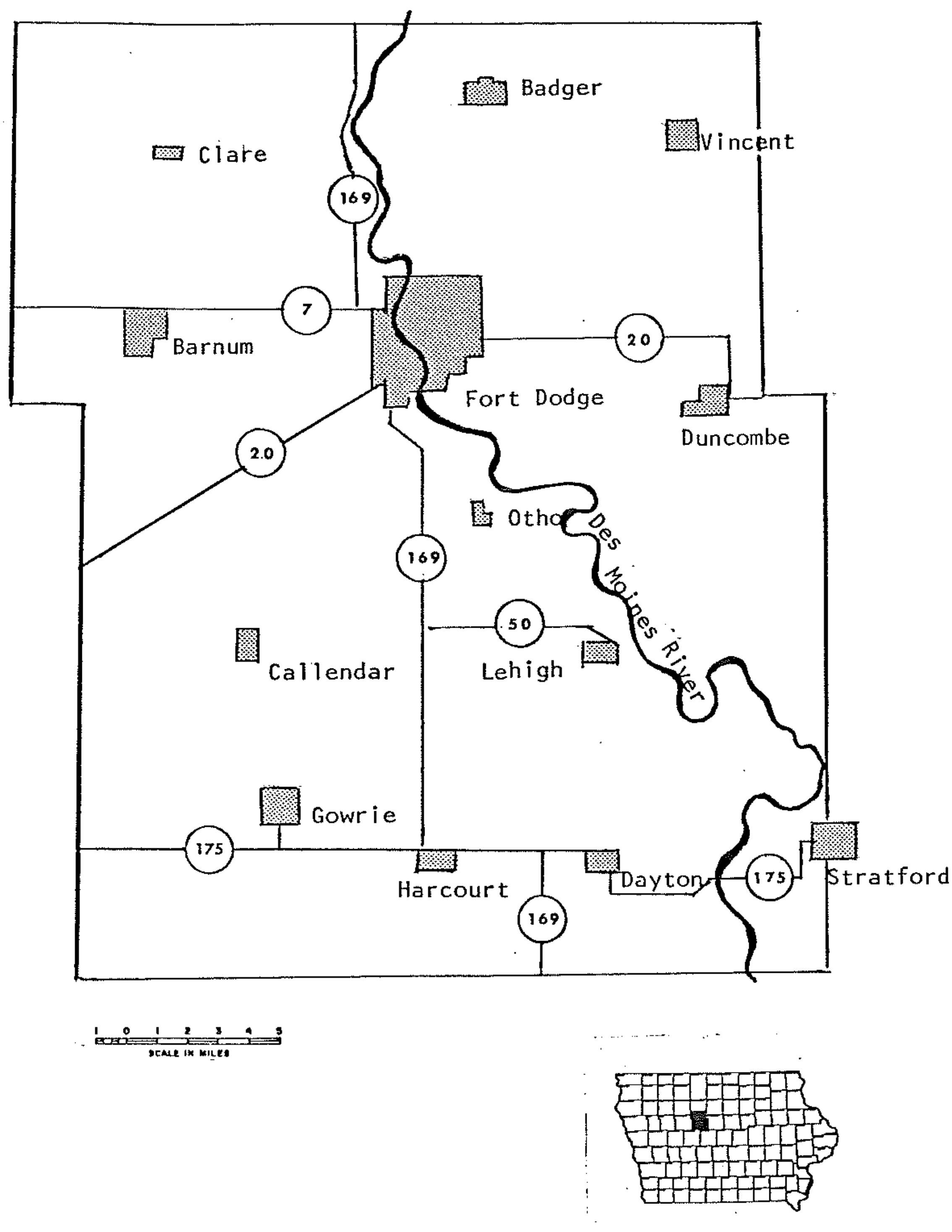
Total suspended particulate (TSP) is one of the six pollutants for which the federal EPA has declared national air quality standards for the protection of human health and welfare. A set of strategies to control TSP emissions, and thereby reduce ambient concentrations of this pollutant to acceptable 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

Webster County is located in the relatively flat plains of north-central of Iowa. The City of Fort Dodge is the major urban center located in the north-central section of the county and is bisected by the Des Moines River which flows through Webster County from the north to the southeast. (See Figure 1) The 1970 population for the Fort Dodge metropolitan area was 31,263; the 1970 population for Webster County was 48,391. Major industrial processes in Webster County consist of grain processing and transferring, and mineral product manufacturing. Major sources of fugitive dust and fugitive emissions include grain

Figure 1
Illustration of Webster County
and Location in Iowa



transferring, mineral product transferring, construction, agricultural tilling, and roads (both paved and unpaved).

Webster 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 northwest and the south to southeast, except for the area of Webster County in the Des Moines River Valley, which may tend to have winds channeled in directions paralleling the valley. The mean annual temperature is 48 degrees Fahrenheit, the mean annual precipitation is 30 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

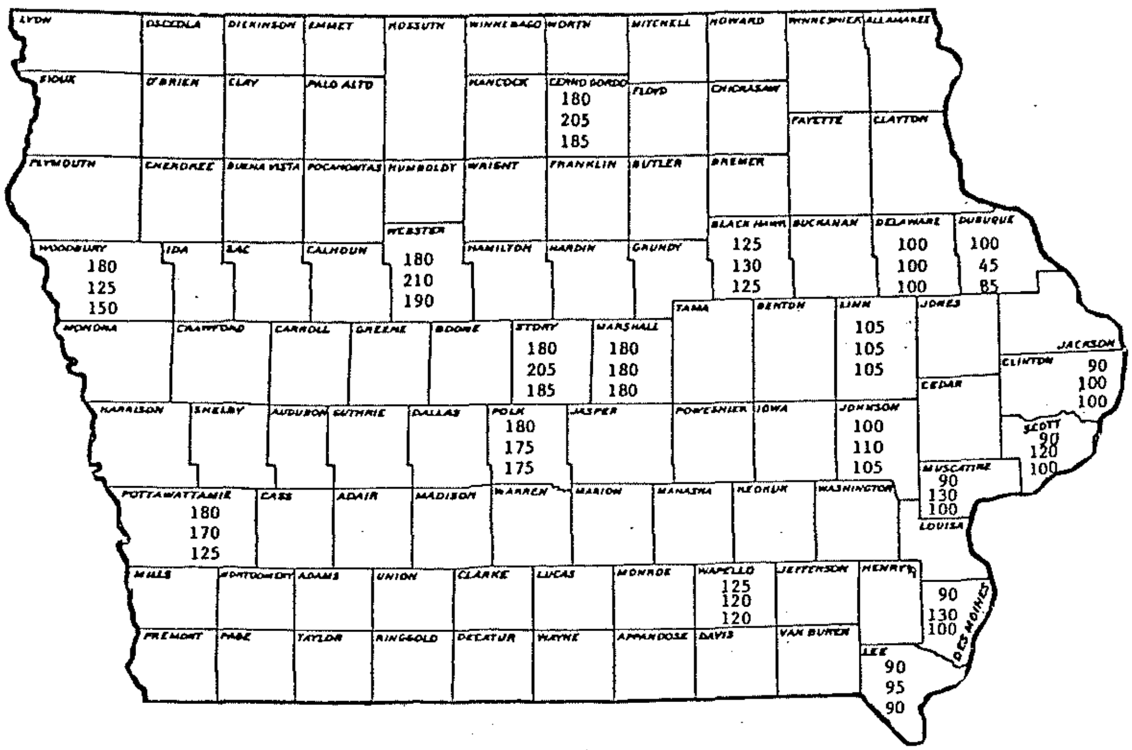
Source Contributions to the Recorded
Background Level at Backbone State Park
(Values shown are in micrograms per cubic meter [ug/m^3])

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

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.

