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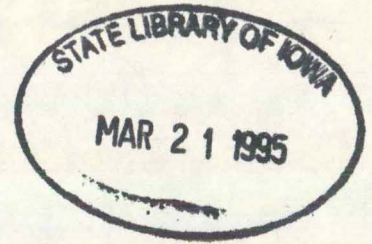
THE UNIVERSITY OF IOWA

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AIR QUALITY SURVEY
SIOUX CITY, IOWA

May 1-12, 1972

#72-68

Report on the
Air Quality in Sioux City during
a Twelve-Day Period in May

By

P D Larson

K H Schultz

Chemist, Air Pollution Section

Air Pollution Technician



Submitted to the Iowa Air Pollution Control Commission by the
State Hygienic Laboratory
13 July 1972

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SIoux CITY AIR QUALITY SURVEY

On 1 May 1972, the mobile air pollution control laboratory, operated by personnel of the State Hygienic Laboratory, was taken to Sioux City for a short-term, ambient air quality survey. Air samples were taken within the capabilities of the laboratory and limitations imposed by power and parking space requirements. The survey was conducted during a twelve-day period from 1 May through 12 May 1972. The sites were chosen to be as representative as possible of the general surrounding area, without unduly maximizing or minimizing the effect of any point source of pollution within that area.

Site selections were made with the advice and cooperation of local city officials. Four sites were selected from those utilized during the previous survey that was conducted in November 1968. The first site at John Street represents a residential area. The second site at Sunset Plaza, a shopping center, was located in a residential area. The plaza is adjacent to a heavily traveled street. The third site at City Hall, is centered in a commercial area. The fourth site was at the city maintenance garage, in the approximate center of an industrial area along the Floyd River channel.

Data from hi-volume sampling for the total survey period, show that suspended particulate levels exceed primary standards on occasion in the Sioux City area. A geometric mean of 110 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) for suspended particulates was obtained during this survey. This value is approximately one and one-half times the primary standard of $75 \mu\text{g}/\text{m}^3$ (annual). This value is typical of the findings in most of the communities surveyed by the mobile laboratory. At City Hall, one 24-hour sample of $348 \mu\text{g}/\text{m}^3$ was 30% greater than the individual 24-hour, primary standard of $260 \mu\text{g}/\text{m}^3$ (not to be exceeded more than once per year). Although the sampling location at the City Garage was close to two asphalt batching operations, the wind was in the opposite direction during the sampling period, so consequently the values obtained do not relate to the asphalt plant emissions.

Coefficient of haze (COH) data correlated with hi-volume sampling results for suspended particulates. The geometric mean of 0.15 COH is well below the St Louis standard of 0.4 COH per 1,000 lineal feet, which is used for comparison purposes, since there are no established Federal or Iowa standards. COH values show the same trends as the hi-volume samples, but since smaller particle sizes are measured by this method, it is possible for the averages to be

relatively lower than the hi-volume results when compared to the standards. The sampler for COH was inoperative at the City Garage.

Sulfur dioxide was not detected during the course of the survey. Minimal combustion of fossil fuels at this time of year, combined with the variable wind speeds and directions, would probably disperse any sulfur dioxide which may have been emitted. These two factors precluded the detection of SO₂ at the sampling sites.

