United States
Environmental Protection
Agency

Air and Hazardous
Materials Division
230 South Dearborn Street
Chicago, Illinois 60604

EPA 905/4-80-007
October 1980

Region V

EPA

Interregional TSP Study For The Steubenville-Weirton-Wheeling Interstate Air Quality Control Region

GCA-TR-80-53-G

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Research Triangle Park, NC 27711

Contract No. 68-02-2539
Task Order No. 9

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INTERREGIONAL TSP STUDY FOR THE STEUBENVILLE-WEIRTON-WHEELING INTERSTATE AQCR

Final Report

October 1980

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DISCLAIMER

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ABSTRACT

The objective of this effort is to assist the states of Ohio and West Virginia in defining the causes of nonattainment of TSP standards in the Steubenville-Weirton-Wheeling Interstate AQCR. This effort was carried out using microinventories, microscopic and chemical analysis, meteorological studies, and dispersion modeling.

The conclusion of this study is that 24-hour violations of the NAAQS for suspended particulates often occur as a result of emissions from a specific plant or plants; bringing these plants into compliance with existing regulations should result in attainment of the short-term secondary standard. Attainment of the annual primary standard, however, is not likely to occur based only on enforcement of existing regulations. Control of fugitive emissions and fugitive dust, in addition to compliance of point source stack emissions, is required to meet the annual NAAQS.

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ACKNOWLEDGMENTS

GCA would like to acknowledge the support provided by John Paskevicz and Jim Phillips of EPA Region V and Bill Belanger of EPA Region III, as well as the state and local agencies responsible for air quality in the valley. The microscopic analysis was performed by Susan Bianchetti under the direction of Dr. Charles Spooner of GCA and the chemical analyses by Mary Kozik under the direction of Dr. Kenneth McGregor. Gary Hunt provides the summary of organics concentrations.

EXECUTIVE SUMMARY

The Steubenville-Weirton-Wheeling AQCR includes a heavily industrialized section of the Ohio River. Numerous steel mills, coal-fired power plants, and other industrial sources, many of which emit significant quantities of particulate, line the river; the hills that form the valley extend about 500 feet above river level.

This combination of high regional particulate emission plus the poor ventilation normally observed in a valley result in an area with a strong potential to exceed the National Ambient Air Quality Standards (NAAQS) for particulate matter. These standards, which are designed to protect the public health, state that the annual concentration should not exceed 75 $\mu g/m^3$ and that a daily concentration of 260 $\mu g/m^3$ can only be exceeded once per year. Secondary standards set up to protect the public welfare are 150 $\mu g/m^3$ as a 24-hour average, to be exceeded only once per year, and a 60 $\mu g/m^3$ annual guideline which is to be used for assessment of attainment of the short-term standard.

Review of the 1978 air quality data recorded at sites throughout the region indicates that most sites exceed the annual primary standard and that several sites exceed the 24-hour standard. Only East Rochester, which is not located within the valley, was in attainment of all standards.

The purpose of this study is to investigate the causes of nonattainment, in particular, identifying particular sources or source classes that contribute significantly to high observed concentrations.

Throughout the study, reference is made to three general classes of emissions, i.e., point source emissions, fugitive emissions and fugitive dust emissions. Point source emission include gaseous and particulate emissions which are emitted through a primary exhaust system, such as a stack, flue, or control system. An example of this type of emission is the exhaust gases from a coal combustion boiler. Fugitive emissions include both gaseous and particulate emissions that result from industrial related operations and which escape to the atmosphere through windows, doors, vents, etc., but not through a primary exhaust system. Fugitive emissions may result from metallurgical furnace operations, materials handling, transfer and storage operations, and other industrial processes where emissions escape to the atmosphere. Fugitive dust emissions, on the other hand, are generally related to natural or man-associated dusts (particulate only) that become airborne due to the forces of wind, man's activity, or both. Fugitive dust emissions may include windblown particulate matter from unpaved dirt roads, tilled farm lands, exposed surface areas at construction sites, etc. Natural dusts that become airborne during dust storms are also included as fugitive dusts.

SUMMARY OF TASKS

The project was divided into five separate tasks; these were:

- Point Source Inventory Collection
- Site-Specific Microinventory Development
- Chemical and Microscopic Analysis of Hi-Vol Filters
- Meteorological Data Analysis
- Source-Receptor Impact Analysis

The point source inventory was based upon data supplied by the States representative of calendar year 1977. As the base year for air quality and meteorological data is 1978, the inventory was modified to reflect the closing of three facilities during 1977. No further effort was made to reflect 1978 emissions. In general, it was found that the majority of point sources in the valley were out of compliance with emissions regulations, often by a factor of 2 or more. This is true for sources both in Ohio and West Virginia. Review of compliance schedule for the major emitters indicates all should meet point source emissions standards by the end of 1982. In performing this study, a range of emissions bounded by actual and allowable levels was used to evaluate the potential impact of point sources.

These inventories summarize only point source emissions and do not address the fugitive and fugitive dust emissions from facilities in the valley. These latter emissions are generally uninventoried and uncontrolled. Determination of the impact of these emissions so that the effect of regulations can be evaluated is one of the goals of the present study.

Microinventories were developed for 20 monitor sites in the valley. This involved performing a detailed survey within a 1-mile radius of each monitor. Sources of combustion and fugitive emissions were inventoried. An empirical model which can be used to compute the impact of each source on the monitor was applied to the 20 monitors. The results of this procedure indicated that the model was apparently not applicable to an industrialized, rural area. The model had been developed using data from urban areas. The point source submodel of this procedure, however, which is based on a distance-weighed rollback model, was used to estimate the impact on TSP levels of noncompliance with emissions regulations. The results indicated that a 60 to 95 percent reduction in point source impacts would result if all sources were in compliance.

Chemical and microscopic analysis of about 80 hi-vol filters exposed during 1978 was carried out. Microscopically, particles were sized and categorized by phase. The principal phases observed were flyash, coal fragments, soot, iron oxides, minerals, and biologicals. The concentration of various ions and elements was determined using chemical analytical techniques. Data are provided as to the concentrations of arsenic, iron, lead, mercury, vanadium, nitrates, sulfates, chlorides, ammonium, and polycyclic organic matter found on the hi-vol filters. This information is not available for all filters due to sample unavailability and resource limitations.

A meteorological analysis was performed for a total of 30 days during 1978 on which at least one monitor exceeded 150 $\mu g/m^3$. These days were categorized into valleywide, quasi-valleywide, and isolated cases depending upon the number of monitors exceeding the standard. Differences in regional wind patterns were studied on violation days versus nonviolation days in an attempt to identify sources potentially producing high concentrations.

As a final task, the chemical, microscopic, meteorological, and emissions data were applied to a series of monitors which were selected using two criteria. One was that the concentration difference between adjacent monitors be great and the second, that the wind direction be well defined. A total of seven such cases were analyzed.

These case studies generally resulted in one or several facilities in the valley being identified as the cause of high concentrations. When possible, this was confirmed using simple diffusion modeling techniques. In several instances, however, no obvious source could be identified and it was concluded either that the tests used did not detect the critical difference between filters, that an error may have occurred in originally determining the mass of particulate on the filter, or that the particulate on the filter had been physically lost or chemically changed during storage.

CONCLUSIONS

The results of the microscopic and chemical analyses indicated the following average breakdown of particulate type on a filter:

SOURCE CATEGORY IMPACT

Category	Concentration (± Std. Dev.) ($\mu g/m^3$)	Source type
Minerals	30 (±6.9)	Fugitive emissions Fugitive dust
Coal fragments	21 (±6.4)	Fugitive emissions
Iron oxide	8 (±5.5)	Fugitive emissions Point source emissions
Flyash	22 (±4.6)	Point source emissions
Soot	10 (±3.2)	Point source emissions
Sulfates and nitrates[a]	15 (±9.7)	Point source emissions Transport
Other[b]	6	
Total	112	

[a]Adjusted for SO_4 concentration in flyash.

[b]Includes biologicals, glass, burned wood, and tire rubber.

This tally is based on the filter samples used in the upwind-downwind analyses and, thus, do not necessarily represent the average condition. However, the variance in the estimates among the various filters was not great, giving credence for the use of these numbers to generalize. The standard deviation in measured TSP values is 62 $\mu g/m^3$, indicating that a wide range of concentrations are included in the estimate.

The estimated combustion and process source impact (i.e., emissions from stacks) range from 32 $\mu g/m^3$ to about 40 $\mu g/m^3$. Most of the iron oxide is assumed to be process emission due to its small size. Mobile sources are estimated to account for only about 3.4 $\mu g/m^3$ of this total based on average lead concentrations on the filter of 0.3 $\mu g/m^3$. Control of point source emissions (i.e., those from well-defined stacks) down to the allowable level will result in a 50 to 95 percent reduction in emissions; this will result in a reduction of about 22 to 27 $\mu g/m^3$ in average TSP concentrations. Hence, control of point source emissions alone is not expected to be adequate for attainment of the primary annual standard at all sites.

Attainment of the annual standard will require implementation of regulations controlling fugitive dust and fugitive emissions throughout the valley. Much of the "Minerals" category is composed of fine-grained calcite, some portion of which results from industrial processes such as limestone crushing. Coal fragments emitted during pulverizing or entrained from coal piles also represent a significant portion of total particulates observed on the filters. Control of fugitive emissions in these categories will be required to attain the annual standard.

The individual day analyses, however, consistently indicated that exceedance of the secondary 24-hour standard is often caused by the impact of a particular source or sources on a monitor. In the case studies, the sources which apparently caused short-term standards violations included:

- Ohio Edison Sammis Plant/Stratton
- Weirton Steel/Weirton
- Wheeling-Pittsburgh Steel/Mingo Jct.
- Wheeling-Pittsburgh Steel/Yorkville
- Koppers Co./Follansbee
- Ohio Ferro-Alloy/Clarington

Reduction of the emissions from these sources to the allowable levels would often have resulted in the 24-hour secondary standard not being exceeded. This list should not be considered complete due to the limited number of filters studied. It is very likely that further analysis would identify other sources as contributing significantly to short-term standards violations.

RECOMMENDATIONS

The following actions are recommended based on the results of this study:

- Regulations should be developed for the control of fugitive emissions from industrial sources.
- Regulations should be developed for control of fugitive emissions from coal piles and for the prevention of coal pile fires.
- All point sources should be brought into compliance with existing emission limitations.
- Procedures used by local agencies to determine TSP and component concentrations should be audited.

SECTION 1

INTRODUCTION

PURPOSE OF STUDY

The Steubenville-Weirton-Wheeling AQCR includes a heavily industrialized section of the Ohio River. Numerous steel mills, coal-fired power plants, and other industrial sources, many of which emit significant quantities of particulate, line the river; the mountains that form the valley extend about 500 feet above river level.

This combination of high regional particulate emission plus the poor ventilation normally observed in a valley result in an area with a strong potential to exceed the National Ambient Air Quality Standards (NAAQS) for particulate matter. These standards, which are designed to protect the public health, state that the annual concentration should not exceed 75 $\mu g/m^3$ and that a daily concentration of 260 $\mu g/m^3$ can only be exceeded once per year. Secondary standards set up to protect the public welfare are 150 $\mu g/m^3$ as a 24-hour average, to be exceeded only once per year, and a 60 $\mu g/m^3$ annual guideline which is to be used for assessment of attainment of the short-term standard.

Review of the 1978 air quality data recorded at sites throughout the region, those presented in Figure 1, indicate that most sites exceed the annual primary standard and that several sites exceed the 24-hour standard. These data are presented in Table 1. Only East Rochester, which is not located within the valley, was in attainment of all standards.

The purpose of this study is to investigate the causes of nonattainment, in particular, identifying particular sources or source classes that contribute significantly to high observed concentrations.

Collection and analysis of data has involved completion of five tasks. Included is the development of microinventories around 20 monitor sites, performance of chemical and microscopic analysis on selected filters, review of meteorological data, and, finally, summarization of all information into source-receptor relationships.

DATA BASE

Hourly meteorological data for 1978 were collected both from the National Weather Service and from local agency monitors. Data collected at the Greater Pittsburgh Airport were used for all parameters other than winds.

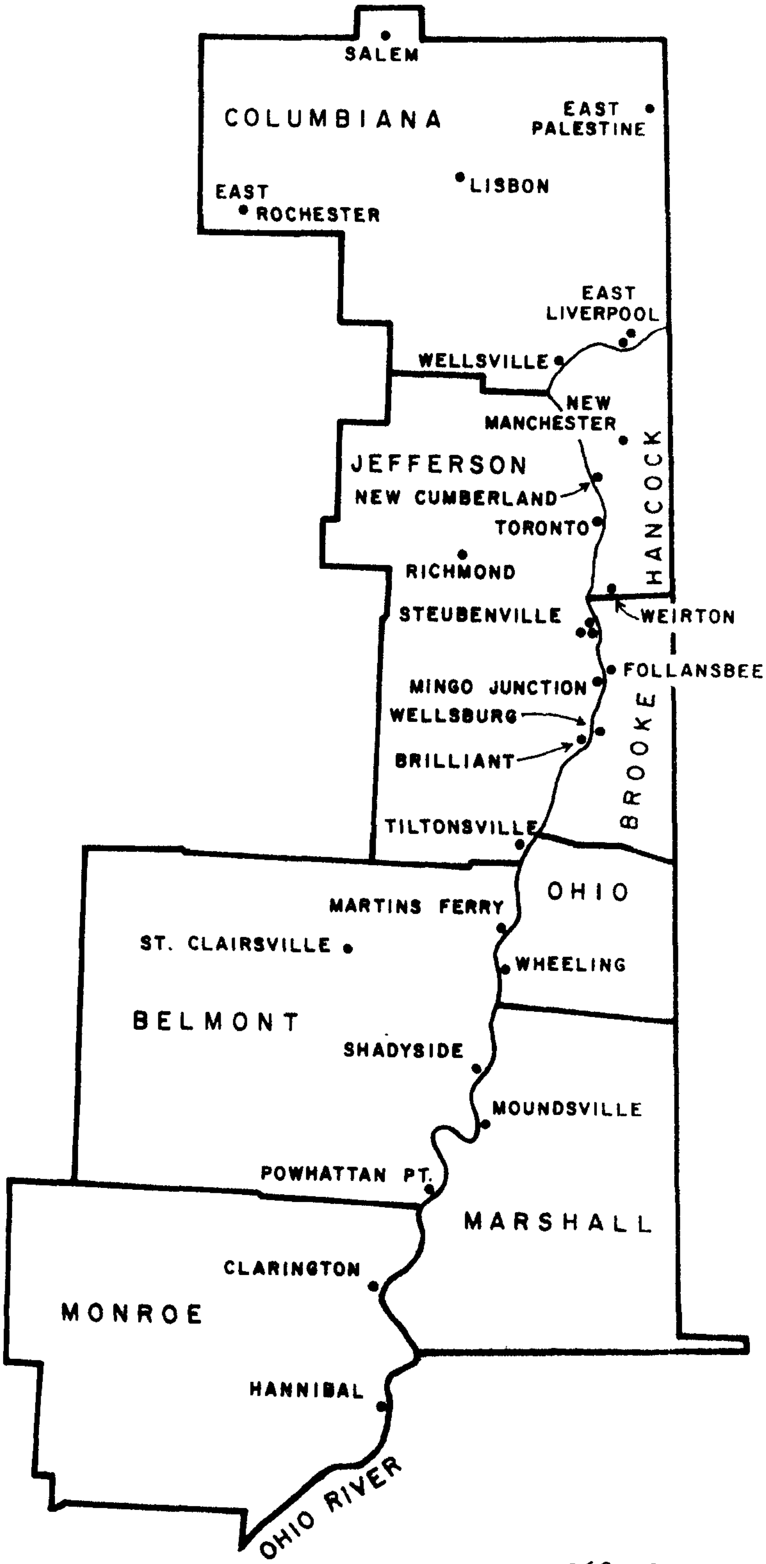

Figure 1. Monitor site locations.

TABLE 1. 1978 TOTAL SUSPENDED PARTICULATE CONCENTRATIONS

Site	Annual ($\mu g/m^3$)	Second highest 24-hour ($\mu g/m^3$)
New Manchester	86	196
New Cumberland	72	193
Weirton	96	208
Follensbee	95	194
Wellsburg	82	211
Moundsville	76	168
East Liverpool Fire	106	279
East Liverpool CH	88	177
Wellsville	94	269
Toronto	-*	211
Steubenville-Jefferson	94	336
Steubenville CH	109	279
Mingo Jct	131	309
Brilliant	75	168
Tiltonsville	77	152
Martins Ferry	76	173
Shadyside	80	152
Powhattan Pt.	97	253
Clarington	83	360
Hannibal	61	206
Salem CH	93	289
Wheeling	77	148
Lisbon	67	152
East Palestine	64	149
East Rochester	50	119
Richmond	70	217
St. Clairsville	59	151

*Site moved in mid-year.

This includes mixing heights, temperature, and the factors used in determining stability class. Wind speed and direction data were available on a sporatic basis from sites in Steubenville, Wellsburg, Weirton, and Wheeling. The Wellsburg data were most often available and were typically used to characterize valley flow.

Ambient particulate data were supplied from the EPA SAROAD system. Filters used for chemical and microscopic analysis were supplied by the responsible local agencies, North Ohio Valley Air Authority and the Northern Panhandle Regional Office of the West Virginia Air Pollution Control Commission.

The emissions data used in the analysis are described in Section 2.

SECTION 2

INVENTORY DEVELOPMENT

The first step in categorizing the relative impact of sources an an area such as the Ohio River Valley is to develop an accurate inventory of emissions. For particulates, this includes categorizing both emissions resulting from fuel combustion and process sources which are emitted through stacks and also fugitive emissions. Throughout the study, reference is made to three general classes of emissions, i.e., point source emissions, fugitive emissions and fugitive dust emissions. Point source emissions include gaseous and particulate emissions which are emitted through a primary exhaust system, such as a stack, flue, or control system. An example of this type of emission is the exhaust gases from a coal combustion boiler. "Fugitive emissions include both gaseous and particulate emissions that result from industrial related operations and which escape to the atmosphere through windows, doors, vents, etc., but not through a primary exhaust system. Fugitive emissions may result from metallurgical furnace operations, materials handling, transfer and storage operations, and other industrial processes where emissions escape to the atmosphere. Fugitive dust emissions, on the other hand, are generally related to natural or man-associated dusts (particulate only) that become airborne due to the forces of wind, man's activity, or both. Fugitive dust emissions may include windblown particulate matter from unpaved dirt roads, tilled farm lands, exposed surface areas at construction sites, etc. Natural dusts that become airborne during dust storms are also included as fugitive dusts."[1]

This section describes the attempts made at compiling an accurate inventory of point sources plus the results of a field program designed to assess the impact of fugitive emissions at each monitor in the valley.

POINT SOURCE INVENTORY

Inventories of all facilities in the study area with emissions greater than 25 tons/year were supplied in hard copy form. Ohio, through EPA Region V, provided the 1975 NEDS point source inventory to serve as the basis for the study; the W. Virginia agency supplied a listing of 1977 actual and allowable emissions by source. The latter data did not include stack parameters or control information. GCA also requested that particle size and composition data from stacks be supplied; however, it was indicated that this type of data were unavailable.

Initial review of these data indicated that a number of the NEDS sources were assigned incorrect site coordinates. These were corrected using a map supplied by W. Virginia APCC. Late in the project, it was also learned that Ohio EPA maintained two in-house inventories in which they placed much more reliance than the NEDS data. These data were the Ohio Emissions Inventory System (EIS) records for 1977 and a set of hand calculated worksheets representing 1975 baseline. Comparison of these data sets revealed substantial differences, often on the order of thousands of tons/year, in the estimates of annual emissions. A preliminary review of the data sets indicated that differences in fuel use and assumed control efficiency accounted for most of the discrepancies.

Through discussions with OEPA engineers, it was determined that the actual emission rates specified in each inventory were appropriate for the period represented. The allowable emissions in the EIS system were determined to be in error. It was mutually agreed with OEPA that the actual emissions listed in the EIS be used in the present study. The allowable emissions for each source were re-calculated using the hand calculated sheets as a basis and correcting for changes in throughput and control efficiency.

Appendix A presents a list of each major facility in the study area and specifies location data plus actual and allowable emissions. These data are assumed to represent the year 1977. Three sources which closed before 1978, the base year for this study from the standpoint of air quality data, were deleted from the inventory. These were:

- Ohio Power Co. Tidd Plant (August 1976)
- Federal Paperboard (August 1977)
- Ohio Ferro Alloy (Jefferson County Plant) (August 1977)

MICROINVENTORY METHODOLOGY

Microinventories were developed for 20 monitor sites located throughout the study area where TSP concentrations exceeded the NAAQS. These sites were selected because they were judged to be representative of sites experiencing all of the various particulate problems common to the area. Some sites were selected because they were close to industrial point sources, while other sites were chosen because they were located near large sources of fugitive dust.

Site Survey

The first step in developing microinventories was to conduct detailed site surveys of each of the 20 selected monitor sites. Using aerial photographs as a guide, the GCA project team surveyed the area within a 1-mile radius of each monitor site. The 1-mile radius was broken down into sectors as shown in Figure 2 in order to summarize the locations of particulate sources. Outstanding features of each site were noted, such as the site classification (residential, commerical, and industrial), type and height of structure, supporting monitor, distance of monitor from roadway, description of major local surroundings, and major local sources. Sources of fugitive dust in each sector and the size of these sources was also recorded. The fugitive dust sources observed frequently included unpaved parking lots, cleared areas, railroad yards and unpaved storage areas. In addition, vehicle miles traveled (VMT) data for major roadways was obtained from local planning agencies. These data were needed to estimate the amount of entrained dust from roadways.

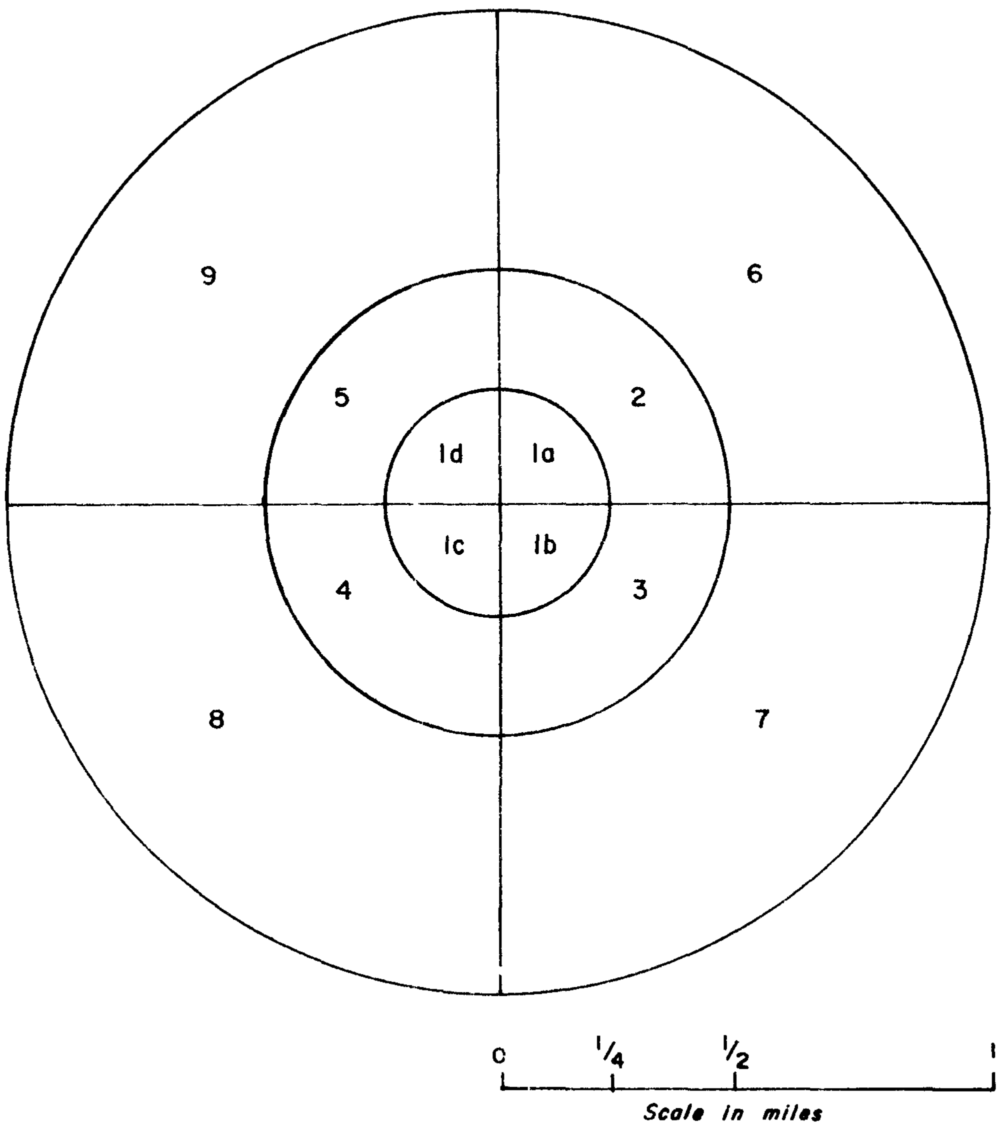

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Figure 2. One-mile radius sectors for describing location of particulate sources and predominant land use classification.

Emissions from fuel-burning area sources located within a 1-mile radius of each site were also determined. The States of Ohio and West Virginia each provided estimates of emissions from residential and commercial sources burning natural gas, coal and oil for each county. The number of houses in each county and the portion of houses burning each fuel type were used to estimate the emissions per house. The same distribution of fuel use was assumed for each site, and the number of houses at each site or site sector counted using aerial photographs. Multiplying the number of houses in each sector by the emissions rate for each fuel type provided estimates of emissions from residential and commercial structures for each sector. Estimates of industrial emissions by sector were gathered from NEDS data and the state.

Emissions Calculation

The data from the site surveys were then summarized into the format developed by T.G. Pace, as shown in Appendix B. Once the activity rate for each fugitive source had been identified for each sector the emission factors were applied. The emission factors selected were those used in a recent study of TSP in the Pittsburgh area.[2] Since the study area is so close to Pittsburgh, the climatological and soil characteristics which determine fugitive emissions, were assumed to be identical. Table 2 shows the fugitive emission factors applied to the source activity rates identified through the site survey.

TABLE 2. PARTICULATE EMISSION FACTORS

Source category	Emission factor	Units
Railroad yards	0.03	ton/ac/yr
Reentrained dust		
Clean paved streets	2.6	g/VMT
Commercial streets	11.3	g/VMT
Exhaust	0.6	g/VMT
Unpaved roads	2.3	lb/VMT
Cleared or exposed areas	0.02	ton/ac/yr
Construction	0.21	ton/ac/mo
Agriculture	0.02	ton/ac/yr
Aggregate storage	1.4	ton/ac/yr
Slag piles	0.5	ton/ac/yr
Unpaved parking lots	1.1	lb/VMT
Unpaved storage areas	0.1	ton/ac/yr
Coal storage	0.97	ton/ac/yr

RESULTS

The Pace equation was used to predict the area, local and point source impacts at each of the 20 monitor sites. The Area Source Summaries comprise the area source component of the Pace equation. The local source component is based on estimates of emissions generated by traffic on roadways within 200 ft of the monitor. The point source component is emissions from point sources within a 10-mile radius of the monitor. Table 3 presents a summary of area, local, and point source impacts at each monitor site as derived using the following equation:

$$AVGAQ = 0.00451\ (AREA) + 0.00096\ (POINT) + 50.5\ (LOCAL)$$

where

AVGAQ = Annual geometric mean ($\mu g/m^3$)

$$AREA = \frac{A_1}{0.0324} \frac{25}{HGT} + \frac{A_2+A_3+A_4+A_5}{0.16} + \frac{A_6+A_7+A_8+A_9}{0.6084}$$

The constants 0.0324, 0.16 and 0.6084 are the square of the radius in miles to the area weighted center of the annular ring defined by the sectors in the numerator.

A_i = Total area source emissions in sector i, tons/yr

HGT = Height of sampler, ft

$$POINT = \sum_{i=1}^{n} \frac{PSEM_i}{D_i^2} (WWF)$$

n = Number of point sources within 10 miles (16 kilometers)

$PSEM_i$ = Emissions from point source i, ton/yr

D_i = Distance to point source i, mile (lower limit of D_i is 0.5)

WWF = Wind weighting factor, computed as annual wind direction frequency of occurrence (percent) in quadrant where source is located, divided by 25.

$$LOCAL = \frac{\ln ADT_1}{\sqrt{HGT^2+DIS_1^2}} + \frac{\ln ADT_2}{\sqrt{HGT^2+DIS_2^2}}$$

TABLE 3. MICROINVENTORY SOURCE IMPACT COMPUTATIONS

	Area ($\mu g/m^3$)	Point ($\mu g/m^3$)	Local ($\mu g/m^3$)	Total ($\mu g/m^3$)	1978 Observed ($\mu g/m^3$)
OHIO					
East Liverpool Fire	0.38	0.70	8.37	9.45	106
East Liverpool City Hall	0.65	1.42	3.78	5.85	90
Wellsville	1.17	2.21	4.36	7.74	94
Toronto	0.52	6.00	3.88	10.4	-*
Steubenville (Adams)	0.55	8.20	11.26	20.01	94
Steubenville (Courthouse)	0.44	9.31	8.45	18.20	109
Mingo Junction	0.93	12.3	10.51	23.74	131
Brilliant	0.61	54.7	1.98	57.29	75
Tiltonsville	0.68	4.5	15.05	20.23	77
Martins Ferry	1.48	0.95	15.12	17.55	76
Shadyside	1.20	1.16	12.50	14.86	80
Powhattan Point	0.54	12.91	4.13	17.58	97
Clarington	0.13	0.88	8.50	9.51	83
Hannibal	0.32	0.18	2.62	3.12	61
WEST VIRGINIA					
New Manchester	0.13	10.97	5.82	16.92	86
New Cumberland	0.24	10.54	6.20	16.98	72
Weirton	0.62	8.00	3.18	11.80	96
Follansbee	2.17	25.38	2.01	29.56	95
Wellsburg	0.80	4.79	2.90	8.49	82
Moundsville	0.97	35.07	5.60	41.64	76

*Site moved in mid-year.

ADT_i = Average daily traffic on nearby road i, veh/day

DIS_i = Distance to road i, ft
(upper limit of DIS_i is 200 ft)

The wind direction factors, WWF, were computed using Pittsburgh data and are

Source bearing (deg)	WWF
315.1 - 45.0	0.726
45.1 - 135.0	0.731
135.1 - 225.0	0.846
225.1 - 315.0	1.693

A correlation analysis between the predicted total particulate concentration plus each of the components (area, point, and local) indicated no significant agreement. An obvious outlier, the Brilliant site which is dominated by several major power plants, was removed from the analysis but no significant improvement was gained.

The conclusion of this analysis is that the Pace equation, which was empirically developed using urban data, can not realistically be used in a rural, industrial area which is apparently dominated both by tall stacks (stack height is not a factor in the Pace equation) and by fugitive process and storage pile emissions.

With this conclusion in mind, an attempt can be made to assess the impact of noncompliance of point sources on ambient particulate levels. Table 4 presents estimates of particulate concentrations, based upon Pace's extremely simple point source model, for actual emission rates and allowable emission rates.* Used in this manner, the values in Table 4 provide an estimate of the percent reduction in the point source component which would result if all sources operated at the allowable level. The reductions range from 0 to over 90 percent for the various monitors.

*When allowable was greater than actual, the source was assumed to be emitting at the actual level.

TABLE 4. ACTUAL AND ALLOWABLE POINT SOURCE IMPACTS USING PACE EQUATION

	Predicted actual point source impact ($\mu g/m^3$)	Predicted allowable point source impact ($\mu g/m^3$)	Percent reduction
OHIO			
East Liverpool Fire Station	0.70	0.11	84
East Liverpool City Hall	1.42	0.40	72
Wellsville	2.21	0.26	88
Toronto	6.00	1.37	77
Steubenville (Adams)	8.20	3.70	55
Steubenville (Courthouse)	9.31	4.31	54
Mingo Junction	12.3	5.60	54
Brilliant	54.7	4.13	92
Tiltonsville	4.5	0.19	96
Martins Ferry	0.95	0.17	82
Shadyside	1.16	0.10	91
Powhattan Point	12.91	1.73	87
Clarington	0.88	0.41	53
Hannibal	0.18	0.18	0
WEST VIRGINIA			
New Manchester	10.97	1.00	91
New Cumberland	10.54	1.20	89
Weirton	8.00	3.16	61
Follansbee	25.38	5.98	76
Wellsburg	4.79	0.77	84
Moundsville	35.07	2.57	93

SECTION 3

MICROSCOPIC ANALYSIS

The analysis of selected hi-vol filters by optical microscopy was carried out in several steps. First, an overview of particle types present within the valley was obtained by subjecting 55 filters, distributed among the 20 valley sites and 6 sampling days, to preliminary screening. Using the results obtained from this analysis, EPA selected a subset of 20 filters for more detailed analysis. Then later in the program, two additional sets of filters were analyzed. The first of these sets comprised 10 filters drawn from unanalyzed filters in the initial set of 55; these 10 were selected from three days with quite well-defined airflow within the valley. The second set comprised 27 filters distributed broadly throughout the year and were selected to allow upwind-downwind analysis.

Table 5a provides the monitor location, exposure date and TSP concentration for each filter in the initial set. In this table the 20 filters subjected to detailed analysis are indicated by asterisks and the filters in the additional set of 10 are indicated by daggers. Table 5b gives this information for the last set containing the 27 filters.

Chemical analyses were also conducted on the 20 filters indicated by asterisks in Table 5a and on 26 of the filters listed in Table 5b. This section of the report describes the methodology and the results of the microscopic work; Section 4 describes the chemical analysis.

METHODOLOGY

Characterization of phases present on the filters was performed by polarized light microscopy. The analysis was carried on a piece of filter approximately 10 mm x 10 mm mounted on a glass slide and covered with an immersion oil and cover slip. The polarized light microscope is suited to the determination of crystalline phases present on these filters, although the analysis is hampered somewhat by the fine grained nature of the particulate on the filters. Broadly speaking, the filters contained combustion products, mineral matter, and biological debris. Much of the combustion material is more or less opaque so that inference as to the identity of this material is based largely on shape and optical properties such as refractive index and possibly birefringence (i.e., whether the particle is crystalline or not). A wide variety of combustion products could be identified and include unburned coal fragments, coal fly ash, soot, glassy fly ash (incineration products) and semiopaque glass. Mineral phases present were easily identified despite their small size.

TABLE 5a. FILTER SELECTION

Site	3/21	4/26	5/26	6/1	6/7	12/28
	Concentration (μg/m^3)					
West Virginia						
New Manchester	76	67	104*			
New Cumberland				-	84*	52
Weirton	138†	115*	182			
Follansbee				194*	83	68
Wellsburg	134*	140†	246			
Moundsville				173†	97*	76
Ohio						
E. Liverpool, F.S.	165*	130†	216			
E. Liverpool, C.H.				128*	136	-
Wellsville	-	84	169*			
Toronto				132	113	102*
Steubenville, Adams St.	-	-	-	141†	181*	-
Steubenville, C.H.				236*	98	115
Mingo Junction	141†	177†	309*			
Brilliant				203†	108	147*
Tiltonsville	70	94	152*			
Martins Ferry				146†	61	113*
Shadyside	69	121	125*			
Powhattan Point				287*	96	98
Clarington	148†	103	545*			
Hannibal				-	39*	61

*Filter selected for detailed analysis by EPA.

†Filter included in additional set of 10.

TABLE 5b. FILTER SELECTION

Date	Site and Concentration (μg/m^3)
1/2/80	Brilliant (43), Tiltonsville (152), Martins Ferry (36)
1/14/80	Weirton (152), Follansbee (73)
2/7/80	Steubenville, C.H. (178), Mingo Junction (57)
2/8/80	Steubenville, Adams St. (49)
4/2/80	E. Liverpool, F.S. (75), E. Liverpool, C.H. (52), Powhattan Pt. (180), Clarington (68)
4/8/80	New Manchester (38), New Cumberland (169), Weirton (208), Toronto (155)
4/9/80	Steubenville, Adams St. (106)
4/26/80	New Manchester (67), Follansbee (75), Steubenville, C.H. (81), Brilliant (95)
7/25/80	Shadyside (72), Powhattan Pt. (179), Clarington (35)
9/11/80	Wellsville (269)
9/17/80	E. Liverpool, C.H. (175), Wellsville (93)

For more positive identification of questionable particles, scanning electron microscopy was used. In particular, it was relied upon to investigate submicron particles and fume from the Clarington and Brilliant sites after large amounts of silica dust had been found on one filter from the Clarington site.

Identification of particles was initially made on a volume basis. These values were then converted to a weight basis using assumed densities for each class of particle. The densities used in this analysis are based on McCrone[3] and are:

Particle Density

Particle Class	Density (g/cc)
Iron oxide	5.6
Minerals	2.6
Combustion products	2.2
Biologicals	1.0

The conversion to weight percent was accomplished using the formula

$$W_i = \frac{d_i V_i}{\sum_j d_j V_j}$$

where

W_i = weight percent for phase i

d_i = density of phase i

V_i = volume percent for phase i

j = summation index over all phases

Particle size distributions were determined on selected filters in varying amounts of detail using an image shearing eyepiece. With each of the 20 selected filters, fields of observation were randomly selected and particles that were found directly beneath the intersection of the eyepiece crosshairs were sized and counted. This procedure was performed until 300 particles had been categorized. No distinction was made among phases. With each filter in the set of 10, cumulative frequency distributions were obtained for three phases of combustion-related particles: coal fragments, fly ash and soot. With the set of 27 filters, the size range of each of the principal phases was specified.

RESULTS

This section summarizes general characteristics of particulates as determined from the various sets of filters that were analyzed. More detailed discussions describing the phases found on individual filters are provided in Section 6 where source-receptor relationships are investigated.

Relative Concentrations of Major Phases

The average composition of the particulates have been summarized in terms of four components: iron oxide; other combustion products including fly ash, coal fragments and soot; minerals; and biological products such as pollen, spores and stellate hairs. Summaries have been prepared from two basic data sets. One set is made up of the preliminary screening results of the initial 55 filters; the other set contains the results from the last two groups of filters that were analyzed in somewhat greater detail (i.e., one group of 10 filters and one group of 27 filters). The summary information for each of these two major data sets is presented in two figures. The first of each set of two shows the average composition at each monitoring site. At the left of the second figure, the average composition of particulate on days when the concentration exceeded the secondary standard of 150 $\mu g/m^3$ is compared with the average concentration found on days when the concentration was less than the standard; at the right, the average concentrations on summer and winter days are compared. Figures 3 and 4 summarize the analyses of the 55 filters that underwent preliminary screening and Figures 5 and 6 summarize the more detailed analysis of the 37 filters.

Before commmenting upon the results, it should be mentioned that the variation found from filter to filter was frequently large. This variation is due in part to the nature of the analytical procedure itself and in part to real variations among the filters. This particular program was not designed to separate the two effects but other studies have indicated large differences in results obtained by different analysts and by different laboratories.[2] Some idea of the total variation experienced can be gained from Table 6 which presents averages and standard deviations for the data obtained from the set of 37 filters.

TABLE 6. VARIATION IN COMPOSITION DATA OBTAINED FROM 37 FILTERS

	Iron oxide	Other combustion products	Minerals	Biological products
Mean percent	6.2	58.5	25.6	9.2
Median percent	5	59	26	3
Standard deviation	6.0	9.9	11.5	14.0

Of the four components, the concentration of "other combustion products" is the most consistent from site to site, and the concentration of "biological products" is the most variable.