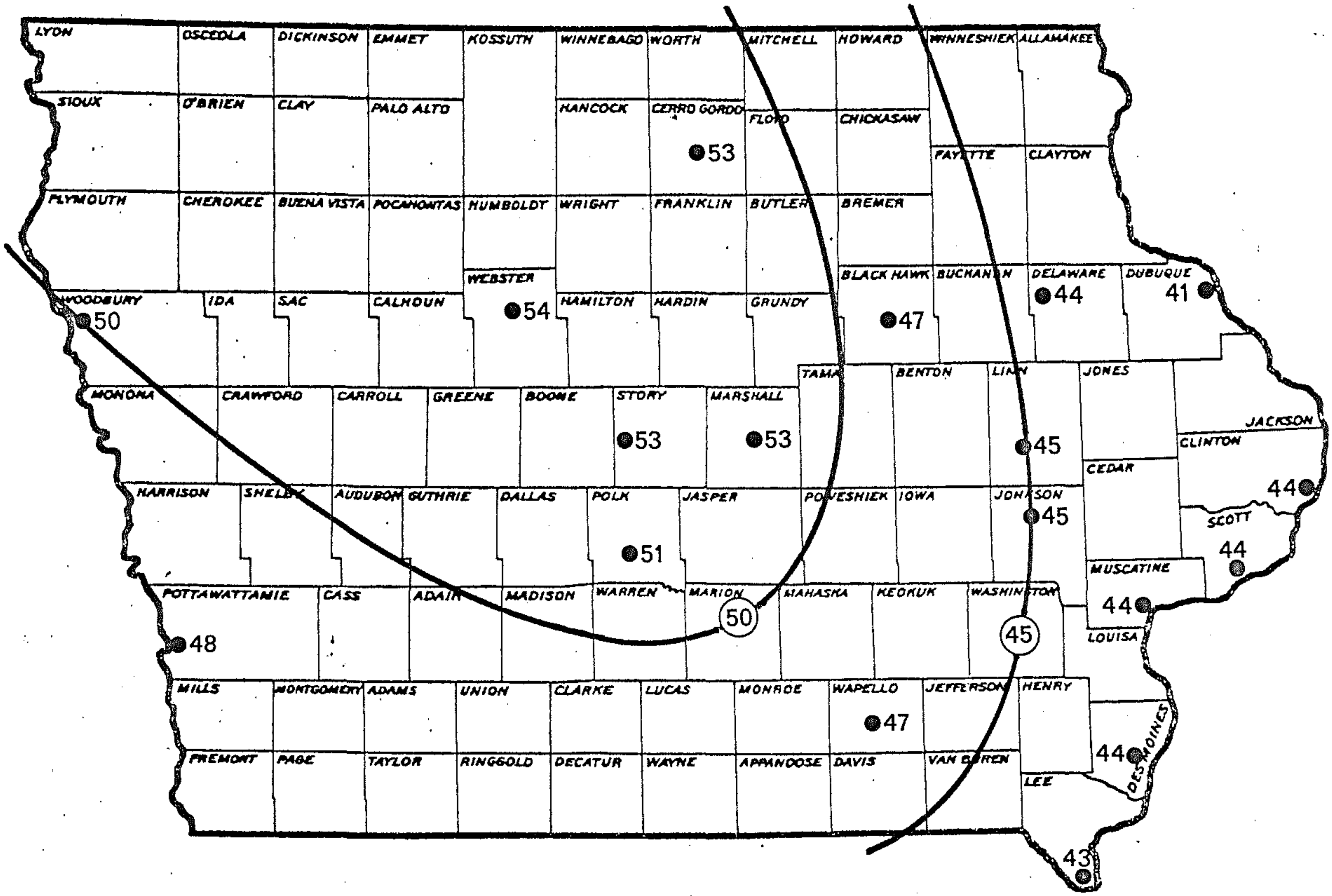


Figure 3
Estimations of Rural Background levels in Iowa
(Values shown are arithmetic means in micrograms per cubic meter)

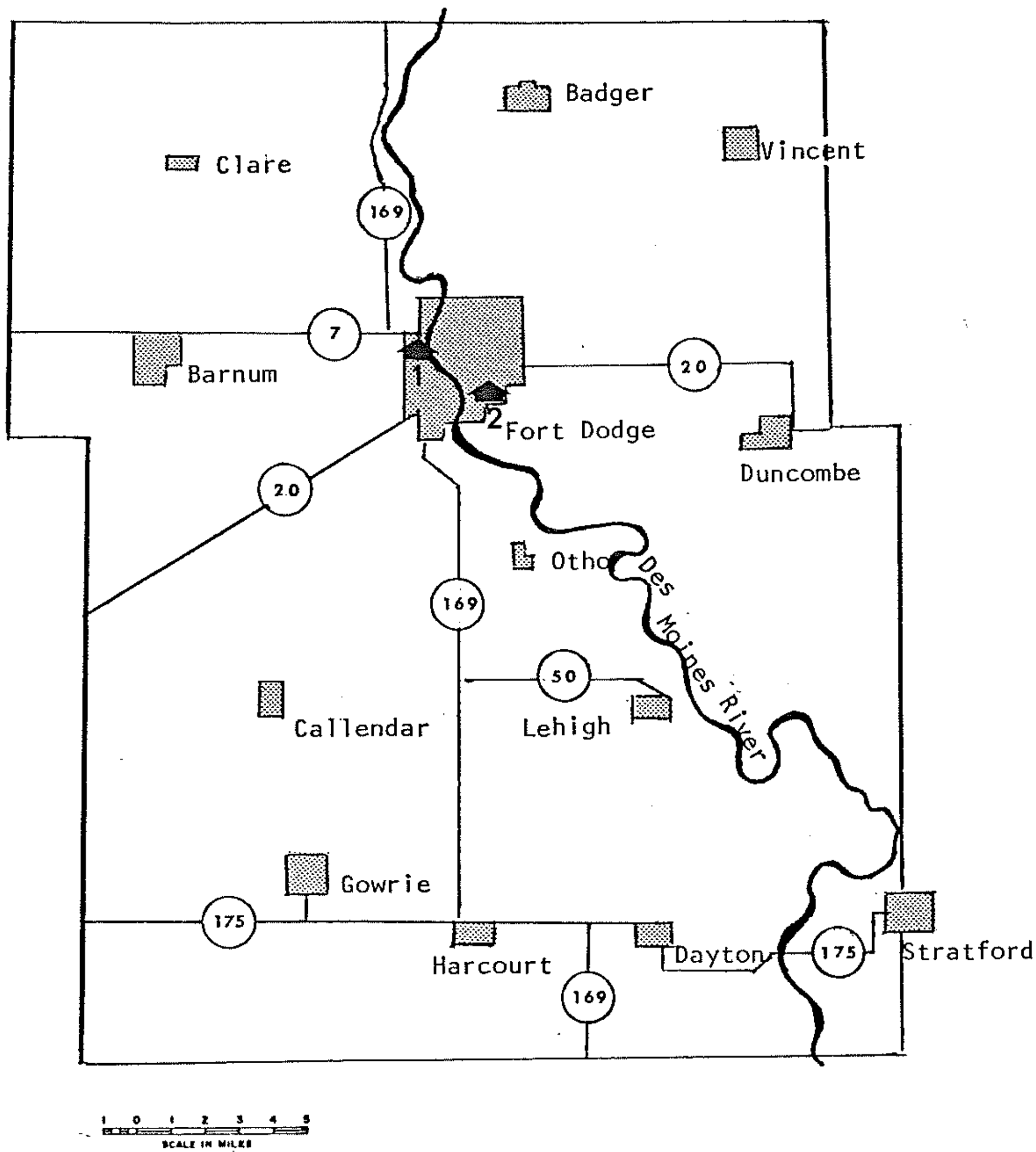
increase or decrease the contribution of agricultural sources, an estimation of background throughout the State has been developed as shown in Figure 3.

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. Two State owned high volume samplers are currently located in Fort Dodge. These monitors are located at (1) Municipal Water Plant, Phinney Park Drive; and (2) Highland Park School, Ninth Avenue South and Twenty-fifth Street; (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 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.

Figure 4
Location of Suspended Particulate Air
Monitoring Equipment in Webster County



Monitor Locations

1 Water Plant
2 Highland Park School

TABLE 2

Air monitoring data for Fort Dodge

Location	Year	Number of Samples	Maximum 24-Hour Value	2nd Max. 24-Hour Value	Arithmetic Mean	Geometric Mean	Standard Geometric Deviation
1. Munici-	1973	43	139.8	111.3	58	52	1.59
pal	1974	57	141.0	132.0	57	51	1.65
Water	1975	59	360.0	138.0	53	42	1.92
Plant	1976	61	138.0	108.0	48	41	1.79
	1977	61	129.0	111.0	48	43	1.57
2. Highland	1976*	46	542.0	366.0	107	90	1.70
Park	1977	54	253.0	184.1	81	69	1.78
School							

* 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, average 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 concentraton 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 Fort Dodge 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 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 Webster 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 census population for 1970 and updated from projections from the Iowa Office of Planning and Programming.[3] The 1977 Fort Dodge population growth was estimated at 1.008 times the 1970 census figure.

The Webster 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	19 tons per year
Residential Solid Waste	47 tons per year

Commercial-Institutional Emissions

Total commercial-institutional emissions for fuel use and solid waste disposal in Webster 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.