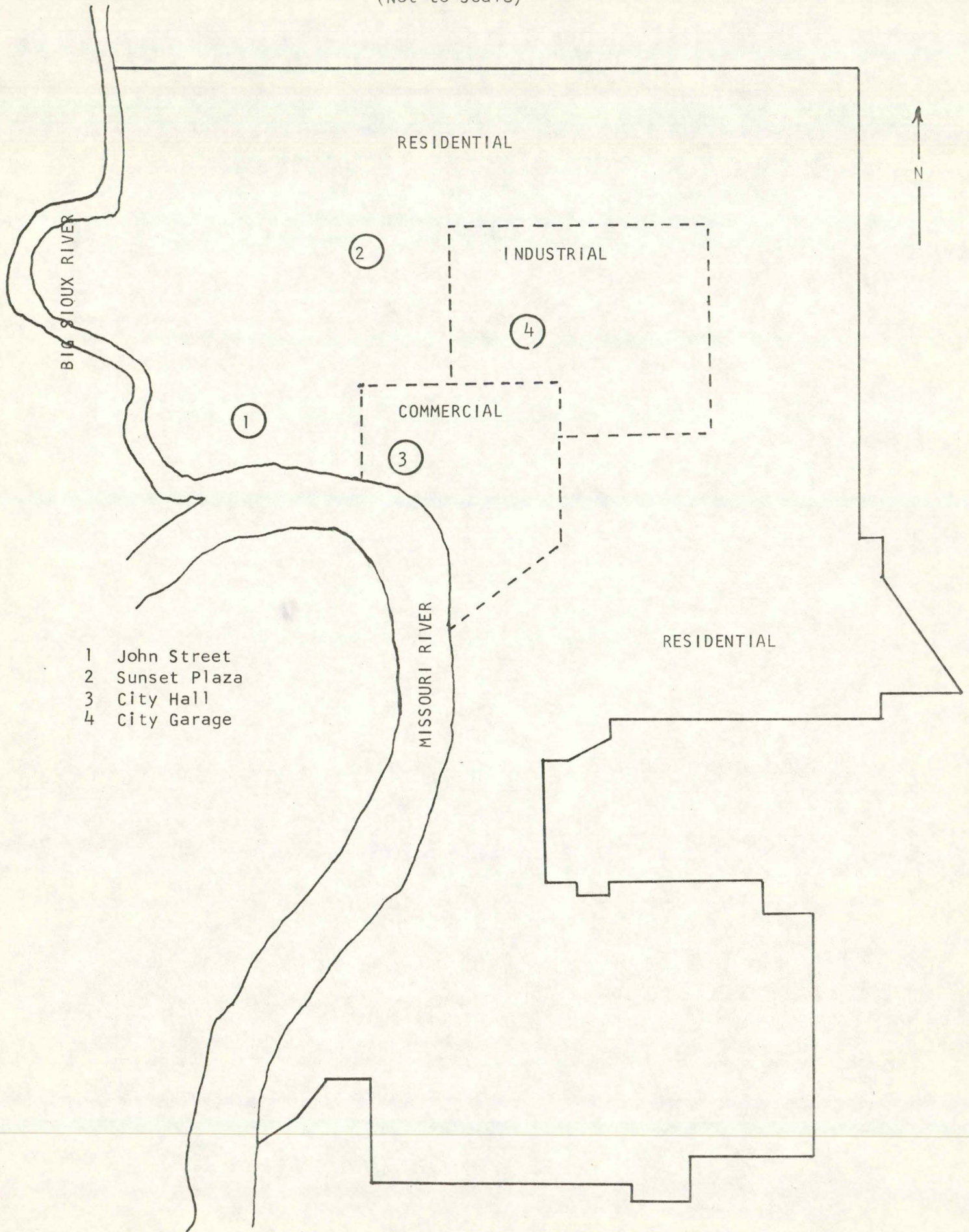
Carbon monoxide (CO) data were within expected ranges, with higher values being obtained in the downtown commercial area and near major traffic arteries. Significant 8-hour levels, which exceeded the 8-hour primary standard of 9 parts per million (ppm), were obtained at the downtown location at City Hall. During the majority of this period the winds were calm to light (2 mph or less), resulting in an accumulation of CO, especially during peak traffic periods and while vehicles were waiting for a traffic light change.

In summary, under the existing weather conditions, air quality parameters at each sampling site, with the exception of City Hall, appear to be satisfactorily below the established standards for all pollutants. Subsequent surveys at other times of the year will undoubtedly produce different results.

In the downtown area, the calm meteorological conditions and heavy traffic permitted an accumulation of particulates and carbon monoxide to be in excess of the EPA standards. This indicates a potential problem during periods of calm and stable atmospheric conditions.

This report is not to be considered a comprehensive treatment of the overall air quality in Sioux City, but rather as an evaluation of specific parameters under prevailing conditions that existed during the survey period.

js



- 1 John Street
- 2 Sunset Plaza
- 3 City Hall
- 4 City Garage

NATIONAL PRIMARY AND SECONDARY
AMBIENT AIR QUALITY STANDARDS

Sulfur Oxides (primary)

- a. $80 \mu\text{g}/\text{m}^3$ (0.03 ppm) - annual arithmetic mean
- b. $365 \mu\text{g}/\text{m}^3$ (0.14 ppm) - maximum 24-hour concentration not to be exceeded more than once per year

Sulfur Oxides (secondary)

- a. $60 \mu\text{g}/\text{m}^3$ (0.02 ppm) - annual arithmetic mean
- b. $260 \mu\text{g}/\text{m}^3$ (0.1 ppm) - maximum 24-hour concentration not to be exceeded more than once per year.
- c. $1,300 \mu\text{g}/\text{m}^3$ (0.5 ppm) - maximum 3-hour concentration not to be exceeded more than once per year.

Particulate Matter (primary)

- a. $75 \mu\text{g}/\text{m}^3$ - annual geometric mean
- b. $260 \mu\text{g}/\text{m}^3$ - maximum 24-hour concentration not to be exceeded more than once per year.

Particulate Matter (secondary)

- a. $60 \mu\text{g}/\text{m}^3$ - annual geometric mean
- b. $150 \mu\text{g}/\text{m}^3$ - maximum 24-hour concentration not to be exceeded more than once per year.