Several general conclusions can be drawn from the summary figures. First, the average composition of particulates is fairly constant throughout the valley, throughout the year, and for concentrations above or below the secondary standard. Second, roughly 65 percent of the particulates are the result of primary metals processing and other year-round combustion related activity. This may be compared with a U.S. composite average of about 25 percent reported from a

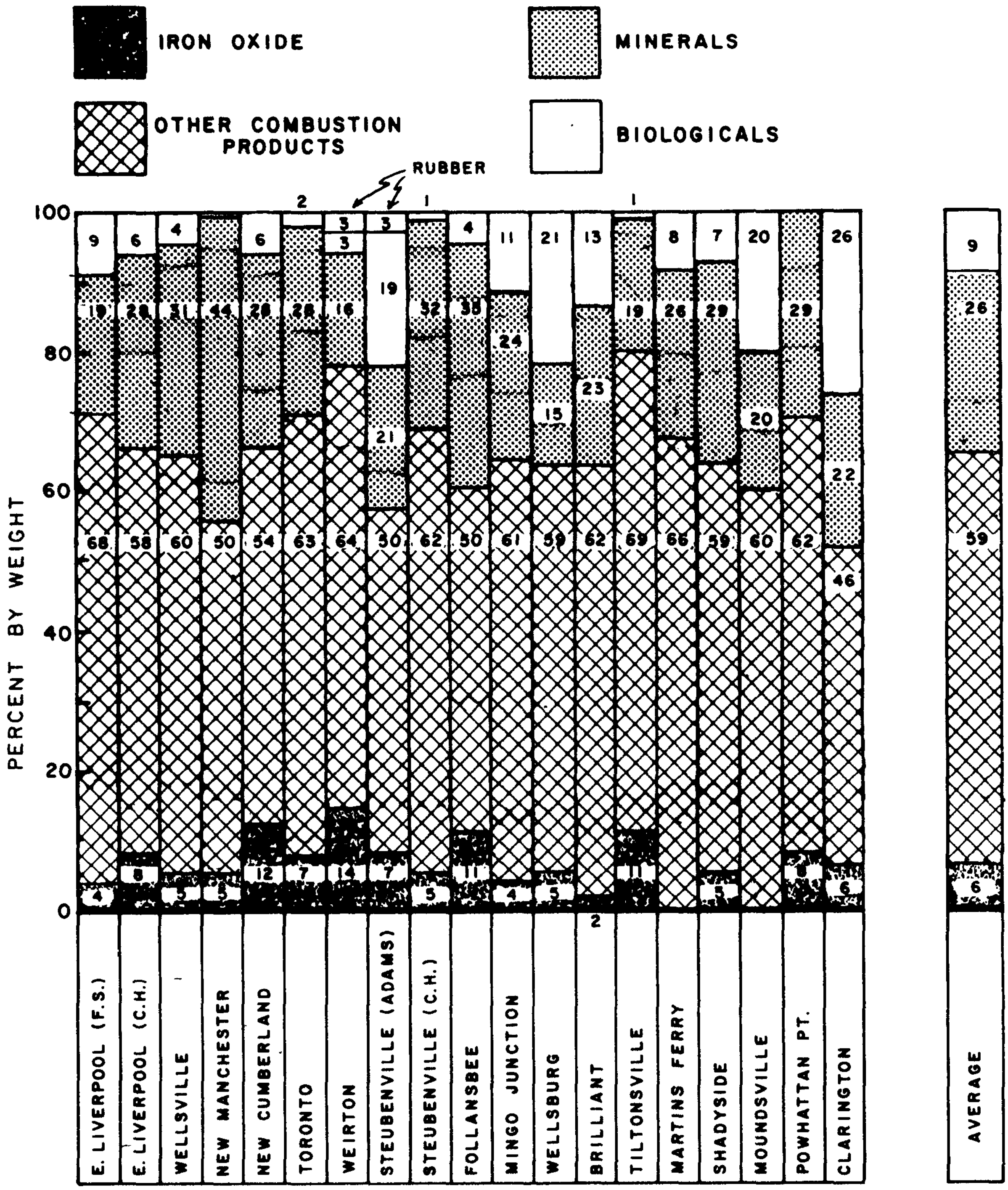


Figure 3. Average composition of particulates at 20 hi-vol sites as determined from preliminary screening (n = 55).

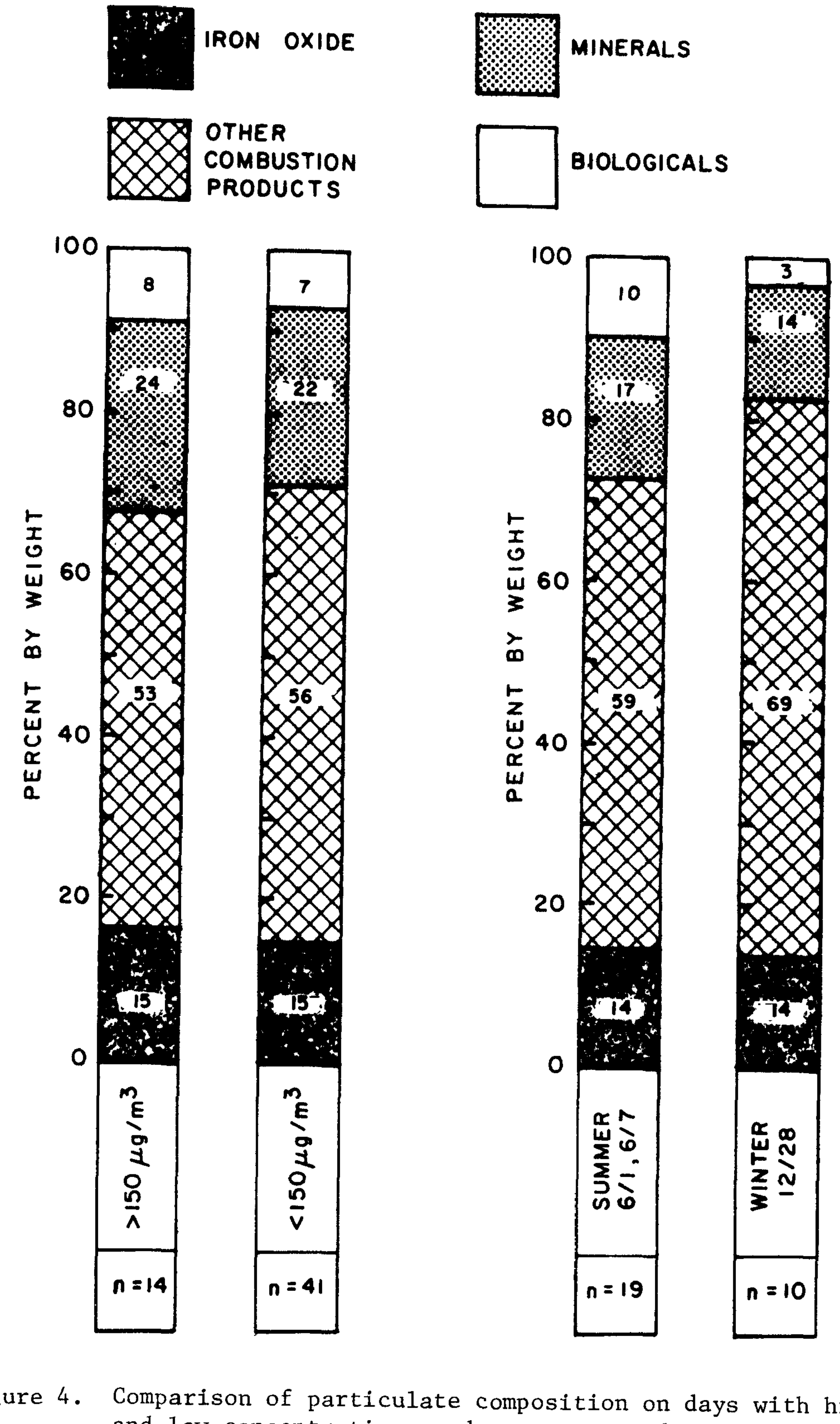


Figure 4. Comparison of particulate composition on days with high and low concentrations and on summer and winter days as determined from preliminary screening.

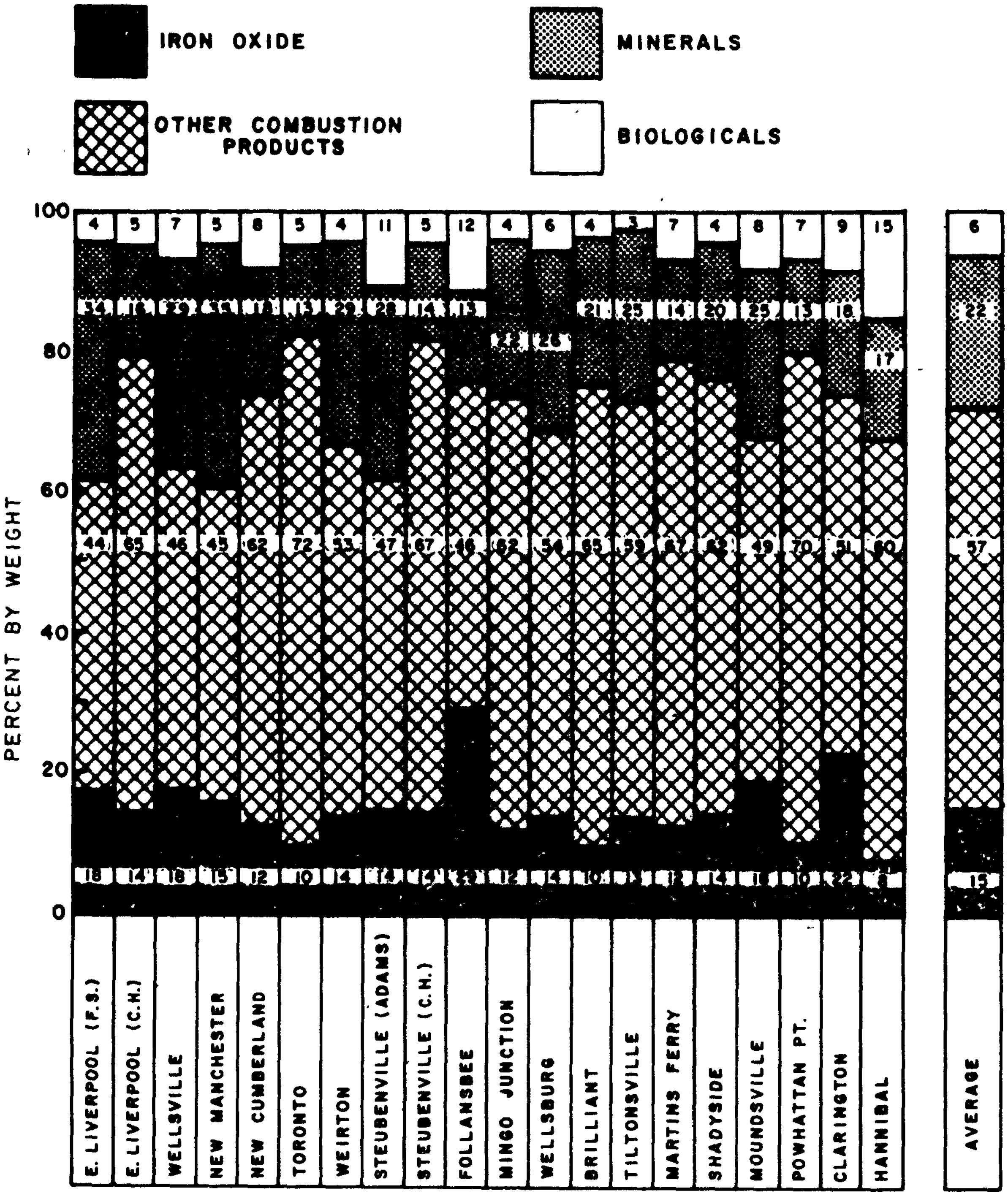


Figure 5. Composition of particulates on selected filters from 19 sites (n = 37).

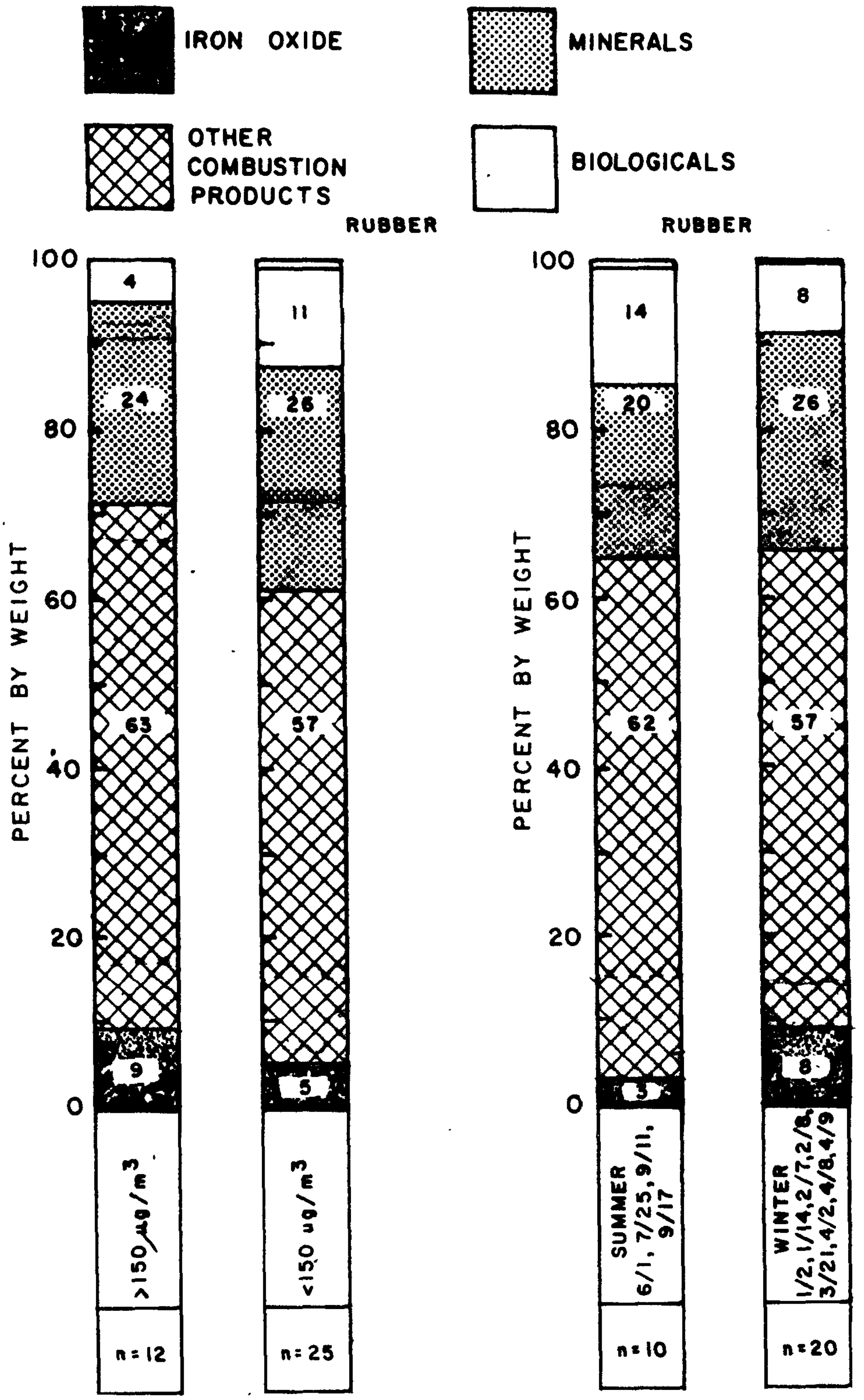


Figure 6. Comparison of particulate composition on days with high and low concentrations and on summer and winter days as determined from selected filters from 19 sites.

study of filters in 14 cities.[4] Third, minerals make up about one-quarter of the particulates by weight. This is in contrast to the U.S. composite average of 65 percent. And fourth, although it can not be deduced from the averages presented in these figures, the role played by biologicals ranges from insignificant to dominant. Among the filters analyzed, estimates of the contribution by weight percent of the biologicals ranged from 0 to 65 percent. The median contribution by biologicals, however, is 3 percent by weight, indicating that a few high values significantly skewed the mean towards the high end.

Particle Size Distribution

Table 7 presents particle size distributions determined from the set of 20 selected filters. Mass median diameters, taken from this table, have been rearranged in Table 8 to display any obvious differences between location along the valley, or sampling date, and mass median diameter. None are apparent. The data from the 20 sites have therefore been combined to provide an estimate of the average mass median diameter for the 20 samples. This average, 61 μm, reflects the extreme influence of a relatively small number of large particles. It should also be borne in mind that a large number of the particles less than about 1 μm is diameter are not included in the distribution due to limitations in optical microscopy.

The average cumulative size distributions for coal fragments, fly ash, and soot determined from the set of 10 filters are shown in Table 9. Of the particles sized on each sample, the largest were consistently coal fragments.

The particle size range estimates obtained from the analysis of 27 filters provide interesting information with regard to the mineral fraction. This component was dominated by fine calcite particles ranging in size from about 1 μm to an upper limit of 20 μm.

TABLE 7. PARTICLE SIZE DISTRIBUTION

ID	Site	Date	Concentration ($\mu g/m^3$)	Size range (percent of total)						Mass median diameter (μ)
				1.0 - 2.5 μ	2.6 - 5.0 μ	5.1 - 10.0 μ	10.1 - 15.0 μ	15.1 - 40.0 μ	> 40.1 μ	
3414	Moundsville	6/7/78	97	47	17	2.7	3	27	3.3	80
3416	Wellsburg	3/21/78	134	36.7	21.6	13.3	6.7	18.3	3.4	95
3419	Follansbee	6/1/78	194	41.7	15	21.7	8.3	6.7	6.6	>100
3423	Weirton	4/26/78	115	53	17.3	12	5	5.7	7	90
3426	New Cumberland	6/7/78	84	42	17	19	8.7	8	5.3	85
3432	Steubenville (Adams)	6/7/78	181	49.7	23	12.7	5.3	7.3	2	45
3430	New Manchester	5/26/78	104	48	11	16.7	13	11	0.3	25
3644	Brilliant	12/28/78	147	32	13.3	12	6.7	29.3	6.7	>100
3647	Clarington	5/26/78	545	44.3	16.7	11	14.7	9	4.3	90
3648	E. Liverpool CH	6/1/78	128	46.6	6.3	15.7	9.3	20.7	1.3	60
3651	E. Liverpool FS	3/21/78	165	48.3	14.3	3.7	7	26.7	0	21
3654	Hannibal	6/7/78	39	70	9	4.3	6	6.3	4.3	45
3656	Steubenville (CH)	6/1/78	236	55.7	2.3	7.3	8.3	24.7	1.3	31
3661	Martins Ferry	12/28/78	113	59.3	13	9.3	5.3	10.7	2.3	45
3664	Mingo Jct	5/26/78	309	51	11.7	8	9.7	17.3	2.3	45
3665	Powhattan Pt	6/1/78	287	32.7	21.7	9.3	11	23.3	2.3	50
3670	Shadyside	5/26/78	125	34	12.7	28.7	7.3	16	1.3	100
3673	Tiltonsville	5/26/78	152	44.7	17.3	9	5.3	23.3	0.3	30
3676	Toronto	12/28/78	102	46.7	18.7	14.7	13	3.7	3.7	50
3678	Wellsville	5/26/78	169	37.7	16.0	18	12.7	15.7	0	35

TABLE 8. FREQUENCY DISTRIBUTION OF MASS MEDIAN DIAMETERS

Mass median diameter (μm)	Frequency	Site	Date
0-9	0		
10-19	0		
20-29	2	E. Liverpool (F.S.), New Manchester	3/2, 5/26
30-39	3	Wellsville, Steubenville (Adams Jeff), Tiltonsville	5/26, 6/1, 5/26
40-49	4	Steubenville (Adams), Mingo Junction, Martins Ferry, Hannibal	6/7, 5/26, 12/28, 6/7
50-59	2	Toronto, Powhattan Pt.	12/28, 6/1
60-69	1	E. Liverpool (C.H.)	6/1
70-79	0		
80-89	2	New Cumberland, Monndsville	6/7, 6/7
90-99	3	Weirton, Wellsburg, Clarington	6/1, 5/26, 12/28

TABLE 9. CUMULATIVE SIZE DISTRIBUTIONS OF COAL, FLY ASH, AND SOOT PARTICLES

	Particle size (μm)						
	3	5	10	15	20	25	50
	Percent (less than)						
Coal	60	70	80	88	92	96	99.6
Fly ash	77	85	94	98	99.7	100	100
Soot	61	69	82	89	94	98	100

SECTION 4

CHEMICAL ANALYSIS

Chemical analysis was performed on a total of 46 filters to determine the concentration of various metals, ions, and organics composing the particulate. These 46 filters comprised the subset of 20 selected for detailed analysis from the original set of 55, plus 26 filters from the additional set of 27. The 20 filters were analyzed for arsenic, iron, lead, mercury, vanadium, and organics; and when sufficient filter was provided, for nitrate, sulfate, choride, and ammonium. The 26 filters were analyzed for arsenic, iron, sulfate, and nitrate. The selection of these filters is described in Section 3.

METHODOLOGY

To perform all of the analyses, approximately three-quarters of the hi-vol filter was required. The Ohio EPA was able to provide only one-half. Since the Ohio agency routinely analyzes for sulfates on selected filters, it was decided to omit the ion analysis of the 14 Ohio filters in the set of 20. State data, when available, are reported. All analyses were performed for this set of W. Virginia filters.

Appendix E describes the methodology and quality assurance techniques used in performing these analyses.

RESULTS

Tables 10 and 11 present, respectively, the results of the metal and ion and organics analyses of the 20 filters. Ohio's method of selecting filters for analysis was to analyze the first three filters collected each month. Most of the days selected for intensive analysis in the present study fell at the end of the month. Hence, sulfate data are available from only 6 of the 14 Ohio filters listed in Table 10. Table 12 presents the results for the set of 26 filters.

Review of the metals data indicates that lead levels are quite low; none of the 24-hour observations exceed 50 percent of the 1.5 $\mu g/m^3$ quarterly average ambient standard. This indicates that major sources of lead, most notably the automobile, are not significant contributors in the valley. Vanadium levels also are low; this is appropriate for an area not heavily dependent upon residual oil for energy. Comparison of the arsenic and iron data with those recorded in various urban areas of the East indicates these data to be slightly elevated.

TABLE 10. CHEMICAL COMPOSITION, DATA FROM 20 FILTERS

ID	Site	Date	Total Concentration ($\mu g/m^3$)	Ion and Elemental Concentrations								
				Arsenic ($\mu g/m^3$)	Iron ($\mu g/m^3$)	Lead ($\mu g/m^3$)	Mercury ($\mu g/m^3$)	Vanadium ($\mu g/m^3$)	Nitrate ($\mu g/m^3$)	Sulfate ($\mu g/m^3$)	Chloride ($\mu g/m^3$)	Ammonium ($\mu g/m^3$)
3414	Moundsville	6/7/78	97	0.0066	1.31	0.185	0.0073	0.0067	2.05	14.67	0.579	0.96
3416	Wellsburg	3/21/78	134	0.0489	1.72	0.144	0.023	0.0121	4.78	7.23	3.94	0.11
3419	Follansbee	6/1/78	194	0.053	9.07	0.420	0.0027	0.0131	5.77	15.66	0.950	1.23
3423	Weirton	4/26/78	115	0.0187	6.53	0.248	0.0052	0.021	2.18	6.97	—	—
3426	New Cumberland	6/7/78	84	0.0165	1.85	0.212	0.0015	0.012	2.67	16.11	0.668	0.51
3430	New Manchester	5/26/78	104	0.0069	1.70	0.191	0.011	0.0076	1.87	15.02	—	—
3432	Steubenville (Adams)	6/7/78	181	0.0083	1.03	0.343	0.010	0.008	—	12.8	—	—
3644	Brilliant	12/28/78	147	0.0200	0.98	0.235	0.0015	0.0025	—	NP†	—	—
3647	Clarington	5/26/78	545	0.0176	1.91	0.411	0.008	0.0085	—	NP†	—	—
3648	E. Liverpool CH	6/1/78	128	0.0082	1.10	0.397	0.0075	0.0086	—	19.9	—	—
3651	E. Liverpool FS	3/21/78	165	0.0111	2.71	0.271	0.0015	0.0079	—	NP†	—	—
3654	Hannibal	6/7/78	39	0.0044	0.03	0.064	0.0151	0.0040	—	14.8*	—	—
3656	Steubenville (C.H.)	6/1/78	236	0.0368	7.61	0.590	0.0014	0.0119	—	21.3	—	—
3661	Martins Ferry	12/28/78	113	0.0136	1.72	0.707	0.0017	0.0045	—	NP†	—	—
3664	Mingo Jct	5/26/78	309	0.0493	9.36	0.093	0.0075	0.0149	—	NP†	—	—
3665	Powhattan PT	6/1/78	287	0.0173	2.15	0.159	0.0006	0.0081	—	89.9‡	—	—
3670	Shadyside	5/26/78	125	0.0129	1.61	0.492	0.0036	0.0079	—	NP†	—	—
3673	Tiltonsville	5/26/78	152	0.0153	1.92	0.281	0.0030	0.0056	—	NP†	—	—
3676	Toronto	12/28/78	102	0.0049	0.52	0.221	0.0074	0.0026	—	20.8	—	—
3678	Wellsville	5/26/78	169	0.0166	1.83	0.388	0.0021	0.0054	—	NP†	—	—

*Regional Average

†NP Sample not processed

‡Clarington data

TABLE 11. ORGANICS COMPOSITION DATA

Filter I.D.	Site	Date	Anthracene	Fluoranthene/ Pyrene	Benzanthacene/ Chrysene/ Triphenylene	Benzo(K) fluoranthene	Benzo(a)pyrene/ Benzo(e)pyrene	1,2,3,4 dibenzanthracene	7,12-dimethylbenzanthracene	1,2,5,6-dibenzanthracene	Benzo(ghi) perylene	Total
3414	Moundsville	6/7/78	ND	ND	0.425	0.425	0.463	ND	ND	1.16	2.47	4.49
3416	Wellsburg	3/21/78	ND	ND	0.111	0.082	0.111	ND	ND	0.044	0.311	0.66
3419	Follansbee	6/1/78	ND	ND	0.742	0.610	0.907	ND	ND	1.15	1.98	5.39
3423	Weirton	4/26/78	ND	3.48	0.435	0.279	0.331	ND	ND	0.740	1.22	6.48
3426	New Cumberland	6/7/78	ND	ND	0.130	0.393	0.550	ND	ND	1.53	3.30	5.90
3430	New Manchester	5/26/78	ND	ND	0.777	0.777	1.13	ND	ND	1.84	2.12	6.65
3432	Steubenville (Adams)	6/7/78	ND	ND	0.083	0.090	0.638	ND	ND	0.169	0.488	1.47
3644	Brilliant	12/28/78	ND	ND	0.979	1.10	1.49	ND	ND	2.51	1.53	7.61
3647	Clarington	5/26/78	ND	ND	0.426	0.264	0.135	ND	ND	0.441	0.646	1.91
3648	E. Liverpool CH	6/1/78	ND	ND	0.329	0.212	0.226	ND	ND	0.411	0.959	2.14
3651	E. Liverpool FS	3/21/78	ND	ND	0.493	0.320	0.369	ND	ND	1.67	2.03	4.88
3654	Hannibal	6/7/78	ND	ND	0.087	0.041	0.032	ND	ND	0.044	0.087	0.29
3656	Steubenville CH	6/1/78	ND	ND	1.14	1.33	1.97	ND	ND	3.04	4.31	11.79
3661	Martins Ferry	12/28/78	ND	ND	1.09	0.907	1.45	ND	ND	3.17	6.53	13.15
3664	Mingo Junction	5/26/78	ND	ND	3.49	4.99	6.24	ND	ND	14.4	15.0	44.12
3665	Powhattan Pt.	6/1/78	ND	ND	0.984	0.749	0.043	ND	ND	1.83	2.44	6.43
3670	Shadyside	5/26/78	ND	ND	0.290	0.311	0.352	ND	ND	0.476	1.29	2.72
3673	Tiltonsville	5/26/78	ND	ND	0.638	0.460	0.638	ND	ND	0.830	2.55	5.12
3676	Toronto	12/28/78	ND	ND	0.421	0.273	0.315	ND	ND	0.999	1.74	3.75
3678	Wellsville	5/26/78	ND	ND	0.138	0.244	0.288	ND	ND	0.421	0.886	1.98

ND = Not Detectable. All concentrations in nanograms per cubic meter. No adjustment made for blank filter levels.

TABLE 12. CHEMICAL COMPOSITION DATA FROM 26 FILTERS

Site	Filter I.D.	Date	Total	Concentration (μg/m^3)			
				Arsenic	Iron	Sulfate	Nitrate
E. Liverpool FS	6411	4/2/78	75	0.02	1.20	7.5	1.45
E. Liverpool CH	6409	4/2/78	52	0.07	0.90	6.7	1.74
E. Liverpool CH	6410	9/17/78	175	0.04	1.39	24.6	2.50
Wellsville	6427	9/11/78	269	0.03	3.43	34.3	2.50
Wellsville	6428	9/17/78	93	0.06	1.10	25.8	3.10
New Manchester	6419	4/8/78	38	0.05	0.80	4.4	1.92
New Manchester	3429	4/26/78	67	0.005	1.36	5.2	2.44
New Cumberland	6418	4/8/78	169	0.07	2.20	6.5	0.50
Toronto	6426	4/8/78	155	0.02	1.70	6.5	3.05
Weirton	6430	4/8/78	208	0.01	5.60	10.4	1.52
Steubenville Adams	6423	2/8/78	49	0.02	0.43	9.0	3.67
Steubenville Adams	6424	4/9/78	106	0.08	2.83	8.6	2.4
Steubenville CH	6414	2/7/78	178	0.03	2.70	44.5	1.70
Steubenville CH	6415	4/26/78	81	0.10	1.98	9.6	6.00
Follansbee	6412	1/14/78	73	-	-	12.0	1.48
Follansbee	6413	4/26/78	75	0.08	1.88	6.4	2.52
Mingo Junction	6417	2/7/78	57	0.12	0.70	13.0	0.77
Brilliant	6405	1/2/78	. 43	0.04	0.71	9.9	1.81
Brilliant	6406	4/26/78	95	0.04	1.92	7.2	3.68
Tiltonsville	6425	1/2/78	152	0.07	2.22	21.4	3.66
Martins Ferry	6416	1/2/78	36	0.07	0.44	9.6	1.74
Shadyside	6422	7/25/78	72	0.06	1.20	17.4	3.78
Powhattan Pt.	6420	4/2/78	180	0.10	3.78	10.8	3.42
Powhattan Pt.	6421	7/25/78	179	0.28	1.12	23.0	1.52
Clarington	6407	4/2/78	68	0.03	1.05	8.0	2.40
Clarington	6408	7/25/78	35	0.02	0.66	12.0	3.54

Sulfate concentrations, however, are quite high when compared to the East. This confirms the results of other studies that this general area experiences some of the highest sulfate levels observed in the country. As will be discussed in a later section, some isolated pockets of high sulfate concentrations were apparent. In Table 10 the value of 89.9 $\mu g/m^3$ measured at Clarington is considerably higher than other values recorded on that day. The TSP level at Powhattan and Clarington are also elevated above those in the vicinity.

Nitrate concentrations ranged from 0.11 to 6.0 $\mu g/m^3$ and averaged 2.3 $\mu g/m^3$. These values are in agreement with values reported throughout most of the East but are somewhat lower than those typically found in urban areas from Chicago eastward through the industrial areas to Philadelphia.

Three filters were analyzed for sulfates by both the Ohio and GCA laboratories. In two cases GCA concentrations were greater than those found by Ohio; in the third case, the Ohio concentration was approximately twice that of GCA. The results are presented in Table 13.

TABLE 13. COMPARISON OF SULFATE CONCENTRATIONS DETERMINED BY TWO LABORATORIES

Site	Filter I.D.	Date	Sulfate concentration ($\mu g/m^3$)	
			Ohio EPA	GCA
Brilliant	6405	1/2/78	3.8	9.9
Clarington	6407	4/2/78	5.9	8.0
East Liverpool, C.H.	6409	4/2/78	13.8	6.7

SIGNIFICANCE OF ORGANICS

Introduction

Polynuclear aromatic hydrocarbons (PNAs, POMs, PAHs) are ubiquitously distributed in the environment. While a number of potential sources for these materials have been cited, the consensus of the scientific community is that combustion of fossil fuels is the primary source.[5] In addition, the majority of PNAs are associated with particulate emissions from such sources, owing to their condensation on particulate surfaces as they leave the flue gas.

The characterization of PNA emission has often included quantitative measurements of a single species, namely benzo(a)pyrene. As a result of its proven carcinogenicity and prevalence in ambient particulate samples B(a)P is routinely used as an indicator of both potential mutagenic activity and the presence of additional polynuclear aromatic materials.

While B(a)P does serve a role in the identification of PNA sources, more useful data can be derived from a characterization of individual PNA species. Such data have often been implemented in identifying potential sources of polynuclear aromatic materials. The absence or presence of certain PNA homologues can be instrumental in isolating the PNA source(s). For instance, PNA mixtures from petroleum oil sources, e.g., oil spills typically contain a variety of alkyl homologues and lack unsubstituted species.[6] Also, within a group of combustion source types further distinguishing characteristics can be present. A distinct correlation has been demonstrated between concentration of B(a)P and coronene in regions of high traffic density, for instance.[7] In fact, concentration of the non-carcinogen coronene correlates well with urban traffic density.[8] Such correlations are useful in assigning sources of polynuclear aromatic materials in areas of high industrial activity. By observation of PNA distributions as affected by meterological conditions, seasonal variations, and type of industrial activity, one can predict the influence of industrial emission sources in a particular region.

Results

The majority of available data on PNA concentrations in and around the coke and steel industry deals specifically with ambient concentration of benzo(a)-pyrene absorbed on suspended particulate matter. Some discussion of this data as well as some background data on B(a)P concentrations in non-industrial areas would enhance the interpretation of the analytical data presented here.

Typically, ambient B(a)P concentrations in urban industrial atmospheres are highest in the winter months owing to the increased input of domestic combustion sources.[9,10] As the majority of our data was collected during the summer months when fossil fuel combustion for heat is lowest, we might conclude that the PNA concentration are apt to be minimum concentrations for this region, and would predominantly reflect the input of PVA-producing industrial processes.

B(a)P concentrations for a non-industrial, non-urban area such as the Grand Canyon in Arizona ranged from >0.1 - 0.2 ng/m^3 for the calendar period 1967-1974.[11] Similar data is recorded for Acadia National Park in Maine where concentrations range from 0.1 - 0.3 ng/m^3 for the same calendar period.

A sharp contrast to these data, however, are typical PNA concentrations for ambient air samples taken in urban industrial areas, particularly in the vicinity of steel and coking operations. Broddin[12] reports background values of 10 ng/m^3 for total benzopyrenes collected in the vicinity of two coking oven emission source in Belgium. Total benzopyrenes near the source itself were in the order of 470 ng/m^3. Likewise, data collected by Von Lehmden[13] reports total benzopyrene of 12.7 ng/m^3 near steel and coke oven emission sources. Both of these studies were conducted during the spring and summer months when PNA concentrations are typically lower. The samples were collected 1/4 to 1-1/2 miles from an urban area containing coke manufacturing sources. By comparison typical B(a)P concentrations range from 0.38 - 2.76[11] ng/m^3 for the calendar period 1966-1975. For the same period the report had given typical B(a)P values for cities with coking operations in the range of 1.21 - 5.34 ng/m^3.[11]

As a result of these findings, our data is best interpreted by concentrating on the total benzopyrene numbers, as no additional information specific to coking oven operations can be derived from the entire PNA distribution pattern. The total benzopyrene numbers observed at the Hannibal and Powhattan Pt. stations very closely approximate B(a)P numbers for the background non-urban areas cited earlier. As we proceed northward along the Ohio River basin, the total benzopyrene numbers increase significantly above these levels but still do not concur with typical values cited for ambient air in the proximity of coking oven operations. Our numbers range from 0.032 to 1.97 ng/m^3 with the exception of the 6.29 ng/m^3 value reported for the Mingo Junction station. Only this latter value approximates typical values for coke oven regions. The majority of our data approximates expected values for typical U.S. urban areas. In fact, two of the higher concentrations were collected during the winter months when PNA values are characteristically higher than equivalent samples collected during warm weather periods. This includes the value of 1.45 $\mu g/m^3$ reported for Martins Ferry and 1.49 $\mu g/m^3$ reported for the Brilliant Station. For this reason their two data points are not really approximate to their discussion.

In closing, it would be appropriate to conclude that PNA concentrations at all of the stations studied were significantly higher than typical background stations such as Hannibal. The marked increase in total benzopyrene concentrations and total PNAs in proceeding upriver can be attributable to the increased industrial activity.

However, to state that the prevalence of coking and steel operations was the sole contributing factor would be merely conjecture. If they were the sole industrial sources in the entire region then perhaps such a statement would be appropriate. However, since the power industries, prevalent in this region, are also a potential source of PNA emission, additional data points would be necessary to differentiate between the two emission sources

SECTION 5

AIR QUALITY - EMISSIONS ANALYSIS

Under this task, meteorological and annual emissions data were examined on 30 days during 1978 when at least one of the 20 valley monitors exceeded the secondary standard in an attempt to identify obvious source-receptor relationships. These 30 days included the 6 days from which filters were selected for analysis, as described in Section 3.

METHODOLOGY

The distribution of TSP within the valley on the 30 selected days was examined and the days separated into three categories: valleywide violation days, quasi-valleywide violation days, and spatially-isolated violation days. It was expected that only isolated violation days would prove to be helpful in the identification of source-receptor relationships, but for completeness meteorological conditions prevailing during the other two violation categories were also reviewed and summarized.

Meteorological data available for use in the analysis comprised the following: wind direction at Weirton, Wellsburg, Steubenville, Wheeling, and Pittsburgh, as available; morning and afternoon mixing layer heights and windspeeds at Pittsburgh; and synoptic weather maps. Daily TSP concentration maps and summaries of the meteorological data were submitted in Monthly Progress Reports No. 6 and No. 7, respectively. The most complete sets of wind data within the valley were obtained from the Wellsburg and Steubenville sites. As shown later, the wind direction at the two sites was not consistent and the Wellsburg data were selected as being the more representative of the general airflow within the valley. Appendix D provides a brief description of the synoptic weather pattern experienced each day.

Examination of the wind data on these selected days reveals that wind direction typically is quite variable both along the valley and at the individual monitoring sites. In addition, winds measured within the valley will only occasionally be representative of the air stream into which emissions from major power plants are ejected. Thus, the use of 24-hour TSP observations for the development of source-receptor relationships has severe limitations; as a consequence, results will be qualitative in nature and should be considered as supportive evidence only.

Table 14 is a frequency distribution of the number of sites experiencing concentrations greater than 150 $\mu g/m^3$ on the 30 days. It can be seen from this distribution that the selected days fall into three groups. On 17 days four or fewer sites had concentrations greater than 150 μg/m³. These have been designated isolated violation days, and have been selected for detailed study. At the other extreme are the three valleywide violation days on which 14 of the 20 monitoring sites exceeded 150 μg/m³. In between is the group of 10 days referred to as quasi-valleywide violation days on which the number of violation sites ranged from 6 to 11.

TABLE 14. FREQUENCY DISTRIBUTION OF NUMBER OF SITE VIOLATIONS

Number of sites > 150 μg/m³	Frequency of occurrence	
1	11	Isolated violation days
2	1	
3	5	
4	-	
5	-	
6	1	Quasi-valleywide violation days
7	1	
8	3	
9	2	
10	1	
11	2	
12	-	
13	-	
14	3	Valleywide violation days
15	-	
Total	30	

RESULTS

Overview

For a detailed account of emissions in the vicinity of each of the 20 valley monitors, reference should be made to Appendix A of this report. In this section, the analysis will consist principally of identifying those point sources which are judged to be upwind of monitors experiencing an exceedance of the secondary standard on isolated violation days.

Before proceeding to the detailed analysis, it is helpful to get an overview of the major centers of point source emissions within the study area. Figure 7 presents this information in the form of an emission density map with 2.5 km by 2.5 km grid squares. This map shows that the principal concentration of emissions is contained along the valley roughly from Brilliant to Weirton, with a second source to the west of New Manchester. A third major region of emissions lies to the south near the junction of Belmont, Monroe, and Marshall counties.