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

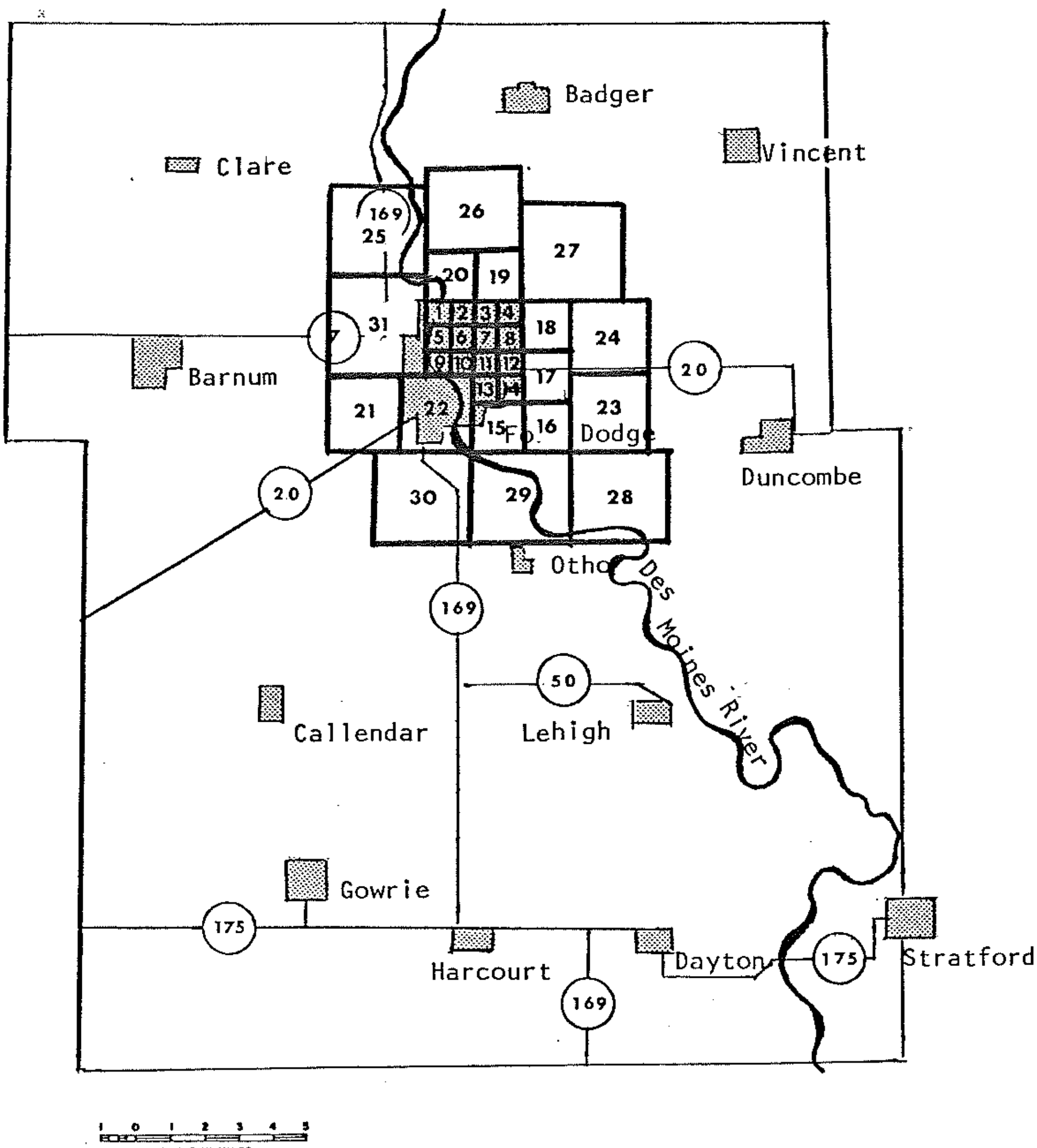
	1977
Commercial-Institutional Fuel	60 tons per year
Commercial-Institutional Solid Waste	33 tons per year

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)[4] 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

Figure 5
Area Source Grid Pattern
for Webster County



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.[5,6] 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. 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	203 tons per year
Fugitive (paved roads)	3160 tons per year
Fugitive (unpaved roads)	12160 tons per year

Transportation - Railroads

Total railroad fuel use emissions for railroads in Webster County were taken from the NEDS data supplied by EPA. Approximate track mileage was estimated for each designated area. Emissions were distributed by the proportion 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 Fort Dodge Airport emissions were distributd as a 2.3 square kilometer area source. Emissions were based on projections from the State airport system plan.[6]

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 Fort Dodge, therefore wind data from Des Moines, located south of Fort Dodge, were chosen. The wind data from Des Moines were chosen because of the similar topography and relatively close location.

Other necessary meteorological parameters that were obtained for Fort Dodge are shown on the following page:

Average daily mixing depth:	1250 meters
Average ambient temperature	282 degrees Kelvin (9 degrees Celsius)
Average ambient pressure	981 millibars

Results

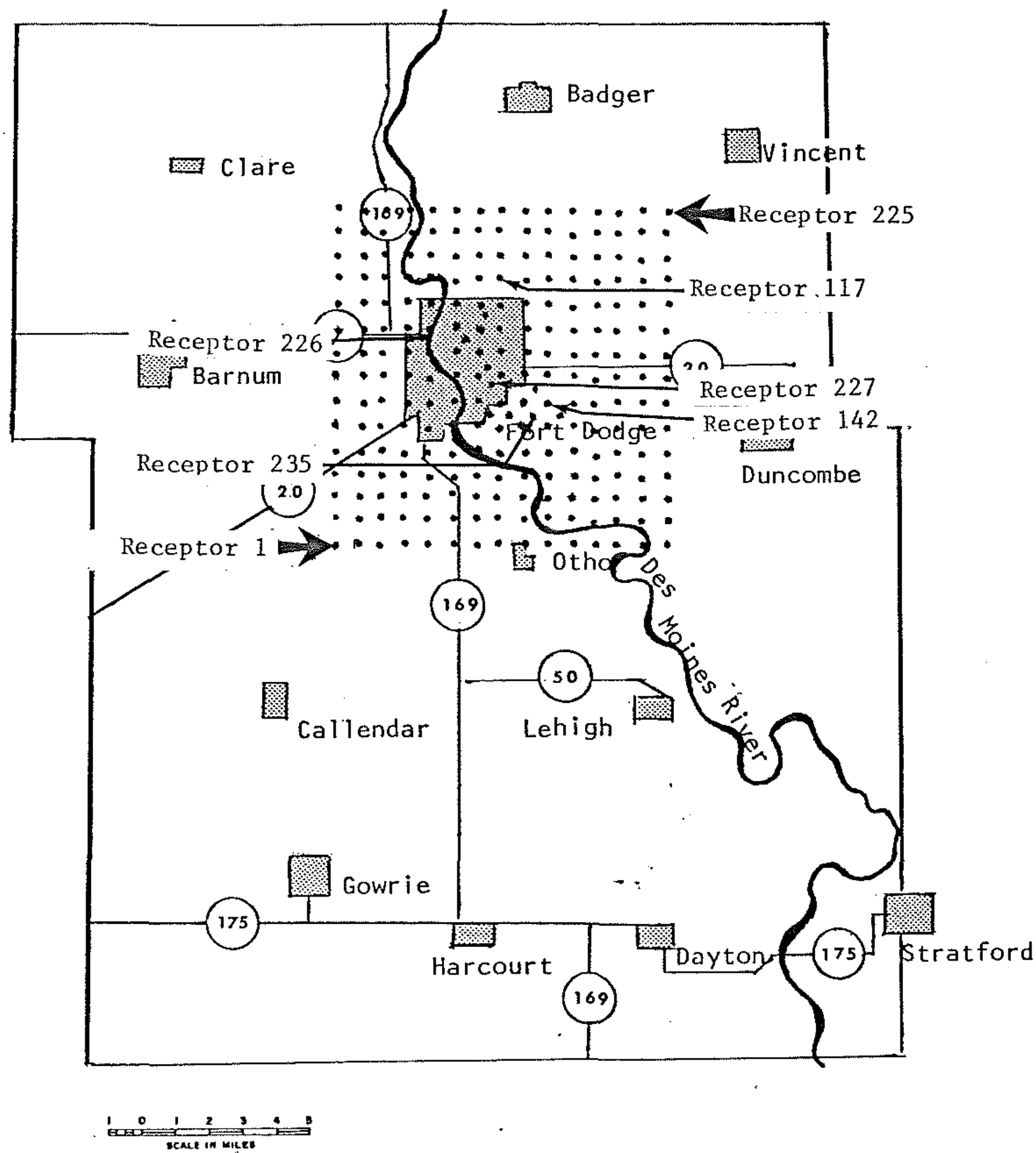
A grid area of 15 kilometers by 15 kilometers was set up around Fort Dodge with receptors placed at one kilometer intervals as shown in Figure 6. Twelve additional receptors located throughout the city were also included in the total receptor count.

Expected concentrations at each receptor are given in Appendix B. Graphical displays of these results are illustrated in Figure 7 for Webster County and Figure 8 for the City of Fort Dodge. Each line represents an isopleth of suspended particulate concentration as an annual arithmetic mean. The highest concentration expected was 153 micrograms per cubic meter at receptor 142.

To estimate the impact of each source on a receptor, a special audit was requested for receptors 117, 142, 226, 227, and 235. Results for each source are given in Appendix B while a summary is shown in Table 3.

To estimate the accuracy of the modeling results, a comparison of expected concentrations and monitoring data is shown in Table 4. There is an extremely large difference between the actual monitored value and the projected concentration at the Water Plant site. The discrepancy appears to be caused by improper point source input data, specifically fugitive dust sources, and insufficient meteorological data. Fugitive dust source emissions are overestimated and therefore not distributed properly producing unrealistically high concentrations near the monitoring site. The large contribution from Land-O-Lakes Big 4 and Wiesten

Figure 6
Receptor Locations for the Fort Dodge
AQDM Model



NOTE: Except for Receptors 226-237, grid numbering runs bottom to to top and left to right.