Carbon Monoxide (primary and secondary)

- a. $10 \text{ mg}/\text{m}^3$ (9 ppm) - maximum 8-hour concentration not to be exceeded more than once per year.
- b. $40 \text{ mg}/\text{m}^3$ (35 ppm) - maximum 1-hour concentration not to be exceeded more than once per year.

Primary Standard - level of air quality necessary, with an adequate margin of safety, to protect the public health.

Secondary Standard - levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

SUSPENDED PARTICULATES
24-Hour Samples

<u>DATE</u>	<u>LOCATION</u>	<u>SUSPENDED PARTICULATE ($\mu\text{g}/\text{m}^3$)</u>
5/1/72	John St & Highland Ave	49.5
5/2/72	(Lyons Park)	114
5/3/72		106 (14 $\frac{1}{2}$ -hr sample)
5/4/72	Sunset Plaza	89.4
5/5/72		118
5/8/72	City Hall	348
5/9/72		102
5/10/72	City Garage	104
5/11/72		102 (16-hour sample)

ARITHMETIC MEAN 126
GEOMETRIC MEAN 110

Particulate Matter (primary)

- a. $75 \mu\text{g}/\text{m}^3$ - annual geometric mean
- b. $260 \mu\text{g}/\text{m}^3$ - maximum 24-hour concentration not to be exceeded more than once per year.

Particulate Matter (secondary)

- a. $60 \mu\text{g}/\text{m}^3$ - annual geometric mean
- b. $150 \mu\text{g}/\text{m}^3$ - maximum 24-hour concentration not to be exceeded more than once per year.

COEFFICIENT OF HAZE

COH Values - 2-hour Samples

<u>DATE</u>	<u>LOCATION</u>	<u>TIME</u>	<u>COH</u>
5/1/72	John Street	2000-2200	0.16
		-2400	0.08
		AVG	0.12
5/2/72	John Street	0001-0200	0.0
		-0400	0.08
		-0600	0.04
		-0800	0.12
		-1000	0.12
		-1200	0.16
		-1400	0.12
		-1600	0.04
		-1800	0.08
		-2000	0.08
		-2200	0.08
		-2400	0.04
AVG	0.08		
5/3/72	John Street	0001-0200	0.12
		-0400	0.08
		-0600	0.04
		-0800	0.40
		-1000	0.12
		-1200	0.12
		-1400	0.04
		-1600	0.08
		-1800	0.16
		-2000	0.12
		-2200	0.24
		-2400	0.16
AVG	0.14		
5/4/72	John Street	0001-0200	0.12
		-0400	0.12
		-0600	0.32
		-0800	0.24
		-1000	0.08
		-1100	0.08
AVG	0.16		

<u>DATE</u>	<u>LOCATION</u>	<u>TIME</u>	<u>COH</u>
5/4/72	Sunset Plaza	1200-1400	0.12
		-1600	0.04
		-1800	0.12
		-2000	0.20
		-2200	0.20
		-2400	0.12
		AVG	0.13
5/5/72	Sunset Plaza	0001-0200	0.12
		-0400	0.08
		-0600	0.04
		-0800	0.20
		-1000	0.28
		-1200	0.20
		-1400	0.24
		-1600	0.20
		-1800	0.16
		-2000	0.28
		-2200	0.28
		-2400	0.12
		AVG	0.18
5/6/72	Sunset Plaza	0001-0200	0.04
		-0400	0.04
		-0600	0.08
		-0800	0.0
		-1000	0.04
		-1200	0.16
		-1400	0.12
		-1600	0.16
		-1800	0.08
		-2000	0.12
		-2200	0.08
		-2400	0.12
		AVG	0.09
5/7/72	Sunset Plaza	0001-0200	0.08
		-0400	0.04
		-0600	0.04
		-0800	0.0
		-1000	0.04
		-1200	0.0
		-1400	0.04
		-1600	0.12
		-1800	0.08

<u>DATE</u>	<u>LOCATION</u>	<u>TIME</u>	<u>COH</u>
5/7/72	Sunset Plaza	1800-2000	0.16
		-2200	0.12
		-2400	0.12
		AVG	0.07
5/8/72	Sunset Plaza	0001-0200	0.04
		-0400	0.08
		-0600	0.04
		-0800	0.12
		-1000	0.12
		-1200	0.16
		-1400	0.16
		AVG	0.10
5/8/72	City Hall	1600-1800	0.53
		-2000	0.32
		-2200	0.24
		-2400	0.24
AVG	0.33		
5/9/72	City Hall	0001-0200	0.24
		-0400	0.20
		-0600	0.20
		-0800	0.95
		-1000	0.69
		-1200	0.32
		-1400	0.36
		-1600	0.40
		-1800	0.28
		-2000	0.20
		-2200	0.69
		-2400	0.57
		AVG	0.42
5/10/72	City Hall	0001-0200	0.40
		-0400	0.28
		-0600	0.20
		-0800	0.16
		-1000	0.20
		-1200	0.16
AVG	0.23		
Average COH for Survey		0.17	
Geometric mean for Survey		0.15	