Table 15 summarizes the air quality data for each of the three violation categories identified in Table 14. For convenience, the sites have been listed from north to south in Table 15. It can be seen from this table that there is

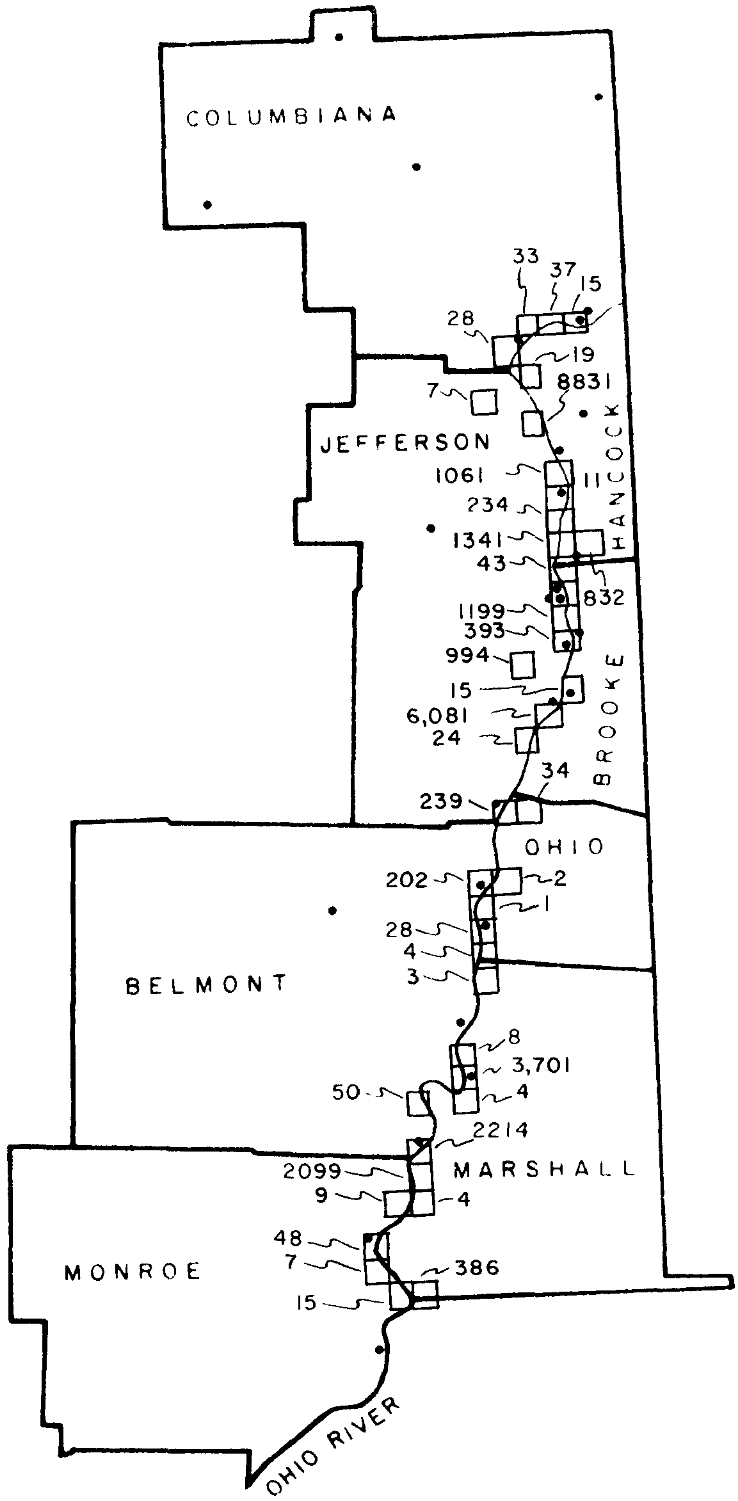


Figure 7. Point source emission density map. Emissions are in ton/yr/km^2 averaged over 2.5 × 2.5 km grid squares. Unidentified points are approximate location of monitors.

TABLE 15. NUMBER OF VIOLATIONS AND AVERAGE CONCENTRATION AT EACH SITE BY VIOLATION CATEGORY

Site	Violation category								
	Isolated			Quasi-valleywide			Valleywide		
	N	Number >150 μg/m³	Average concentration (μg/m³)	N	Number >150 μg/m³	Average concentration (μg/m³)	N	Number >150 μg/m³	Average concentration (μg/m³)
East Liverpool (Fire Station)	17	3	106	10	9	200	3	3	232
East Liverpool (City Hall)	16	3	116	8	2	124	3	2	157
Wellsville	17	2	90	10	9	190	3	3	222
New Manchester	15	0	68	10	3	132	3	2	195
New Cumberland	16	0	71	9	1	131	3	2	204
Toronto	11	0	67	8	6	175	2	2	312
Weirton	16	1	94	10	7	160	3	2	225
Steubenville (Jeff. Co. Bldg.)	17	3	97	10	6	174	3	3	314
Steubenville (Court House)	17	2	106	9	8	205	3	3	320
Follansbee	16	2	99	8	4	143	2	2	218
Mingo Junction	17	8	140	9	9	188	3	3	284
Wellsburg	14	0	95	9	4	148	1	1	246
Brilliant	17	0	84	10	2	118	3	2	157
Tiltonsville	17	1	86	10	0	113	3	2	129
Martins Ferry	16	0	75	10	0	107	3	3	166
Shadyside	17	1	92	10	0	103	3	1	140
Moundsville	13	0	86	9	1	99	3	0	140
Powhattan Point	15	1	89	10	7	175	2	1	172
Clarington	17	1	83	9	6	208	3	3	305
Hannibal	16	0	63	10	2	124	3	2	200
Average Concentration (μg/m³)			90			151			217

a rough correspondence between the centers of point-source emissions shown in Figure 7 and air quality. Each of the violation categories will be examined in some detail in the discussion which follows.

Valleywide Violation Days

May 26th, August 24th, and November 4th were the three days classified as valleywide violation days. On these days unusually high TSP concentrations were experienced not only within the valley itself, but also at sites outside of the valley to the west. On each of the 3 days, the study area experienced synoptic weather conditions conducive to light variable winds and no significant precipitation. On May 26th, a high pressure center remained over the area throughout the day; on August 24th, a high pressure cell dominated the southeastern part of the United States; and on November 4th, a high pressure ridge extended southwestward over the study area. Also, on May 26th and August 24th morning mixing heights were exceptionally low, being 95 and 88 meters, respectively. Thus, weather conditions were favorable for the accumulation and intermingling of pollutants within the valley air mass on each of the 3 days. Under these conditions, it is difficult, if not impossible, to attribute site violations to individual source contributions. However, in moving southward along the valley from the Steubenville-Weirton-Follansbee area, concentrations drop significantly and then rise near the southern end of the study area (see Table 15) indicating an impact from a new set of sources.

Table 16 shows combined wind direction frequency distributions for the 3 days at Wellsburg and Steubenville within the valley and Pittsburgh 30 miles to the east. There is rough similarity between the distributions for Wellsburg and Pittsburgh, with each showing a minimum of easterly winds and a maximum of northerly winds. The difference between the secondary maximum of southerly winds at Wellsburg and the secondary maximum of southeasterly winds at Pittsburgh may be a result of channeling at the Wellsburg site. In contrast, the distribution for Steubenville is flatter, with all directions represented, but with a maximum of east and east-southeast winds.

Quasi-valleywide Violation Days

The 10 days on which violations occurred at from 6 to 11 sites were:

9 March	1 June	13 July	18 August	11 October
20 May	7 July	19 July	5 September	10 November

The average concentrations observed at each site during this 10-day period have been taken from Table 15 and plotted in Figure 8. Of note is the approximate agreement between the areas with high point-source emissions and high average concentrations (see Figure 7). Also of interest is the relatively low concentration observed at the City Hall in East Liverpool in comparison with the high concentration observed at the Fire Station in East Liverpool. The difference in monitor heights (City Hall, 65 ft; Fire Station, 18 ft), the close proximity of East Pennsylvania Avenue to the Fire Station, and the high frequency of southerly winds suggest a greater impact of fugitive dust at the Fire Station.

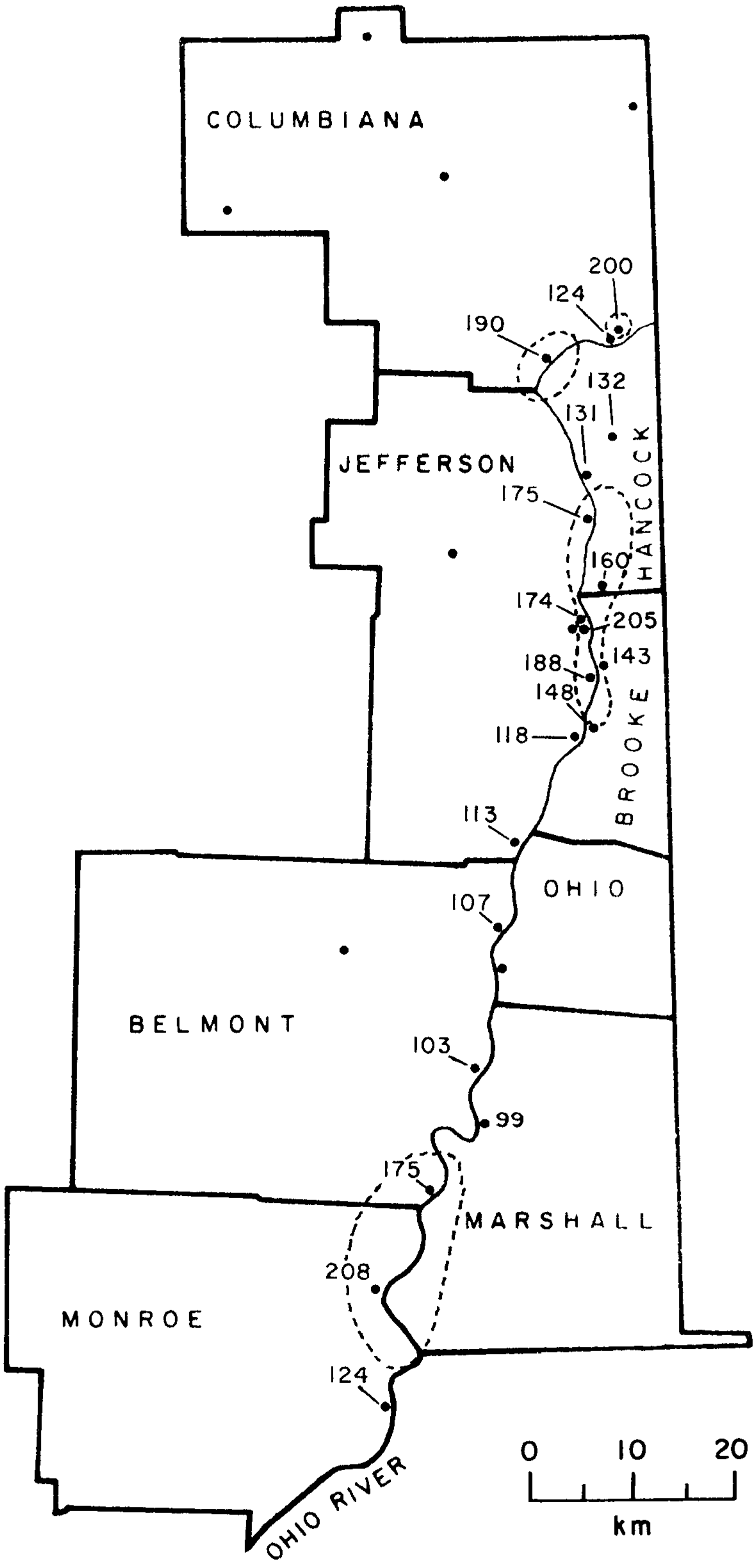


Figure 8. Average TSP concentrations during quasi-valleywide violation days. Dashed lines enclose approximate areas with average concentrations > 150 μg/m^3.

TABLE 16. COMBINED WIND DIRECTION FREQUENCY DISTRIBUTION AND AVERAGE WIND SPEED FOR VALLEYWIDE VIOLATION DAYS

Direction (deg)	Wellsburg (percent)	Pittsburgh (percent)	Steubenville (percent)
30	6.3	4.8	4.2
60	0	0	4.2
90	0	0	15.3
120	0	4.8	18.1
150	7.9	9.5	9.7
180	11.1	0	6.9
210	4.8	0	11.1
240	6.3	9.5	5.6
270	17.5	19.0	8.3
300	6.3	4.8	4.2
330	11.1	19.0	2.8
360	28.6	28.6	9.7
Total	99.9	100.0	100.1
Average speed (mph)	-	6.0	2.3

Table 17 presents the combined wind direction frequency distributions for these 10 days. At Wellsburg, the maximum frequency is from the south, with a secondary maximum from the north. At Steubenville, maximum frequencies are from the southeast. The Pittsburgh distribution is roughly intermediate between the other two, but in contrast to Wellsburg, no winds from 320 to 10 degrees were observed.

Isolated Violation Days

Table 18 presents the available wind data from Wellsburg, Steubenville, and Pittsburgh for the 17 days designated as isolated violation days. Emissions and meteorological data for these days have been reviewed in an attempt to identify source-receptor relationships. The procedure followed for each of the sites experiencing an exceedance was to superimpose composite wind direction frequency roses for the days when exceedances occurred upon the point source emission fields out to a distance of approximately 5 miles. Point sources upwind from the monitors could then be identified. Additionally, for comparison purposes, wind direction roses were prepared for the nonviolation days at each site. In preparing the wind roses, the wind direction data from the Wellsburg site were used. The figure for each site contains two parts. Part a presents the wind roses and point source emissions out to about 5 miles; part b identifies these sources and includes additional sources to a distance of 10 miles. Table 19 summarizes the number of exceedances experienced by each of the 12 sites.

TABLE 17. COMBINED WIND DIRECTION FREQUENCY DISTRIBUTION AND AVERAGE WIND SPEED FOR QUASI-VALLEYWIDE VIOLATION DAYS

Direction (deg)	Wellsburg (percent)	Steubenville (percent)	Pittsburgh (percent)
30	3.3	4.2	4.7
60	0.9	4.6	1.6
90	0	9.6	1.6
120	2.3	25.4	7.8
150	12.7	23.7	26.6
180	28.6	9.6	12.5
210	15.5	6.7	14.1
240	11.3	4.6	12.5
270	6.1	1.2	9.4
300	2.8	5.4	9.4
330	5.6	1.7	0
360	10.8	3.3	0
Total	99.9	100.0	100.2
Average speed (mph)		2.8	5.9

East Liverpool--

Because of their proximity, the two sites in East Liverpool will be discussed together. Throughout the discussion it should be borne in mind that the East Side Fire Station hi-vol is located at a height of 18 feet and is approximately 45 feet from Pennsylvania Avenue, while the monitor at City Hall is at a height of 65 feet. Table 19 shows that 6 isolated violation days occurred at East Liverpool. Three of these (12 August, 30 August, and 17 September) were at the City Hall monitor, and three (21 March, 14 April, and 25 July) were at the Fire Station. Note that the exceedances occurred on different days at the two sites.

TABLE 18. FREQUENCY DISTRIBUTIONS OF WIND DIRECTION, AVERAGE WIND SPEED AND SITE EXCEEDANCES ON ISOLATED VIOLATION DAYS

Date / Site	Direction (deg) 30	60	90	120	150	180	210	240	270	300	330	360	No direction[a]	Total	Average speed (mph)	Site exceedance
January 2																
Wellsburg													24	24		Tiltonsville
Steubenville					1	8	11	4						24	4	Shadyside
Pittsburgh								1	5	2				8	16.5	
January 14																
Wellsburg	1									1	4	18		24		
Steubenville							1	1		18	4			24	4	Weirton
Pittsburgh	1										5	2		8	12.4	
February 1																
Wellsburg	6				3	6	4	1	2		2			24		
Steubenville				6	7	2	2	2		2	3			24	2	Mingo Junction
Pittsburgh						3		4					1	8	6.8	
February 7																
Wellsburg								1	2	3	17	1		24		
Steubenville							12	7	2	3				24	4	Steubenville (C.H.)
Pittsburgh									3	4	1			8	11.9	
February 13																
Wellsburg													24	24		
Steubenville		3	1			1					2	5	12	24	4	Mingo Junction
Pittsburgh	2	6												8	8.9	
February 19																
Wellsburg	11		1		2					3	4	3		24		
Steubenville			2	3		2			1	9	5	2		24	2	Mingo Junction
Pittsburg	1	1							1	1	1	2	1	8	5.6	
March 21																
Wellsburg					2	5	6	1	1				9	24		E. Liverpool (F.S.)
Steubenville				5	8	4	5	2						24	5	Steubenville (JCB)
Pittsburg						2	3	1	1	1				8	14.4	Follensbee
April 14																
Wellsburg					4	3		1	2	3	8		3	24		E. Liverpool (F.S.)
Steubenville				2	4	3	3	9	2	1				24	4	Follensbee
Pittsburg								2	2	4				8	13.1	Mingo Junction
April 26																
Wellsburg	2											22		24		
Steubenville										5	11	8		24	8	Mingo Junction
Pittsburgh	1	5	1									1		8	12.5	

(continued)

TABLE 18 (continued)

Date / Site	Direction (deg) 30	60	90	120	150	180	210	240	270	300	330	360	No direction[a]	Total	Average speed (mph)	Site exceedance
June 7																
Wellsburg	1	2	1			7	9				1		3	24		Wellsville
Steubenville		1	4	5	6	3	1			2	2			24	4	Steubenville (JCB)
Pittsburgh			2	1	1		2	2						8	9.8	Mingo Junction
July 25																
Wellsburg					4	9	10						1	24		E. Liverpool (F.S.)
Steubenville				12	10		2							24	3	Wellsville
Pittsburgh					1	1	5						1	8	5.9	Steubenville (JCB)
July 31																
Wellsburg	1	1			1	2	1	4	2	1	4	4	3	24		
Steubenville			2	7	9		2	4						24	2	Mingo Junction
Pittsburgh		1			1		1	1	1	2		1		8	6.6	
August 6																
Wellsburg													24	24		
Steubenville			1	7	6		3	2	3			2		24	1	Powhattan PT
Pittsburgh	1			1			1			1		4		8	6.0	
August 12																
Wellsburg	1	1		1	2		1		4	2	8	2	2	24		E. Liverpool (C.H.)
Steubenville	2	1	1	1			1		6	5	2	5		24	3	Steubenville (C.H.)
Pittsburgh	4	1	1									1	1	8	4.0	Mingo Junction
August 30																
Wellsburg													24	24		
Steubenville			1	2	3	2	4	1	3	5	2	1		24	2	E. Liverpool (C.H.)
Pittsburgh		1				1		1			1	1	3	8	4.6	
September 17																
Wellsburg					1	14	8						1	24		
Steubenville			2	12	7	2	1							24	3	E. Liverpool
Pittsburgh						1	2	1					4	8	3.7	
December 28																
Wellsburg	5				2				1	3	3	10		24		
Steubenville		1	1	2	2		2	3	3	2	1	7		24		Clarington
Pittsburgh	1	3						1	1	1		1		8		
All days %																
Wellsburg	9.7	1.4	0.7	0.3	7.2	15.9	13.4	2.8	4.8	5.5	17.6	20.7		100.0		
Steubenville	0.5	1.8	4.8	14,4	14.9	7.6	12.4	8.8	5.1	13.6	8.6	7.6		100.1	3.5	
Pittsburgh	8.8	14.4	3.2	1.6	2.4	6.4	9.6	11.2	11.2	12.8	7.2	11.2		100.0	10.1	

[a]Missing data or calm.

TABLE 19. NUMBER OF EXCEEDANCES PER SITE ON ISOLATED VIOLATION DAYS

Site	Number of exceedances				
	Number of sites >150 $\mu g/m^3$				Total
	1	2	3	4	
E. Liverpool (Fire Station)	-	-	3	-	3
E. Liverpool (City Hall)	2	-	1	-	3
Wellsville	-	-	2	-	2
Weirton	1	-	-	-	1
Steubenville (Jeff. Co.)	-	-	3	-	3
Steubenville (Court House)	1	-	1	-	2
Follansbee	-	-	2	-	2
Mingo Junction	5	-	3	-	8
Tiltonsville	-	1	-	-	1
Shadyside	-	1	-	-	1
Powhattan PT	1	-	-	-	1
Clarington	1	-	-	-	1

Figure 9a shows a major difference in the wind direction roses for violation and nonviolation days, with southerly winds being most frequent on violation days and northerly winds being most frequent on the remaining days. The orientation of Pennsylvania Avenue, shown in the upper part of Figure 9a, suggests that fugitive dust from vehicular traffic may have been a major source of particulate on these 3 days. There are no other obvious upwind sources of major significance nearby. Figure 9b identifies the sources.

Examination of Figure 10a shows that southerly and south-southwesterly winds also predominated on the 3 violation days at the City Hall. In this case, the height of the monitor rules out major contributions from nearby fugitive dust sources. Again, there appear to be no very significant upwind sources nearby. Examination of Figures 10b and Table 18 shows that the Ohio Edison Plant (Source No. 10) 6.6 miles to the SSW lies upwind of the City Hall for much of the time on 30 August and 17 September. On 12 August, however, winds along the valley were principally from the northwest quadrant. The most likely source shown in the inventory under these circumstances would be the Homer Laughlin plant about 1-1/4 miles to the west. It is also likely that whenever the wind has a significant westerly component local lower-level emissions are channeled toward the monitor by the river valley and its northern wall which rises sharply north of the business district.

Figure 11 was prepared from the 30-day data base in an attempt to use wind direction to differentiate sources impacting on the two East Liverpool sites. All days on which the secondary standard was exceeded at either site and the difference between the two sites was at least 20 $\mu g/m^3$ were selected

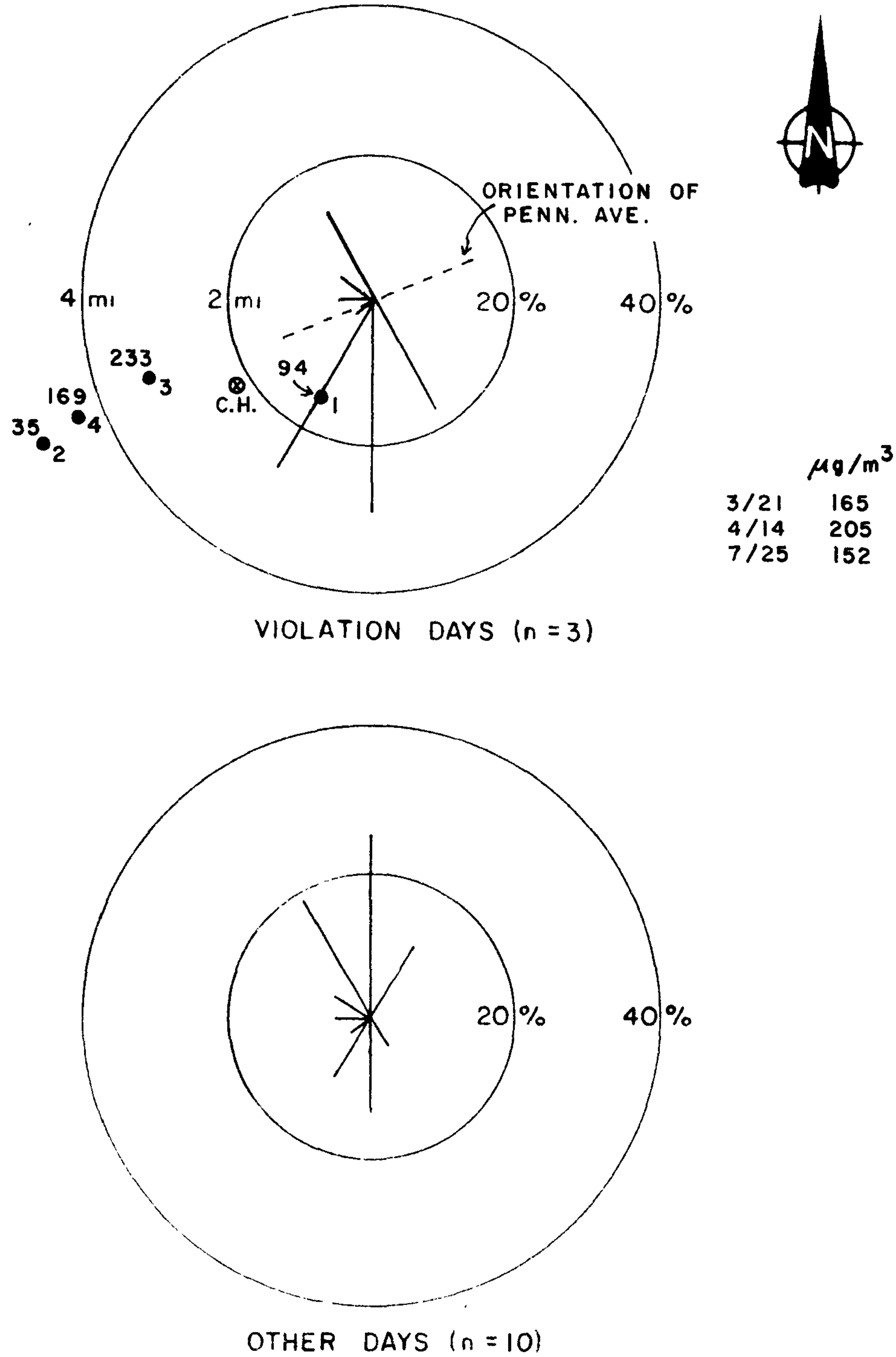
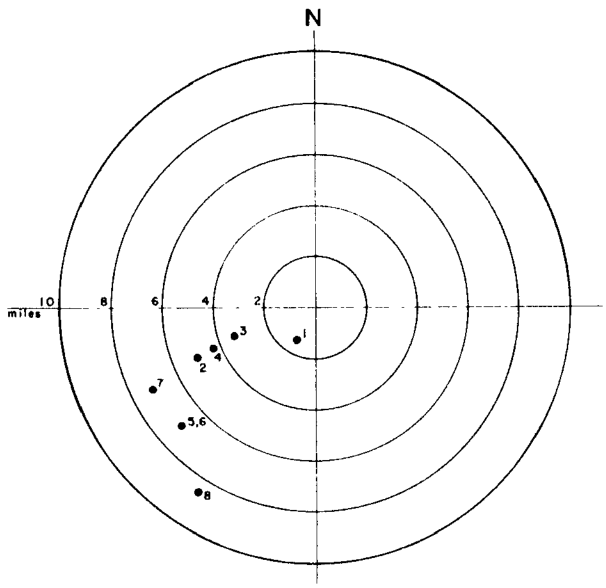


Figure 9a. Wind direction roses for selected days at East Liverpool (Fire Station). Locations of major nearby point sources and their annual emissions in tons per year are also shown in the upper part of the figure.



POINT SOURCE SUMMARY

SITE: E LIVERPOOL FIRE   UTM: 538.55 E , 4498.35 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
537.50	4496.20	94.00	1.54	210.2	1	TAYLOR,SMITH,KTA
531.00	4495.20	35.00	5.08	247.4	2	QUAKER STATE OIL
533.40	4496.60	233.00	3.38	251.5	3	HOMER LAUGHLIN C
531.90	4495.70	169.00	4.45	248.5	4	GLOBE REFRACTORI
530.00	4491.00	57.00	7.01	229.5	5	TRI-STATE ASPHAL
530.00	4491.00	59.00	7.01	229.5	6	TRI-STATE ASPHAL
528.10	4493.10	172.00	7.27	243.5	7	SWANK REFRACTORIE
531.10	4486.70	12715.00	8.59	212.6	8	OHIO EDISON CO.

Figure 9b. Point source summary - East Liverpool Fire Station.

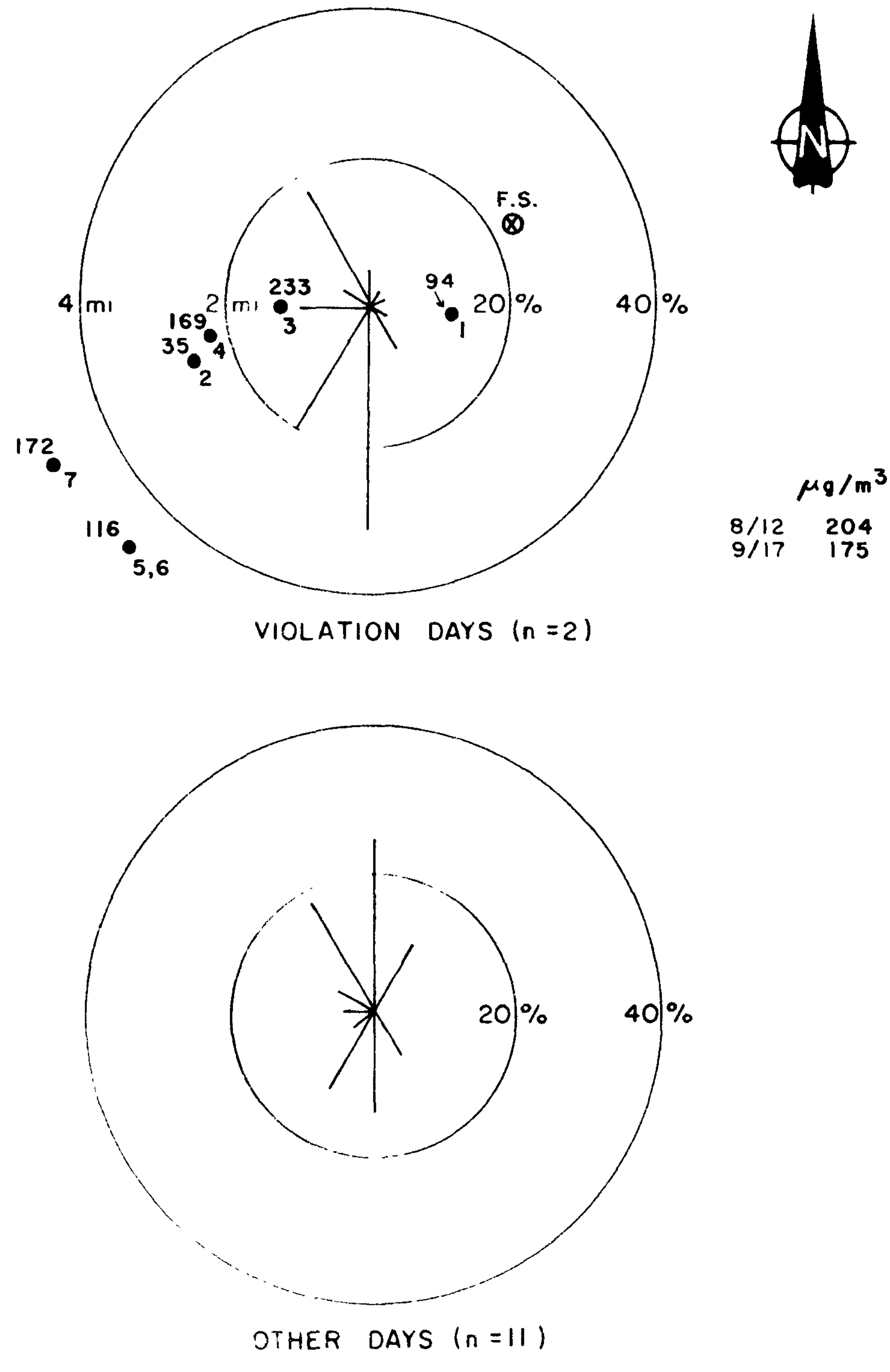
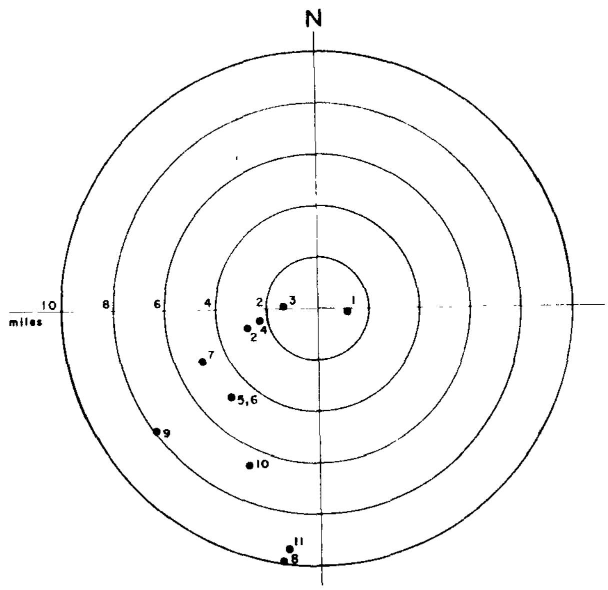


Figure 10a. Wind direction roses for selected days at East Liverpool (City Hall). Locations of major nearby point sources and their annual emissions in tons per year are also shown in the upper part of the figure.



POINT SOURCE SUMMARY

SITE: E LIVERPOOL CH UTM: 535.46 E , 4496.46 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
537.30	4496.20	94.00	1.15	98.1	1	TAYLOR.SMITH.KTA
531.00	4495.20	35.00	2.88	254.2	2	QUAKER STATE OIL
533.40	4496.60	233.00	1.28	273.9	3	HOMER LAUGHLIN C
531.90	4495.71	169.00	2.26	257.9	4	GLOBE REFRACTORI
530.00	4491.00	57.00	4.80	225.0	5	TRI-STATE ASPHAL
530.00	4491.00	59.00	4.80	225.0	6	TRI-STATE ASPHAL
528.10	4493.10	172.00	5.03	245.5	7	SWANK REFACTORIE
533.30	4480.70	35.00	9.89	187.8	8	KAUL CLAY CO.
525.30	4488.90	43.00	7.87	233.3	9	F.J. DANDO CO:
531.10	4486.70	12715.00	6.64	204.1	10	OHIO EDISON CO.
533.50	4481.50	461.00	9.38	187.5	11	OHIO EDISON CO./

Figure 10b. Point source summary - East Liverpool City Hall.

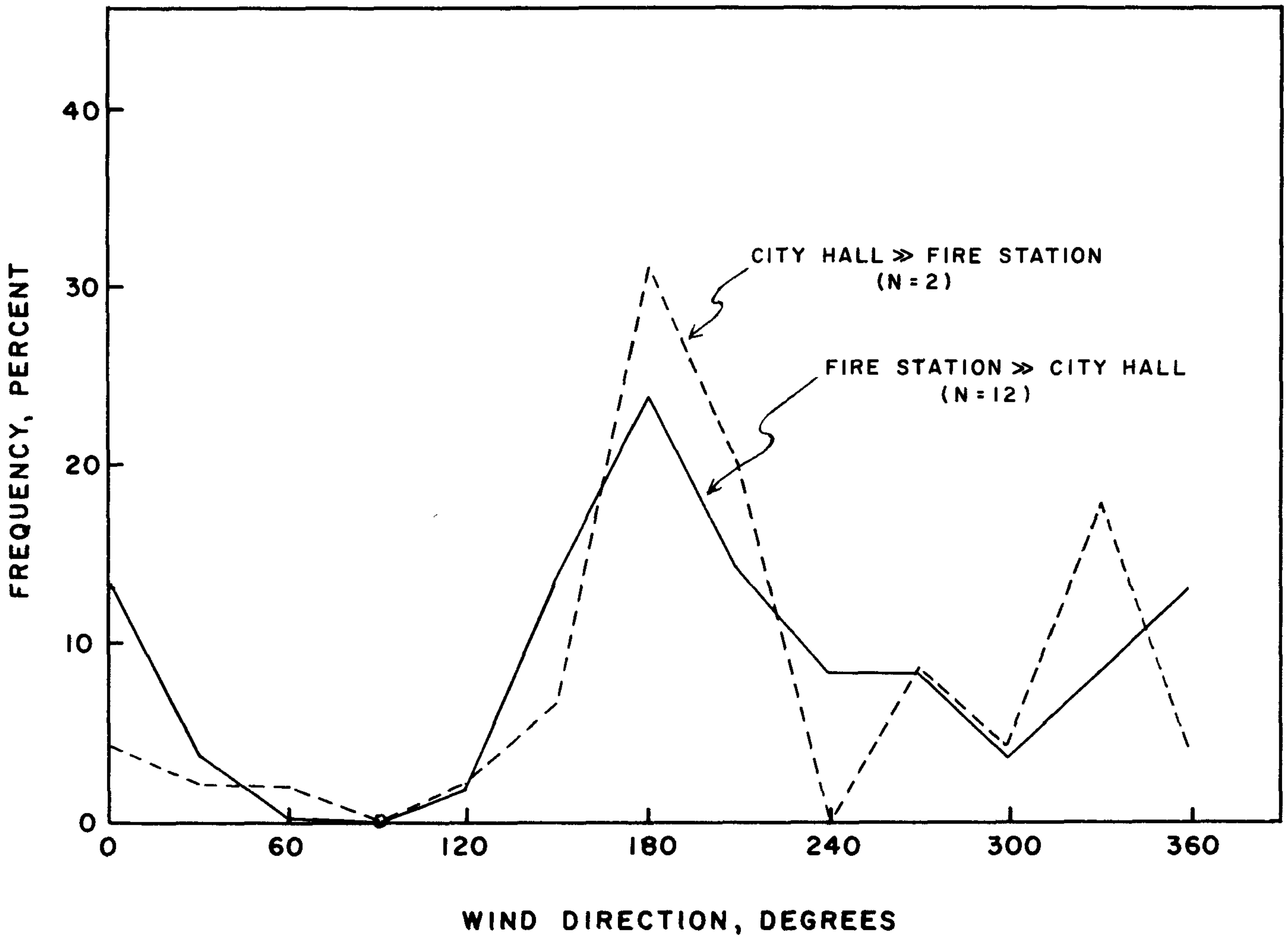


Figure 11. Comparison of wind directions at Wellsburg when the concentration at the Fire Station in East Liverpool exceeds that at the City Hall with those when the concentration gradient is reversed.

for study. These days were then grouped according to the site with the higher concentation, and the wind direction frequency distribution for the two groups plotted. The major feature of each distribution is the large proportion of southerly winds. Since the inventory shows no sources to the northwest of either site, no attempt has been made to relate the differences between the two curves from 240 to 360 degrees to point-source emissions.

Wellsville--

Figure 12a shows that south and southwesterly winds prevailed on the 2 violation days at Wellsville. Small upwind sources include the Swank Refractories (Source No. 7) and Tri-State Asphalt (Source Nos. 5 and 6). Elevated concentrations at East Liverpool on both these days suggested contributions within the valley from the Ohio Edison Plant (Source No. 10). Figure 12b identifies the sources.

Weirton--

As shown in Figure 13a, winds on the 1 isolated violation day at Weirton were almost entirely from the north and northwest, bracketing the major Weirton Steel operations which are identified on the WVAPCC-NPRO site map as: Brown's Island Coke Battery, Mainland Coke Plant, Boiler House, Sinter Plants, BOF Plant, and Strip Mill. Total emissions from upwind sources 1 through 6 plus 8 are approximately 15,000 tons per year. All of the remaining nearby point sources are to the south-southwest. Concentrations at Toronto, New Cumberland and New Manchester upwind of the Weirton Steel Plants range from 24 to 41 $\mu g/m^3$ suggesting an impact of the order of 100 $\mu g/m^3$ from these sources at the Weirton monitor. Figure 13b identifies the sources.

Steubenville--

There were 3 isolated violation days at the Jefferson County Building (Adams Street) site and two at the Court House, but none of the violation days were common at the two sites. Two of the differences between the sites that may be of significance are a difference in height, and a difference in topographical setting. In particular, the terrain rises abruptly immediately to the west of the Jefferson County Building, the elevation of which is already 80 feet above that of the Court House. This results in a blocking of pollution moving in from the east, and also affects the direction of the wind at the County Building. The Court House is approximately 0.36 miles to the east and its monitor is located 50 feet above street level.