Figure 7
Webster County
1977 Suspended Particulate Isopleth Map
(values shown are arithmetic means in micrograms per cubic meter)

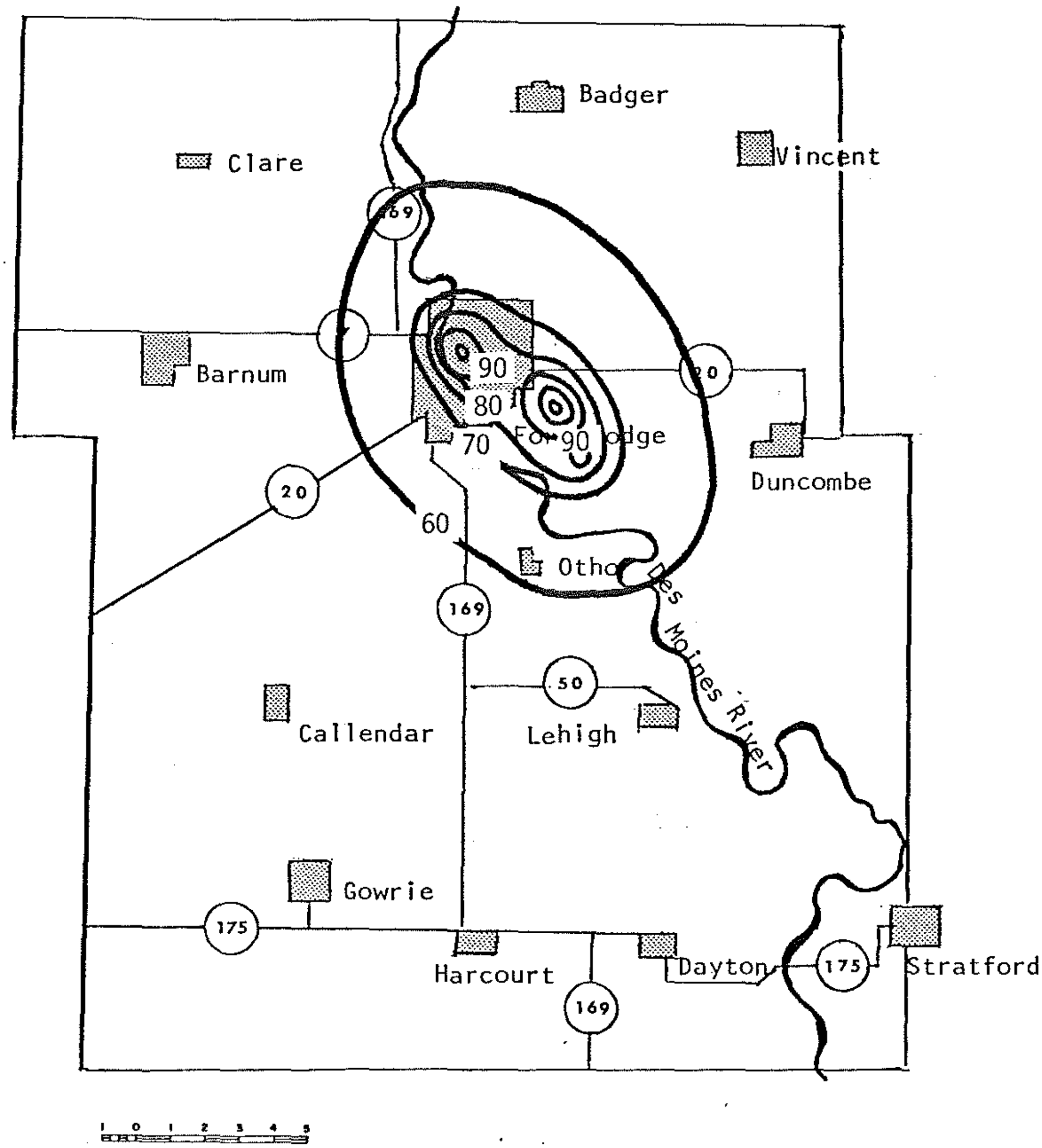


Figure 8
Suspended Particulate Isopleth Map
For Fort Dodge
(values shown are arithmetic means in micrograms per cubic meter)

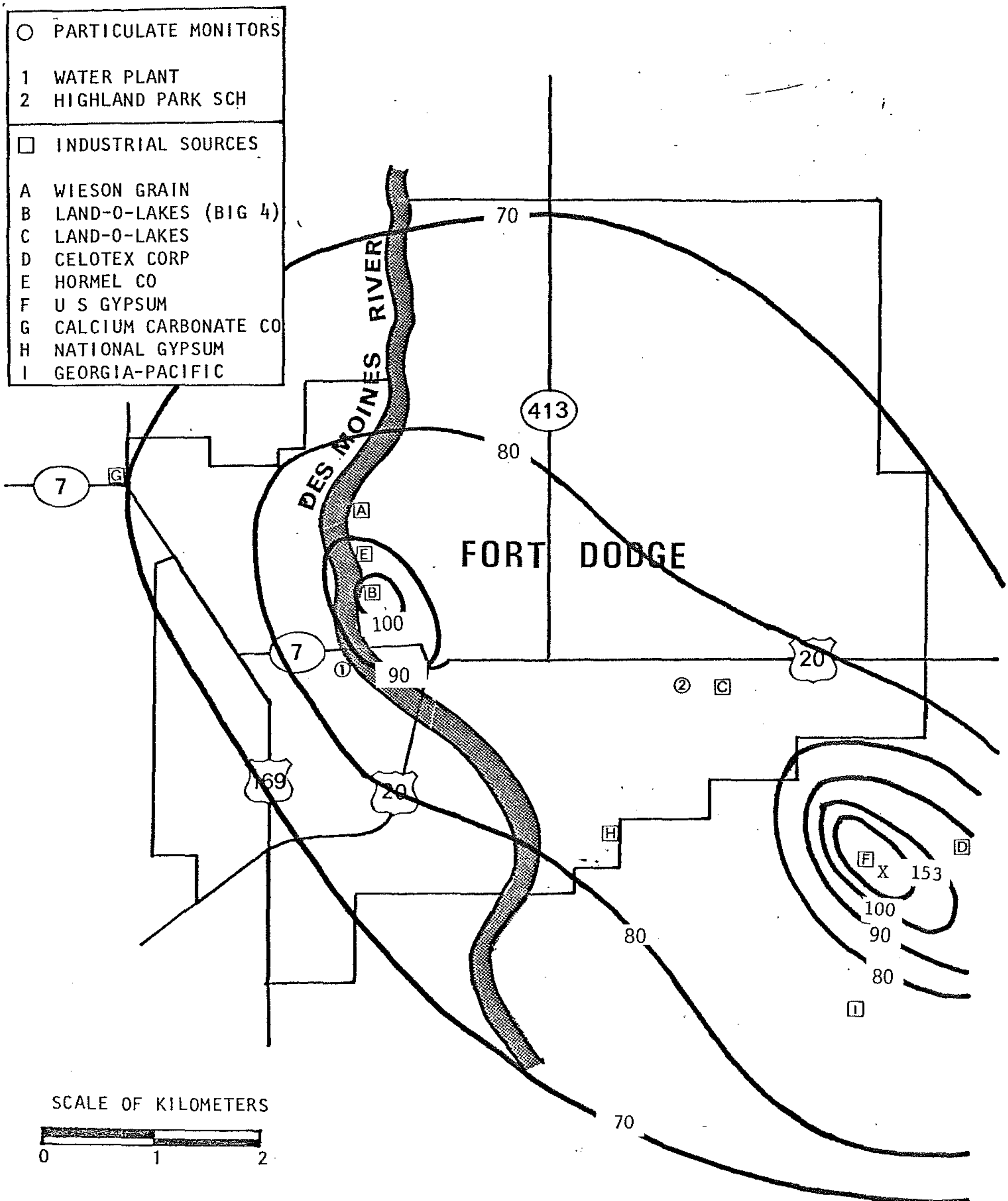


TABLE 3
Source Contributions to Five
Selected Receptors
(values shown are in micrograms per cubic meter)

Source	Receptor 226 Water Plant	Receptor 227 Highland Park School	Receptor 235 Southeast of Fort Dodge	Receptor 117 North Central Fort Dodge	Receptor 142 Southeast of Fort Dodge
Point Sources					
Georgia-Pacific Co. Plant	0.7	2.1	6.7	0.9	7.7
National Gypsum Co.	0.9	2.3	2.7	1.0	2.7
Celotex	0.1	0.3	0.5	0.2	0.9
U. S. Gypsum Plant	0.8	3.6	12.9	1.3	78.9
Land-O-Lakes Big 4	18.7	1.6	0.9	1.0	0.7
Hormel & Co	0.7	0.2	0.2	0.2	0.1
Calcium Carbonate	0.0	0.0	0.0	0.0	0.0
Wieston Grain Co.	2.4	0.1	0.1	0.1	0.1
Land-O-Lakes	0.1	8.3	0.6	0.3	0.7
Area Sources	9.9	10.8	8.4	5.5	7.5
Airport	0.0	0.0	0.0	0.0	0.0
Background	54.0	54.0	54.0	54.0	54.0
Total Concentration	88.3	83.3	87.0	64.5	153.3

Grain is believed to be overcalculated in the model because of the assumption of a particulate size of 20 microns. The sources of particulate at these two companies are for the most part fugitive in nature and generally would have a particulate size large enough to promote fallout. Therefore a reduction in the annual projected contribution, as shown in Table 4, from these sources of 80 to 90 percent is estimated because of fallout. The Water Plant monitoring site is also believed to be affected by the complex terrain of the Des Moines' River Valley. The AQDM cannot model the area accurately because of the different meteorological conditions associated with this type of topography.

In contrast to the Water Plant site, the projected concentration for the Highland Park School monitor compares closely with the actual 1977 monitored value, indicating correct model inputs.

TABLE 4

Comparison of Air Monitoring Data

with Projected Concentrations

Monitor Location	1977 Arithmetic Mean	Projected Concentration
1. Municipal Water Plant	48	89
2. Highland Park School	81	84

Although the calculated concentrations may not be exactly the same as the actual monitored values, the projected concentrations represent averages that do not reflect changing weather and plant operation conditions which can cause a variation in the actual monitored values. Therefore, these projections should be used more as a guideline on locating high concentration areas than an exact calculation of suspended particulate levels at each receptor.