Soiling Index

St Louis 0.4 COH/1000 lineal feet, annual geometric mean

CARBON MONOXIDE
SIOUX CITY

(Values in Parts per Million)

DATE	LOCATION	TIME	PEAK	AVERAGE MAXIMUM CONCENTRATION	
				1 Hour	8 Hours
5/1/72	John Street & Highland Ave (Lyons Park)	0001-2400	Instrument Malfunction		
5/2/72		1100-1200	9	2	
		-1300	4	2	
		-1400	5	2	
		-1500	8	3	
		-1600	16	5	
		-1700	17	5	
		-1800	20	4	
		-1900	7	4	3.4
		-2000	25	4	3.6
		-2100	12	4	3.9
		-2200	7	3	3.9
		-2300	6	3	3.6
		-2400	6	3	3.4
5/3/72		0001-0100	17	2	2.9
		-0200	8	2	3.1
		-0300	2	1	2.8
		-0400	4	1	2.4
		-0500	1	0.5	1.9
		-0600	21	1	1.7
		-0700	20	4	1.8
		-0800	11	3	1.9
		-0900	5	2	1.9
		-1000	6	1	1.8
		-1100	2	1	1.8
		-1200	5	3	1.9
		-1300	5	3	2.2
		-1400	7	3	2.5
		-1500	6	3	2.4
		-1600	5	2	2.2
		-1700	6	3	2.4
		-1800	4	2	2.5
		-1900	10	4	2.9
		-2000	18	4	3.0
		-2100	11	4	3.1
		-2200	6	3	3.1
		-2300	6	2	3.0
		-2400	5	2	3.0
5/4/72		0001-0100	7	2	2.9
		-0200	4	2	2.9
		-0300	7	2	2.6

AVERAGE
MAXIMUM CONCENTRATION

<u>DATE</u>	<u>LOCATION</u>	<u>TIME</u>	<u>PEAK</u>	<u>1 Hour</u>	<u>8 Hours</u>		
5/4/72	John Street & Highland Ave	0300-0400	3	2	2.4		
		-0500	9	2	2.1		
		-0600	5	2	2.0		
		-0700	12	4	2.2		
		-0800	25	5	2.6		
		-0900	9	3	2.8		
		-1000	20	6	3.2		
		-1100	13	3	3.4		
		-1200	--	--	---		
		5/4/72	Sunset Plaza	1200-1300	6	3	
-1400	7			3			
-1500	6			2			
-1600	8			3			
-1700	7			3			
-1800	6			2			
-1900	10			2			
-2000	7			2	2.5		
-2100	25			3	2.5		
-2200	7			3	2.5		
-2300	3			2	2.5		
-2400	4			1	2.2		
5/5/72				0001-0100	4	1	2.0
				-0200	3	1	1.9
		-0300	3	1	1.8		
		-0400	1	1	1.6		
		-0500	1	1	1.4		
		-0600	3	1	1.1		
		-0700	4	2	1.1		
		-0800	7	4	1.5		
		-0900	9	5	2.0		
		-1000	8	4	2.4		
		-1100	12	5	2.9		
		-1200	7	4	3.2		
		-1300	7	4	3.6		
		-1400	8	4	4.0		
		-1500	8	4	4.2		
		-1600	13	3	4.1		
		-1700	8	5	4.1		
		-1800	12	5	4.2		
		-1900	12	6	4.4		
		-2000	11	6	4.6		
-2100	20	9	5.2				
-2200	16	6	5.5				
-2300	8	4	5.5				
-2400	15	4	5.6				
5/6/72		0001-0100	7	3	5.4		
		-0200	10	3	5.1		
		-0300	8	3	4.8		

AVERAGE
MAXIMUM CONCENTRATION

<u>DATE</u>	<u>LOCATION</u>	<u>TIME</u>	<u>PEAK</u>	<u>1 Hour</u>	<u>8 Hours</u>		
5/6/72	Sunset Plaza	0300-0400	3	2	4.2		
		-0500	7	2	3.4		
		-0600	2	1	2.8		
		-0700	2	1	2.4		
		-0800	3	1	2.0		
		-0900	4	1	1.8		
		-1000	5	2	1.6		
		-1100	8	1	1.4		
		-1200	10	3	1.5		
		-1300	7	2	1.5		
		-1400	6	2	1.6		
		-1500	8	2	1.8		
		-1600	9	2	1.9		
		-1700	11	3	2.0		
		-1800	9	2	2.0		
		-1900	4	1	2.0		
		-2000	6	1	1.8		
		-2100	7	1	1.6		
		-2200	9	2	1.6		
		-2300	5	1	1.6		
		-2400	14	2	1.6		
		5/7/72		0001-0100	6	1	1.4
				-0200	7	1	1.2
				-0300	3	1	1.2
-0400	3			1	1.2		
-0500	2			1	1.2		
-0600	2			1	1.1		
-0700	1			1	1.1		
-0800	3			1	1.0		
-0900	3			1	1.0		
-1000	4			1	1.0		
-1100	2			1	1.0		
-1200	3			1	1.0		
-1300	8			2	1.1		
-1400	4			1	1.1		
-1500	7			2	1.2		
-1600	9			2	1.4		
-1700	8			2	1.5		
-1800	4			3	1.8		
-1900	6			2	1.9		
-2000	4			1	1.8		
-2100	9			2	1.9		
-2200	3			1	1.9		
-2300	4			1	1.8		
-2400	10			2	1.8		
5/8/72		0001-0100	3	1	1.6		
		-0200	1	1	1.4		
		-0300	4	1	1.2		
		-0400	1	1	1.2		
		-0500	3	1	1.1		