Examination of Figures 14a and 14b show a line of major point sources extending southward along the river. As identified by the WVACC-NPRO site maps, these are, with increasing distance from the Steubenville monitors: Weirton Steel, Steubenville Works; Wheeling-Pittsburgh Steel, Steubenville Plant; Wheeling-Pittsburgh Steel, Coke Plant, Koppers Company; Wheeling-Pittsburgh Steel, Sinter Plant; and Wheeling-Pittsburgh Steel, Mingo Plant. The combined annual emissions from the cluster of sources shown in this small area in Figures 14a and 14b are approximately 9900 tons per year. In addition, the complex of power plants 8 miles to the south emits over 66,000 tons per year and the Satralloy Plant, located within the Cross Creek Valley to the southwest emits over 6,000 tons of particulates per year. The composite wind rose shown in Figure 14a suggests that a combination of these sources is responsible

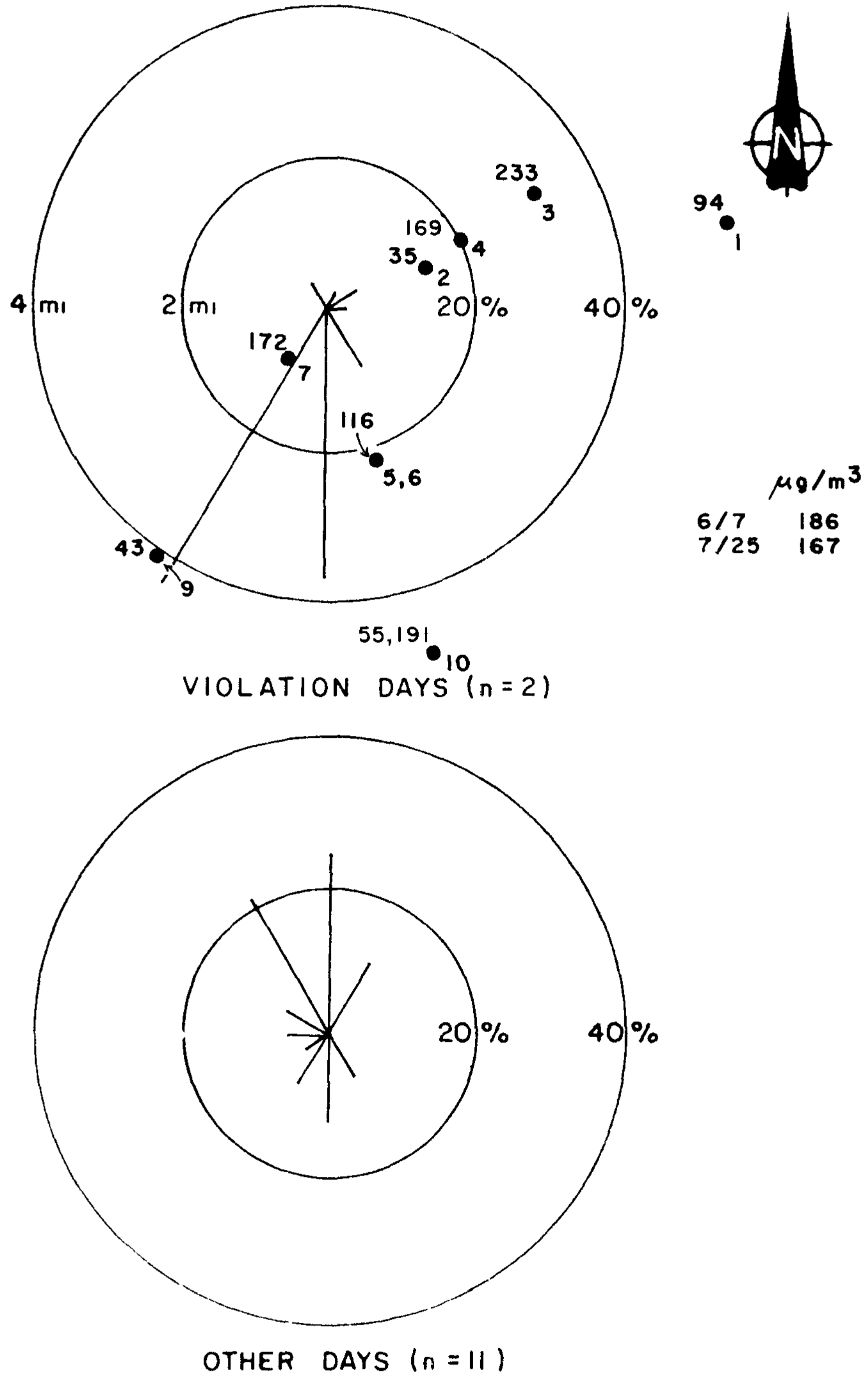
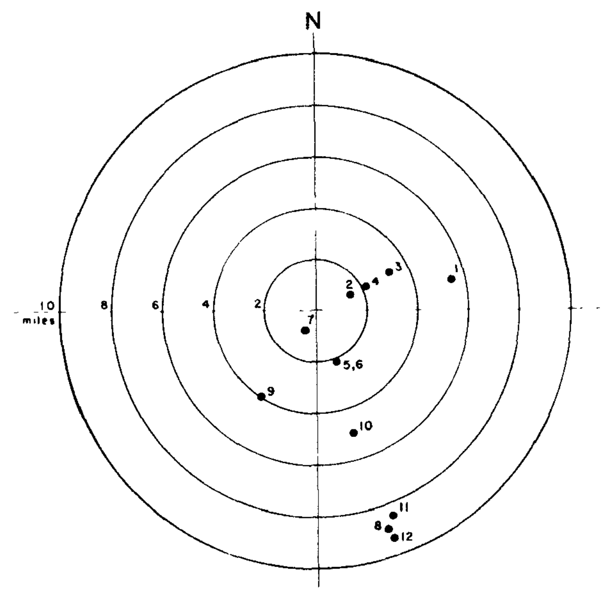


Figure 12a. Wind direction roses for selected days at Wellsville. Locations of major nearby point sources and their annual emissions in tons per year are also shown in the upper part of the figure.



POINT SOURCE SUMMARY

SITE: WELLSVILLE UTM: 528.88 E , 4494.25 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
537.50	4496.20	94.00	5.37	77.0	1	TAYLOR,SMITH,&TA
531.00	4495.20	35.00	1.44	66.0	2	QUAKER STATE OIL
533.40	4496.60	233.00	3.17	62.6	3	HOMER LAUGHLIN C
531.90	4495.70	169.00	2.08	64.4	4	GLOBE REFRACTORI
530.00	4491.00	57.00	2.14	161.0	5	TRI-STATE ASPHAL
530.00	4491.00	59.00	2.14	161.0	6	TRI-STATE ASPHAL
528.10	4493.10	172.00	0.86	214.1	7	SWANK REFACTORIE
533.30	4480.70	35.00	8.86	161.9	8	KAUL CLAY CO.
525.30	4488.90	43.00	4.00	213.8	9	F.J. DANDO CO.
531.10	4486.70	12715.00	4.89	163.6	10	OHIO EDISON CO.
533.50	4481.50	161.00	8.43	160.1	11	OHIO EDISON CO./
533.70	4480.00	1989.00	9.35	161.3	12	TORONTO PAPERBOA

Figure 12b. Point source summary - Wellsville.

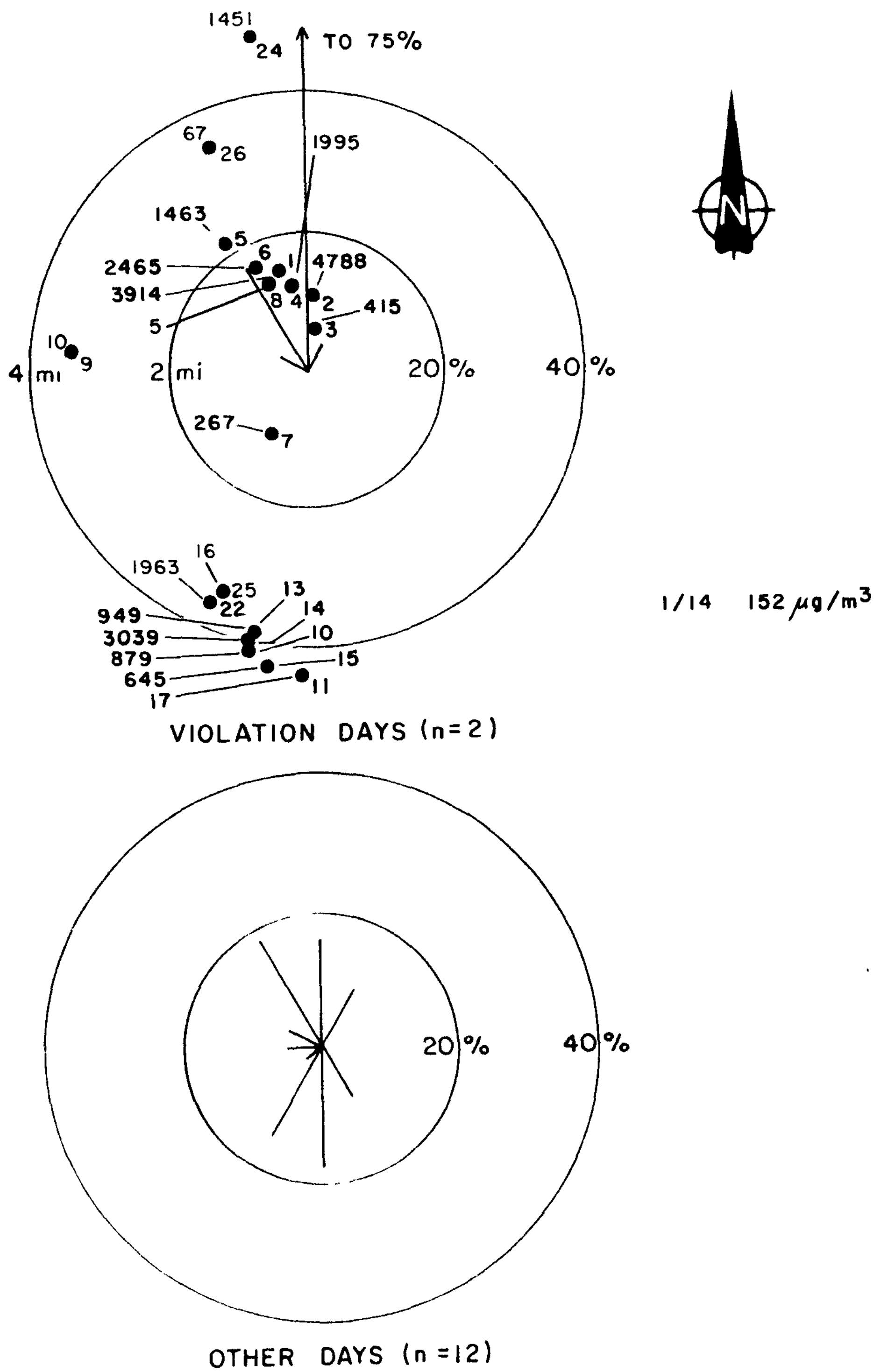
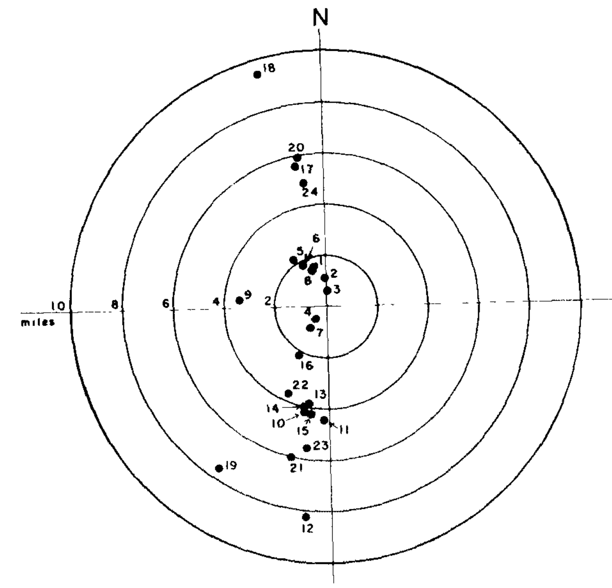


Figure 13a. Wind direction roses for selected days at Weirton. Locations of major nearby point sources and their annual emissions in tons per year are also shown the upper part of the figure.



POINT SOURCE SUMMARY

SITE: WEIRTON UTM: 534.90 E , 4472.08 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
534.50	4474.90	3914.00	1.49	345.5	1	WEIRTON STEEL/NA
535.00	4473.80	1788.00	1.07	3.3	2	WEIRTON STEEL/NA
535.00	4473.00	415.30	0.58	6.2	3	WEIRTON STEEL/NA
534.20	4471.10	1995.00	0.75	215.6	4	WEIRTON STEEL/NA
533.30	4475.00	1463.00	2.17	327.0	5	WEIRTON STEEL/NA
533.70	4474.50	2465.00	1.68	333.6	6	WEIRTON STEEL/NA
534.00	4470.70	267.00	1.02	213.1	7	STANDARD SLAG CO
534.20	4474.20	5.00	1.39	341.7	8	INTERNATIONAL MI
529.50	4472.50	10.00	3.37	274.5	9	IRON CITY SAND &
533.30	4465.50	879.30	4.19	192.8	10	KOPPERS CO.
534.60	4464.80	17.00	4.53	182.4	11	INTERNATIONAL MI
533.30	4458.90	94. 0	8.25	186.9	12	BANNER FIBERBOAR
533.60	4465.90	949.00	3.92	191.9	13	WHEELING PITTSBU
533.50	4465.80	3039.00	4.00	192.6	14	WHEELING PITTSBU
533.80	4465.30	645.00	4.27	189.2	15	WHEELING PITTSBU
533.20	4468.90	1100.00	2.24	208.1	16	FEDERAL PAPERBOA
533.30	4480.70	35.00	5.45	349.5	17	KAUL CLAY CO.
531.10	4486.70	12715.00	9.39	345.4	18	OHIO EDISON CO.
527.90	4462.00	20658.00	7.62	214.8	19	SATRALLOY INC.,
533.50	4481.50	161.00	5.92	351.5	20	OHIO EDISON CO./
532.50	4462.60	81.00	6.07	194.2	21	STANDARD SLAG CO
532.50	4466.70	1915.00	3.66	204.0	22	WHEELING-PITTSBU
533.50	4463.20	1218.00	5.59	189.0	23	WHEELING-PITTSBU
533.70	4480.00	1389.00	4.98	351.4	24	TORONTO PAPERBOA

Figure 13b. Point source summary - Weirton.

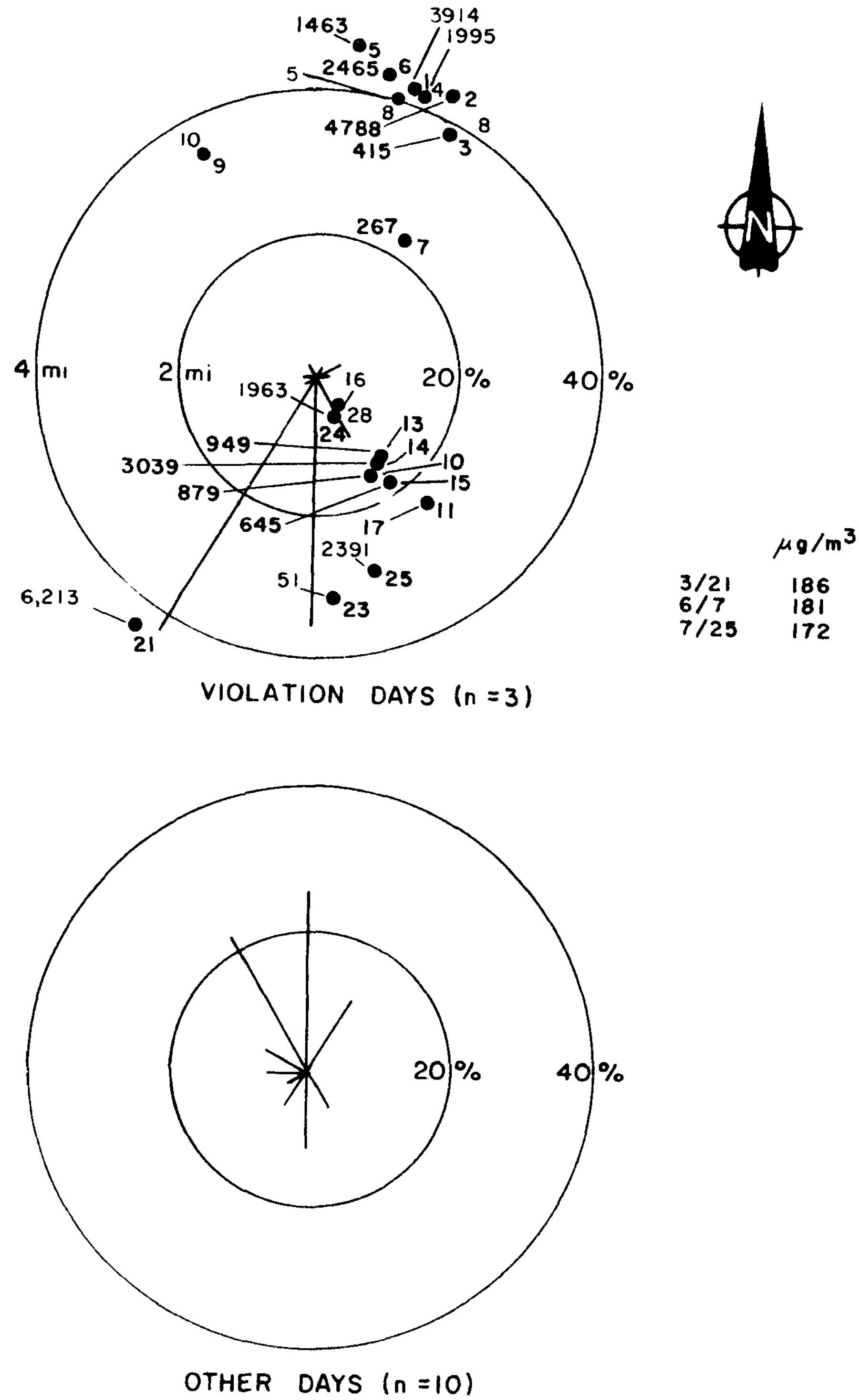
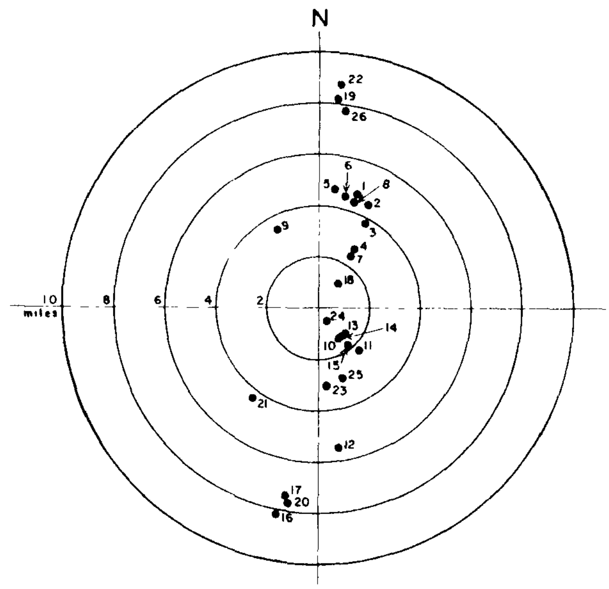


Figure 14a. Wind direction roses for selected days at Steubenville (Jefferson County Building). Locations of major nearby point sources and their annual emissions in tons per year are also shown in the upper part of the figure.



POINT SOURCE SUMMARY

SITE: STEUBENVILLE AD   UTM: 532.08 E , 4467.58 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	& NAME
534.30	4474.40	5911.00	4.46	18.1	1	WEIRTON STEEL/NA
535.10	4473.80	1788.00	4.27	25.2	2	WEIRTON STEEL/NA
535.00	4473.00	415.00	3.83	28.3	3	WEIRTON STEEL/NA
534.20	4471.10	1935.00	2.56	31.1	4	WEIRTON STEEL/NA
533.00	4475.00	1465.00	4.65	7.1	5	WEIRTON STEEL/NA
533.70	4474.50	2465.00	4.42	13.2	6	WEIRTON STEEL/NA
534.00	4470.70	267.00	2.28	31.6	7	STANDARD SLAG CO
534.20	4474.20	5.00	4.32	17.8	8	INTERNATIONAL MI
529.50	4472.50	10.00	3.45	332.4	9	IRON CITY SAND &
533.40	4465.50	879.00	1.53	147.5	10	KOPPERS CO.
534.60	4464.80	17.00	2.33	137.7	11	INTERNATIONAL MI
533.30	4458.90	94.00	5.45	172.0	12	HANNER FIBERBOAR
533.60	4465.90	949.00	1.41	137.8	13	WHEELING PITTSBU
533.50	4465.80	3039.00	1.41	141.3	14	WHEELING PITTSBU
533.80	4465.30	645.00	1.77	142.9	15	WHEELING PITTSBU
529.40	4454.90	480.00	8.05	191.9	16	BUCKEYE POWER
530.00	4455.80	58514.00	7.43	190.0	17	CARDINAL OPER. C
533.20	4468.90	1100.00	1.08	40.4	18	FEDERAL PAPERBOA
533.30	4481.70	55.00	8.19	5.3	19	KAUL CLAY CO.
530.00	4455.50	28609.00	7.62	189.8	20	OHIO POWER CO.
527.90	4462.00	20638.00	4.33	216.8	21	SATRALLOY INC.
533.50	4481.50	461.00	8.70	5.8	22	OHIO EDISON CO./
532.50	4462.60	81.00	3.10	175.1	23	STANDARD SLAG CO
532.50	4466.70	1915.00	0.61	154.3	24	WHEELING-PITTSBU
533.50	4463.20	1218.00	2.86	162.0	25	WHEELING-PITTSBU
533.70	4480.00	1939.00	7.78	7.1	26	TORONTO PAPERBOA

Figure 14b. Point source summary - Steubenville, Jefferson County Building.

for the elevated concentration at the County Building. On the average, the concentration was about 30 $\mu g/m^3$ higher here than at Mingo Junction, implying a substantial contribution from sources inbetween.

A second line of point sources is shown in Figures 15a and 15b extending northward from the Steubenville monitors to the Weirton Steel Complex about 4-1/2 miles away. The inventory shows one intermediate source, Standard Slag (Source No. 7). Additional Sources shown on the West Virginia site map include Continental Can and Metal Lithograph. Emissions indicated by this complex of sources are approximately 15,500 tons per year. The composite Wellsburg wind direction rose shown in Figure 15a indicates a prevailing northwesterly wind during the 2 isolated violation days at the Court House. It appears likely that the elevated levels on these days was due to a southerly drift of pollutants from these multiple sources.

As was done with the East Liverpool sites, concentrations at the two Steubenville sites were studied to see if differences in wind direction accounted for the concentration gradient between the two sites. Again, the procedure was to select days when at least one site exceeded the secondary standard and the difference between the two sites was at least 20 $\mu g/m^3$. The days were then grouped according to which site had the higher concentration, and the composite wind direction frequency distributions for the two groups plotted. Figure 16 shows the result. The two distributions are quite similar, with each showing a predominance of southeasterly winds. For this investigation, winds from the Steubenville site were used instead of from Wellsburg.

One pair of filters exposed at the Steubenville sites on 7 June was subjected to microscopic analysis during the original screening process. It is of interest to note that exceptionally large quantities of biological material, much of it stellate hairs, were found on the County Building filter. Observed concentrations were: County Building, 181 $\mu g/m^3$; Court House, 98 $\mu g/m^3$.

Follansbee--

The composite wind rose for the 2 violation days (Figure 17a), shows numerous upwind sources witnin 4 miles. Examination of the daily wind records shows predominantly southerly winds on 21 March, indicating a major contribution from the Mingo Wheeling-Pittsburgh Steel Plant. Concentrations at Brilliant and Wellsburg to the south of this source averaged 28 $\mu g/m^3$ lower than the concentration at Follansbee. On 14 April, the wind shifted from southerly to northwesterly early in the day apparently leading to an impact of perhaps 70 $\mu g/m^3$ from the immediate upwind sources (concentrations at the two Steubenville sites averaged 91 $\mu g/m^3$). In this case, the principal nearby upwind sources were the Wheeling-Pittsburgh Steel Coke and Sinter Plants, and Koppers Co. Figure 17b identifies the sources.

Mingo Junction--

The greatest number of isolated violation days which occurred at any of the sites was at Mingo Junction (see Table 19). Wind direction data from Wellsburg were available for 7 of the 8 days, and the composite wind roses for violation and nonviolation days are shown in Figure 18a. On the 7 violation days, the predominant directions are from the northwest, north, and northeast. The Wheeling-Pittsburgh Steel and Koppers Co. plants with

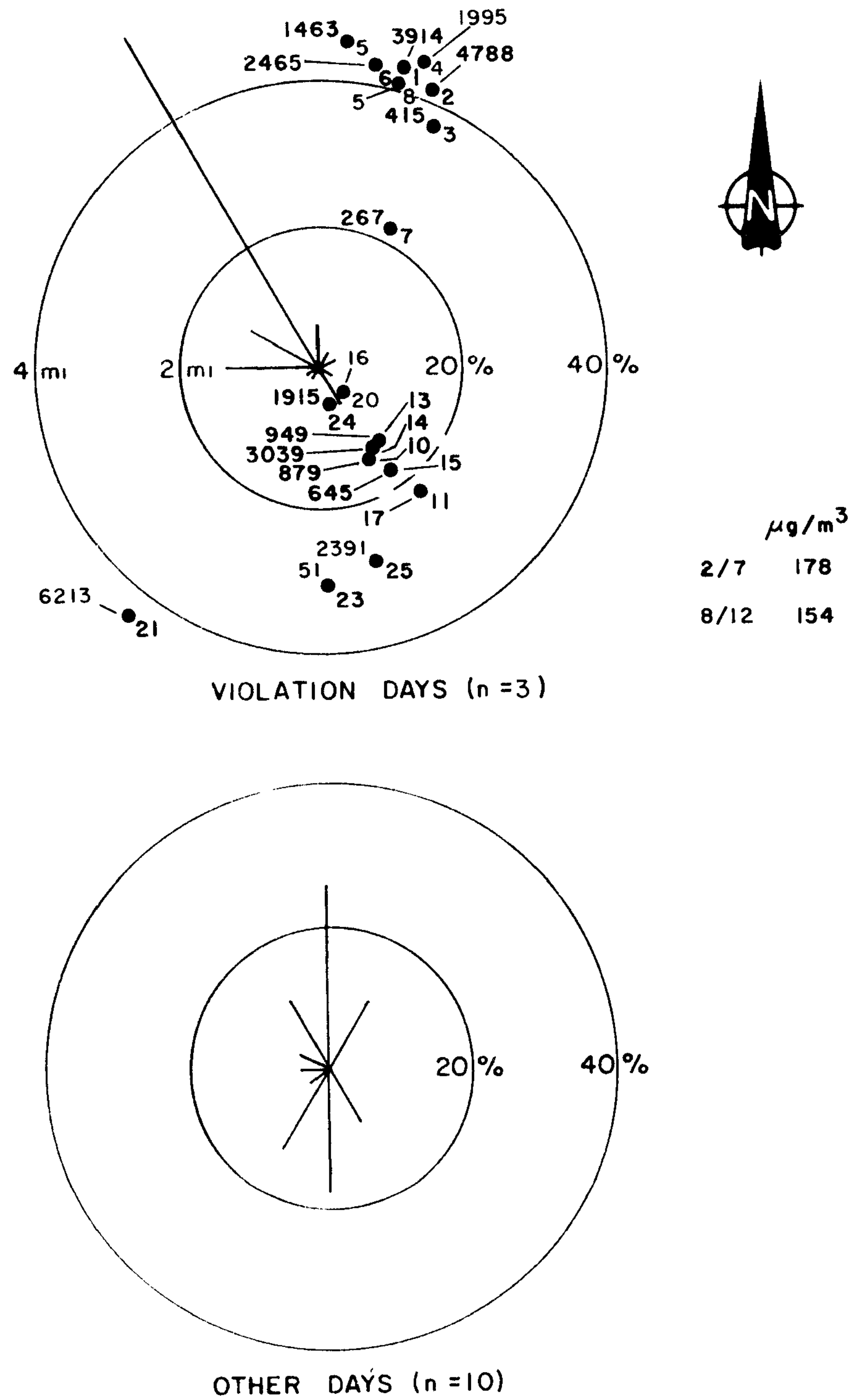
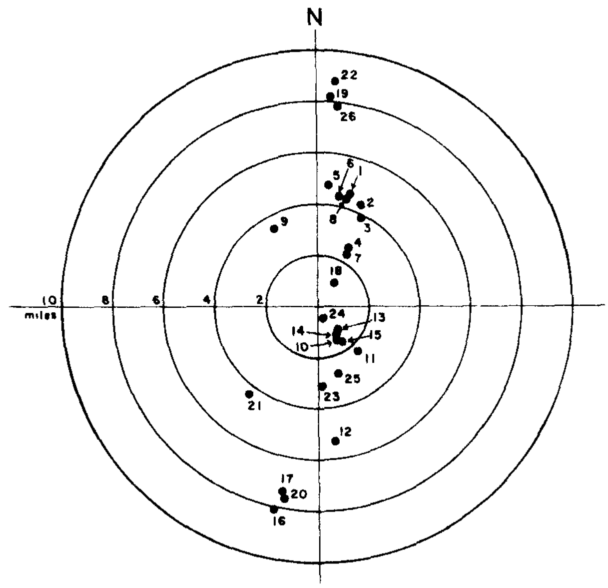


Figure 15a. Wind direction roses for selected days at Steubenville (Court House). Locations of major nearby point sources and their annual emissions in tons per year are also shown in the upper part of the figure.



POINT SOURCE SUMMARY

SITE: STEUBENVILLE CH   UTM: 532.24 E , 4467.55 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	& NAME
534.30	4474.40	3914.00	4.44	16.8	1	WEIRTON STEEL/NA
535.00	4473.80	4788.00	4.25	23.8	2	WEIRTON STEEL/NA
535.00	4473.00	415.00	3.80	26.9	3	WEIRTON STEEL/NA
534.20	4471.10	1995.00	2.52	28.9	4	WEIRTON STEEL/NA
533.00	4475.00	1463.00	4.65	5.8	5	WEIRTON STEEL/NA
533.70	4474.50	2465.00	4.41	11.9	6	WEIRTON STEEL/NA
534.00	4470.70	267.00	2.24	29.2	7	STANDARD SLAG CO
534.20	4474.20	5.00	4.31	16.4	8	INTERNATIONAL MI
529.50	4472.50	10.00	3.51	331.0	9	IRON CITY SAND &
533.40	4465.50	879.00	1.46	150.5	10	KOPPERS CO.
534.60	4464.80	17.00	2.25	139.3	11	INTERNATIONAL MI
533.30	4458.90	94.00	5.42	173.0	12	BANNER FIBERBOAR
533.60	4465.90	949.00	1.33	140.5	13	WHEELING PITTSBU
533.50	4465.80	3039.00	1.34	144.2	14	WHEELING PITTSBU
533.80	4465.30	645.00	1.70	145.2	15	WHEELING PITTSBU
529.40	4454.90	480.00	8.06	192.6	16	BUCKEYE POWER
530.00	4455.80	58314.00	7.43	190.8	17	CARDINAL OPER. C
533.20	4468.90	1100.00	1.03	35.5	18	FEDERAL PAPERBOA
533.30	4480.70	35.00	8.20	4.6	19	KAUL CLAY CO.
530.00	4455.50	28609.00	7.62	190.5	20	OHIO POWER CO.
527.90	4462.00	20638.00	4.38	218.0	21	SATRALLOY INC.,
533.50	4481.50	461.00	8.70	5.2	22	OHIO EDISON CO./
532.50	4462.60	81.00	3.08	177.0	23	STANDARD SLAG CO
532.50	4466.70	1915.00	0.55	162.9	24	WHEELING-PITTSBU
533.50	4463.20	1218.00	2.82	163.8	25	WHEELING-PITTSBU
533.70	4480.00	1989.00	7.79	6.7	26	TORONTO PAPERBOA

Figure 15b. Point source summary - Steubenville Court House.

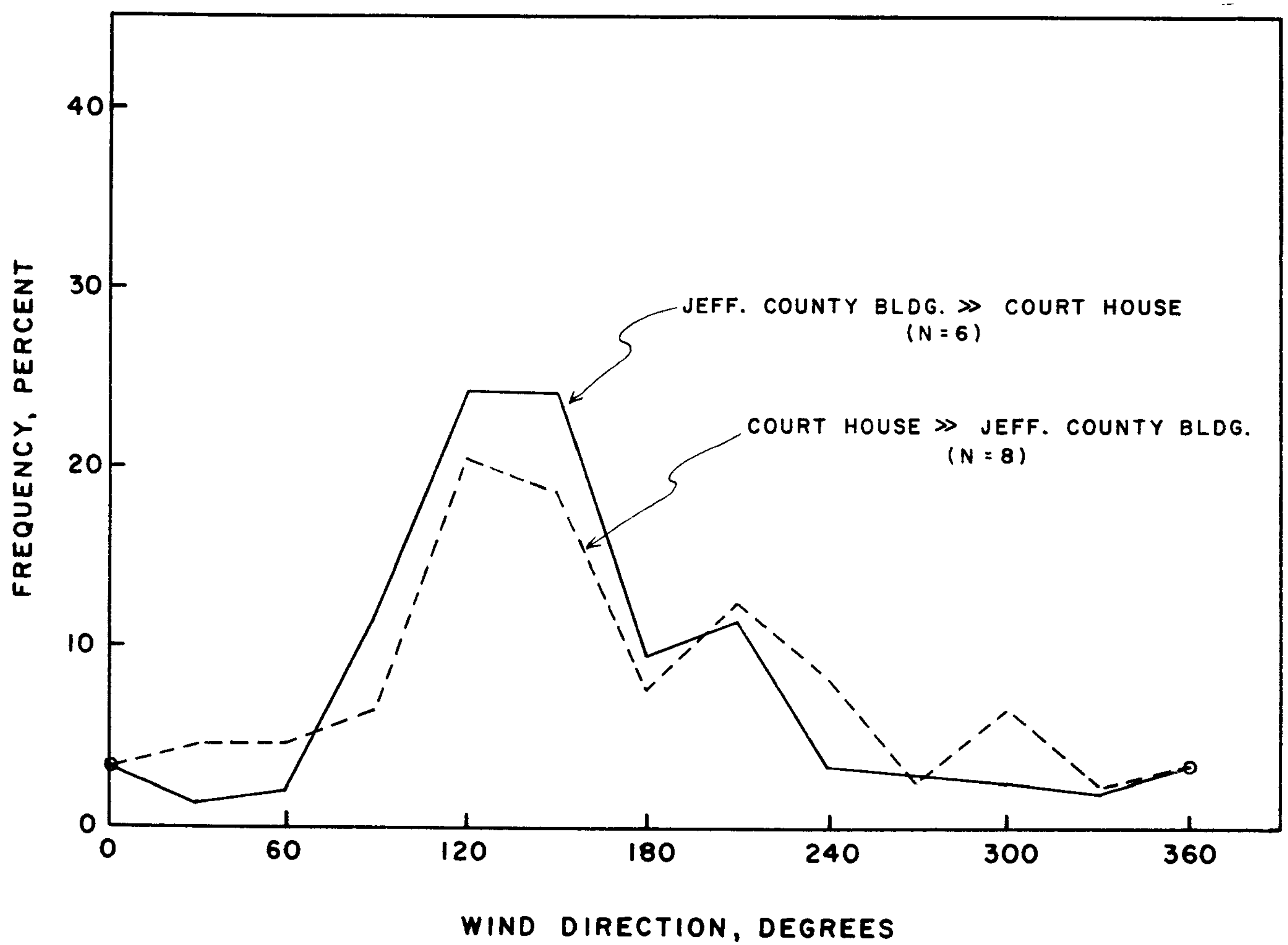


Figure 16. Comparison of wind directions at Steubenville on days when the concentration at the Jefferson County Building exceeds that at the Court House with those when the concentration gradient is reversed.

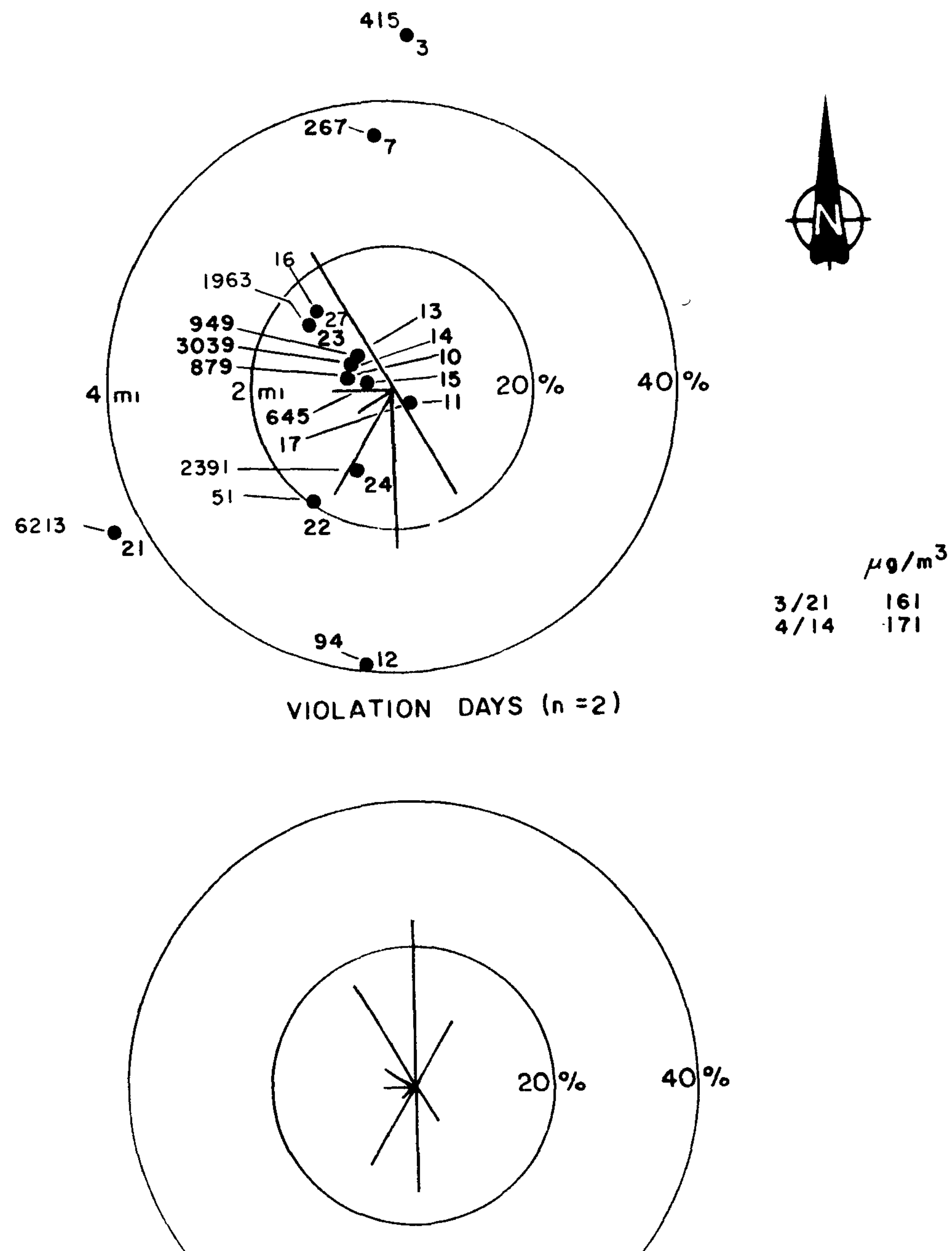
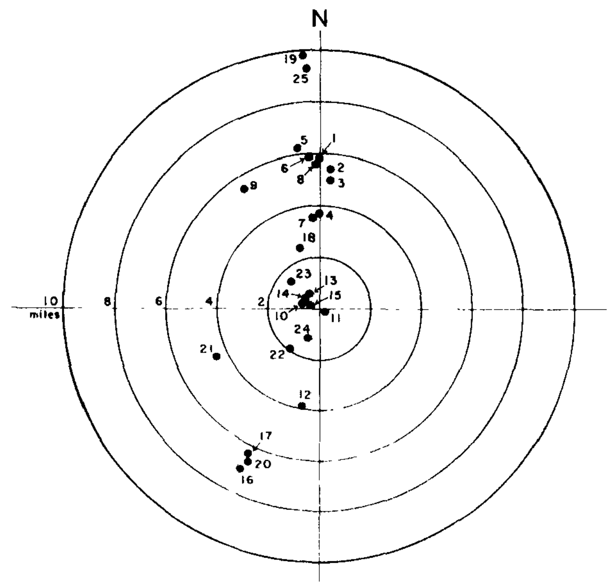


Figure 17a. Wind direction roses for selected days at Follansbee. Locations of major nearby point sources and their annual emissions in tons per year are also shown in the upper part of the figure.