A breakdown of the annual suspended particulate concentrations by source type using this model for southern Fort Dodge, northern Fort Dodge, and a Webster County rural area is shown in Table 5. A graphical display of the estimated contributions by various suspended particulate source types is shown in Figure 9.

The largest sources of particulates shown in the table excluding background are from industrial sources and fugitive dust from transportation sources. The industrial sources located southeast of Fort Dodge account for about ten percent of the total projected concentration with higher percentages near these sources. Other industrial sources located in Fort Dodge account for another ten percent. Even with the required air pollution control equipment, the industrial contribution to the predicted particulate levels remains relatively high. However, a large percentage of the sources contributing to the particulate levels calculated for Fort Dodge are fugitive dust sources that do not currently require stringent control. Also, fluctuations in annual averages may be seen when breakdown or maintenance of installed air pollution control equipment occurs.

Another large source of particulates shown in Table 6 is transportation oriented sources causing fugitive dust. These fugitive dust emissions are estimated to contribute nearly ten 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 only one percent. As would be expected, the largest amount of fugitive dust is from paved and unpaved roads in the urban area and from unpaved roads in the rural areas.

TABLE 5

Breakdown of Annual Suspended Particulate Concentration for Three Selected Sites in the Fort Dodge area

Sources of Particulate	Expected Concentrations (ug/m^3)		
	Southern Fort Dodge	Northern Fort Dodge	Rural Webster County
Point Sources (Industrial Process)	18.5	5.0	0.0
Area Sources			
Fuel use (Residential and Commercial)	0.6	0.3	0.0
Solid Waste Disposal (Open Burning)	0.9	0.4	0.1
Transportation			
Exhaust, Tire Wear	1.5	0.7	0.0
Fugitive Dust from Paved Roads	7.3	3.1	0.2
Fugitive Dust from Unpaved Roads	0.4	0.9	1.7*
Miscellaneous (structural fire, construction)	0.1	0.1	0.0
Background	54.0	54.0	54.0
TOTAL	83.3	64.5	56.0

* An additional contribution from rural unpaved roads is included in the background concentration.

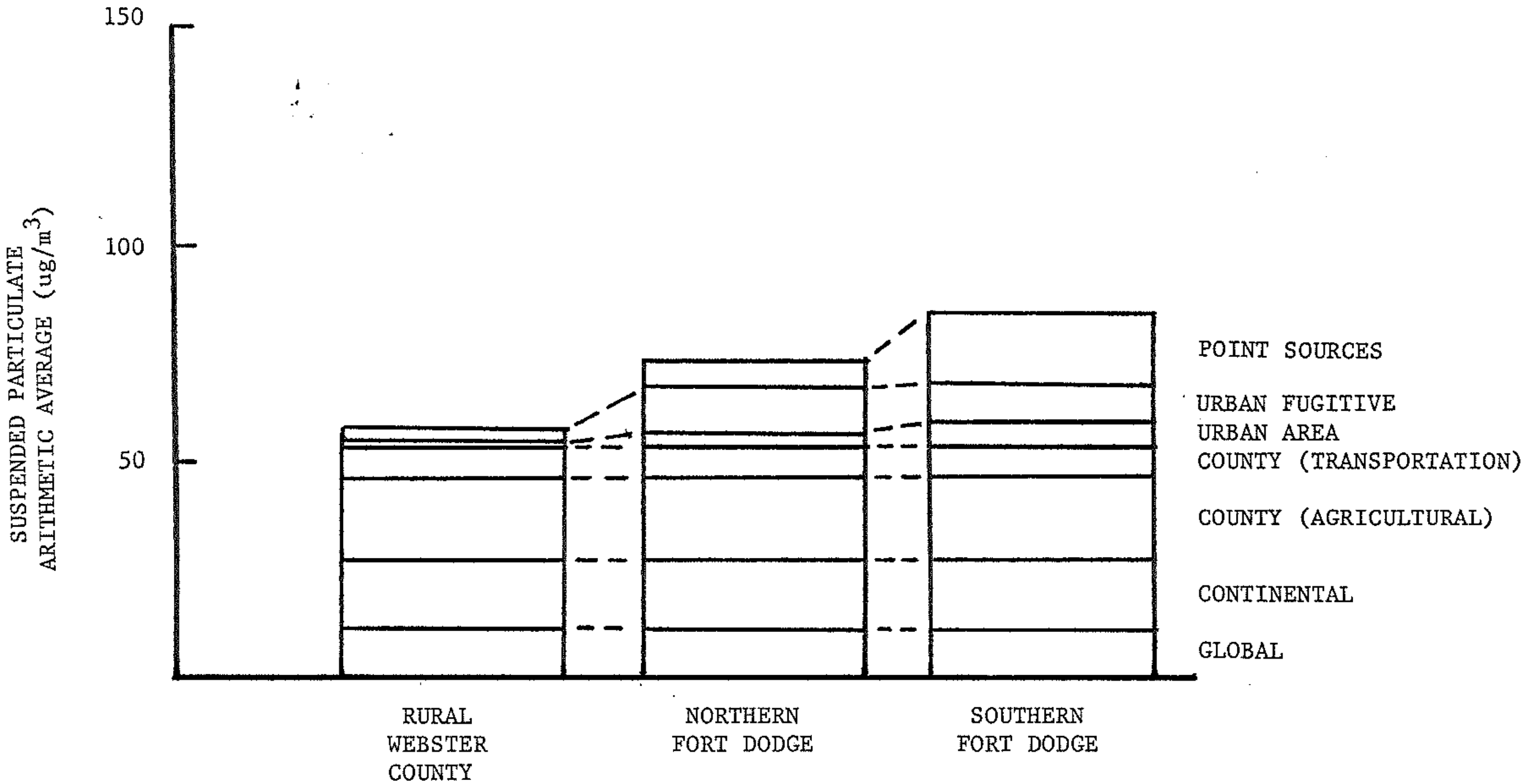


Figure 9. Estimated contributions of various suspended particulate source types

Summary

The AQDM results for Fort Dodge indicate two areas of high particulate potential. One area is located in the river valley close to industrial sources and the other area is located in southeastern Fort Dodge and extends south and east of the city boundaries.

The first area, along the river, is calculated to be high because of fugitive emissions from two grain elevators. These emissions, however, appeared to be modeled incorrectly because of the poor comparison with the monitor that is also located in the river valley. The extremely low monitoring values indicate that the monitoring site is not affected by point or area sources and is remote enough to record only background concentrations.

The second area, southeast of Fort Dodge, appears to be modeled more correctly when compared with the actual monitoring data. However, since only one monitor is available to compare with the model projections, caution is advised in using the maximum concentrations as precise values. The particulates in this area are generated by the operation of the gypsum plants southeast of Fort Dodge and area sources throughout this region. The operation of the gypsum plants, however, appear to be the largest contributor, accounting for nearly sixty-five percent of the generated particulates not considered as background at the Highland Park School monitoring site. Most of the sources at the gypsum plants emitting the largest amount of particulates are fugitive sources that do not have control equipment.

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. "Official Iowa Population Projections, 1975-2020", Iowa Office of Planning and Programming, Series I-76, No. 1, July, 1976.

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

5. 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.

6. 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.