AVERAGE
MAXIMUM CONCENTRATION

<u>DATE</u>	<u>LOCATION</u>	<u>TIME</u>	<u>PEAK</u>	<u>1 Hour</u>	<u>8 Hours</u>		
5/8/72	Sunset Plaza	0500-0600	1	1	1.1		
		-0700	5	2	1.2		
		-0800	5	2	1.2		
		-0900	6	2	1.4		
		-1000	3	2	1.5		
		-1100	3	2	1.6		
		-1200	4	2	1.8		
		-1300	3	1	1.8		
		-1400	3	2	1.9		
		-1500	--	--	---		
		5/8/72	City Hall (6th & Douglas)	1500-1600	32	15	
-1700	43			18			
-1800	37			14			
-1900	29			8			
-2000	18			8			
-2100	17			7			
-2200	27			11			
-2300	18			5	10.8		
-2400	12			4	9.4		
5/9/72				0001-0100	10	4	7.6
				-0200	6	3	6.2
		-0300	17	3	5.6		
		-0400	12	3	5.0		
		-0500	5	3	4.5		
		-0600	6	4	3.6		
		-0700	11	6	3.8		
		-0800	49	12	4.8		
		-0900	51	14	6.0		
		-1000	41	10	6.9		
		-1100	57	15	8.4		
		-1200	37	10	9.2		
		-1300	36	10	10.1		
		-1400	52	12	11.1		
		-1500	41	13	12.0		
		-1600	82	19	12.5		
		-1700	48	19	13.5		
		-1800	49	14	14.0		
		-1900	19	5	12.8		
		-2000	70	9	12.6		
		-2100	24	7	12.2		
-2200	48	9	11.9				
-2300	62	8	11.2				
-2400	11	7	9.8				
5/10/72		0001-0100	7	5	8.0		
		-0200	10	4	6.8		
		-0300	85	3	6.5		
		-0400	8	4	5.9		
		-0500	5	2	5.2		
		-0600	7	3	4.5		

AVERAGE
MAXIMUM CONCENTRATION

<u>DATE</u>	<u>LOCATION</u>	<u>TIME</u>	<u>PEAK</u>	<u>1 Hour</u>	<u>8 Hours</u>		
5/10/72	City Hall	0600-0700	14	3	3.9		
		-0800	11	5	3.6		
		-0900	13	4	3.5		
		-1000	9	3	3.4		
		-1100	11	3	3.4		
		-1200	7	3	3.2		
		-1300	--	--	---		
		5/10/72	City Garage	1300-1400	2	1	
-1500	7			3			
-1600	4			2			
-1700	12			3			
-1800	6			4			
-1900	17			4			
-2000	5			4			
-2100	5			3	3.0		
-2200	17			5	3.5		
-2300	7			4	3.6		
-2400	14			4	3.9		
5/11/72				0001-0100	20	5	4.1
				-0200	15	5	4.2
		-0300	21	6	4.5		
		-0400	21	6	4.8		
		-0500	7	4	4.9		
		-0600	6	4	4.8		
		-0700	6	4	4.8		
		-0800	6	4	4.8		
		-0900	14	5	4.8		
		-1000	14	4	4.6		
		-1100	10	4	4.4		
		-1200	5	3	4.0		
		-1300	7	5	4.1		
		-1400	6	5	4.2		
		-1500	3	2	4.0		
		-1600	4	2	3.8		
		-1700	2	1	3.2		
		-1800	8	2	3.0		
		-1900	Instrument Malfunction				
		-2000					
		-2100	6	4	---		
		-2200	5	4	---		
		-2300	5	4	---		
-2400	5	4	---				
5/12/72		0001-0100	5	3	---		
		-0200	4	3	---		
		-0300	4	3	---		

<u>DATE</u>	<u>LOCATION</u>	<u>TIME</u>	<u>PEAK</u>	AVERAGE MAXIMUM CONCENTRATION	
				<u>1 Hour</u>	<u>8 Hours</u>
5/12/72	City Garage	0300-0400	9	4	3.6
		-0500	5	3	3.5
		-0600	10	4	3.5
		-0700	12	4	3.5