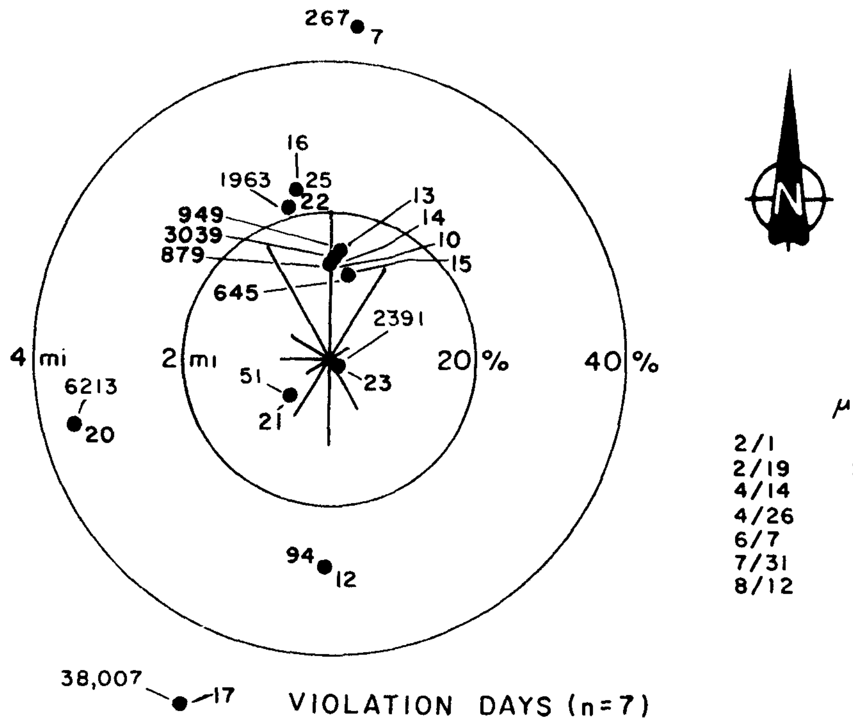


POINT SOURCE SUMMARY

SITE: FOLLANSBEE UTM: 534.38 E , 4465.12 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	& NAME
534.37	4474.40	3914.00	5.77	359.5	1	WEIRTON STEEL/NA
535.[illegible]	4473.80	4788.00	5.41	4.1	2	WEIRTON STEEL/NA
535.[illegible]	4473.00	415.00	4.91	4.5	3	WEIRTON STEEL/NA
534.2[illegible]	4471.10	1995.00	3.72	358.3	4	WEIRTON STEEL/NA
533.[illegible]	4475.00	1463.00	6.20	352.0	5	WEIRTON STEEL/NA
533.[illegible]	4474.50	2465.00	5.84	355.9	6	WEIRTON STEEL/NA
534.[illegible]	4470.70	267.00	3.47	356.1	7	STANDARD SLAG CO
534.20	4474.20	5.00	5.64	358.9	8	INTERNATIONAL MI
529.50	4472.50	10.00	5.50	326.5	9	IRON CITY SAND &
533.40	4465.50	879.00	0.65	291.1	10	KOPPERS CO.
534.60	4464.80	17.00	0.24	145.5	11	INTERNATIONAL MI
533.30	4458.90	94.00	3.92	189.8	12	BANNER FIBERBOAR
533.60	4465.90	949.00	0.68	314.9	13	WHEELING PITTSBU
533.50	4465.80	3039.00	0.69	307.7	14	WHEELING PITTSBU
533.80	4465.30	645.00	0.38	287.2	15	WHEELING PITTSBU
529.40	4454.90	480.00	7.07	206.0	16	BUCKEYE POWER
530.00	4455.80	58314.00	6.40	205.2	17	CARDINAL OPER. C
533.2[illegible]	4468.90	1100.00	2.46	342.7	18	FEDERAL PAPERBOA
533.[illegible]	4480.70	55.[illegible]	9.70	356.0	19	KAUL CLAY CO.
530.[illegible]	4455.5[illegible]	28[illegible]	6.57	204.5	20	OHIO POWER CO.
5[illegible]	[illegible]62.00	20638.[illegible]	4.47	244.3	21	SATRALLOY INC.
[illegible]	[illegible]462.60	81.[illegible]	1.95	216.7	22	STANDARD SLAG CO
[illegible]	[illegible]466.70	1915.[illegible]	1.53	310.0	23	WHEELING-PITTSBU
[illegible]	[illegible]463.2[illegible]	121[illegible]	1.31	204.6	24	WHEELING-PITTSBU
[illegible]	[illegible]	1989.	9.26	357.4	25	TORONTO PAPERBOA

Figure 17b. Point source summary - Follansbee.



	$\mu g/m^3$
2/1	183
2/19	235
4/14	160
4/26	177
6/7	174
7/31	174
8/12	182

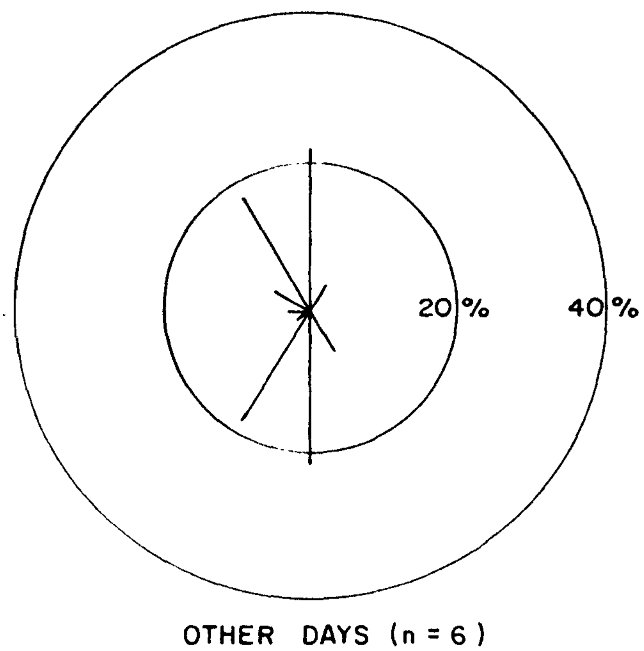
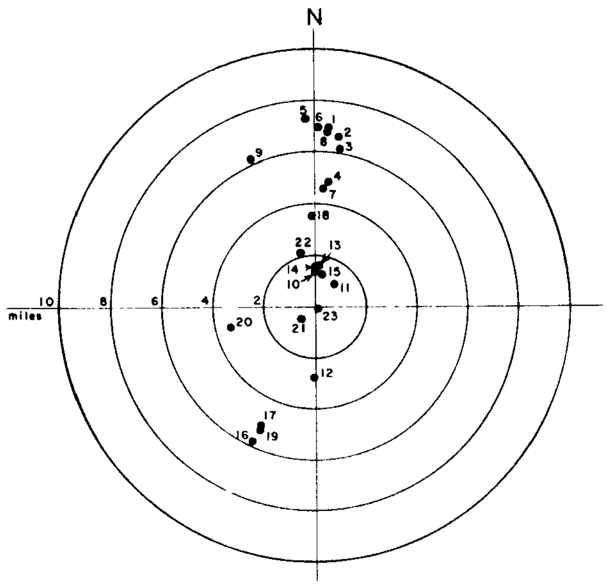


Figure 18a. Wind direction roses for selected days at Mingo Junction. Locations of major nearby point sources and their annual emissions in tons per year are also shown in the upper part of the figure.



POINT SOURCE SUMMARY

SITE: MINGO JUNCTION UTM: 533.39 E , 4465.38 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	& NAME
534.30	4474.40	3914.00	6.87	4.7	1	WEIRTON STEEL/NA
535.00	4473.80	4788.00	6.55	8.8	2	WEIRTON STEEL/NA
535.30	4473.00	415.00	6.06	9.5	3	WEIRTON STEEL/NA
534.20	4471.10	1995.00	4.82	6.0	4	WEIRTON STEEL/NA
533.00	4475.00	1463.00	7.22	358.1	5	WEIRTON STEEL/NA
533.70	4474.50	2465.00	6.91	1.6	6	WEIRTON STEEL/NA
534.00	4470.70	267.00	4.56	4.7	7	STANDARD SLAG CO
534.20	4474.20	5.00	6.74	4.5	8	INTERNATIONAL MI
529.50	4472.50	10.00	6.16	336.9	9	IRON CITY SAND &
533.40	4465.50	879.00	1.32	0.2	10	KOPPERS CO.
534.60	4464.80	17.00	1.16	40.4	11	INTERNATIONAL MI
533.50	4458.90	94.00	2.79	181.2	12	HANNER FIBERBOAR
533.60	4465.90	949.00	1.57	4.7	13	WHEELING PITTSBU
533.50	4465.80	5039.00	1.50	2.5	14	WHEELING PITTSBU
533.80	4465.30	645.00	1.22	12.0	15	WHEELING PITTSBU
529.40	4454.90	480.00	5.83	205.2	16	BUCKEYE POWER
530.00	4455.80	58314.00	5.16	204.1	17	CARDINAL OPER. C
533.20	4468.90	1100.00	3.43	358.0	18	FEDERAL PAPERBOA
530.00	4455.50	28609.00	5.33	203.3	19	OHIO POWER CO.
527.40	4462.00	20658.00	3.52	255.9	20	SATRALLOY INC.
532.50	4462.60	81.00	0.74	228.9	21	STANDARD SLAG CO
532.50	4466.70	1915.00	2.13	344.9	22	WHEELING-PITTSBU
533.50	4465.20	1218.00	0.13	150.0	23	WHEELING-PITTSBU

Figure 18b. Point source summary - Mingo Junction.

emissions totaling nearly 4900 tons per year lie about 1-1/2 miles in this direction, and an additional Wheeling-Pittsburgh facility emitting approximately 2000 tons per year lies roughly 2 miles away to the north-northwest. Also, the monitor is source specific being located immediately to the west of a BOF shop and blast furnace facility operated by Wheeling-Pittsburgh Steel, and sheltered by sharply rising terrain immediately to its west. Emissions from this Mingo Junction facility (Source No. 23) are listed as 2391 tons per year in the inventory. The proximity of the monitor to the Mingo Plant prevents any meaningful separation of the relative impact of these major sources on these days. Figure 18b identifies the sources.

Except for the Cardinal Power Plant located about 5-1/2 miles to the south-southwest, the point source with the greatest annual emissions is Satralloy, located within a separate valley roughly 4 miles from the monitor in a south-southwest direction.

The composite plot for nonviolation days shows nearly equal weighting between winds from the north and north-northwest and those from the south and south-southwest. A more detailed examination of the wind data in Table 18, however, shows that on 2 of the 3 nonviolation days with northerly winds (14 January and 7 February) a major storm was moving up the Atlantic Coast and the study area was experiencing moderate northwesterly flow and light snowfall. Under these conditions, particulate concentrations tend to be low because of rapid dispersion, reduced fugitive-dust emissions due to snow cover and wet surfaces, the cleansing effect of precipitation in general, and low background levels. Of the violation days, the most similar synoptic pattern occurred on 26 April when a low was also moving up the Atlantic coast but had only reached Cape Hatteras by the end of the day. The winds on this day were more northerly and there was no precipitation. The third nonviolation day with northerly winds at Wellsburg was 28 December. Table 18 shows that the wind at Steubenville on that day was highly variable, and also, that the wind had an easterly component for a considerable portion of the day at Wellsburg.

Clarington--

Figure 19a shows that the prevailing winds on the single isolated violation day (28 December) were northerly, and that the concentration exceeded that at the nearest site to the north, Powhattan Point, by 74 $\mu g/m^3$. Sources implicated by the wind direction are the Mitchell and Kammer power plants roughly 5 and 6 miles away toward the north-northeast. Figure 19b identified the sources.

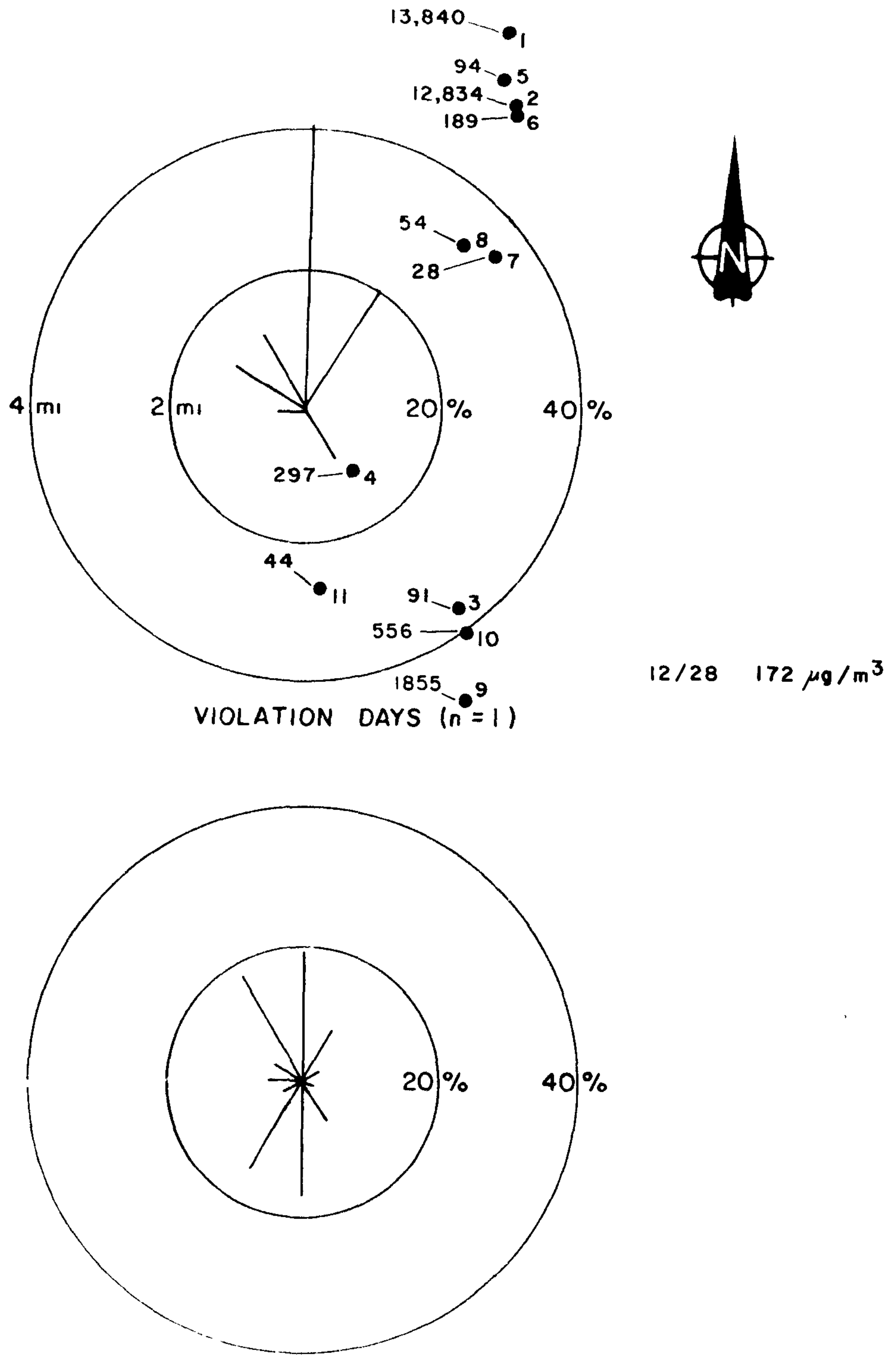
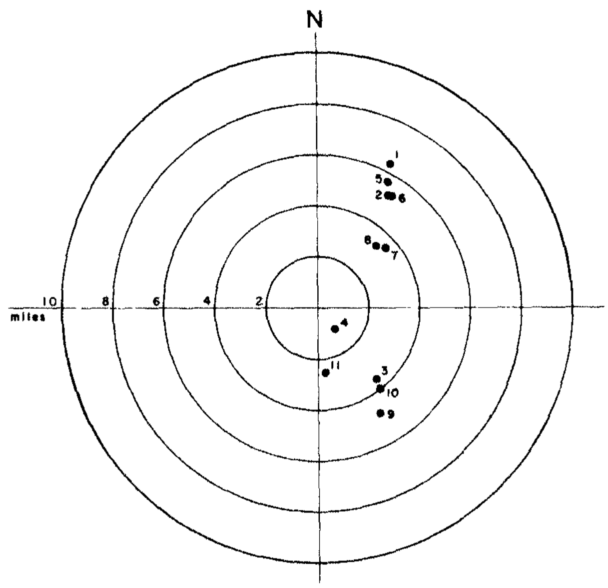


Figure 19a. Wind direction roses for selected days at Clarington. Locations of major nearby point sources and their annual emissions in tons per year are also shown in the upper part of the figure.



POINT SOURCE SUMMARY

SITE: CLARINGTON UTM: 511.08 E , 4401.65 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
515.50	4410.50	13840.00	6.15	26.6	1	KAMMER POWER STA
515.70	4408.70	12834.00	5.24	33.3	2	MITCHELL POWER P
514.70	4397.20	91.00	3.57	140.9	3	MOBAY CHEMICAL C
512.20	4400.20	297.00	1.14	142.3	4	PPG INDUSTRIES
515.50	4409.50	94.00	5.60	29.4	5	MOUNTAINEER CARB
515.70	4408.60	189.00	5.19	33.6	6	H.B. REED CO.
515.30	4405.30	28.00	3.47	49.2	7	CITIES SERVICE CO
514.70	4405.40	3002.00	3.24	44.0	8	OHIO FERRO ALLOY
515.00	4395.00	1864.00	4.80	149.5	9	ORMET CORP.
515.00	4396.50	205.00	4.02	142.7	10	CONSOLIDATED ALU
511.50	4397.50	44.00	2.59	174.2	11	QUARTO MINING CO

Figure 19b. Point source summary - Clarington.

SECTION 6

SOURCE IMPACT ANALYSIS

As a final task, an attempt has been made to combine the chemical and microscopic analyses with the emissions and meteorological data in order to better understand the sources or source categories which are causing non-attainment of TSP standards. Inherent in this type of study is the limitation that an emissions inventory is not available for the specific day of interest. Hence, annual emissions estimates must be utilized and any special occurrences affecting a monitor on a certain day can not be identified. These special occurrences include such events as control equipment failure, localized fires, plowing, and extraordinary vehicular activity which have an impact on a monitor.

As described in Section 3, the filters which were analyzed were selected for particular reasons and not randomly. Hence, attempts to extrapolate results to an annual basis may not be statistically significant. Two types of analysis have been carried out as part of this effort:

- interspecies correlations, and
- upwind/downwind relationships

This section describes the results of these analyses.

INTERSPECIES CORRELATIONS

A technique which is often used to assess the factors relating to high TSP concentrations is interspecies correlation. This technique involves computing a matrix of correlation coefficients between individual chemical species estimates for one or several sites and drawing conclusions as to which species and, hence, sources of these species, significantly explain the variance in TSP levels. A significant positive correlation coefficient between TSP and one or a group of elements would suggest that the sources of the element are a cause of high TSP concentrations.

The data used in this analysis were derived from the third set of filters which were studied — the 25 filters selected for upwind-downwind analysis. In addition to using the chemical species data which were measured for these filters (SO_4, NO_3, Fe, As), the major particle categories, identified optically, were included. These categories were minerals, flyash, coal fragments, soot, and iron oxide. These components constituted about 97 percent of the visible particulate on a filter. Two other categories were also included in the correlation study; these were the adjusted TSP levels (total particulates minus sulfates and nitrates) and the ratio of iron-to-arsenic (Fe/As). The adjusted TSP levels may be expected to correlate better with optical studies as secondary particulates are typically too small to see. Computations of mass concentrations based on the optical analysis use the adjusted TSP to represent the reference concentration. The Fe/As ratio is often an indicator of the impact of flyash and coal fragments. This ratio in coal is about 100:1 and in coal flyash about 30:1. This change in ratio occurs due to selective control of the various elements. Iron normally remains as a solid in flue gas and is captured by the control equipment. Arsenic is often vaporized and thus condenses after entering the ambient air. This factor is confounded in an area such as the AQCR 181 due to the significant amount of iron oxides emitted. Soil also has a very high Fe/As ratio, on the order of 10,000:1. So high values of this parameter on a filter would suggest iron oxides or soils as major source categories. Low values suggest flyash or coal fragments. It should be noted that valley-specific analyses of source constituents were not available for this study.

The technique used in this analysis was to study all samples collectively, regardless of location, meteorological conditions or sampling date. This was done in an attempt to have an acceptable sample size (there were at most two samples from a site) and range of concentration. It is recognized that this could obscure certain significant relationships.

Table 20 presents the correlation between the mass percent of each optical category observed on the filter and the unadjusted TSP. (Similar results were obtained using adjusted TSP).

TABLE 20. CORRELATION COEFFICIENTS AND MEAN PERCENTAGES

	Percent of mass represented by component				
	Minerals	Flyash	Coal fragments	Soot	Iron oxides
TSP	-0.46	0.16	0.14	0.20	0.32
Mean and Std. Dev. (percent)	30.3 ± 7.3	22.9 ± 4.8	22.1 ± 6.7	11.3 ± 3.3	8.1 ± 4.8

When using mass percentages, correlation coefficients indicate whether the portion represented by any component changes with changing concentration. Based on the number of samples (25), the 5 percent level for "r" is 0.38.

Review of these results shows that the portion of the particulate described as minerals declines significantly as TSP concentrations increase. This implies that minerals, and hence their principal sources - soils and process emissions - are most likely not the cause of high 24-hour TSP concentrations in the valley.

The other four categories all have positive but nonsignificant correlations coefficients. This implies that there is no pattern to the change in percentage with changing TSP levels. One can imply that the mean percentage does not change and that, as an example, flyash is as likely to comprise 23 percent of the particulate on a filter at low concentration as it is at high concentration.

Table 21 presents the correlation matrix for the elemental species data. Again, an absolute value for r of greater than 0.38 indicates a nonrandom relationship. Review of these data in relation to the adjusted TSP levels (ATSP) indicates that each of the optically determined categories is strongly correlated to ATSP. This indicates that the concentration of each of these components increases quite linearly (though not necessarily with a slope of 1.0) with increasing TSP. Sulfates and iron also correlate well with TSP but no significant fit is found for nitrates or arsenic. The adjusted and unadjusted TSP levels correlate at 0.99.

The nitrate concentrations are completely uncorrelated with sulfate concentrations. It is known that coal fly ash contains a significant amount of water-soluble sulfate, 5-22 percent by weight.[14] Fly ash does not contain significant amounts of nitrates. If the principal source of nitrates are assumed to be long range transport, then this lack of correlation between these two components suggests that transport was not a significant factor on the days studied. SO_2 was found to correlate significantly only with coal fragments, however, the sulfur in coal is not expected to be in sulfate form in significant quantities.

Arsenic was found to correlate significantly only with the mass of coal fragments observed on the filter. The concentration of iron was found to correlate significantly with each of the optical components, in particular, the iron oxides and with TSP concentrations. This is expected since iron is a component of each of these categories.

UPWIND-DOWNWIND COMPARISON

As noted in Section 3, the third set of filters were selected to allow upwind-downwind comparisons for the purpose of identifying probable sources causing concentrations in excess of 150 $\mu g/m^3$. The filters were selected by identifying days on which the wind direction was fairly well defined and there were isolated violations of the standard. A total of 30 filters were selected which would have allowed 12 case studies to be performed. Subsequently, however, errors in filter identification, sampling period, and measured concentrations invalidated a key filter in six of the sets, allowing only six for further study.

In several instances, no conclusion can be drawn as to the cause of the high concentration. This occurs when two filters with extremely different reported concentrations have identical species analysis. In several cases where this happens, further study indicated that an error had occurred in

TABLE 21. CORRELATION MATRIX OF OPTICAL AND CHEMICAL ANALYSES

	Minerals	Flyash	Coal fragments	Soot	Iron oxides	SO_4	NO_3	As	Fe	Fe/As	TSP	ATSP	Mean ($\mu g/m^3$)	Std. Dev. ($\mu g/m^3$)
Minerals	-	0.76	0.73	0.82	0.38	0.37	-0.06	0.08	0.68	0.31	0.90	0.93	31.9	16.9
Flyash		-	0.69	0.70	0.70	0.34	-0.16	-0.03	0.76	0.47	0.92	0.94	26.1	16.1
Coal fragments			-	0.69	0.41	0.66	-0.18	0.44	0.52	0.20	0.85	0.85	25.3	18.0
Soot				-	0.50	0.48	-0.02	0.01	0.62	0.24	0.87	0.87	13.0	9.8
Iron oxides					-	-0.01	-0.25	-0.02	0.87	0.68	0.66	0.71	10.3	10.4
SO_4						-	-0.00	0.11	0.20	-0.03	0.49	0.43	13.2	9.6
NO_3							-	-0.11	-0.02	-0.16	-0.11	-0.16	2.5	1.16
As								-	-0.11	-0.37	0.13	0.12	0.060	0.055
Fe									-	0.68	0.74	0.77	1.73	1.20
Fe/As										-	0.37	0.41	65.4	116.5
TSP											-	0.99	112.0	62.3
ATSP												-	94.9	58.9

Notes: ATSP = TSP - (SO_4 + NO_3)

First five columns (Minerals through Iron oxides) based on optical analysis.
Others based on chemical analysis
N = 25 $r_{0.05} \approx 0.38$

reporting the concentration. In several cases, it was not possible to ascertain the cause of the difference or eliminate the filter. In these cases, one or more of the following reasons for not identifying the source of the concentration difference is true:

- the methods used did not detect the critical component which was different between filters,
- material was lost from the filter or chemically modified before being received by GCA,*
- the estimated volumetric flow rate was incorrect for the sample, or
- the filter was improperly weighed.

It was not possible to attribute any of these factors to a particular filter.

The filter worksheets used in this study are presented in Appendix C of this report, including those subsequently invalidated.

Case 1 - 2 January 1978

Filters	Concentrations ($\mu g/m^3$)
Martin's Ferry	36
Tiltonsville	152
Brilliant	43

Wind - Southwesterly

Review of the Martin's Ferry and Brilliant filters indicates that they are almost identical with regard to concentration of TSP, SO_4, and NO_3 plus each of the optical components. The exception is that the Brilliant filter, located downwind of Tiltonsville experienced slightly higher iron concentrations.

The Tiltonsville site, however, experienced sulfate, nitrate, and mineral impacts which are twice as high as the other two sites. The impact of combustion type products at this site was five to seven times greater than at Brilliant or Martin's Ferry.

Review of sources upwind of this monitor suggests that the most likely source is the Wheeling-Pittsburgh Yorktown Plant located about one-half mile southwest of the monitor. This source contains a number of coal-fired boilers estimated to emit 1265 tons/year of particulate. This assumption is confirmed by the size of the particles observed at Tiltonsville; coal fragments and flyash at this site were often greater than 50 μm in size while similar particles at Martin's Ferry and Brilliant were all less than 40 μm. The large particles are often the result of a relatively close source.

*The filters were exposed 1 to 2 years before analysis.

The stacks from the source were modeled using the hourly meteorological data for this date. The results indicated an impact of about 6 μg/m³. This impact is most likely underestimated due to problems in defining wind direction in the valley. This estimate does not include the impacts of any fugitive emissions from this facility.

The conclusion of this case study is that fugitive and stack emissions from the Yorktown Plant resulted in an estimated impact of over 100 μg/m³ at the Tiltonsville monitor. Much of the particulate was relatively large and, hence, was not carried north as far as the monitor in Brilliant. Review of all data, however, suggest that there may have been an error in initially measuring total particulate on the filter. The factor of 2 difference in NO_3 and minerals is somewhat unexpected. As all species concentrations are reported relative to the total particulate mass, this would have resulted in overestimation of all optical components. If this error has occurred, then the impact of this source would be about 25 μg/m³, more in line with the model predictions.

Case 2 - 14 January 1978

Filters	Concentrations (μg/m³)
Follansbee	73
Weirton	152

Wind - Northerly

This set was originally to have contained the Toronto site which recorded a concentration of 24 μg/m³ and is upwind of Weirton; however, this filter was not available from Ohio. Insufficient filter was also available to perform all chemical analyses on the Weirton and Follansbee filters. Hence, only SO_4 and NO_3 data are available from Follansbee.

Review of the microscope data indicate that each site is experiencing about 20 μg/m³ of minerals and 4 μg/m³ of pollen. The major difference in components is in the combustion category. Review of the particle size data for these two sites suggests that both monitors are being impacted by relatively nearby sources; both had flyash and coal particles over 50 μm.

Upwind of the Weirton site is the Weirton Steel facility. This source is most likely the cause of the high concentrations recorded at Weirton. The PTMTP was applied to the stacks for this facility using the hourly meteorology for that day and an impact of 65 μg/m³ was estimated. When fugitive emissions are added to this estimate, the level is expected to be approximately equal to the excess particulate found on the filter over the concentration observed at Toronto.

Case 3 - 2 February 1978

Filter	Concentrations ($\mu g/m^3$)
Steubenville Court House	178

Wind - Northerly

Problems with the "low concentration" filters which were to be used in this case invalidated their use. Review of the chemical and microscopic data from this monitor however provides some interesting observations. This monitor experienced very high concentrations of sulfate and coal fragments, 44 $\mu g/m^3$ and 49 $\mu g/m^3$, respectively. This sulfate level is quite high in relation to the level recorded at Adams St. in Steubenville of 4.4 $\mu g/m^3$. The concentration at Adams St. was only 49 $\mu g/m^3$ however.

On this day, a situation similar to this also occurred at the Clarington site. The concentration at all of the other monitors in that area is about 40 to 50 $\mu g/m^3$. The Clarington monitor, however, reported 123 $\mu g/m^3$ and NOVAA reported the SO_4 level at 28 $\mu g/m^3$.

Based on this information, no obvious source of the particulate and high sulfate level can be identified. The sulfate in the observed fly ash accounts for less than 10 $\mu g/m^3$ of the 44.5 $\mu g/m^3$ which was observed. The size distribution of particles on the filter indicates most are less than 40 μm. This would suggest that a localized source is not the cause of the high concentration.

Case 4 - 2 April 1978

Filters	Concentrations ($\mu g/m^3$)
Powhattan Point	180
Clarington	68

Wind - Northerly

A set of filters had originally been collected which included the two E. Liverpool sites. One of these sites had a concentration of 75 $\mu g/m^3$ and the second was reported as 176 $\mu g/m^3$. However, the analysis ultimately indicated that the high concentration should actually have been 52 $\mu g/m^3$. The higher concentration is the value reported to EPA by the local agency. During performance of this study, the value was determined to be a transcription error and the latter value found to be the correct concentration. Hence, no further effort has been expended. These filters are described in Appendix C.

The high concentration observed at Powhattan Point is extremely isolated; no other site in that section of the valley exceeds 90 $\mu g/m^3$. Review of the percent breakdown by class of the particules observed microscopically at the Powhattan Point and Clarington sites indicates that they are identical within the accuracy of the technique. The filters are both characterized by small particle sizes (<40μ) with the exception that coal fragments at Powhattan were observed to range up to 65 microns.

The iron and arsenic concentrations are in proportion to the differences in concentration between the sites; the SO_4 and NO_3 concentrations are slightly higher at Powhattan.

Review of the inventory indicates no major sources north of Powhattan Point. A large slag dump is located southwest of the monitor, however, no slag was observed on the filter.

In this case, again, no apparent cause for the concentration difference can be determined. One must assume either the tests used did not detect the cause of the high concentration or an error occurred in weighing the filter.

Case 5 - 8 April 1978

Filters	Concentrations (μg/m³)
Weirton	208
Toronto	155
New Cumberland	169
New Manchester	38

Wind - Northwesterly

The microscopically determined classification of particles for this case study fairly strongly delineates the New Cumberland and Toronto sites as being almost identical; the New Manchester site as appearing like "background"; and the Weirton site as showing a more complex situation than the more northern sites.

Each of the three southern monitors have estimated mineral impacts estimated at about 40 μg/m³ while New Manchester has a mineral impact of 13 μg/m³. At all four sites, the size of the minerals, mostly calcite, is quite small (<10 μm) implying a relatively distant source. The New Cumberland site has an estimated impact from flyash of 44 μg/m³ and some flyash particles up to 100 μm were observed on the filter. The flyash on the other two southern filters was smaller (<70 μm) and that for New Manchester less than 30 μm. The Weirton site shows a major impact from iron oxide (41 μg/m³) although the size of the particles is less than 5 μm.

Review of the inventory for a source which would impact the three southern monitors but not New Manchester during northwesterly winds leads to the Sammis Plant which emits over 55,000 tons/year of particulate. Use of the PTMTP model with hourly meteorological data for this day suggests a 24-hour average impact of about 40 to 60 μg/m³. This is consistent with the flyash estimates.

The higher concentrations observed at the Weirton site most likely result from operation of the Weirton Steel facility. This facility is apparently contributing about 30 μg/m^3 of iron oxide, 5 μg/m^3 of coal fragments, and 10 μg/m^3 of flyash. This level of impact is consistent with previous PTMTP runs.

Case 6 - 26 April 1978

Filters	Concentrations (μg/m^3)
Wellsburg	140
Mingo Junction	177
Brilliant	95
Steubenville CH	81
New Manchester	67
Follansbee	75

Wind - Northerly

The analysis of minerals for these sites indicates a relatively uniform concentration throughout the area; the particles are all small (<20 μm) suggesting that localized fugitive dust emissions are not the cause of high concentrations. The flyash concentrations are low compared to a day such as 8 April; they average less than 15 μg/m^3 at all sites except Mingo Junction and Wellsburg. These latter two sites recorded much higher concentrations of each of the combustion components. These results suggest that the elevated TSP levels recorded at Mingo Junction and Wellsburg are the result of the numerous steelmaking facilities to the north of Mingo Junction. These include several Wheeling-Pittsburgh facilities and Koppers Co.

Case 7 - 17 September 1978

Filters	Concentrations (μg/m^3)
Wellsville	93
E. Liverpool CH	175

Wind - Southerly

This filter pair is quite interesting because the chemical species concentrations and the distribution of particulates among the microscopically defined categories are identical. Only the total concentration on the filters is different. The particle size ranges also are identical with the exception that flyash and coal fragment particles have an upper diameter of about 67 μm at E. Liverpool and 27 μm at Wellsville.

PTMTP was used to model the Sammis Plant for this day and was found to have no impact at Wellsville and an impact of about 20 μg/m^3 at E. Liverpool.

This day is one with high sulfate levels which contribute strongly to high concentrations throughout the valley. No obvious source or source category can be associated with the E. Liverpool concentrations.

OTHER STUDIES

Two days were studied in an attempt to gain an overview of conditions in the valley. This study used the first group of 20 filters as basis and the results were as follows.

March 21, 1978

This day is characterized by isolated violations; values above 150 $\mu g/m^3$ were recorded only at Steubenville Court House, E. Liverpool Fire Station, and Follansbee. The filters analyzed include Wellsburg (No. 3416) and E. Liverpool Fire Station (No. 3651). The weather during the day was overcast and windy with south-westerly flow; 0.21 inches of precipitation was recorded at Pittsburgh during the afternoon. The area had just experienced a warm spell and this was the first sampling day on which no snow cover was reported.

Figure 20 presents the regional 24-hour TSP concentrations. Many sites in the valley exceeded 100 $\mu g/m^3$ but no very high concentrations (>200 $\mu g/m^3$) were recorded. Those sites which exceed 150 $\mu g/m^3$ did so by a small margin. Comparison at monitor sites located close to those which exceeded 150 $\mu g/m^3$ indicates that the higher concentration was recorded at the site which was closer to ground level.

Review of the microscopic data indicate that, in general, a larger than usual percent of the particles were in 2.5 to 40. micron range and that a major portion of the particles were mineral in nature. The chemical data for Wellsburg indicate a very high concentration of chloride.

This information combines to indicate that the cause of violations for this day was primarily blowing road dust and salt. The final snow melt had occurred several days before and the sand and salt mixed in the snow piles released. It was quite windy providing opportunity for these particles to be entrained and collected in the hi-vols. This explains why monitors closer to street level recorded higher concentrations and also why concentrations were relatively uniform throughout the valley. The strong winds would provide good ventilation, resulting in relatively low point source impacts.

It is likely that the entire valley would have experienced very high concentrations if precipitation had not occurred during the afternoon. As it was, only those sites closest to the fugitive source collected enough particulate before the rain to result in a 24-hour average violation.

May 26, 1978

A regional violation situation existed on this day. Fourteen sites exceeded the secondary standard and four of these also exceeded the primary standard. Optical and chemical analysis was performed on 6 days, at New Manchester (No. 3430), Clarington (No. 3647), Mingo Junction (No. 3664),

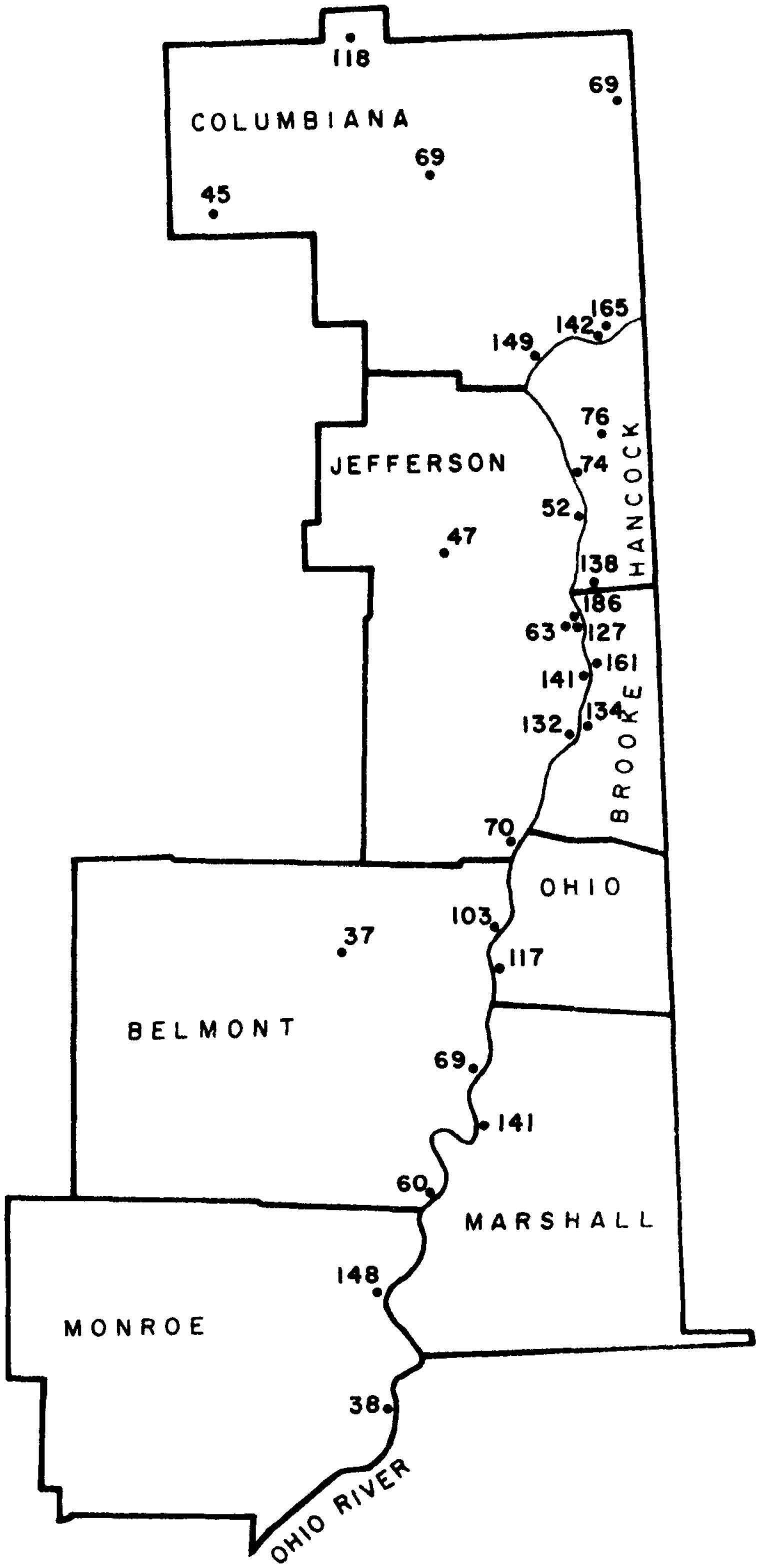


Figure 20. 24-hour TSP concentration - March 21.

Shadyside (No. 3670), Tiltonsville (No. 3673) and Wellsville (No. 3678). The Clarington site recorded the highest 24-hour concentrations measured during 1978 on this day, 545 $\mu g/m^3$. The weather this day was clear with light, variable winds and no precipitation. The wind had been light for at least 4 days preceding May 26, providing little opportunity for flushing of the valley.

Figure 21 describes the regional pattern of TSP levels. Though most sites exceed the 150 $\mu g/m^3$ standard, two areas of very high concentration exist: the Steubenville-Follansbee-Mingo Junction area and the Clarington-Hannibal sites.

The optical analysis did not suggest anomalous particle distributions, however, it was interesting to note that the Clarington filter was characterized as "moderately loaded." The SEM analysis of the Clarington filter revealed an extraordinary finding: the filter fibers were thickly coated with a "scale" which the XRF indicated to be pure silica.

Chemical analysis indicates that sulfate levels are about 15 $\mu g/m^3$, higher than those of March 21 and April 26 but not extreme in comparison to regional averages. The metals analysis did not show any significant increase in levels from those reported on other days.

Concentrations on May 26 are apparently dominated by high background levels of flyash, dust, and biologicals. This background developed after a period of low wind speed, nonprecipitation days. The excessive concentrations measured in the Mingo Junction area most likely result from emissions from the Wheeling-Pittsburgh and Kopper facilities carried by the northerly winds.

In the Clarington area, the extremely fine silica is most likely a process emission. Review of the facilities in the area indicates Ohio Ferro Alloys is the most likely source of this silica.

CONCLUSIONS

The results of the microscopic and chemical analysis indicate the breakdown of the particles on an "average" filter (listed in Table 22).

This tally is based on the filter samples used in the upwind-downwind analyses and, thus, do not necessarily represent the average conditions. However, the variance in the estimates among the various filters was not great, giving credence for the use of these numbers to generalize.