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

APPENDIX A

FORT DODGE, IOWA 1977 PARTICULATE MODELING JUNE 1978

SOURCE DATA

SOURCE NUMBER	SOURCE LOCATION (KILOMETERS) HORIZONTAL	SOURCE LOCATION (KILOMETERS) VERTICAL	SOURCE AREA SQUARE KILOMETERS	ANNUAL SOURCE EMISSION RATE (TONS/DAY) SO2	ANNUAL SOURCE EMISSION RATE (TONS/DAY) PART	STACK DATA HT. (M)	STACK DATA DIAM (M)	STACK DATA VEL (M/SEC)	STACK DATA TEMP (DEG.K)
1	406.1	4702.5	0.0	0.0	0.220	8.4	1.5	11.6	394.
2	406.1	4702.5	0.0	0.0	0.043	4.2	0.3	24.2	294.
3	406.1	4702.5	0.0	0.0	0.410	10.0	0.0	0.0	294.
4	406.1	4702.5	0.0	0.0	0.100	15.0	0.0	0.0	294.
5	403.8	4703.8	0.0	0.0	0.218	25.5	0.9	13.3	361.
6	403.8	4703.8	0.0	0.0	0.012	13.8	0.5	15.8	311.
7	403.8	4703.8	0.0	0.0	0.246	20.0	0.4	18.2	394.
8	403.8	4703.8	0.0	0.0	0.008	14.8	0.3	15.5	394.
9	403.7	4703.7	0.0	0.0	0.137	6.0	0.0	0.0	294.
10	407.4	4702.0	0.0	0.0	0.274	6.0	0.0	0.0	294.
11	407.1	4704.0	0.0	0.0	0.350	29.1	1.2	10.9	377.
12	407.1	4704.0	0.0	0.0	0.018	15.5	0.6	7.1	294.
13	406.2	4703.8	0.0	0.0	0.007	12.1	0.3	25.7	374.
14	406.2	4703.8	0.0	0.0	0.274	12.1	0.3	25.7	374.
15	406.2	4703.8	0.0	0.0	0.027	6.1	0.4	26.8	294.
16	406.2	4703.8	0.0	0.0	0.681	10.0	0.0	0.0	294.
17	401.6	4706.3	0.0	0.0	0.137	6.0	0.0	0.0	294.
18	401.6	4706.3	0.0	0.0	0.468	16.7	0.4	15.2	294.
19	401.6	4706.3	0.0	0.0	0.040	9.1	5.0	2.1	305.
20	401.6	4706.3	0.0	0.0	0.049	16.7	0.7	8.0	300.
21	401.6	4706.3	0.0	0.0	0.049	16.7	0.3	20.0	300.
22	401.6	4706.3	0.0	0.0	0.052	16.7	0.3	20.1	300.
23	401.6	4706.3	0.0	0.0	0.016	18.2	0.3	30.5	294.
24	401.6	4706.3	0.0	0.0	0.041	13.7	0.5	10.1	333.
25	401.6	4706.3	0.0	0.0	0.011	10.7	0.7	10.0	311.
26	401.6	4706.3	0.0	0.0	0.110	6.0	0.0	0.0	294.
27	401.6	4706.3	0.0	0.0	0.022	18.3	0.5	10.0	300.
28	401.4	4706.7	0.0	0.0	0.115	15.8	1.5	4.8	533.
29	401.4	4706.7	0.0	0.0	0.123	19.7	1.3	7.0	300.
30	399.3	4707.4	0.0	0.0	0.014	9.1	0.4	25.0	355.
31	401.3	4707.2	0.0	0.0	0.046	3.0	0.0	0.0	294.
32	401.3	4707.2	0.0	0.0	0.077	6.0	0.0	0.0	294.
33	401.3	4707.2	0.0	0.0	0.016	10.0	5.0	1.0	300.
34	404.8	4705.3	0.0	0.0	0.061	6.0	0.0	0.0	294.
35	404.8	4705.3	0.0	0.0	0.061	6.0	0.0	0.0	294.
36	404.8	4705.3	0.0	0.0	0.020	10.0	1.0	10.0	300.
37	401.0	4707.0	1.00	0.0	0.049	0.0	0.0	0.0	0.
38	402.0	4707.0	1.00	0.0	0.092	0.0	0.0	0.0	0.
39	403.0	4707.0	1.00	0.0	0.127	0.0	0.0	0.0	0.
40	404.0	4707.0	1.00	0.0	0.069	0.0	0.0	0.0	0.
41	401.0	4706.0	1.00	0.0	0.079	0.0	0.0	0.0	0.
42	402.0	4706.0	1.00	0.0	0.284	0.0	0.0	0.0	0.
43	403.0	4706.0	1.00	0.0	0.176	0.0	0.0	0.0	0.
44	404.0	4706.0	1.00	0.0	0.129	0.0	0.0	0.0	0.
45	401.0	4705.0	1.00	0.0	0.060	0.0	0.0	0.0	0.
46	402.0	4705.0	1.00	0.0	0.106	0.0	0.0	0.0	0.
47	403.0	4705.0	1.00	0.0	0.139	0.0	0.0	0.0	0.
48	404.0	4705.0	1.00	0.0	0.124	0.0	0.0	0.0	0.
49	403.0	4704.0	1.00	0.0	0.026	0.0	0.0	0.0	0.
50	404.0	4704.0	1.00	0.0	0.060	0.0	0.0	0.0	0.
51	403.0	4702.0	4.00	0.0	0.487	0.0	0.0	0.0	0.
52	405.0	4702.0	4.00	0.0	0.416	0.0	0.0	0.0	0.
53	405.0	4704.0	4.00	0.0	0.459	0.0	0.0	0.0	0.
54	405.0	4708.0	4.00	0.0	0.051	0.0	0.0	0.0	0.
55	403.0	4708.0	4.00	0.0	0.109	0.0	0.0	0.0	0.
56	401.0	4708.0	4.00	0.0	0.118	0.0	0.0	0.0	0.
57	397.0	4702.0	9.00	0.0	0.315	0.0	0.0	0.0	0.
58	399.0	4702.0	9.00	0.0	0.227	0.0	0.0	0.0	0.
59	407.0	4702.0	9.00	0.0	0.141	0.0	0.0	0.0	0.
60	407.0	4705.0	9.00	0.0	0.123	0.0	0.0	0.0	0.
61	397.0	4609.0	16.00	0.0	0.339	0.0	0.0	0.0	0.
62	401.0	4610.0	16.00	0.0	0.269	0.0	0.0	0.0	0.
63	405.0	4608.0	16.00	0.0	0.123	0.0	0.0	0.0	0.
64	407.0	4698.0	16.00	0.0	0.541	0.0	0.0	0.0	0.
65	403.0	4698.0	16.00	0.0	0.342	0.0	0.0	0.0	0.
66	399.0	4698.0	16.00	0.0	0.586	0.0	0.0	0.0	0.
67	397.0	4705.0	16.00	0.0	0.201	0.0	0.0	0.0	0.
68	407.0	4704.0	1.00	0.0	0.482	0.0	0.0	0.0	0.
69	405.0	4703.0	1.00	0.0	0.178	0.0	0.0	0.0	0.
70	404.0	4702.0	1.00	0.0	0.129	0.0	0.0	0.0	0.
71	401.5	4710.5	2.30	0.0	0.022	3.0	0.0	0.0	0.

FORT DODGE SOURCES AND CORRESPONDING

SOURCE NUMBERS

Source Number	Source
1-4	Georgia-Pacific Company
5-10	National Gypsum Company
11-12	Celotex
13-16	U.S. Gypsum
17-27	Land-O-Lakes, Big 4
28-29	George A. Hormel and Company
30	Calcium Carbonate Company
31-33	Wieston Grain Company
34-36	Land-O-Lakes
37-67	Area Sources 1-31
68	Georgia-Pacific Co. (Fugitive)
69-70	U.S. Gypsum (Fugitive)
71	Fort Dodge Airport

APPENDIX B

RECEPTOR CONCENTRATION DATA

RECEPTOR NUMBER	RECEPTOR LOCATION (KILOMETERS) NORTH	RECEPTOR LOCATION (KILOMETERS) OVERT	EXPECTED ARITHMETIC MEAN (MICROGRAMS/CU. METER) SO2	EXPECTED ARITHMETIC MEAN (MICROGRAMS/CU. METER) PARTICULATES
1	397.0	4698.0	0.	57.
2	397.0	4699.0	0.	57.
3	397.0	4700.0	0.	58.
4	397.0	4701.0	0.	59.
5	397.0	4702.0	0.	59.
6	397.0	4703.0	0.	60.
7	397.0	4704.0	0.	60.
8	397.0	4705.0	0.	60.
9	397.0	4706.0	0.	60.
10	397.0	4707.0	0.	60.
11	397.0	4708.0	0.	59.
12	397.0	4709.0	0.	59.
13	397.0	4710.0	0.	59.
14	397.0	4711.0	0.	59.
15	397.0	4712.0	0.	59.
16	398.0	4698.0	0.	58.
17	398.0	4699.0	0.	58.
18	398.0	4700.0	0.	58.
19	398.0	4701.0	0.	59.
20	398.0	4702.0	0.	60.
21	398.0	4703.0	0.	60.
22	398.0	4704.0	0.	60.
23	398.0	4705.0	0.	61.
24	398.0	4706.0	0.	61.
25	398.0	4707.0	0.	61.
26	398.0	4708.0	0.	60.
27	398.0	4709.0	0.	60.
28	398.0	4710.0	0.	60.
29	398.0	4711.0	0.	60.
30	398.0	4712.0	0.	59.
31	399.0	4698.0	0.	58.
32	399.0	4699.0	0.	59.
33	399.0	4700.0	0.	59.
34	399.0	4701.0	0.	60.
35	399.0	4702.0	0.	61.
36	399.0	4703.0	0.	61.
37	399.0	4704.0	0.	61.
38	399.0	4705.0	0.	62.
39	399.0	4706.0	0.	63.
40	399.0	4707.0	0.	63.
41	399.0	4708.0	0.	62.
42	399.0	4709.0	0.	62.
43	399.0	4710.0	0.	61.
44	399.0	4711.0	0.	61.
45	399.0	4712.0	0.	60.
46	400.0	4698.0	0.	58.
47	400.0	4699.0	0.	59.
48	400.0	4700.0	0.	59.
49	400.0	4701.0	0.	60.
50	400.0	4702.0	0.	61.
51	400.0	4703.0	0.	62.
52	400.0	4704.0	0.	62.
53	400.0	4705.0	0.	63.
54	400.0	4706.0	0.	67.
55	400.0	4707.0	0.	66.
56	400.0	4708.0	0.	66.
57	400.0	4709.0	0.	64.
58	400.0	4710.0	0.	62.
59	400.0	4711.0	0.	61.
60	400.0	4712.0	0.	61.
61	401.0	4698.0	0.	59.
62	401.0	4699.0	0.	59.
63	401.0	4700.0	0.	60.
64	401.0	4701.0	0.	61.
65	401.0	4702.0	0.	62.
66	401.0	4703.0	0.	64.
67	401.0	4704.0	0.	66.
68	401.0	4705.0	0.	70.
69	401.0	4706.0	0.	80.
70	401.0	4707.0	0.	87.
71	401.0	4708.0	0.	74.
72	401.0	4709.0	0.	68.
73	401.0	4710.0	0.	64.
74	401.0	4711.0	0.	63.
75	401.0	4712.0	0.	61.
76	402.0	4698.0	0.	59.
77	402.0	4699.0	0.	60.
78	402.0	4700.0	0.	61.
79	402.0	4701.0	0.	62.
80	402.0	4702.0	0.	65.