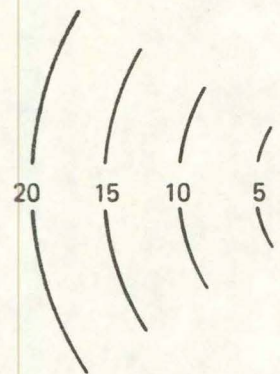
Carbon monoxide (primary and secondary)

- a. 10 mg/m³ (9 ppm) - maximum 8-hour concentration not to be exceeded more than once per year.
- b. 40 mg/m³ (35 ppm) - maximum 1-hour concentration not to be exceeded more than once per year.

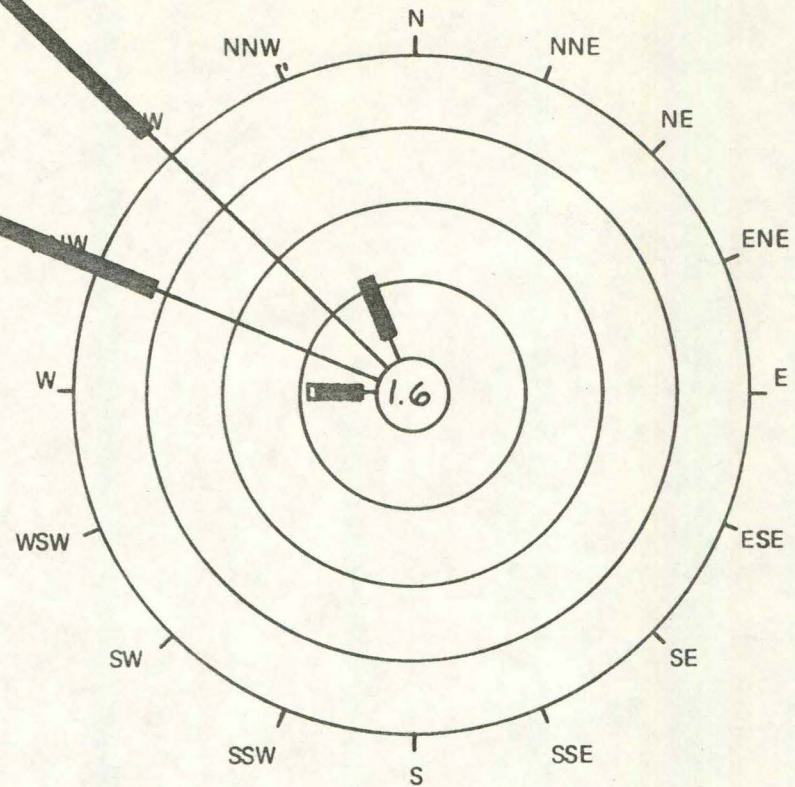
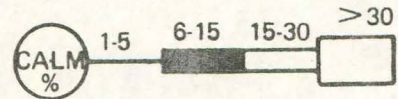
DATE 5/1-4/72

CITY Sioux City

LOCATION John Street



SCALE

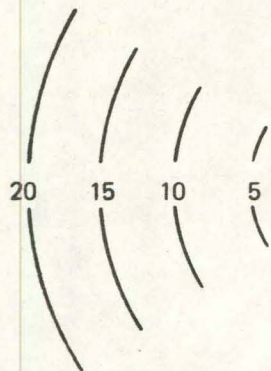


SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL	
1-5.9													1.0	17.	22.	1.6	42.4	
6-14.9													3.0	16.	26.	4.0	48.8	
15-29.9													.4	3.6	3.2		7.2	
>30																		
TOTAL													4.4	36.6	51.2	5.6	98.4	
																	MISSING	0.0
																	CALM	1.6
																	TOTAL	100.0