The estimated combustion and process source impact (i.e., emissions from stacks) ranges from 32 $\mu g/m^3$ to about 40 $\mu g/m^3$. Most of the iron oxide is assumed to be process emission due to its small size. Mobile sources are estimated to account for only about 3.4 $\mu g/m^3$ of this total based on average lead concentrations on the filter of 0.3 $\mu g/m^3$. As noted in Section 2, control of point source emissions down to the allowable level will result in a 50 to 95 percent reduction in emissions; this will result in a reduction of about 22 to 27 $\mu g/m$ in average TSP concentrations. Hence, control of point

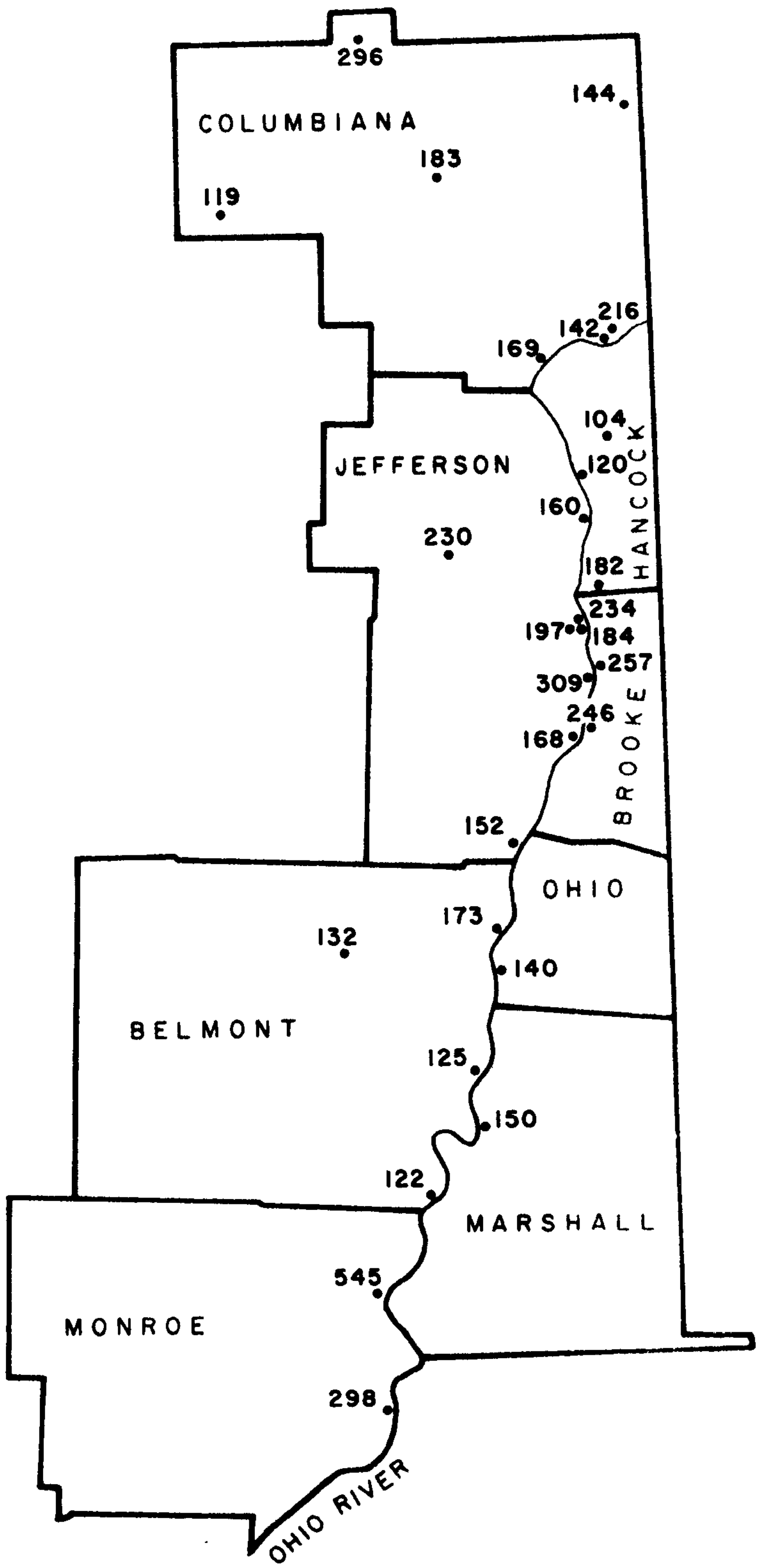


Figure 21. 24-hour TSP concentration - May 26.

TABLE 22. SOURCE CATEGORY IMPACTS

Category	Concentration (Std. Dev.) (μg/m^3)	Source type
Minerals	30 (±6.9)	Fugitive dust and fugitive emissions
Coal fragments	21 (±6.4)	Fugitive emissions
Iron oxide	8 (±5.5)	Fugitive emissions Point source emissions
Flyash	22 (±4.6)	Point source emissions
Soot	10 (±3.2)	Point source emissions
Sulfates and nitrates	15 (±9.7)	Transport Point source emissions
Other[a]	6	

[a]Includes biologicals, glass, burned wood, and tire rubber.

sources alone is not expected to be adequate for attainment of the primary annual standard at all sites.

Attainment of the annual standard will require implementation of regulations controlling fugitive dust and fugitive emissions throughout the valley. Much of the "Minerals" category is composed of fine-grained calcite, some portion of which results from industrial processes such as limestone crushing. Coal fragments emitted during pulverizing or entrained from coal piles also represent a significant portion of total particulates observed on the filters. Control of fugitive emissions in these categories will be required to attain the annual standard.

The individual day analyses, however, consistently indicated that exceedance of the secondary 24-hour standard is often caused by the impact of a particular source or sources on a monitor. In the cases studied, the sources which apparently caused short-term standards violations included:

Ohio Edison Sammis Plant/Stratton

Weirton Steel/Weirton

Wheeling-Pittsburgh Steel/Mingo Jet

Wheeling-Pittsburgh Steel/Yorkville

Koppers Co./Follansbee

Ohio Ferro-Alloy/Clarington

Reduction of the emissions from these sources to the allowable levels would often have resulted in the 24-hour secondary standard not being exceeded for the days studied.

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APPENDIX A

POINT SOURCE INVENTORY

POINT SOURCE INVENTORY

PLANT NAME	X(KM)	Y(KM)	EMISSIONS (T/YR) ACTUAL	ALLOWABLE
TAYLOR,SMITH,&TAYLOR	537.30	4496.20	94.	27.
QUAKER STATE OIL	531.00	4495.20	35.	590.
HOMER LAUGHLIN CHINA	533.40	4496.60	233.	264.
WEIRTON STEEL/NATION	534.30	4474.40	3914.	3492.
WEIRTON STEEL/NATION	535.00	4473.80	4788.	375.
WEIRTON STEEL/NATION	535.00	4473.00	415.	249.
WEIRTON STEEL/NATION	534.40	4474.10	1995.	133.
WEIRTON STEEL/NATION	533.00	4475.00	1463.	1463.
WEIRTON STEEL/NATION	533.70	4474.50	2465.	2465.
STANDARD SLAG COMPAN	534.00	4470.70	267.	394.
INTERNATIONAL MILL S	534.20	4474.20	5.	136.
GLOBE REFRACTORIES S	531.90	4495.70	169.	274.
IRON CITY SAND & GRA	529.50	4472.50	10.	569.
TRI-STATE ASPHALT #3	530.00	4491.00	57.	54.
TRI-STATE ASPHALT #4	530.00	4491.00	59.	54.
KOPPERS CO.	533.40	4465.50	879.	336.
INTERNATIONAL MILL S	534.60	4464.80	17.	136.
BANNER FIBERBOARD CO	533.30	4458.90	94.	55.
WHEELING PITTSBURGH	533.60	4465.90	949.	162.
WHEELING PITTSBURGH	533.50	4465.80	3039.	266.
WHEELING PITTSBURGH	533.80	4465.30	645.	208.
OHIO VALLEY HOSPITAL	523.70	4434.20	78.	63.
BLAW KNOX PENINSULA	524.30	4436.10	6.	89.
CENTRE FOUNDRY	525.20	4438.90	13.	13.
VALLEY CAMP COAL NO.	529.30	4445.00	210.	920.
VALLEY CAMP COAL NO.	523.40	4434.60	96.	256.
KAMMER POWER STATION	515.50	4410.50	13840.	1416.
MITCHELL POWER PLANT	515.70	4408.70	12834.	3210.
WHEELING-PITTSBURGH	522.50	4428.90	18.	187.
ALLIED CHEMICAL-SOUT	516.70	4417.00	313.	194.
MOBAY CHEMICAL CORP.	514.70	4397.20	91.	594.
PPG INDUSTRIES	512.20	4400.20	297.	944.
MOUNTAINEER CARBON C	515.50	4409.50	94.	437.
TRIANGLE P.W.C. INC.	520.90	4420.30	50.	134.
BENWOOD LIMESTONE	523.10	4430.00	21.	112.
H.B. REED CO.	515.70	4408.60	189.	300.
FOSTORIA GLASS	522.30	4419.40	7.	22.
CITIES SERVICE CO.	515.30	4405.30	28.	42.
TRI-STATE ASPHALT	521.00	4417.20	23.	53.
NACCO MINING	501.20	4417.60	60.	100.
WHEELING-PITTSBURGH	524.70	4439.20	1265.	187.

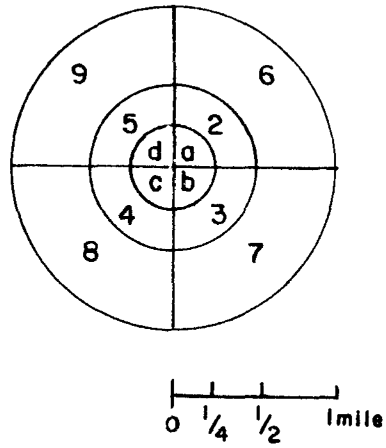
POINT SOURCE INVENTORY

PLANT NAME	X(KM)	Y(KM)	EMISSIONS (T/YR) ACTUAL	ALLOWABLE
TRI STATE ASPHALT	522.70	4431.90	4.	9.
OHIO EDISON/R.E.BURG	520.50	4417.50	23125.	1612.
OHIO VALLEY PAVING P	482.90	4434.80	17.	17.
SWANK REFACTORIES	528.10	4493.10	172.	27.
WALLACE/MURRAY CORP.	511.70	4526.80	525.	1796.
OHIO EDISON CO.	535.90	4520.30	600.	49.
COLUMBIA FOUNDRY CO.	525.20	4525.80	1.	22.
N.R.M. CORP-FOUNDRY	525.30	4525.40	97.	57.
KAISER REFRACTORIES	523.70	4526.10	202.	758.
COLUMBIANA PUMP CO.	526.00	4525.80	45.	6.
OHIO FERRO ALLOYS	514.70	4405.40	54.	214.
ORMET CORP.	515.00	4395.00	1855.	6704.
CONSOLIDATED ALUMINU	515.00	4396.50	556.	554.
QUARTO MINING CO.	511.50	4397.50	44.	51.
BUCKEYE POWER	529.40	4454.90	149.	2401.
CARDINAL OPER. COMP.	530.00	4455.80	38007.	2753.
KAUL CLAY CO.	533.30	4480.70	42.	18.
F.J. DANDO CO.	525.30	4488.90	43.	17.
OHIO EDISON CO./SAMM	531.10	4486.70	55191.	4378.
SATRALLOY INC.	527.90	4462.00	6213.	146.
OHIO EDISON CO./TORO	533.50	4481.50	5135.	623.
STANDARD SLAG CO.	532.50	4462.60	51.	50.
WHEELING-PITTSBURGH	525.40	4445.40	1493.	43.
WHEELING-PITTSBURGH	532.50	4466.70	1963.	1259.
WHEELING-PITTSBURGH	533.50	4463.20	2391.	1430.
TORONTO PAPERBOARD C	533.70	4480.00	1451.	29.
SUMMITSVILLE TILES	509.80	4503.00	233.	86.
NATIONAL STEEL/WEIRT	532.70	4467.00	16.	64.
TITANIUM METALS	533.00	4477.50	67.	127.

APPENDIX B

MICRO INVENTORIES

DESCRIPTION OF SITE



SAROAD Code - 36-1900-003

Location - Fire Station, E. Pennsylvania Ave.,
East Liverpool, Ohio

UTM - N-4498 346, E-000538550

Monitor Height - 18 ft

Site Elevation - 760 ft MSL

Land Use by Sector:

1a.	Residential/Commercial	4.	Residential/Industrial
1b.	Residential	5.	Rural
1c.	Residential/Commercial	6.	Rural/Residential
1d.	Rural	7.	Rural
2.	Residential	8.	Residential
3.	River/Industrial	9.	Residential/Rural

Localized sources within 200 ft of monitor:

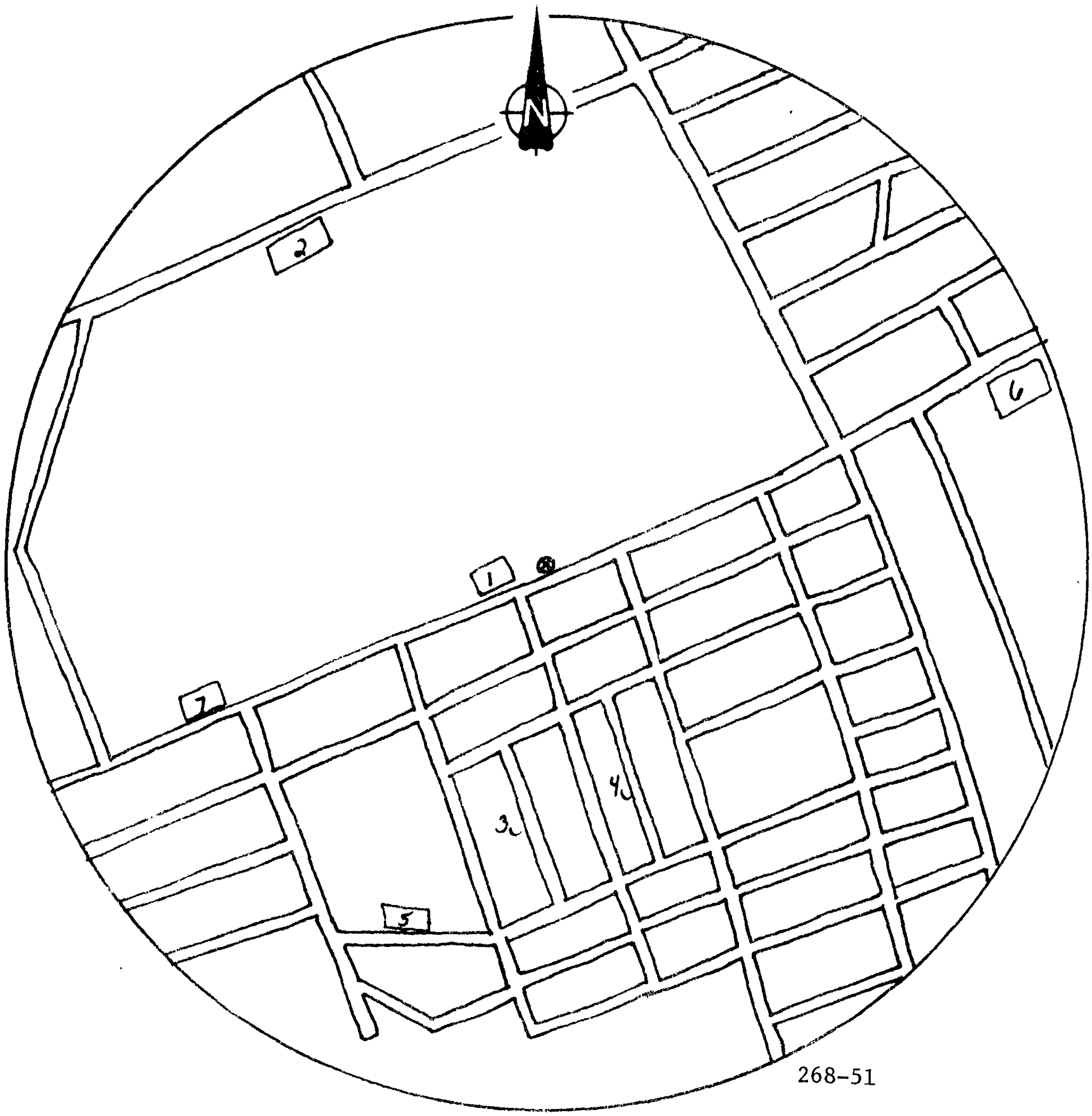
Source	Distance (feet)	Description
Pennsylvania Ave.	45 ft	3090 ADT, Dirty, Curbed

Visible major point sources:

Source	Direction
Sammis Power	200
Taylor, Smith, Taylor	210

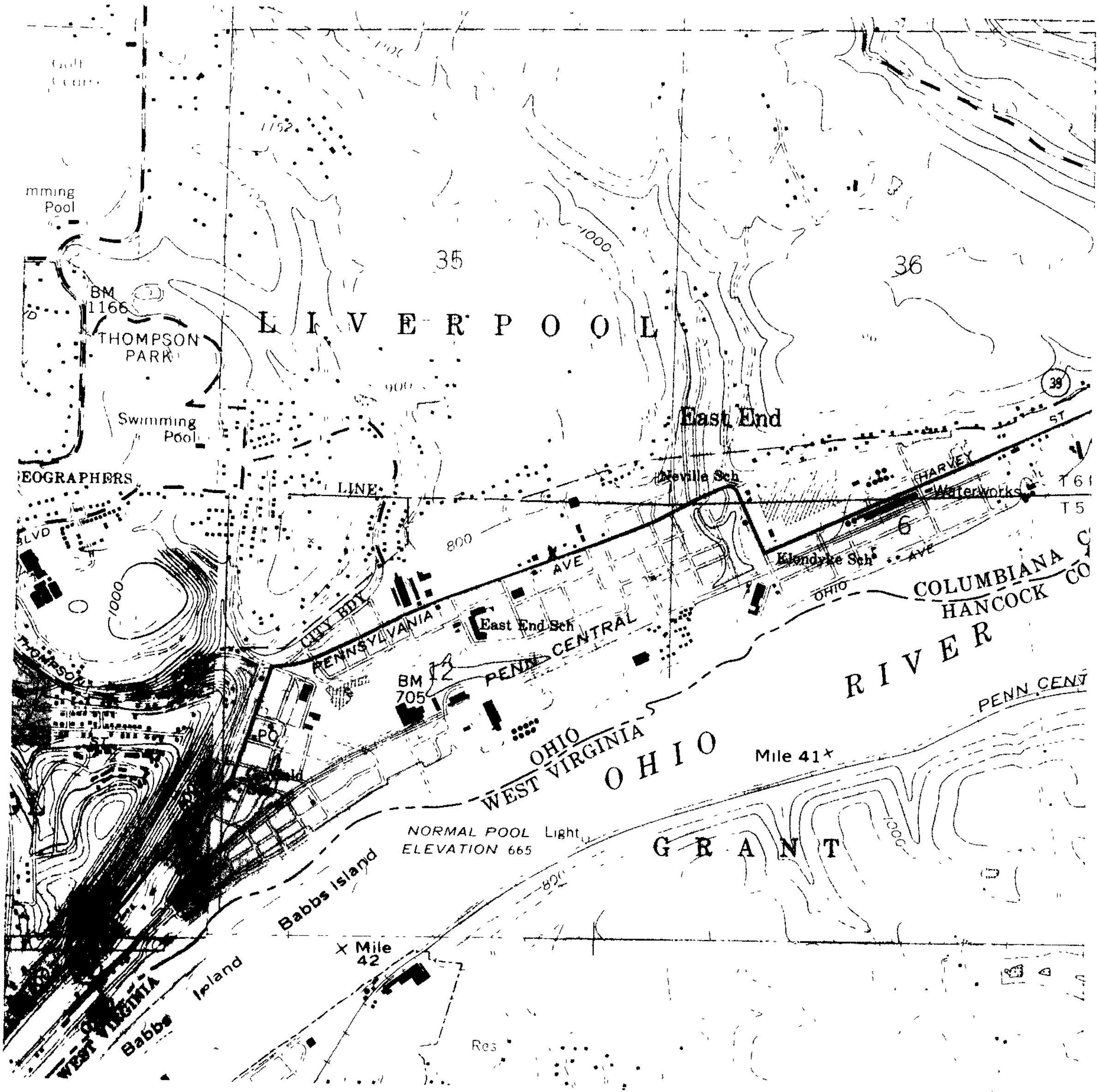
Air quality data:

Year	Geometric mean (μg/m^3)
1977	112
1978	106



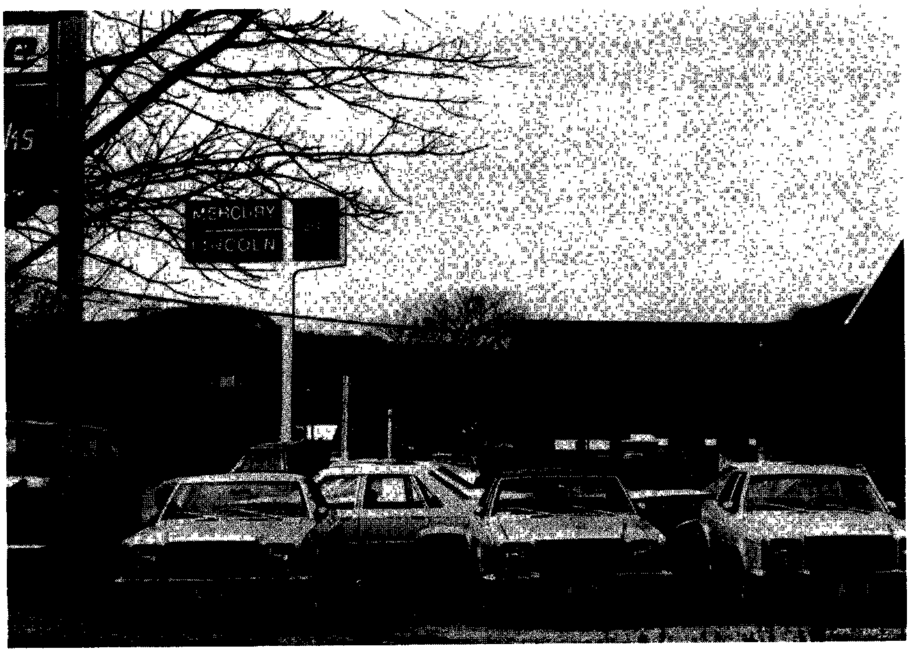
1. Unpaved lot 0.04 ac.
2. Cleared area 0.08 ac.
3. Unpaved road 200 ft.
4. Unpaved road 200 ft.
5. Unpaved lot 0.08 ac.
6. Unpaved lot 0.20 ac.
7. Unpaved lot 0.04 ac.

One-quarter mile radius around East Liverpool, Ohio site.

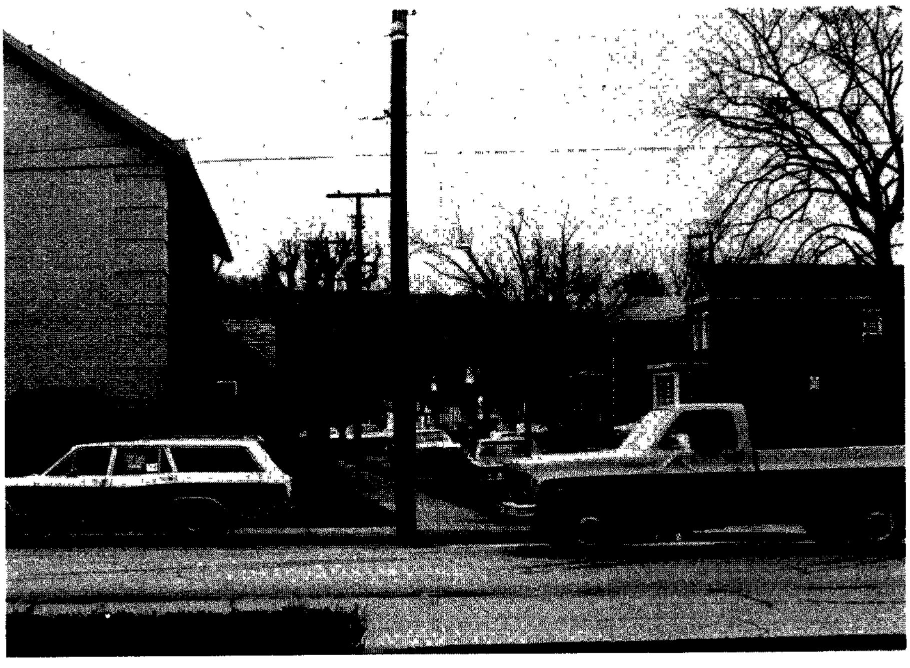


268-52

One-mile radius around East Pennsylvania Ave., East Liverpool site.



East Liverpool fire station site, view to West.



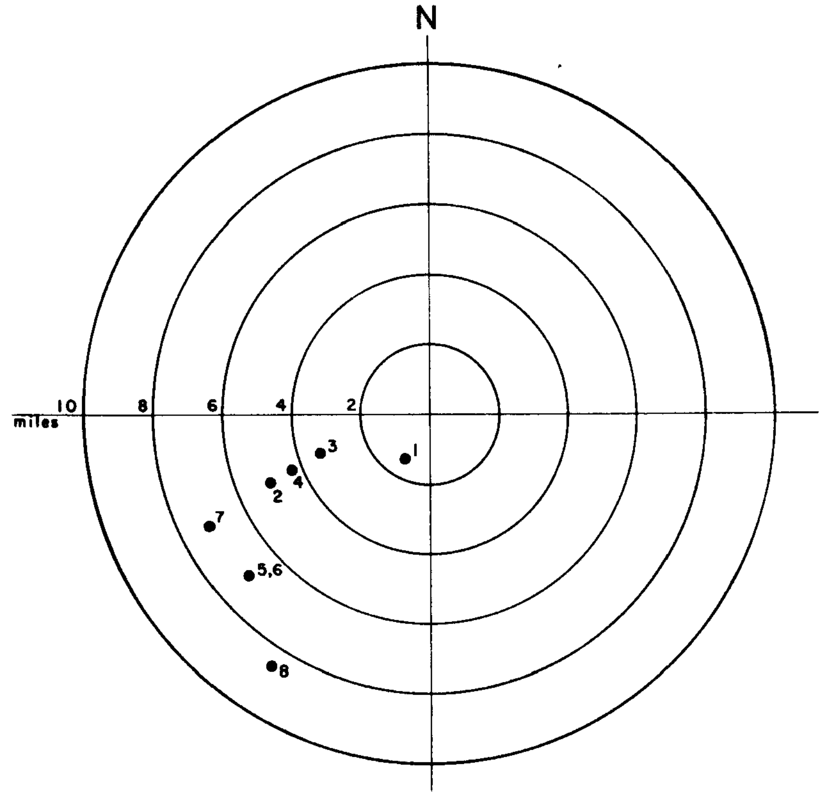
East Liverpool fire station site, view to South.

AREA SOURCE SUMMARY

Site: East Liverpool, Ohio - Fire Station UTM N 4498.346 E 00538.550

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	650 h.u.	1.2	0.7	0.4	0.4	0.4	0.7	0.1	1.0	1.4	6.3
Comm/Ind fuel		neg	neg	neg	neg	neg	neg	neg	neg	neg	-
Incinerators											
Auto exhaust	6,182 VMT	neg	neg		neg		neg		neg		neg
IND PROCESSES:											
Ind processes									4.2		4.2
FUGITIVE DUST:											
Railroad yards	420 A	0.1		0.1	0.1		0.2	0.4	0.4		1.3
Paved streets	6,182 VMT	neg	neg		neg		neg		neg		neg
Unpaved roads	1.5 VMT	neg									neg
Cleared areas	0.08 A										
Construction											
Storage areas											
Unpaved pkg lots	0.36 A	0.2									0.2

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	1.2	1.9	3.2	6.3	51.4	11.9	5.3	68.6
IND PROCESSES	0.0	0.0	4.2	4.2	-	-	6.9	6.9
FUGITIVE DUST	0.3	0.2	1.0	1.5	12.9	1.2	1.6	15.7
Total	1.5	2.1	8.4	12.0	64.3	13.1	13.8	91.2



POINT SOURCE SUMMARY

SITE: E LIVERPOOL FIRE   UTM: 535.55 E , 4496.35 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME
537.30	4496.20	94.00	1.54	210.2	1 TAYLOR,SMITH,&TAYLOR
531.00	4495.20	35.00	5.08	247.4	2 QUAKER STATE OIL
533.40	4496.60	233.00	3.38	251.3	3 HOMER LAUGHLIN CHINA
531.90	4495.70	169.00	4.45	248.3	4 GLOBE REFRACTORIES S
530.00	4491.00	37.00	7.01	229.3	5 TRI-STATE ASPHALT #3
530.00	4491.00	59.00	7.01	229.3	6 TRI-STATE ASPHALT #4
528.10	4493.10	172.00	7.27	243.3	7 SWANK REFACTORIES
531.10	4486.70	55191.00	8.59	212.6	8 OHIO EDISON CO./SAMM

DESCRIPTION OF SITE

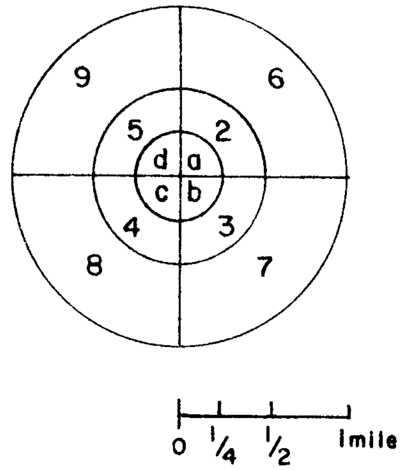
SAROAD Code - 36-1900-001

Location - 126 West Sixth St.,
East Liverpool, Ohio (City Hall)

UTM - N-4496462 E-00535462

Monitor Height - 65 ft

Site Elevation - 760 ft MSL



Land Use by Sector:

1a. Commercial

1b. Commercial

1c. Commercial/Residential

1d. Commercial

2. Residential

3. Industrial/River

4. River

5. Commercial/River

6. Residential/Commercial

7. Residential

8. Industrial/Residential

9. Rural/Residential

Localized sources within 200 ft of monitor:

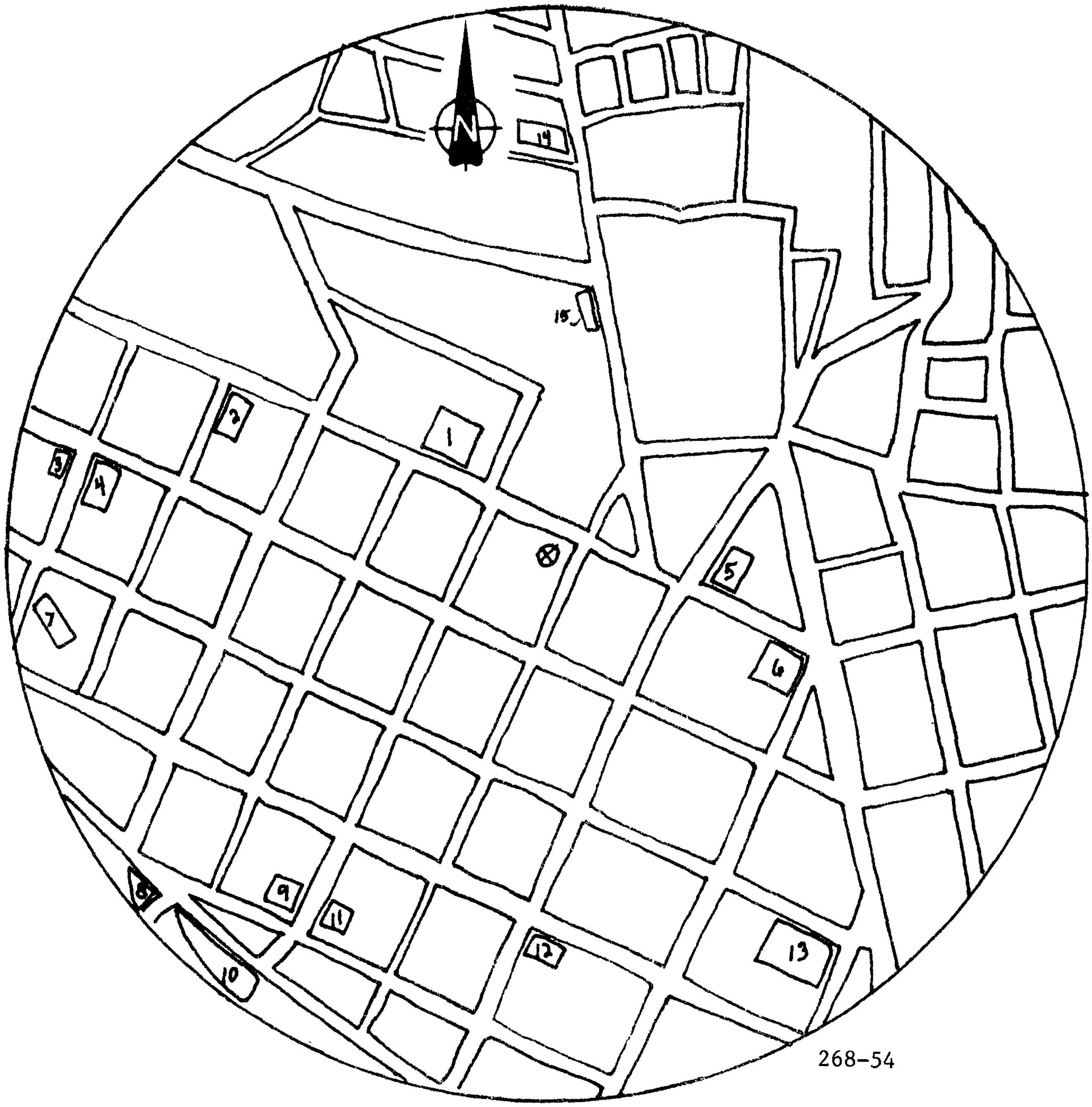
Source	Distance (feet)	Description
West Sixth Street	94 ft	5130 ADT, Clean, Curbed

Visible major point sources:

Source	Direction

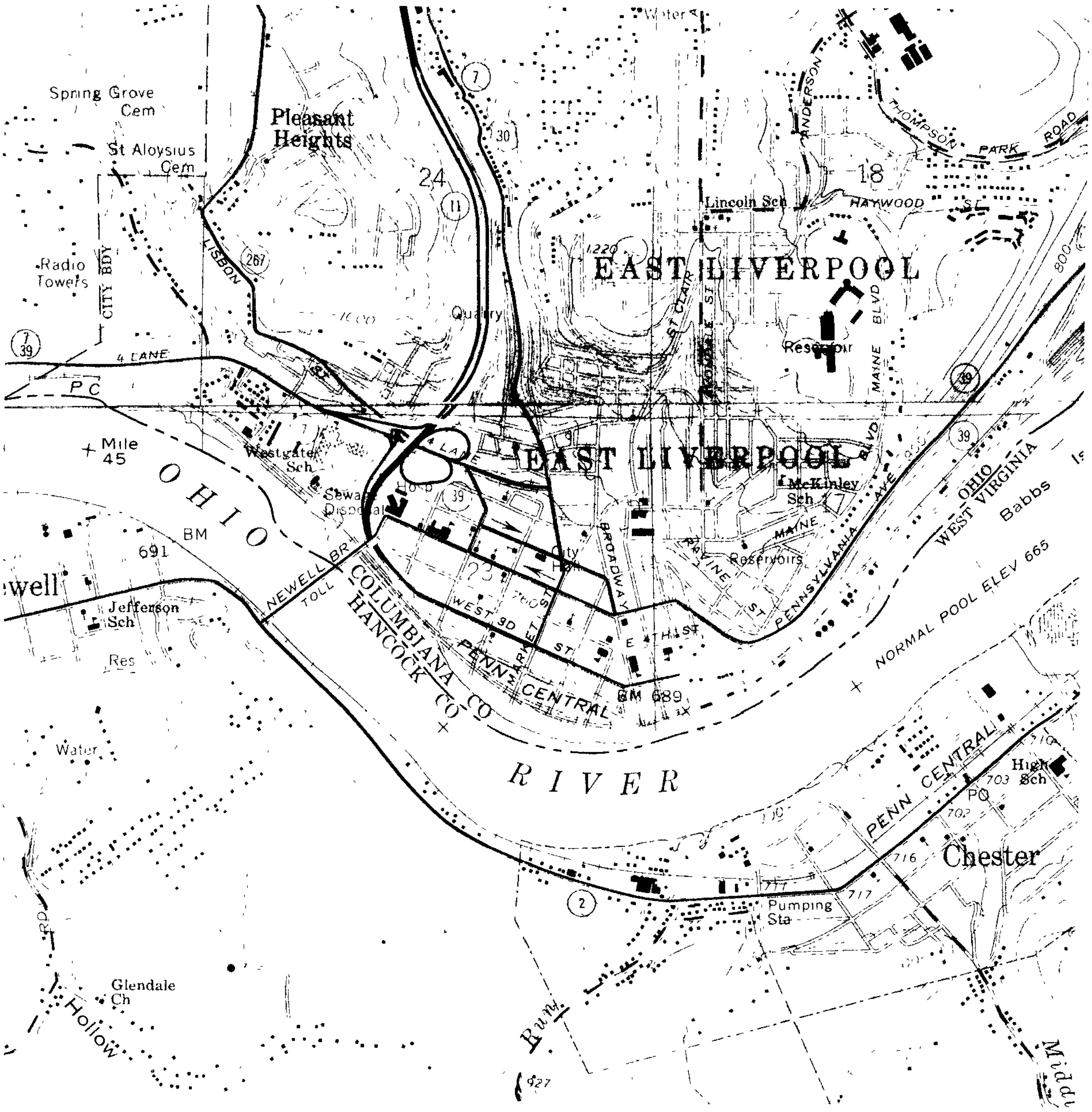
Air Quality Data:

Year	Geometric mean (μg/m^3)
1977	68
1978	90



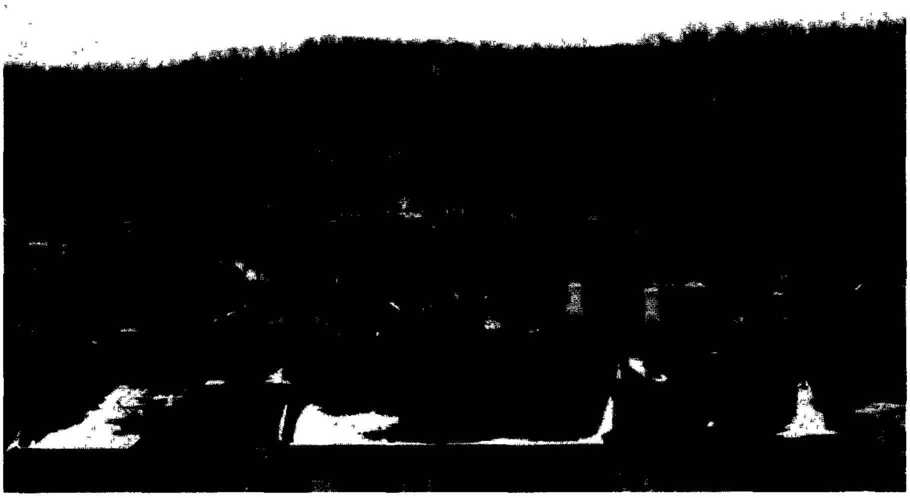
1. Unpaved lot 0.08 ac.
2. Unpaved lot 0.04 ac.
3. Unpaved lot 0.02 ac.
4. Unpaved lot 0.04 ac.
5. Unpaved lot 0.04 ac.
6. Unpaved lot 0.04 ac.
7. Cleared area 0.04 ac.
8. Cleared area 0.04 ac.
9. Unpaved lot 0.04 ac.
10. Cleared area 0.16 ac.
11. Coal piles 0.02 ac.
12. Cleared area 0.02 ac.
13. Unpaved lot 0.12 ac.
14. Cleared area 0.04 ac.
15. Unpaved lot 0.04 ac.

One-quarter mile radius around West Sixth Street, East Liverpool, Ohio site.



One mile radius around West Sixth Street, East Liverpool site.

Court House site, East Liverpool, view to North.