RECEPTOR CONCENTRATION DATA

RECEPTOR NUMBER	RECEPTOR LOCATION (KILOMETERS) HORIZ	VERT	EXPECTED ARITHMETIC MEAN (MICROGRAMS/CU. METER) SO2	PARTICULATES
81	402.0	4703.0	0.	67.
82	402.0	4704.0	0.	70.
83	402.0	4705.0	0.	78.
84	402.0	4706.0	0.	106.
85	402.0	4707.0	0.	86.
86	402.0	4708.0	0.	74.
87	402.0	4709.0	0.	68.
88	402.0	4710.0	0.	65.
89	402.0	4711.0	0.	63.
90	402.0	4712.0	0.	62.
91	403.0	4698.0	0.	60.
92	403.0	4699.0	0.	61.
93	403.0	4700.0	0.	62.
94	403.0	4701.0	0.	65.
95	403.0	4702.0	0.	69.
96	403.0	4703.0	0.	71.
97	403.0	4704.0	0.	75.
98	403.0	4705.0	0.	81.
99	403.0	4706.0	0.	83.
100	403.0	4707.0	0.	77.
101	403.0	4708.0	0.	70.
102	403.0	4709.0	0.	66.
103	403.0	4710.0	0.	64.
104	403.0	4711.0	0.	62.
105	403.0	4712.0	0.	61.
106	404.0	4698.0	0.	60.
107	404.0	4699.0	0.	61.
108	404.0	4700.0	0.	62.
109	404.0	4701.0	0.	65.
110	404.0	4702.0	0.	75.
111	404.0	4703.0	0.	77.
112	404.0	4704.0	0.	83.
113	404.0	4705.0	0.	81.
114	404.0	4706.0	0.	80.
115	404.0	4707.0	0.	73.
116	404.0	4708.0	0.	68.
117	404.0	4709.0	0.	65.
118	404.0	4710.0	0.	63.
119	404.0	4711.0	0.	62.
120	404.0	4712.0	0.	61.
121	405.0	4698.0	0.	61.
122	405.0	4699.0	0.	62.
123	405.0	4700.0	0.	63.
124	405.0	4701.0	0.	67.
125	405.0	4702.0	0.	73.
126	405.0	4703.0	0.	81.
127	405.0	4704.0	0.	84.
128	405.0	4705.0	0.	88.
129	405.0	4706.0	0.	76.
130	405.0	4707.0	0.	69.
131	405.0	4708.0	0.	66.
132	405.0	4709.0	0.	64.
133	405.0	4710.0	0.	63.
134	405.0	4711.0	0.	61.
135	405.0	4712.0	0.	61.
136	406.0	4698.0	0.	62.
137	406.0	4699.0	0.	63.
138	406.0	4700.0	0.	65.
139	406.0	4701.0	0.	68.
140	406.0	4702.0	0.	79.
141	406.0	4703.0	0.	97.
142	406.0	4704.0	0.	153.
143	406.0	4705.0	0.	83.
144	406.0	4706.0	0.	73.
145	406.0	4707.0	0.	68.
146	406.0	4708.0	0.	64.
147	406.0	4709.0	0.	63.
148	406.0	4710.0	0.	62.
149	406.0	4711.0	0.	61.
150	406.0	4712.0	0.	60.
151	407.0	4698.0	0.	62.
152	407.0	4699.0	0.	63.
153	407.0	4700.0	0.	65.
154	407.0	4701.0	0.	70.
155	407.0	4702.0	0.	97.
156	407.0	4703.0	0.	87.
157	407.0	4704.0	0.	92.
158	407.0	4705.0	0.	75.
159	407.0	4706.0	0.	69.
160	407.0	4707.0	0.	65.

RECEPTOR CONCENTRATION DATA

RECEPTOR NUMBER	RECEPTOR LOCATION (KILOMETERS) HORIZ	VERT	EXPECTED ARITHMETIC MEAN (MICROGRAMS/CU. METER) SO2	PARTICULATES
161	407.0	4708.0	0.	63.
162	407.0	4709.0	0.	62.
163	407.0	4710.0	0.	61.
164	407.0	4711.0	0.	60.
165	407.0	4712.0	0.	60.
166	408.0	4698.0	0.	61.
167	408.0	4699.0	0.	62.
168	408.0	4700.0	0.	64.
169	408.0	4701.0	0.	68.
170	408.0	4702.0	0.	78.
171	408.0	4703.0	0.	70.
172	408.0	4704.0	0.	70.
173	408.0	4705.0	0.	66.
174	408.0	4706.0	0.	64.
175	408.0	4707.0	0.	62.
176	408.0	4708.0	0.	61.
177	408.0	4709.0	0.	60.
178	408.0	4710.0	0.	60.
179	408.0	4711.0	0.	59.
180	408.0	4712.0	0.	59.
181	409.0	4698.0	0.	61.
182	409.0	4699.0	0.	61.
183	409.0	4700.0	0.	62.
184	409.0	4701.0	0.	63.
185	409.0	4702.0	0.	65.
186	409.0	4703.0	0.	64.
187	409.0	4704.0	0.	64.
188	409.0	4705.0	0.	62.
189	409.0	4706.0	0.	61.
190	409.0	4707.0	0.	61.
191	409.0	4708.0	0.	60.
192	409.0	4709.0	0.	59.
193	409.0	4710.0	0.	58.
194	409.0	4711.0	0.	58.
195	409.0	4712.0	0.	58.
196	410.0	4698.0	0.	60.
197	410.0	4699.0	0.	60.
198	410.0	4700.0	0.	61.
199	410.0	4701.0	0.	61.
200	410.0	4702.0	0.	62.
201	410.0	4703.0	0.	62.
202	410.0	4704.0	0.	62.
203	410.0	4705.0	0.	60.
204	410.0	4706.0	0.	60.
205	410.0	4707.0	0.	59.
206	410.0	4708.0	0.	59.
207	410.0	4709.0	0.	58.
208	410.0	4710.0	0.	58.
209	410.0	4711.0	0.	58.
210	410.0	4712.0	0.	57.
211	411.0	4698.0	0.	59.
212	411.0	4699.0	0.	59.
213	411.0	4700.0	0.	60.
214	411.0	4701.0	0.	60.
215	411.0	4702.0	0.	60.
216	411.0	4703.0	0.	60.
217	411.0	4704.0	0.	60.
218	411.0	4705.0	0.	59.
219	411.0	4706.0	0.	59.
220	411.0	4707.0	0.	58.
221	411.0	4708.0	0.	58.
222	411.0	4709.0	0.	58.
223	411.0	4710.0	0.	57.
224	411.0	4711.0	0.	57.
225	411.0	4712.0	0.	57.
226	401.1	4706.6	0.	89.
227	404.4	4705.3	0.	84.
228	404.6	4704.8	0.	79.
229	403.5	4703.5	0.	76.
230	406.5	4703.5	0.	126.
231	403.5	4704.5	0.	80.
232	404.5	4703.5	0.	80.
233	403.5	4705.5	0.	78.
234	405.5	4704.5	0.	86.
235	405.5	4703.5	0.	87.
236	402.5	4706.5	0.	81.
237	405.2	4697.6	0.	61.

FORT DODGE SOURCES AND CORRESPONDING

SOURCE NUMBERS

Source Number	Source
1-4	Georgia-Pacific Company
5-10	National Gypsum Company
11-12	Celotex
13-16	U.S. Gypsum
17-27	Land-O-Lakes, Big 4
28-29	George A. Hormel and Company
30	Calcium Carbonate Company
31-33	Wieston Grain Company
34-36	Land-O-Lakes
37-67	Area Sources 1-31
68	Georgia-Pacific Co. (Fugitive)
69-70	U.S. Gypsum (Fugitive)
71	Fort Dodge Airport