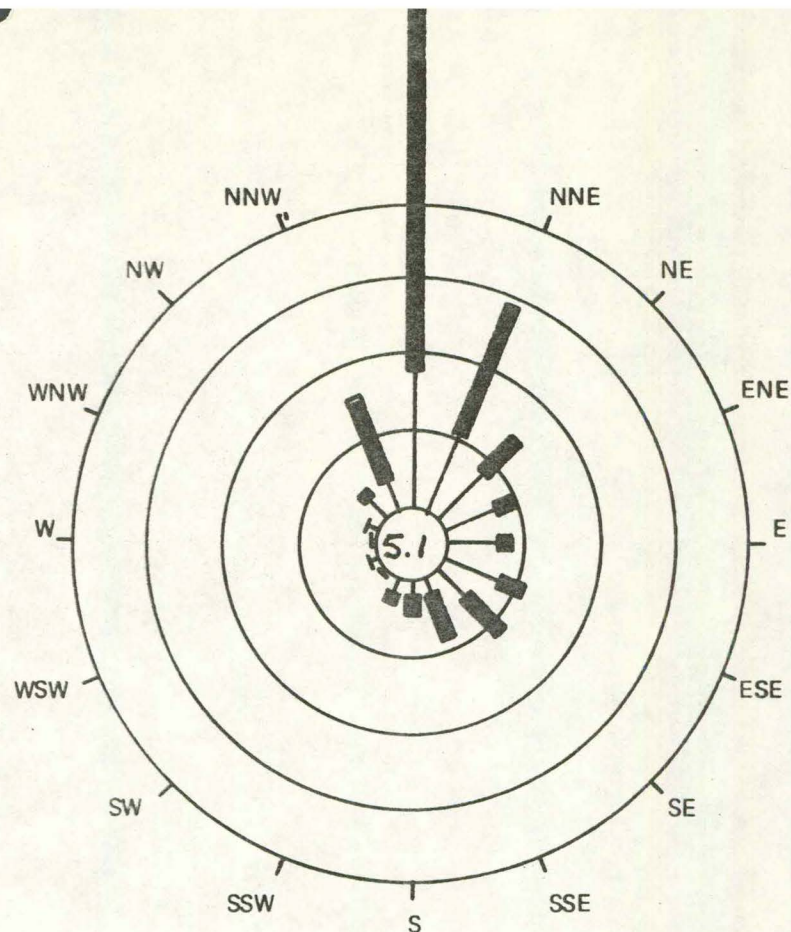
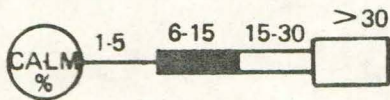
DATE 5/4-8/72

CITY Sioux City

LOCATION Sunset Plaza



SCALE

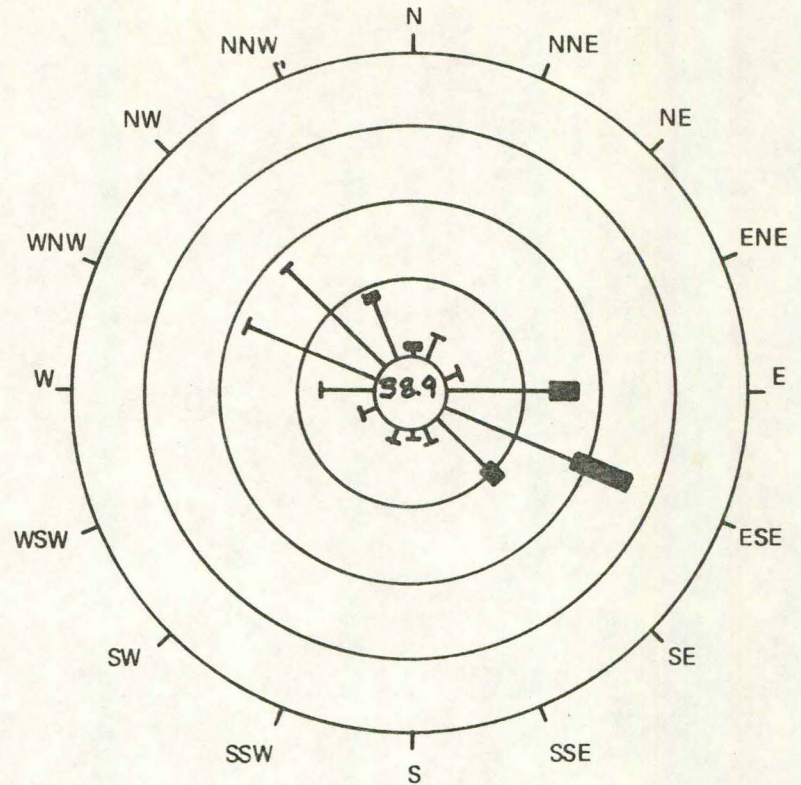
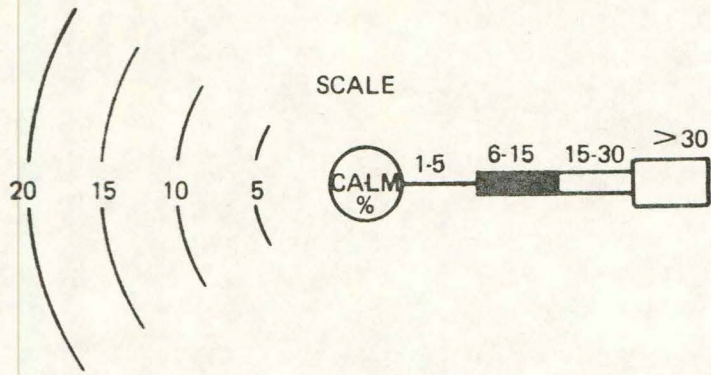


SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL	
1-5.9	8.6	5.3	4.1	3.5	3.3	3.8	2.5	1.0	0.8	1.0	0.3	0.5	0.3	0.8	1.6	1.8	39.1	
6-14.9	24.4	9.1	3.3	1.3	0.8	1.8	3.3	3.1	1.3	0.8					0.5	5.6	55	
15-29.9	0.5															0.3	0.8	
>30																		
TOTAL	33.5	14.4	7.4	4.8	4.1	5.6	5.8	4.1	2.1	1.8	0.3	0.5	0.3	0.8	2.1	7.7	94.9	
																	MISSING	0.0
																	CALM	5.1
																	TOTAL	100.0

DATE 5/8-10/72

CITY Sioux City

LOCATION City Hall

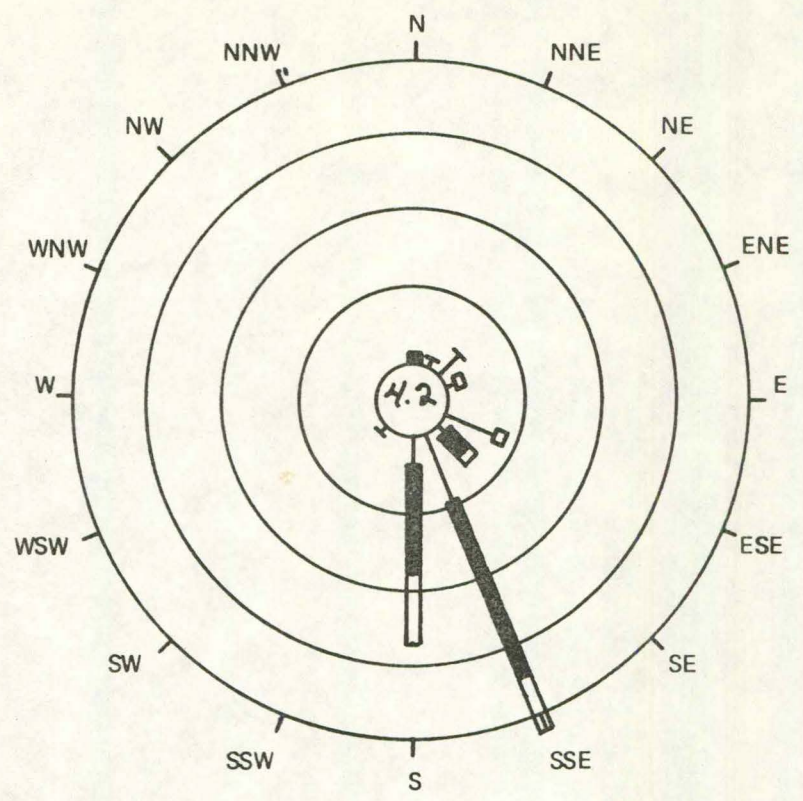
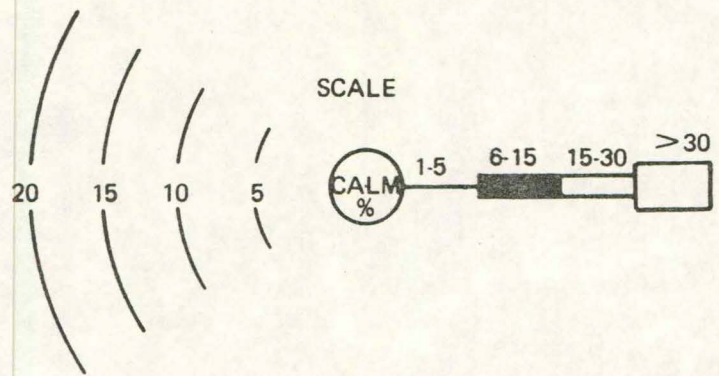


SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL	
1-5.9	0.5	1.7		1.1	6.8	9.0	4.5	1.1	0.5	1.1		1.1	3.4	9.0	9.0	3.9	53.2	
6-14.9	0.5				1.7	3.9	1.1									0.5	7.9	
15-29.9																		
>30																		
TOTAL	1.1	1.7		1.1	8.5	12.9	5.6	1.1	0.5	1.1		1.1	3.4	9.0	9.0	4.5	61.1	
																	MISSING	0.0
																	CALM	38.9
																	TOTAL	100.0

DATE 5/10-12/72

CITY Sioux City

LOCATION City Garage



SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL	
1-5.9		0.6	1.8	0.6		3.5	0.6	4.7	1.8		0.6						14.2	
6-14.9	0.6						1.8	12.4	7.1								21.9	
15-29.9						0.6	0.6	4.1	4.7								10.6	
>30																		
TOTAL	0.6	0.6	1.8	1.2		4.1	3.0	21.2	13.6		0.6						46.7	
																	MISSING	49.1
																	CALM	4.2
																	TOTAL	100.0