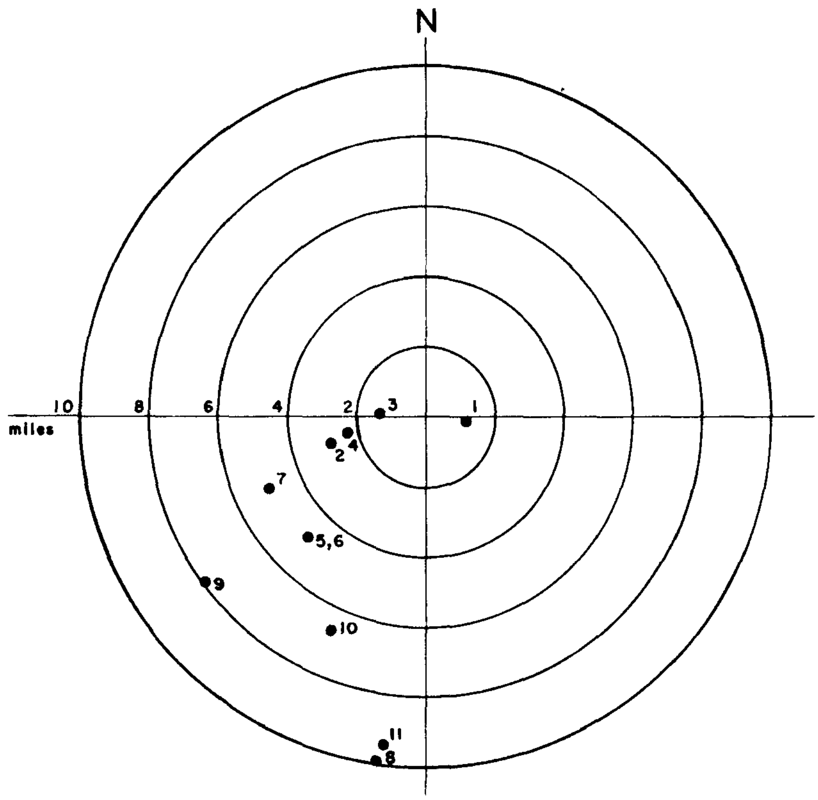
Court House site, East Liverpool, view to South.

AREA SOURCE SUMMARY

Site: East Liverpool, Ohio - City Hall UTM N 4496462 E 00535462

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	2,250 h.u.	4.5	5.6	1.5	0.0	1.9	3.8	1.5	1.1	1.9	21.8
Comm/Ind fuel		0.3	neg	neg	0.0	0.1	0.1	neg	neg	0.1	0.6
Incinerators											
Auto exhaust	2,439 VMT	neg	neg			neg	neg			neg	neg
IND PROCESSES:											
Ind processes										25.0	25.0
FUGITIVE DUST:											
Railroad yards	59.0 A	0.1	0.0	0.2	0.2	0.1	0.1	0.4	0.3	0.2	1.6
Paved streets	2,439 VMT	neg	neg			neg	neg			neg	neg
Unpaved roads											
Cleared areas	0.42 A	neg			neg						neg
Construction											
Aggregate storage	0.02 A	neg									neg
Unpaved pkg lots	0.46 A	0.2									0.2

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	4.8	9.1	8.5	22.4	57.0	56.9	14.0	127.9
IND PROCESSES	0.0	0.0	25.0	25.0	-	-	41.1	41.1
FUGITIVE DUST	0.3	0.5	1.0	1.8	3.6	3.1	1.6	8.3
Total	5.1	9.6	34.5	49.2	60.6	60.0	56.7	177.3



POINT SOURCE SUMMARY

SITE: E LIVERPOOL OH   UTM: 535.46 E , 4496.46 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	& NAME
537.30	4496.20	94.00	1.15	98.1	1	TAYLOR,SMITH,&TAYLOR
531.00	4495.20	35.00	2.88	254.2	2	QUAKER STATE OIL
533.40	4496.60	233.00	1.29	273.9	3	HOMER LAUGHLIN CHINA
531.90	4495.70	169.00	2.26	257.9	4	GLOBE REFFACTORIES S
530.00	4491.00	57.00	4.80	225.0	5	TRI-STATE ASPHALT #3
530.00	4491.00	59.00	4.80	225.0	6	TRI-STATE ASPHALT #4
528.10	4493.10	172.00	5.03	245.5	7	SWANK REFACTORIES
533.30	4480.70	42.00	9.89	187.8	8	KAUL CLAY CO.
525.30	4488.90	43.00	7.87	233.3	9	F.J. DANDO CO.
531.10	4486.70	55191.00	6.64	204.1	10	OHIO EDISON CO./SAMM
533.50	4481.50	5135.00	9.38	187.5	11	OHIO EDISON CO./TORO

DESCRIPTION OF SITE

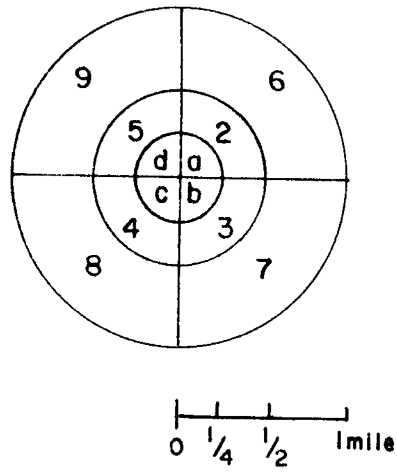
SAROAD Code - 36-7220-002

Location - 1200 Main Street,
Wellsville, Ohio

UTM - N-4494255 E-00528879

Monitor Height - 18 ft

Site Elevation - 710 ft MSL



Land Use by Sector:

1a. Residential

1b. River

1c. Industrial

1d. Residential/Commercial

2. Residential

3. Rural

4. Industrial

5. Rural

6. Residential

7. Rural

8. Industrial

9. Rural/Residential

Localized sources within 200 ft of monitor:

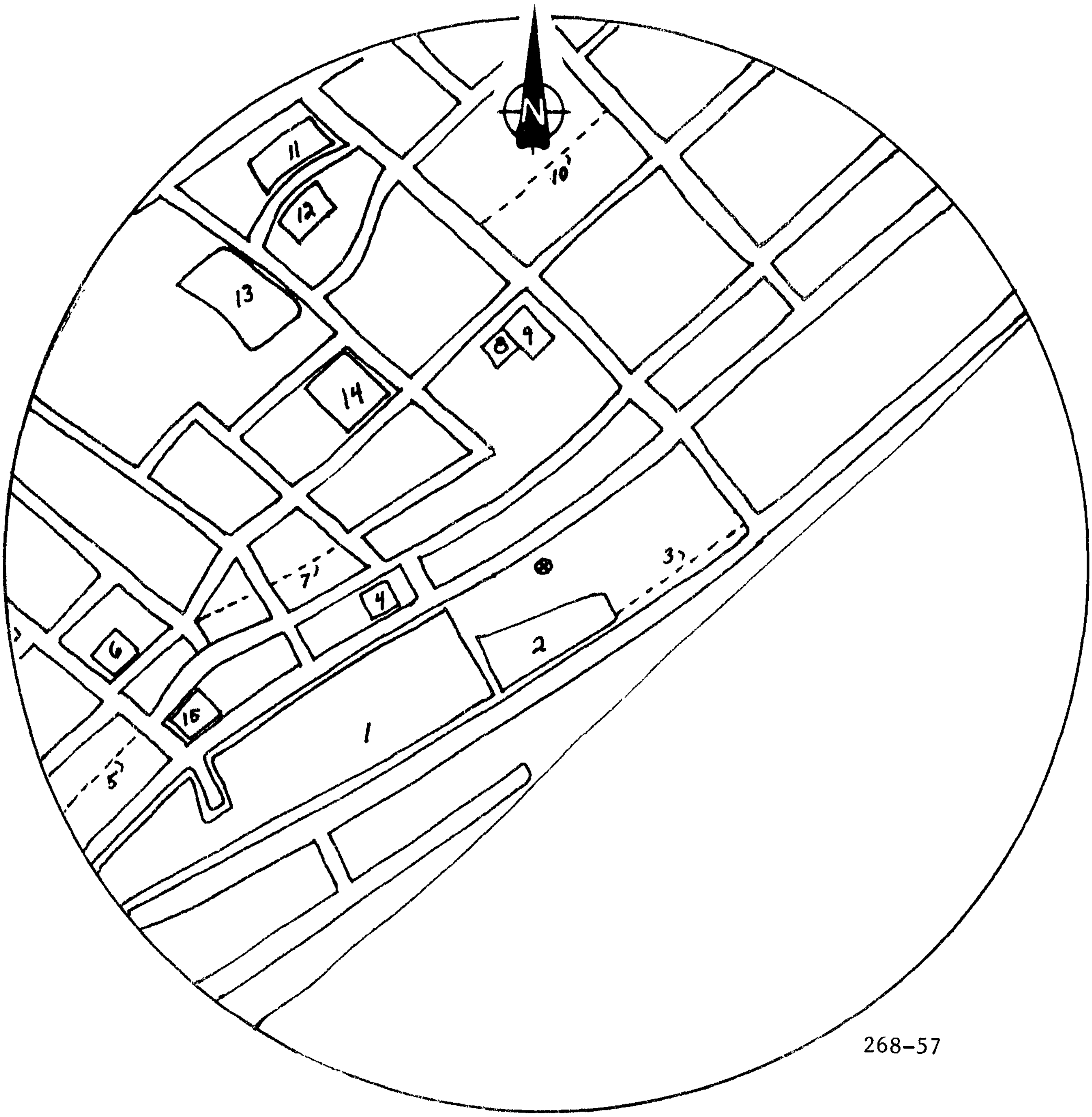
Source	Distance (feet)	Description
Main Street	78 ft	1000* ADT, Clean, Curbed

Visible major point sources:

Source	Direction
Swank Refractory Plant	225

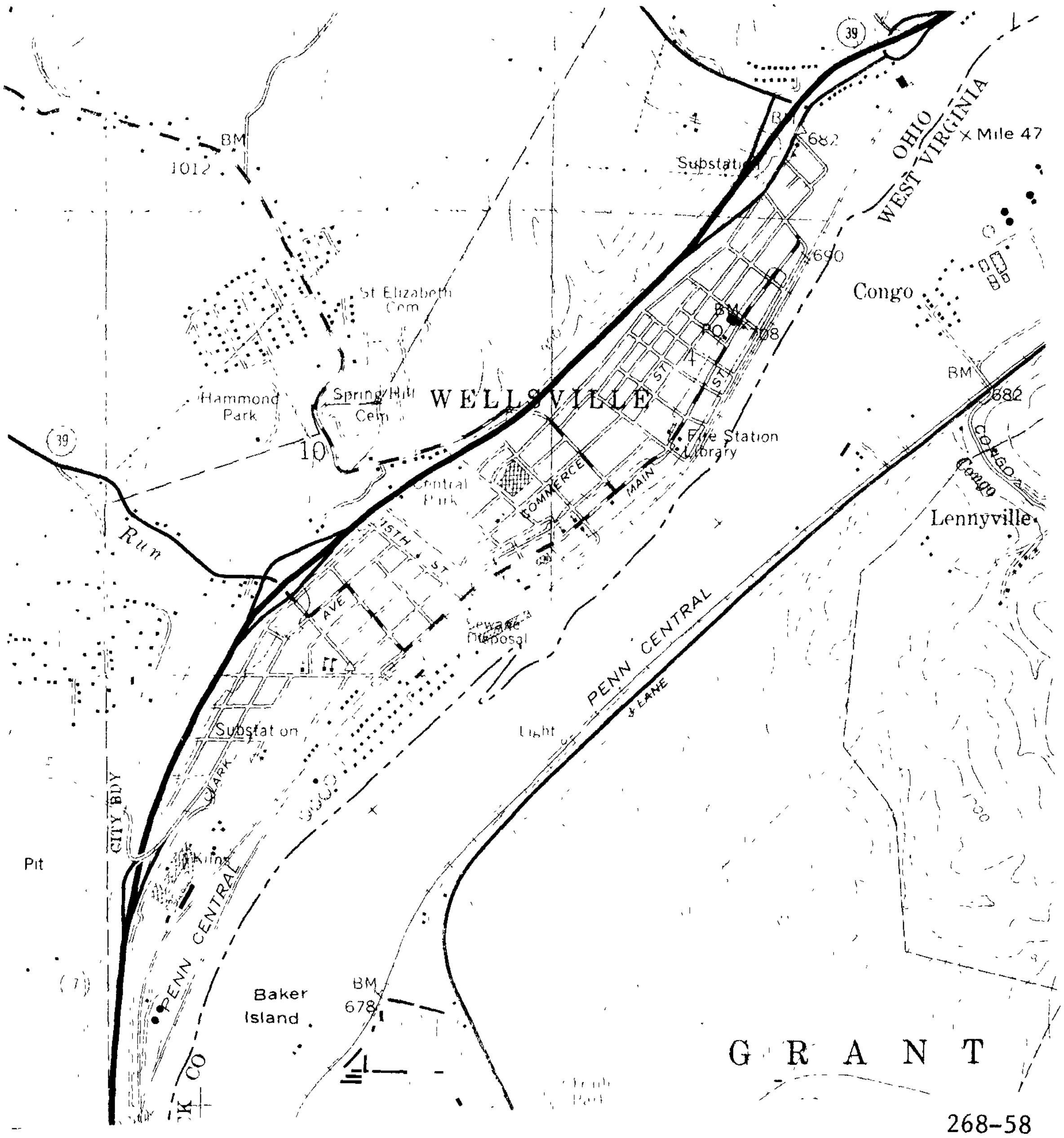
Air Quality Data:

Year	Geometric mean ($\mu g/m^3$)
1977	96
1978	94

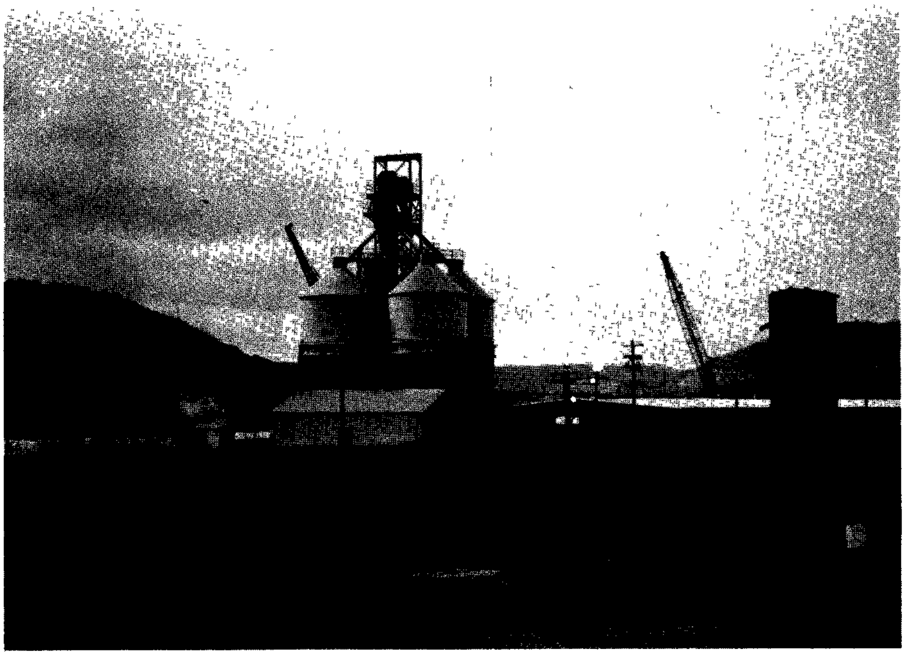


1. Cleared area 2.5 ac.
2. Unpaved lot 0.5 ac.
3. Unpaved road 100 ft.
4. Cleared area 0.04 ac.
5. Unpaved road 200 ft.
6. Unpaved lot 0.04 ac.
7. Unpaved road 300 ft.
8. Unpaved lot 0.04 ac.
9. Unpaved lot 0.04 ac.
10. Unpaved road 300 ft.
11. Unpaved lot 0.2 ac.
12. Unpaved lot 0.08 ac.
13. Cleared area 0.5 ac.
14. Unpaved lot 0.36 ac.
15. Unpaved lot 0.08 ac.

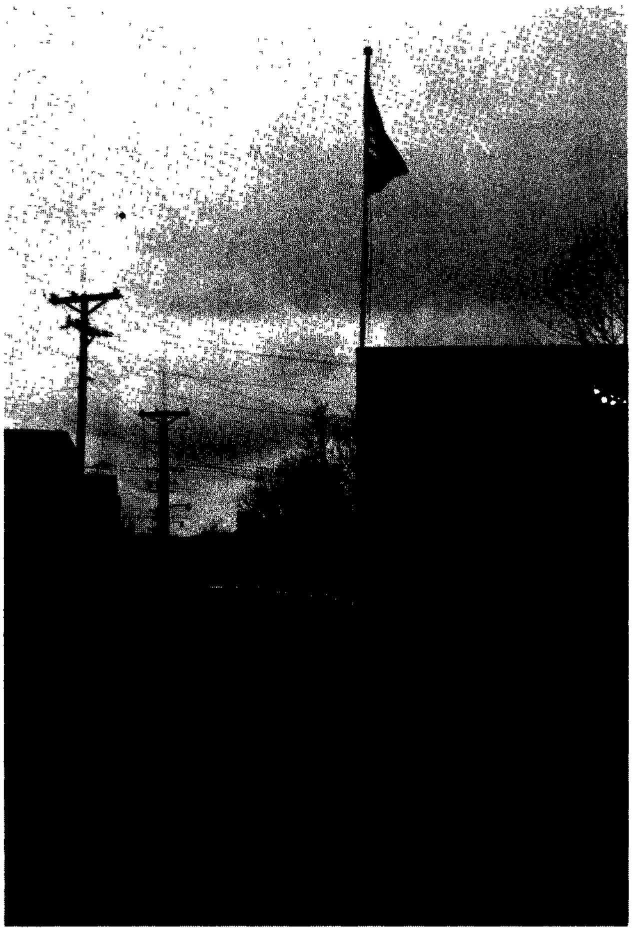
One-quarter mile radius around Wellsville, Ohio site.



One mile radius around Main Street, Wellsville site.



Main Street Wellsville site, view to Southwest



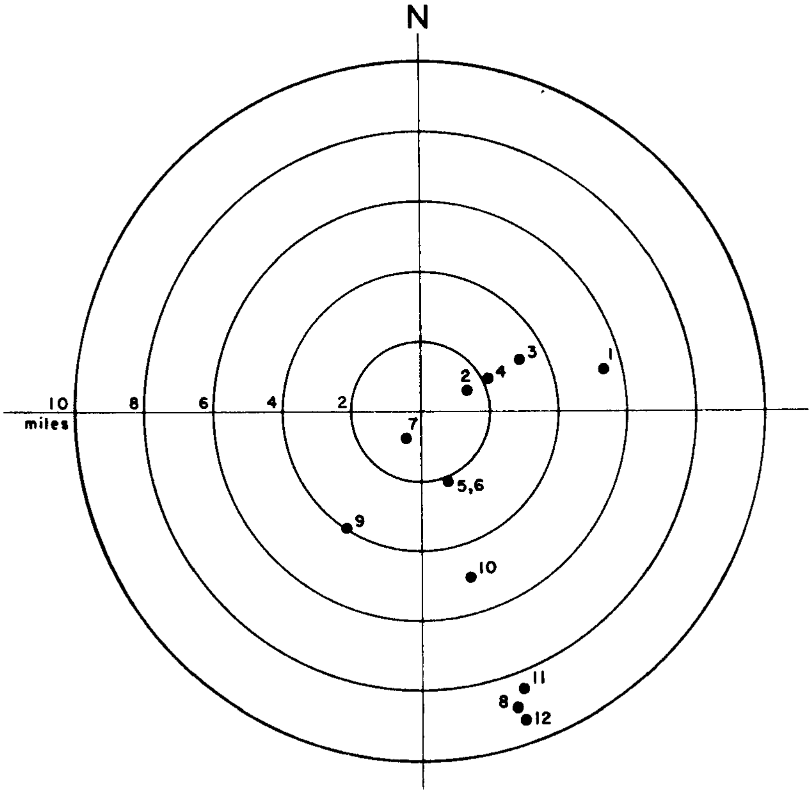
Main Street Wellsville site, view to Northeast

AREA SOURCE SUMMARY

Site: Wellsville, Ohio UTM N 4494255 E 00528879

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	1,576 h.u.	3.8	1.5	0.0	3.3	0.7	3.1	0.0	2.1	0.9	15.4
Comm/Ind fuel		0.1	neg	0.0	0.1	neg	0.1	0.0	0.1	neg	0.4
Incinerators											
Auto exhaust	21,940 VMT	neg	neg		neg		neg		neg		neg
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	54.4 A	0.2	0.1	0.2	0.1	0.0	0.4	0.0	0.4	0.0	1.4
Paved streets	21,940 VMT	neg	neg		neg		neg		neg		neg
Unpaved roads	3.4 VMT	neg									neg
Cleared areas	3.04 A	0.1									0.1
Construction											
Aggregate storage	2.0 A								2.8		2.8
Unpaved pkg lots	1.58 A	0.6	0.1								0.7

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	3.9	5.6	6.3	15.8	167.2	35.0	10.4	212.6
IND PROCESSES	0.0	0.0	0.0	0.0	-	-	-	-
FUGITIVE DUST	0.9	0.5	3.6	5.0	38.6	3.1	5.9	47.6
Total	4.8	6.1	9.9	20.8	205.8	[illegible]	[illegible]	[illegible]



POINT SOURCE SUMMARY

SITE: WELLSVILLE   UTM: 528.88 E , 4494.25 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	& NAME
537.30	4496.20	34.00	5.37	77.0	1	TAYLOR,SMITH,&TAYLOR
531.00	4495.20	35.00	1.44	66.0	2	QUAKER STATE OIL
533.40	4496.60	233.00	3.17	62.6	3	HOMER LAUGHLIN CHINA
531.90	4495.70	169.00	2.09	64.4	4	GLOBE REFRACTORIES S
530.00	4491.00	57.00	2.14	161.0	5	TRI-STATE ASPHALT #3
530.00	4491.00	59.00	2.14	161.0	6	TRI-STATE ASPHALT #4
528.10	4493.10	172.00	0.66	214.1	7	SWANK REFACTORIES
533.30	4480.70	42.00	8.86	161.9	8	KAUL CLAY CO.
525.30	4488.90	43.00	4.00	213.8	9	F.J. DANDO CO.
531.10	4486.70	55191.00	4.89	163.6	10	OHIO EDISON CO./SAMM
533.50	4481.50	5135.00	8.43	160.1	11	OHIO EDISON CO./TORO
533.70	4480.00	1451.00	9.35	161.3	12	TORONTO PAPERBOARD C

DESCRIPTION OF SITE

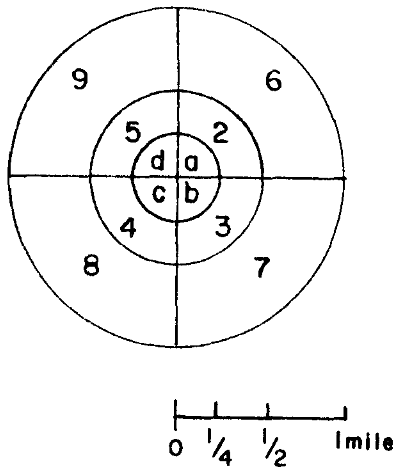
SAROAD Code - 36-6620-001

Location - 602 South Fourth St.,
Toronto, Ohio

UTM - N-4478732 E-00533732

Monitor Height - 29 ft

Site Elevation - 700 ft MSL



Land Use by Sector:

1a.	Commercial/Residential	4.	Commercial
1b.	Residential	5.	Residential
1c.	Commercial	6.	Rural
1d.	Commercial/Residential	7.	Rural
2.	Residential	8.	Commercial/Residential
3.	Rural	9.	Residential/Rural

Localized sources within 200 ft of monitor:

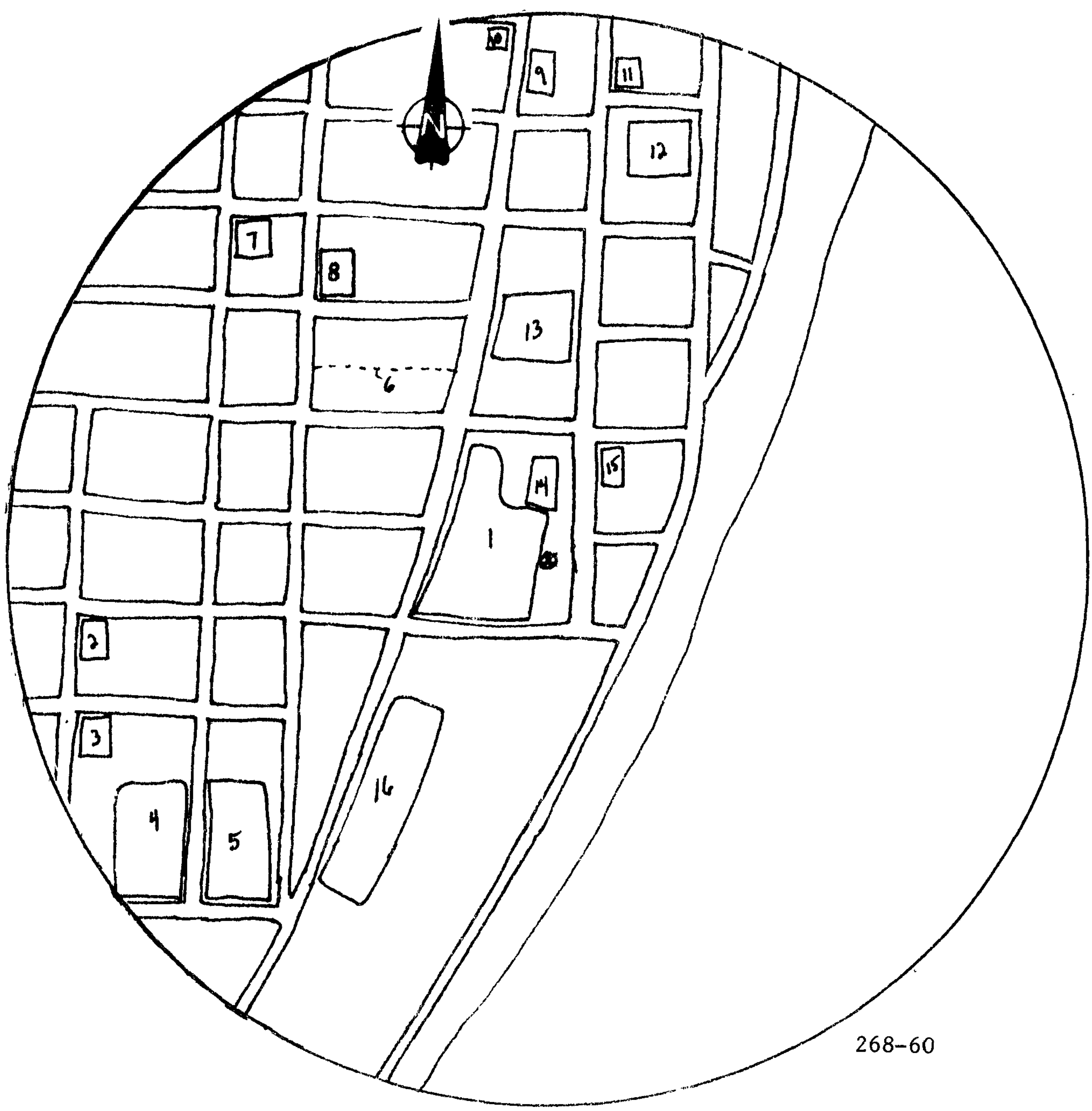
Source	Distance (feet)	Description
South Fourth St.	85 ft	1000* ADT, Cleaned, Curbed

Visible major point sources:

Source	Direction
Toronto Paper board	325°
Titanium Metals	210°
Weirton Steel	190°

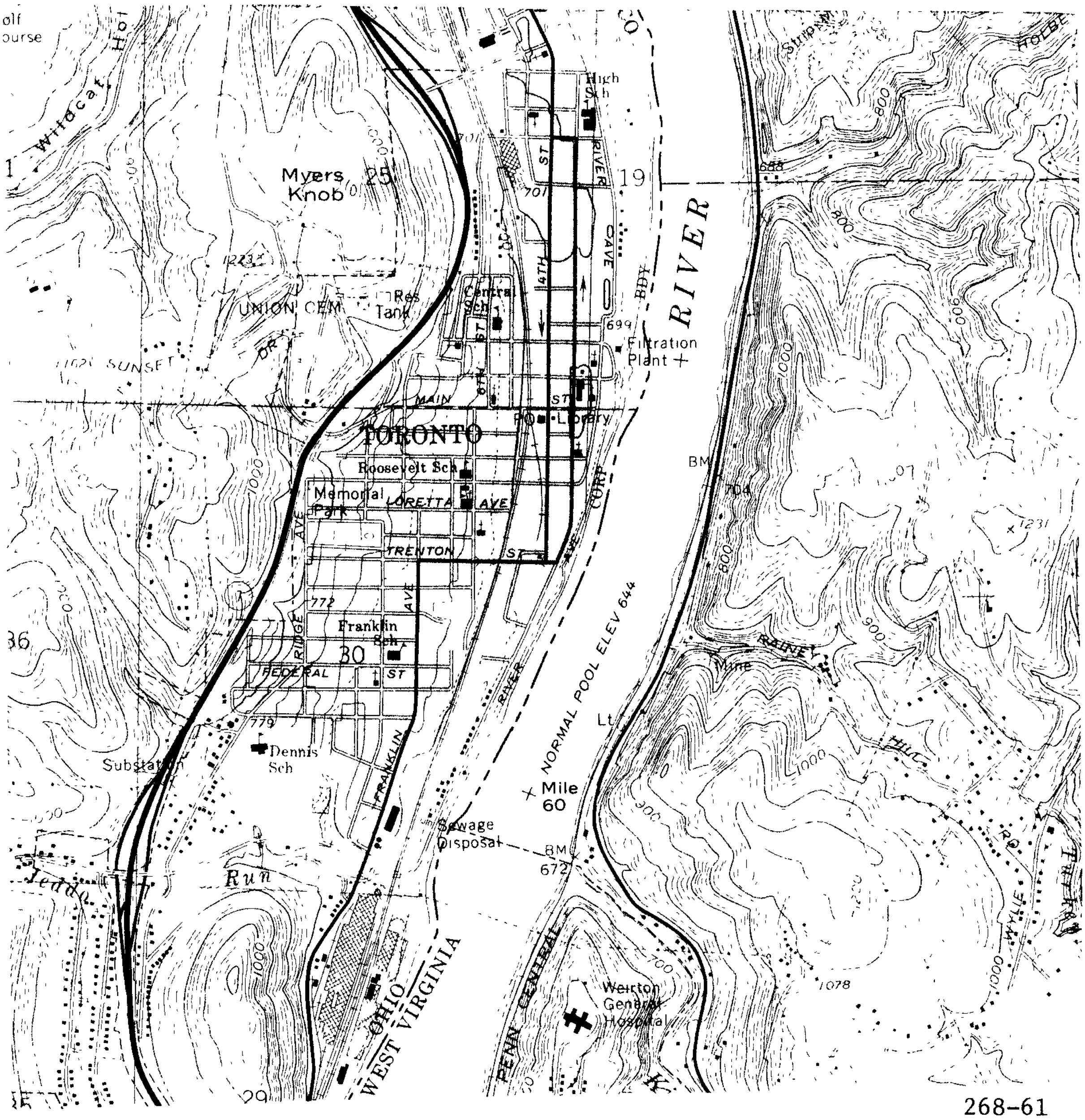
Air Quality Data:

Year	Geometric mean ($\mu g/m^3$)
1977	72 (Federal St.)
1978(Jan.-July)	72 (Federal St.)
1978(Oct.-Dec.)	118 (4th St.)



1. Cleared area 1.0 ac.
2. Construction 0.04 ac.
3. Unpaved lot 0.08 ac.
4. Cleared area 0.5 ac.
5. Cleared area 0.5 ac
6. Unpaved road 200 ft.
7. Cleared area 0.08 ac.
8. Unpaved lot 0.08 ac.
9. Unpaved lot 0.02 ac.
10. Unpaved lot 0.04 ac.
11. Cleared area 0.04 ac.
12. Unpaved lot 0.2 ac.
13. Unpaved lot 0.12 ac.
14. Coal piles 0.08 ac.
15. Unpaved lot 0.04 ac.
16. Unpaved lot 0.75 ac.

One-quarter mile radius around Toronto, Ohio site.



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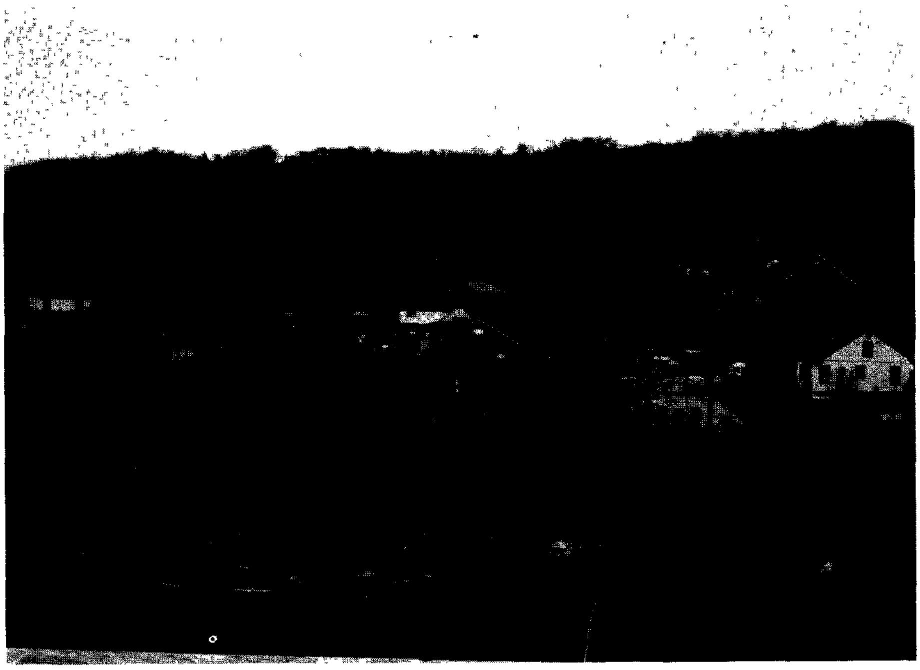
One-mile radius around South Fourth Street, Toronto site.



South Fourth St., Toronto site, view to North.

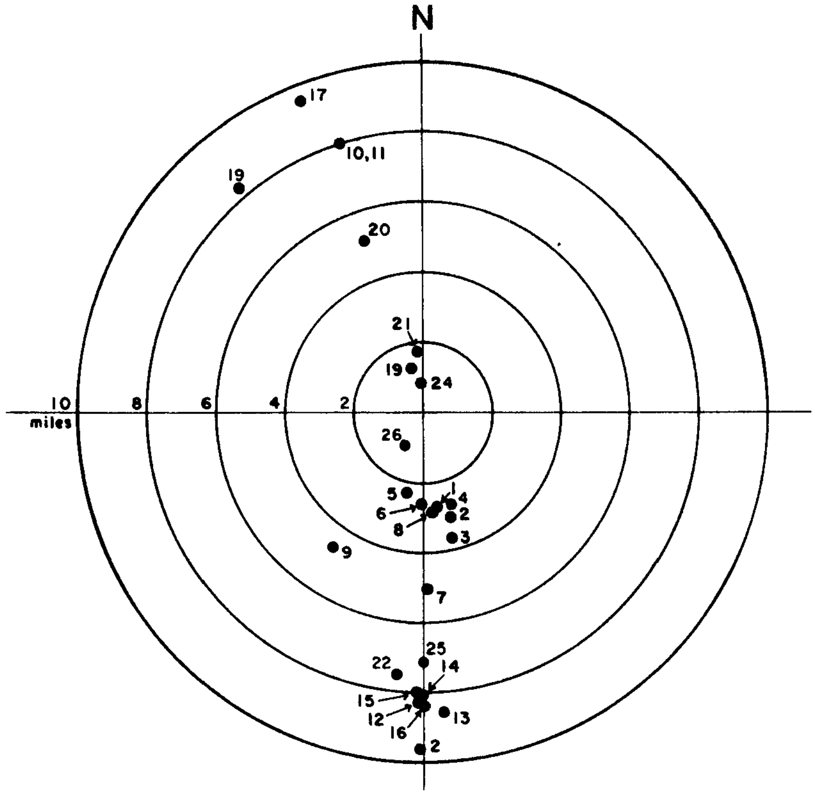
South Fourth St., Toronto site, view to West.