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 226	RECEPTOR 221	RECEPTOR 235	RECEPTOR 117	RECEPTOR 142
1	0.11 %	0.36 %	0.73 %	0.21 %	0.47 %
	0.0990	0.2978	0.6405	0.1356	0.7163
2	0.03 %	0.11 %	0.58 %	0.06 %	0.28 %
	0.0292	0.0883	0.5076	0.0366	0.4326
3	0.28 %	0.89 %	3.62 %	0.48 %	2.00 %
	0.2479	0.7424	3.1636	0.3091	3.0747
4	0.08 %	0.24 %	1.28 %	0.13 %	0.63 %
	0.0676	0.2036	1.1195	0.0850	0.9729
5	0.24 %	0.59 %	0.46 %	0.34 %	0.20 %
	0.2126	0.4925	0.4084	0.2196	0.3129
6	0.02 %	0.06 %	0.06 %	0.03 %	0.02 %
	0.0169	0.0501	0.0507	0.0176	0.0364
7	0.38 %	0.98 %	0.89 %	0.55 %	0.40 %
	0.3355	0.8208	0.7804	0.3550	0.6189
8	0.01 %	0.04 %	0.04 %	0.02 %	0.02 %
	0.0112	0.0328	0.0380	0.0117	0.0239
9	0.23 %	0.70 %	0.78 %	0.30 %	0.26 %
	0.2030	0.5838	0.6853	0.1949	0.4016
10	0.15 %	0.40 %	0.88 %	0.28 %	0.61 %
	0.1343	0.3378	0.7697	0.1796	0.9401
11	0.10 %	0.31 %	0.49 %	0.36 %	0.48 %
	0.0885	0.2559	0.4258	0.2343	0.7420
12	0.01 %	0.03 %	0.07 %	0.03 %	0.11 %
	0.0062	0.0225	0.0632	0.0168	0.1700
13	0.00 %	0.02 %	0.06 %	0.01 %	0.12 %
	0.0038	0.0192	0.0564	0.0069	0.1901
14	0.17 %	0.90 %	2.53 %	0.42 %	4.85 %
	0.1487	0.7509	2.2085	0.2710	7.4412
15	0.02 %	0.10 %	0.37 %	0.04 %	1.44 %
	0.0150	0.0809	0.3202	0.0270	2.2076
16	0.43 %	2.47 %	9.87 %	1.05 %	44.50 %
	0.3782	2.0656	8.6218	0.6821	68.2934
17	4.13 %	0.26 %	0.15 %	0.22 %	0.07 %
	3.6594	0.2139	0.1318	0.1437	0.1089
18	9.16 %	0.85 %	0.51 %	0.75 %	0.24 %
	8.1116	0.7118	0.4461	0.4857	0.3688
19	0.20 %	0.04 %	0.03 %	0.04 %	0.01 %
	0.1740	0.0336	0.0239	0.0249	0.0189
20	0.82 %	0.09 %	0.05 %	0.08 %	0.03 %
	0.7218	0.0734	0.0485	0.0506	0.0385
21	0.95 %	0.09 %	0.05 %	0.08 %	0.03 %
	0.8392	0.0745	0.0467	0.0508	0.0386
22	1.01 %	0.09 %	0.06 %	0.08 %	0.03 %
	0.8900	0.0790	0.0496	0.0539	0.0410
23	0.29 %	0.03 %	0.02 %	0.03 %	0.01 %
	0.2547	0.0242	0.0152	0.0166	0.0126
24	0.68 %	0.07 %	0.04 %	0.07 %	0.02 %
	0.6054	0.0610	0.0389	0.0423	0.0322
25	0.20 %	0.02 %	0.01 %	0.02 %	0.01 %
	0.1752	0.0164	0.0105	0.0114	0.0086
26	3.32 %	0.21 %	0.12 %	0.18 %	0.06 %
	2.9382	0.1717	0.1028	0.1154	0.0874
27	0.37 %	0.04 %	0.02 %	0.04 %	0.01 %
	0.3313	0.0331	0.0209	0.0228	0.0173
28	0.05 %	0.09 %	0.07 %	0.10 %	0.03 %
	0.0451	0.0788	0.0616	0.0641	0.0516
29	0.77 %	0.17 %	0.12 %	0.18 %	0.06 %
	0.6787	0.1559	0.1067	0.1192	0.0926
30	0.04 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0331	0.0088	0.0074	0.0070	0.0064
31	0.99 %	0.07 %	0.04 %	0.07 %	0.02 %
	0.8771	0.0599	0.0383	0.0438	0.0349
32	1.62 %	0.12 %	0.07 %	0.11 %	0.04 %
	1.4318	0.1001	0.0641	0.0732	0.0584
33	0.15 %	0.02 %	0.01 %	0.02 %	0.01 %
	0.1342	0.0197	0.0130	0.0144	0.0118
34	0.06 %	4.71 %	0.29 %	0.19 %	0.20 %
	0.0503	3.9447	0.2555	0.1251	0.3085
35	0.06 %	4.71 %	0.29 %	0.19 %	0.20 %
	0.0503	3.9447	0.2555	0.1251	0.3085
36	0.02 %	0.66 %	0.09 %	0.06 %	0.06 %
	0.0158	0.5515	0.0750	0.0402	0.0853
37	1.22 %	0.08 %	0.04 %	0.06 %	0.02 %
	1.0766	0.0643	0.0357	0.0418	0.0318
38	0.48 %	0.20 %	0.11 %	0.20 %	0.05 %
	0.4261	0.1702	0.1000	0.1321	0.0779
39	0.31 %	0.40 %	0.16 %	0.49 %	0.11 %
	0.2773	0.3336	0.1425	0.3138	0.1672
40	0.12 %	0.27 %	0.12 %	0.42 %	0.07 %
	0.1076	0.2297	0.1071	0.2720	0.1009
41	1.03 %	0.13 %	0.07 %	0.11 %	0.05 %
	0.9111	0.1105	0.0649	0.0717	0.0704
42	2.33 %	0.72 %	0.33 %	0.51 %	0.20 %
	2.0645	0.5987	0.2851	0.3325	0.3009

FORT DODGE, IOWA 1977 PARTICULATE MODELING JUNE 1978

SOURCE CONTRIBUTIONS TO FIVE SELECTED RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

SOURCE	RECEPTOR 226	RECEPTOR 227	RECEPTOR 235	RECEPTOR 117	RECEPTOR 142
43	0.50 %	0.86 %	0.33 %	0.54 %	0.15 %
	0.4446	0.7235	0.2893	0.3478	0.2318
44	0.24 %	1.07 %	0.30 %	0.56 %	0.18 %
	0.2083	0.8985	0.2628	0.3625	0.2766
45	0.35 %	0.10 %	0.07 %	0.07 %	0.03 %
	0.3058	0.0811	0.0603	0.0426	0.0507
46	0.45 %	0.24 %	0.17 %	0.18 %	0.08 %
	[illegible]	0.1969	0.1484	0.1187	0.1197
47	0.37 %	0.67 %	0.29 %	0.31 %	0.15 %
	0.3267	0.5578	0.2589	0.1990	0.2336
48	0.20 %	2.68 %	0.40 %	0.39 %	0.19 %
	0.1740	2.2461	0.3460	0.2528	0.2989
49	0.06 %	0.07 %	0.06 %	0.05 %	0.03 %
	0.0501	0.0598	0.0528	0.0291	0.0451
50	0.09 %	0.42 %	0.27 %	0.15 %	0.10 %
	0.0839	0.3481	0.2355	0.0948	0.1464
51	0.68 %	0.75 %	0.56 %	0.61 %	0.26 %
	0.6056	0.6281	0.4923	0.3931	0.4047
52	0.37 %	0.81 %	1.03 %	0.55 %	0.50 %
	0.3301	0.6804	0.9027	0.3562	0.7610
53	0.46 %	1.20 %	3.61 %	0.89 %	1.55 %
	0.4110	1.0072	3.1515	0.5727	2.3773
54	0.05 %	0.34 %	0.09 %	0.14 %	0.06 %
	0.0464	0.2873	0.0765	0.0882	0.0923
55	0.14 %	0.18 %	0.11 %	0.35 %	0.06 %
	0.1258	0.1496	0.1080	0.2291	0.0996
56	0.24 %	0.14 %	0.10 %	0.18 %	0.05 %
	0.2161	0.1182	0.0973	0.1172	0.0769
57	0.18 %	0.14 %	0.15 %	0.15 %	0.08 %
	0.1563	0.1181	0.1308	0.0998	0.1172
58	0.20 %	0.12 %	0.13 %	0.14 %	0.07 %
	0.1774	0.1022	0.1099	0.0932	0.1002
59	0.08 %	0.16 %	0.21 %	0.16 %	0.11 %
	0.0725	0.1371	0.1853	0.1028	0.1696
60	0.07 %	0.13 %	0.11 %	0.16 %	0.21 %
	0.0627	0.1063	0.0961	0.1037	0.3216
61	0.02 %	0.02 %	0.02 %	0.03 %	0.01 %
	0.0174	0.0171	0.0172	0.0165	0.0170
62	0.02 %	0.02 %	0.02 %	0.02 %	0.01 %
	0.0149	0.0142	0.0143	0.0137	0.0142
63	0.01 %	0.01 %	0.01 %	0.01 %	0.00 %
	0.0063	0.0067	0.0068	0.0064	0.0067
64	0.27 %	0.40 %	0.46 %	0.40 %	0.25 %
	0.2380	0.3324	0.3988	0.2557	0.3868
65	0.22 %	0.24 %	0.23 %	0.26 %	0.12 %
	0.1971	0.1990	0.2024	0.1657	0.1809
66	0.34 %	0.25 %	0.21 %	0.32 %	0.11 %
	0.3006	0.2098	0.1847	0.2096	0.1727
67	0.12 %	0.11 %	0.09 %	0.10 %	0.05 %
	0.1064	0.0887	0.0828	0.0670	0.0803
68	0.30 %	0.99 %	1.58 %	0.65 %	1.74 %
	0.2678	0.8503	1.3853	0.4178	2.6761
69	0.19 %	0.70 %	1.65 %	0.29 %	0.52 %
	0.1706	0.5876	1.4430	0.1869	0.8028
70	0.14 %	0.33 %	0.29 %	0.21 %	0.12 %
	0.1209	0.2792	0.2544	0.1378	0.1853
71	0.03 %	0.02 %	0.01 %	0.05 %	0.01 %
	0.0238	0.0171	0.0114	0.0346	0.0111
BACK-	61.01 %	64.52 %	61.82 %	83.47 %	35.18 %
GROUND	54.	54.	54.	54.	54.
TOTAL	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %
	88.5417	83.7272	87.3782	64.6934	153.5112