AREA SOURCE SUMMARY

Site: Toronto, Ohio UTM N 4478732 E 00533732

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	990 h.u.	1.6	0.8		1.4	2.4	1.7	0.3	1.0	0.9	10.1
Comm/Ind fuel		neg	neg		neg	neg	neg	neg	neg	neg	neg
Incinerators											
Auto exhaust	757 VMT				neg	neg					neg
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	51.2 A	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.3	0.2	1.5
Paved streets	757 VMT				neg	neg					neg
Unpaved roads	0.75 VMT	neg									neg
Cleared areas	3.12 A	0.1					neg				0.1
Construction	0.04 A	0.1									0.1
Aggregate storage	0.08 A	0.1									0.1
Unpaved pkg lots	2.83 A	0.6				0.5			0.2		1.3

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	1.6	4.6	3.9	10.1	42.5	28.8	6.4	77.7
IND PROCESSES	0.0	0.0	0.0	0.0	-	-	-	-
FUGITIVE DUST	1.1	1.0	1.0	3.1	29.3	6.2	1.6	37.1
Total	2.7	5.6	4.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



POINT SOURCE SUMMARY

SITE: TORONTO UTM: 533.73 E , 4478.73 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
534.30	4474.40	3914.00	2.71	172.5	1	WEIRTON STEEL/NATION
535.00	4473.80	4788.00	3.16	165.6	2	WEIRTON STEEL/NATION
535.00	4473.00	415.00	3.65	167.5	3	WEIRTON STEEL/NATION
534.40	4474.10	1995.00	2.91	171.8	4	WEIRTON STEEL/NATION
533.00	4475.00	1463.00	2.36	191.1	5	WEIRTON STEEL/NATION
533.70	4474.50	2465.00	2.63	180.4	6	WEIRTON STEEL/NATION
534.00	4470.70	267.00	4.99	178.1	7	STANDARD SLAG COMPAN
534.20	4474.20	5.00	2.83	174.1	8	INTERNATIONAL MILL S
529.50	4472.50	10.00	4.68	214.2	9	IRON CITY SAND & GRA
530.00	4491.00	57.00	7.97	343.1	10	TRI-STATE ASPHALT #3
530.00	4491.00	59.00	7.97	343.1	11	TRI-STATE ASPHALT #4
533.40	4465.50	879.00	8.22	181.4	12	KOPPERS CO.
534.60	4464.80	17.00	8.67	176.4	13	INTERNATIONAL MILL S
533.60	4465.90	949.00	7.97	180.6	14	WHEELING PITTSBURGH
533.50	4465.80	3039.00	8.04	181.0	15	WHEELING PITTSBURGH
533.80	4465.30	645.00	8.35	179.7	16	WHEELING PITTSBURGH
528.10	4493.10	172.00	9.59	338.6	17	SWANK REFACTORIES
533.30	4480.70	42.00	1.25	347.6	18	KAUL CLAY CO.
525.30	4488.90	43.00	8.21	320.3	19	F.J. DANDO CO.
531.10	4486.70	55191.00	5.21	341.7	20	OHIO EDISON CO./SAMM
533.50	4481.50	5135.00	1.73	355.2	21	OHIO EDISON CO./TORO
532.50	4466.70	1963.00	7.52	185.8	22	WHEELING-PITTSBURGH
533.50	4463.20	2391.00	9.65	180.9	23	WHEELING-PITTSBURGH
533.70	4480.00	1451.00	0.79	358.6	24	TORONTO PAPERBOARD C
532.70	4467.00	16.00	7.32	185.0	25	NATIONAL STEEL/WEIRT
533.00	4477.50	67.00	0.89	210.7	26	TITANIUM METALS

DESCRIPTION OF SITE

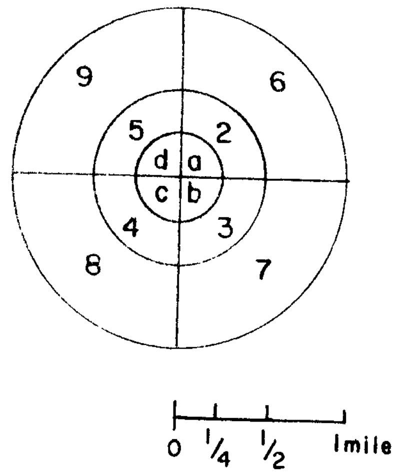
SAROAD Code - 36-6420-012

Location - 814 Adams St.,
Steubenville, Ohio

UTM - N-4467577 E-00532077

Monitor Height - 30 ft

Site Elevation - 780 ft MSL



Land Use by Sector:

1a. Commercial

1b. Commercial

1c. Residential

1d. Residential

2. Residential

3. Commercial

4. Residential

5. Residential

6. Residential

7. Industrial

8. Residential/Rural

9. Residential

Localized sources within 200 ft of monitor:

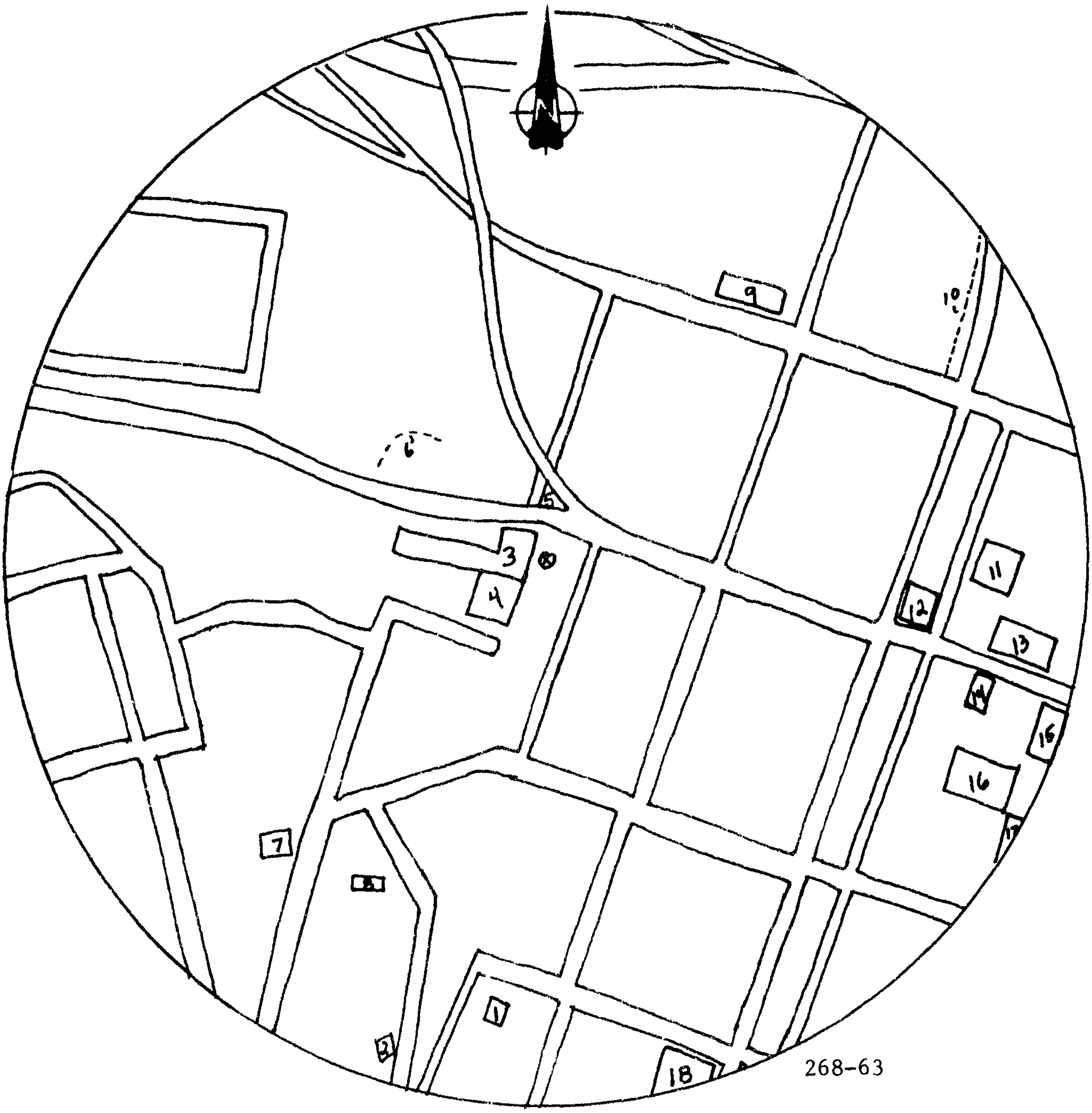
Source	Distance (feet)	Description
Adams St.	100	808 ADT, Clean, Curbed
Eighth St.	49	500* ADT, Clean, Curbed
South St.	119	500* ADT, Clean, Curbed

Visible major point sources:

Source	Direction
Wheeling/Pittsburgh Steel - North	155
Wheeling/Pittsburgh Steel - Sinter/Coke	145
Wheeling/Pittsburgh Steel - Mingo Works	150

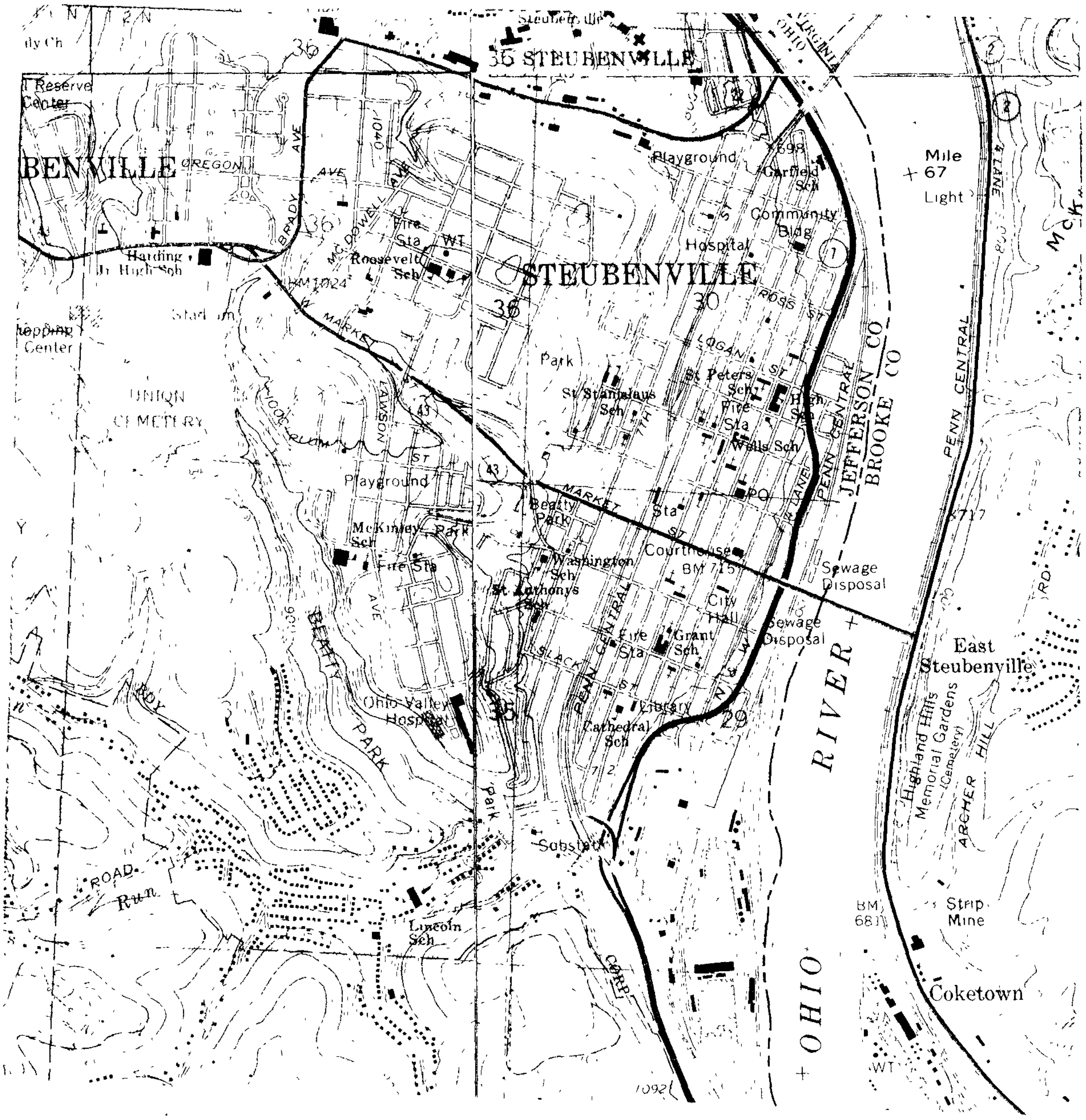
Air Quality Data:

Year	Geometric mean ($\mu g/m^3$)
1977	98
1978	94



1.	Cleared area 0.02 ac.	10.	Unpaved road 300 ft.
2.	Cleared area 0.02 ac.	11.	Unpaved lot 0.06 ac.
3.	Unpaved lot 0.24 ac.	12.	Unpaved lot 0.06 ac.
4.	Unpaved lot 0.12 ac.	13.	Unpaved lot 0.12 ac.
5.	Unpaved lot 0.02 ac.	14.	Unpaved lot 0.04 ac.
6.	Unpaved road 200 ft.	15.	Unpaved lot 0.16 ac.
7.	Unpaved lot 0.04 ac.	16.	Unpaved lot 0.20 ac.
8.	Cleared area 0.02 ac.	17.	Unpaved lot 0.20 ac.
9.	Construction 0.08 ac.	18.	Cleared area 0.36 ac.

One-quarter mile radius around Adams Street, Steubenville, Ohio site.



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One-mile radius around Adams Street, Steubenville site.

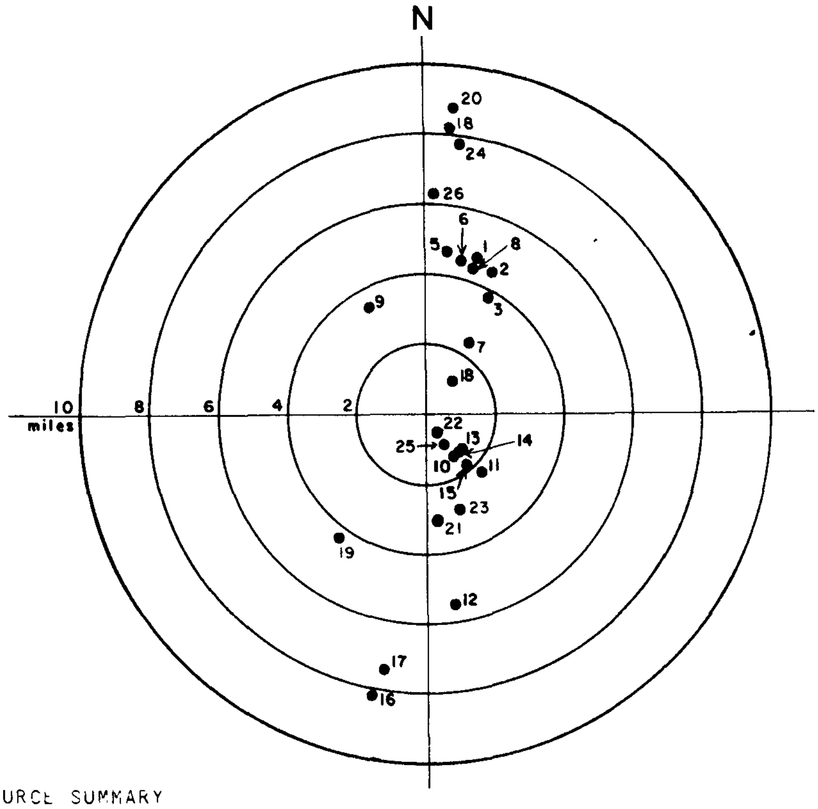
Adams Street, Steubenville site, view to Southeast.

Adams Street, Steubenville site, view to Southwest.

Site: Steubenville, Ohio - Jefferson County Building UTM N 4467577 E 00532077

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	2,010	h.u.	1.2	1.0	2.0	4.5	2.4	neg	1.3	5.9	19.7
Comm/Ind fuel		neg	neg	neg	0.1	0.1	0.1		neg	0.2	0.5
Incinerators											
Auto exhaust											
IND PROCESSES:											
Ind processes				16.0							16.0
FUGITIVE DUST:											
Railroad yards											
Paved streets											
Unpaved roads	1.9 VMT	neg									neg
Cleared areas	0.42	neg									neg
Construction	0.08	neg									neg
Storage areas											
Unpaved pkg lots	1.78	0.5	0.1	0.2							0.8

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	1.4	8.9	9.9	20.2	36.0	55.6	16.3	107.9
IND PROCESSES	0.0	16.0	0.0	16.0	-	100.0	-	100.0
FUGITIVE DUST	0.5	0.3	0.0	0.8	12.9	1.9	-	14.8
Total	1.9	25.2	9.9	37.0	48.9	157.5	16.3	222.7

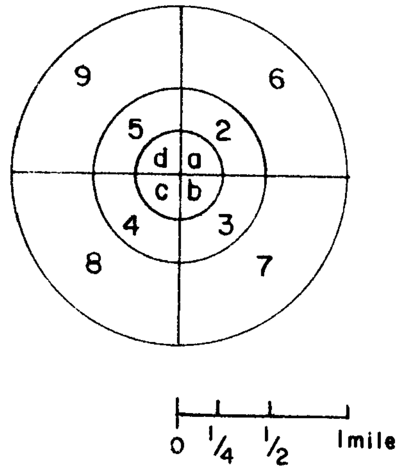


POINT SOURCE SUMMARY

SITE: STEUBENVILLE AD UTM: 532.08 E , 4467.58 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	NAME
534.30	4474.40	3914.00	4.46	18.1	1	WEIRTON STEEL/NATION
535.00	4473.80	4788.00	4.27	25.2	2	WEIRTON STEEL/NATION
535.00	4473.00	415.00	3.63	28.3	3	WEIRTON STEEL/NATION
534.40	4474.10	1995.00	4.30	19.6	4	WEIRTON STEEL/NATION
533.00	4475.00	1463.00	4.65	7.1	5	WEIRTON STEEL/NATION
533.70	4474.50	2465.00	4.42	13.2	6	WEIRTON STEEL/NATION
534.00	4470.70	267.00	2.28	31.6	7	STANDARD SLAG COMPAN
534.20	4474.20	5.00	4.32	17.8	8	INTERNATIONAL MILL S
529.50	4472.50	10.00	3.45	332.4	9	IRON CITY SAND & GRA
533.40	4465.50	879.00	1.53	147.5	10	KOPPERS CO.
534.60	4464.80	17.00	2. 3	137.7	11	INTERNATIONAL MILL S
533.30	4458.90	94.00	5.[illegible]5	172.0	12	PANNER FIBERBOARD CO
533.60	4465.90	949.00	1.[illegible]1	137.8	13	WHEELING PITTSBURGH
533.50	4465.80	3039.00	1.41	141.3	14	WHEELING PITTSBURGH
533.80	4465.30	645.00	1.77	142.9	15	WHEELING PITTSBURGH
529.40	4454.90	149.00	8.05	191.9	16	BUCKEYE POWER
530.00	4455.80	38007.00	7.43	190.0	17	CARDINAL OPER. COMP.
533.30	4480.70	42.00	8.19	5.3	18	KAUL CLAY CO.
527.90	4462.00	6213.00	4.33	216.8	19	SATRALLOY INC.
533.50	4481.50	5135.00	6.70	5.8	20	OHIO EDISON CO./TORO
532.50	4462.60	51.00	3.10	175.1	21	STANDARD SLAG CO.
532.50	4466.70	1963.00	0.61	154.3	22	WHEELING-PITTSBURGH
533.50	4463.20	2391.00	2.86	162.0	23	WHEELING-PITTSBURGH
533.70	4480.00	1451.00	7.78	7.4	24	TORONTO PAPERBOARD C
532.70	4467.00	16.00	0.53	132.9	25	NATIONAL STEEL/WEIRT
533.00	4477.50	67.00	6.19	5.3	26	TITANIUM METALS

DESCRIPTION OF SITE



SAROAD Code - 36-6420-013

Location - 317 Market St.,
Steubenville, Ohio

UTM - N-4467551 E-00532238

Monitor Height - 50 ft

Site Elevation - 700 ft MSL

Land Use by Sector:

1a. Commercial

1b. Industrial

1c. Commercial

1d. Commercial

2. Industrial/Residential

3. Industrial/River

4. Residential

5. Commercial/Residential

6. Rural

7. Industrial/Rural

8. Residential

9. Rural/Residential

Localized sources within 200 ft of monitor:

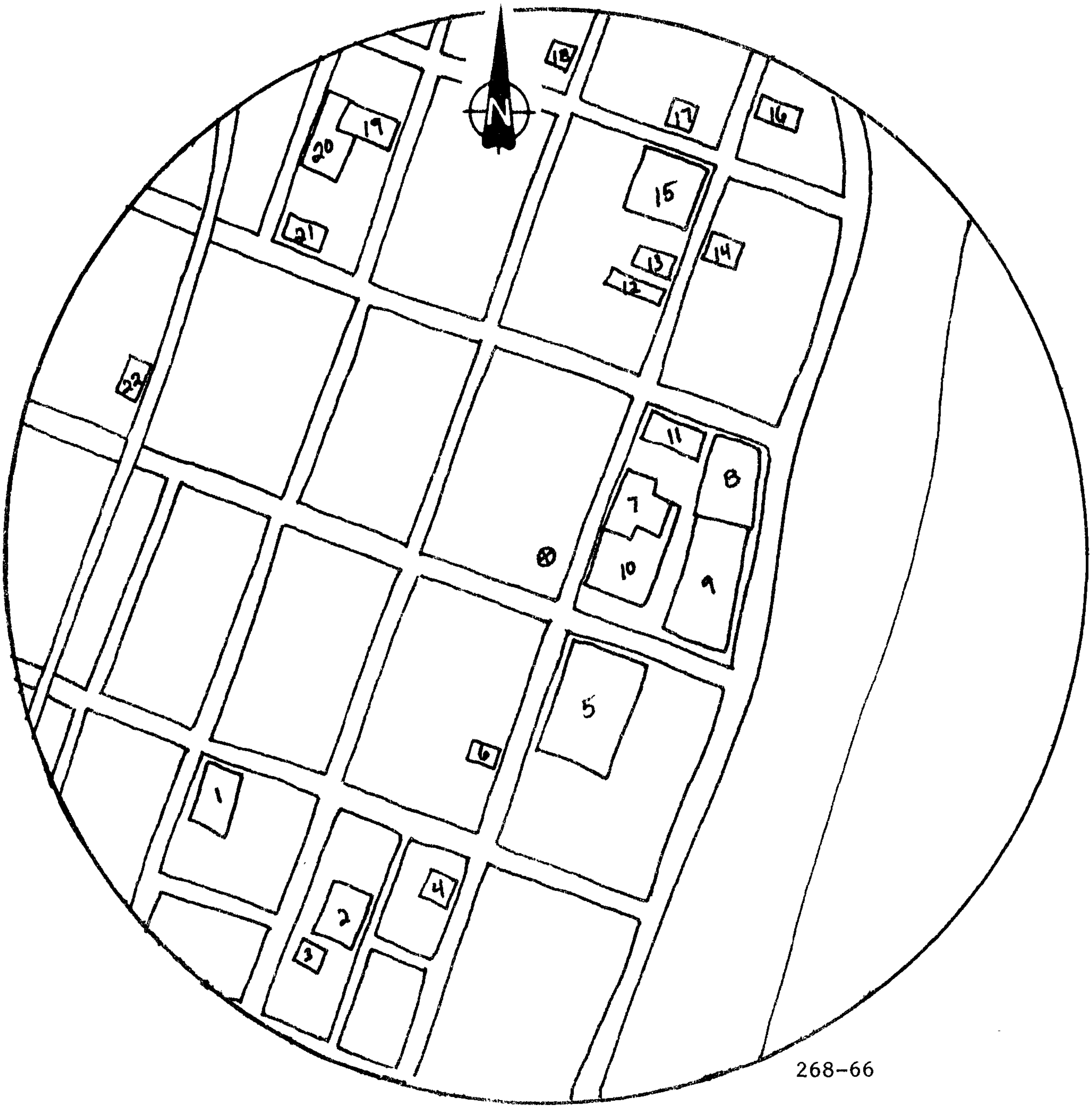
Source	Distance (feet)	Description
S. Third St.	70	1021 Clean, Curbed
Market St.	108	3300 Clean, Curbed
Fourth St.	107	9 Clean, Curbed

Visible major point sources:

Source	Direction
Wheeling/Pittsburgh Steel - North	180
Federal Paperboard (closed)	35
Wheeling/Pittsburgh Sinter Plant, Coke Batteries	145

Air Quality Data:

Year	Geometric mean (μg/m^3)
1977	105
1978	109



1.	Unpaved lot 0.12 ac.	12.	Unpaved lot 0.08 ac.
2.	Unpaved lot 0.20 ac.	13.	Unpaved lot 0.04 ac.
3.	Cleared area 0.02 ac.	14.	Unpaved lot 0.04 ac.
4.	Unpaved lot 0.04 ac.	15.	Unpaved lot 0.30 ac.
5.	Cleared area 0.36 ac.	16.	Unpaved lot 0.04 ac.
6.	Cleared area 0.04 ac.	17.	Unpaved lot 0.04 ac.
7.	Cleared area 0.16 ac.	18.	Unpaved lot 0.04 ac.
8.	Unpaved lot 0.20 ac.	19.	Unpaved lot 0.12 ac.
9.	Cleared area 0.40 ac.	20.	Cleared area 0.12 ac.
10.	Cleared area 0.28 ac.	21.	Unpaved lot 0.06 ac.
11.	Cleared area 0.08 ac.	22.	Cleared area 0.04 ac.

One-quarter mile radius around Market Street, Steubenville, Ohio site.

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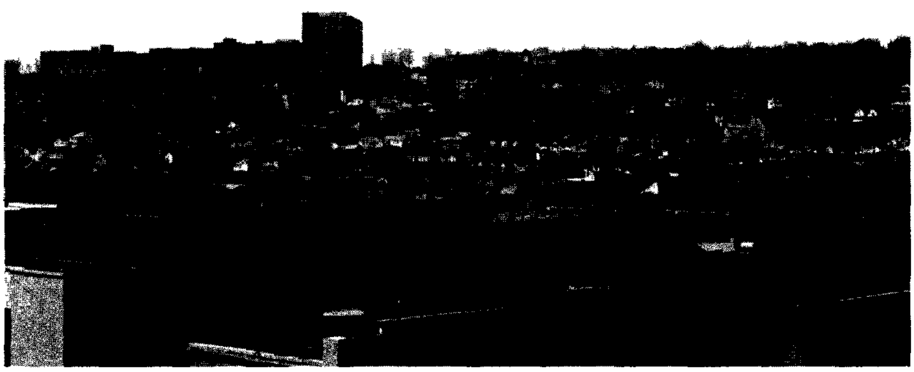
One-mile radius around Market St., Steubenville site.

Steubenville court house site, view to Southeast.



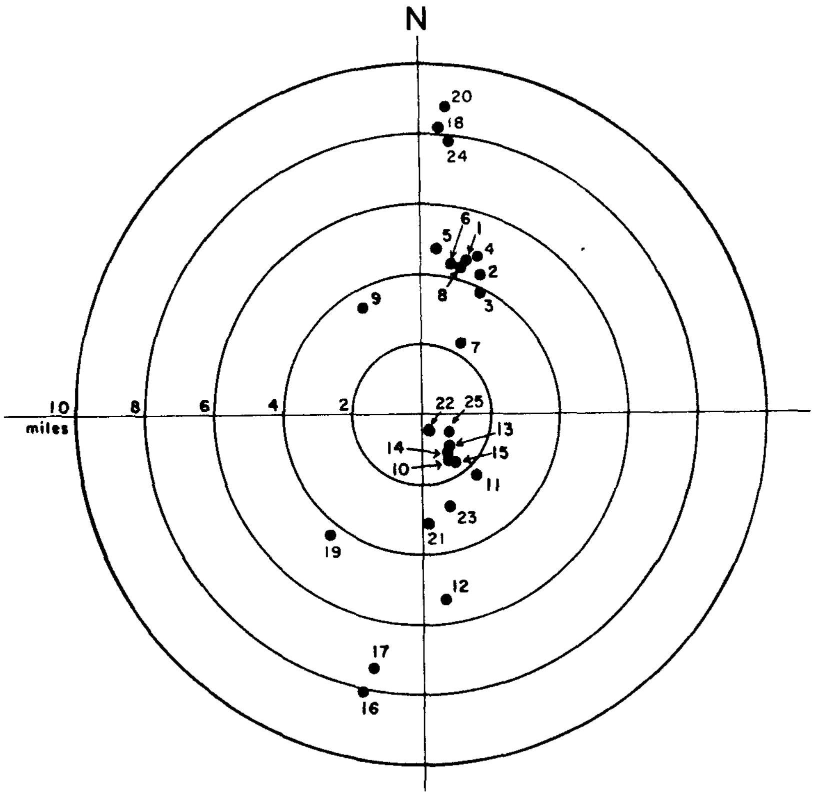
Steubenville court house site, view to Southwest.

AREA SOURCE SUMMARY

Site: Steubenville, Ohio - County Court House UTM N 4467551 E 00532238

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	1,960 h.u.	0.5	0.6	0.1	2.5	1.9	0.3	1.3	6.0	6.0	19.2
Comm/Ind fuel		0.2	neg	neg	0.1	0.1	neg	neg	0.2	0.2	0.8
Incinerators											
Auto exhaust	22,211 VMT	neg									neg
IND PROCESSES:											
Ind processes				16.0							16.0
FUGITIVE DUST:											
Railroad yards	100.1 A	0.2	0.2	0.3	0.2	0.1	0.6	0.6	0.7	0.1	3.0
Paved streets	22,211 VMT	0.1									0.1
Unpaved roads											
Cleared areas	1.5 A	neg									neg
Aggregate storage	1.0 A			1.4							1.4
Storage areas	10 A						0.1				0.1
Unpaved pkg lots	1.66 A	0.6			0.1	0.1					0.8

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	0.7	5.3	14.0	20.0	10.8	33.1	23.0	66.9
IND PROCESSES	0.0	16.0	0.0	16.0	-	100.0	-	100.0
FUGITIVE DUST	0.9	2.4	2.1	5.4	13.9	15.0	3.4	32.3
Total	1.6	23.7	16.1	41.4	24.7	148.1	26.4	199.2



POINT SOURCE SUMMARY

SITE: STEUBENVILLE OH UTM: 532.24 E , 4467.55 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
534.30	4474.40	3914.00	4.44	16.8	1	WEIRTON STEEL/NATION
535.00	4473.80	4788.00	4.25	23.8	2	WEIRTON STEEL/NATION
535.00	4473.00	415.00	3.80	26.9	3	WEIRTON STEEL/NATION
534.40	4474.10	1995.00	4.29	18.3	4	WEIRTON STEEL/NATION
533.00	4475.00	1463.00	4.65	5.8	5	WEIRTON STEEL/NATION
533.70	4474.50	2465.00	4.41	11.9	6	WEIRTON STEEL/NATION
534.00	4470.70	267.00	2.24	29.2	7	STANDARD SLAG COMPAN
534.20	4474.20	5.00	4.31	16.4	8	INTERNATIONAL MILL S
529.50	4472.50	10.00	3.51	331.0	9	IRON CITY SAND & GRA
533.40	4465.50	879.00	1.46	150.5	10	KOPPERS CO.
534.60	4464.80	17.00	2.25	139.3	11	INTERNATIONAL MILL S
533.30	4458.90	94.00	5.42	173.0	12	BANNER FIBERBOARD CO
533.60	4465.90	349.00	1.33	140.5	13	WHEELING PITTSBURGH
533.50	4465.80	3035.00	1.34	144.2	14	WHEELING PITTSBURGH
533.80	4465.30	645.00	1.70	145.2	15	WHEELING PITTSBURGH
529.40	4454.90	149.00	8.06	192.6	16	BUCKEYE POWER
530.00	4455.80	38007.00	7.43	190.8	17	CARDINAL OPER. COMP.
533.30	4480.70	42.00	8.20	4.6	18	KAUL CLAY CO.
527.90	4462.00	6213.00	4.38	218.0	19	SATRALLOY INC.
533.50	4481.50	5135.00	8.70	5.2	20	OHIO EDISON CO./TORO
532.50	4462.60	51.00	3.08	177.0	21	STANDARD SLAG CO.
532.50	4466.70	1963.00	0.55	162.9	22	WHEELING-PITTSBURGH
533.50	4463.20	2391.00	2.82	163.8	23	WHEELING-PITTSBURGH
533.70	4480.00	1431.00	7.79	6.7	24	TORONTO PAPERBOARD C
532.70	4467.00	16.00	0.45	140.0	25	NATIONAL STEEL/WEIRT
533.00	4477.50	67.00	6.20	4.4	26	TITANIUM METALS

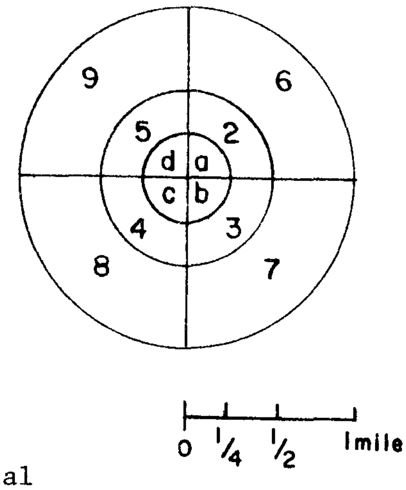
DESCRIPTION OF SITE

SAROAD Code - 36-4420-001

Location - 501 Commercial St.,
Mingo Junction, Ohio

Monitor Height - 20 ft

Site Elevation - 700 ft MSL



Land Use by Sector:

1a.	Industrial	4.	Residential
1b.	Industrial	5.	Residential
1c.	Residential	6.	Industrial/Residential
1d.	Residential	7.	River/Industrial
2.	River	8.	Rural/Industrial
3.	Industrial	9.	Residential/Rural

Localized sources within 200 ft of monitor:

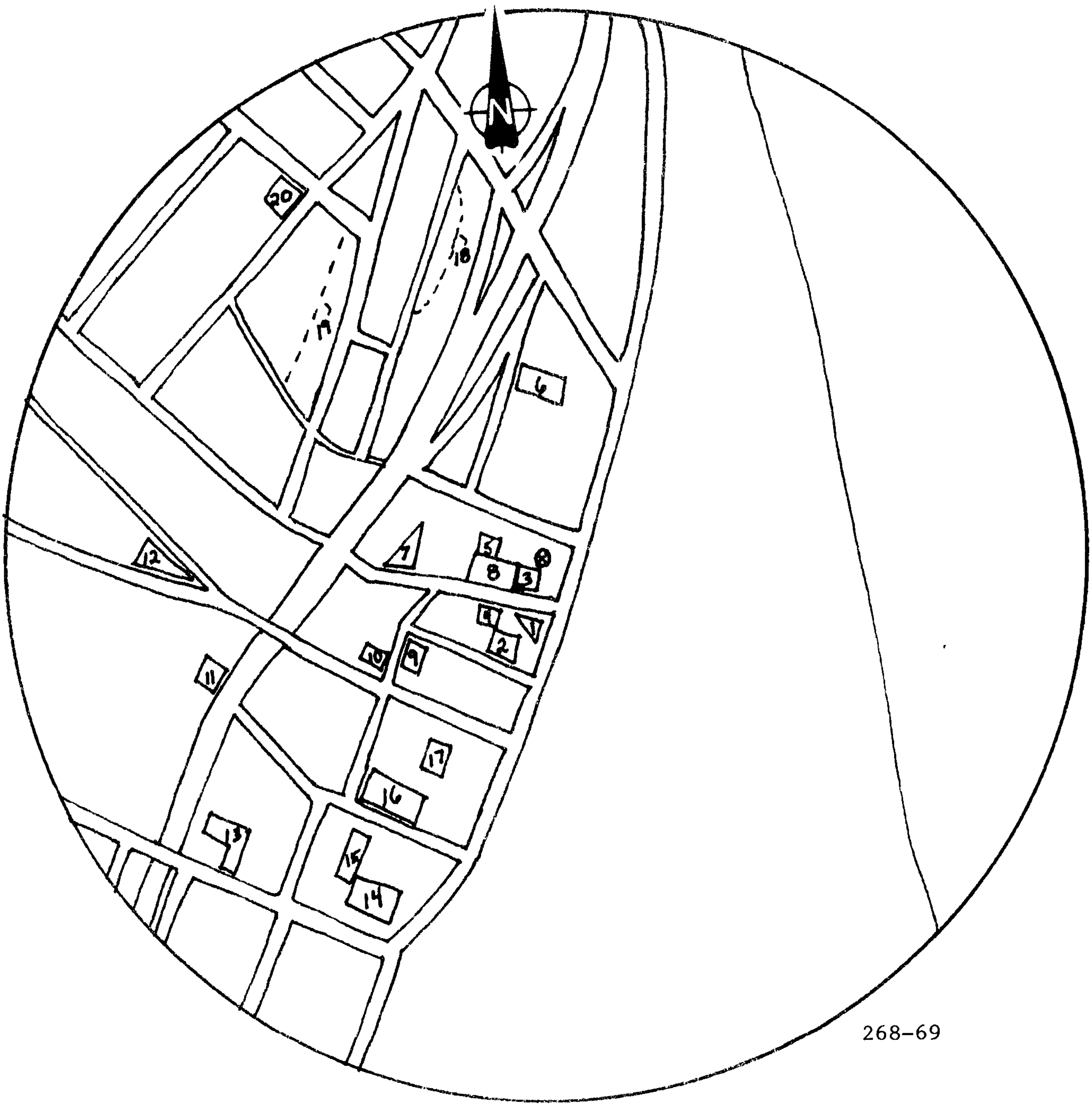
Source	Distance (feet)	Description
Commercial St.	97	2110 ADT
Potter St.	43	500* ADT

Visible major point sources:

Source	Direction
Wheeling/Pittsburgh Steel Co.	115
Cardinal Power	180
Wheeling/Pittsburgh Sinter Plant	005

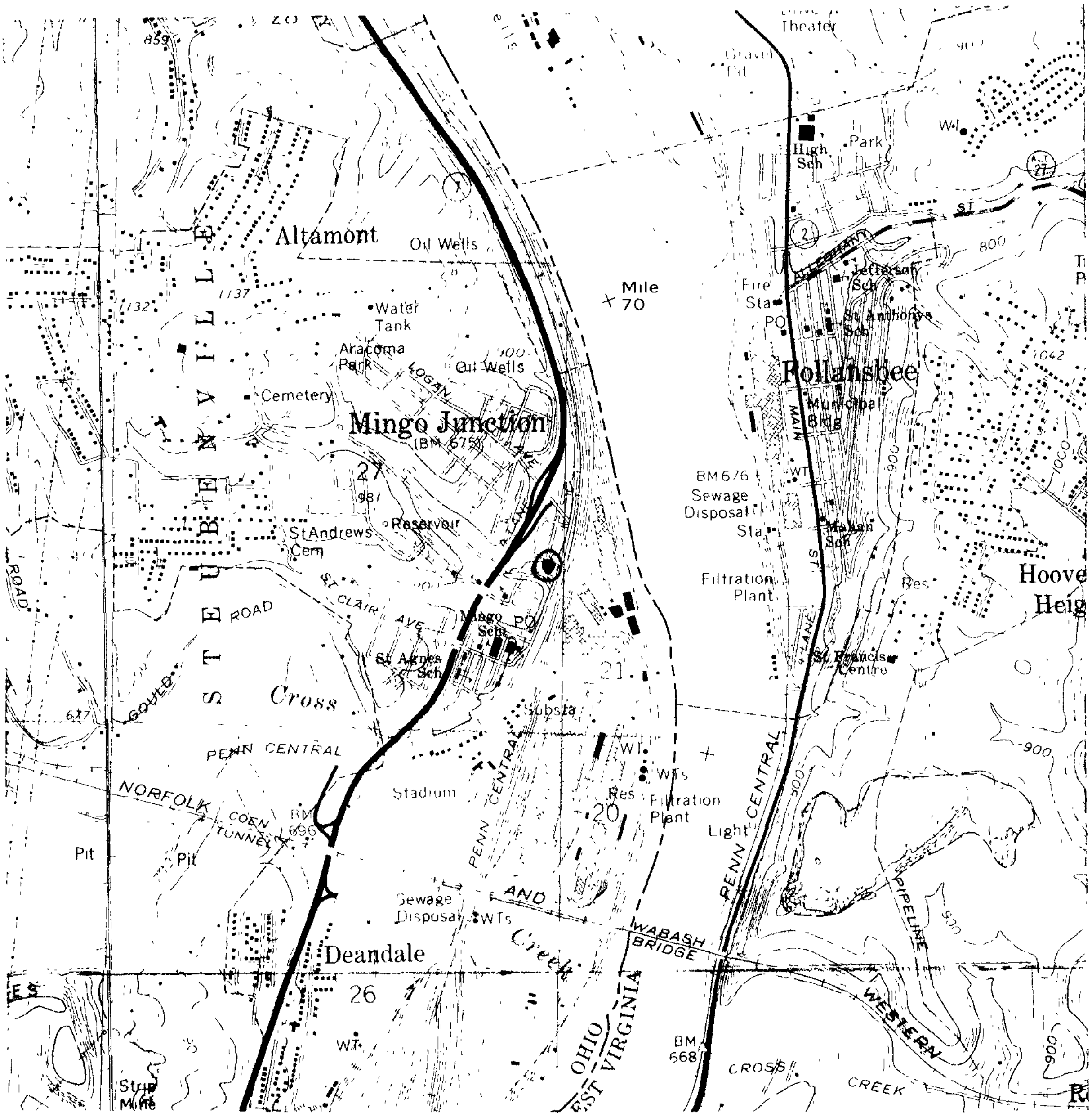
Air Quality Data:

Year	Geometric mean (μg/m^3)
1977	131
1978	131



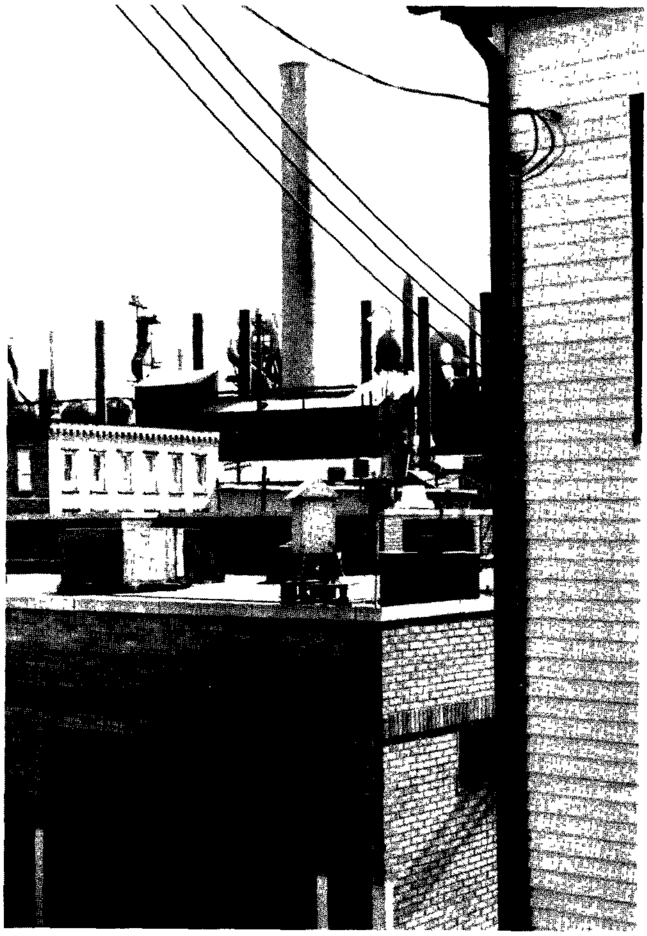
1. Unpaved lot 0.04 ac.
2. Unpaved lot 0.02 ac.
3. Unpaved lot 0.04 ac.
4. Unpaved lot 0.04 ac.
5. Unpaved lot 0.02 ac.
6. Cleared area 0.08 ac
7. Unpaved lot 0.04 ac.
8. Unpaved lot 0.04 ac.
9. Cleared area 0.04 ac.
10. Unpaved lot 0.04 ac.
11. Unpaved lot 0.02 ac.
12. Cleared area 0.04 ac.
13. Unpaved lot 0.06 ac.
14. Unpaved lot 0.08 ac.
15. Unpaved lot 0.04 ac.
16. Unpaved lot 0.08 ac.
17. Unpaved lot 0.02 ac.
18. Unpaved road 200 ft.
19. Unpaved road 200 ft.
20. Cleared area 0.04 ac.

One-quarter mile radius around Mingo Junction, Ohio site.

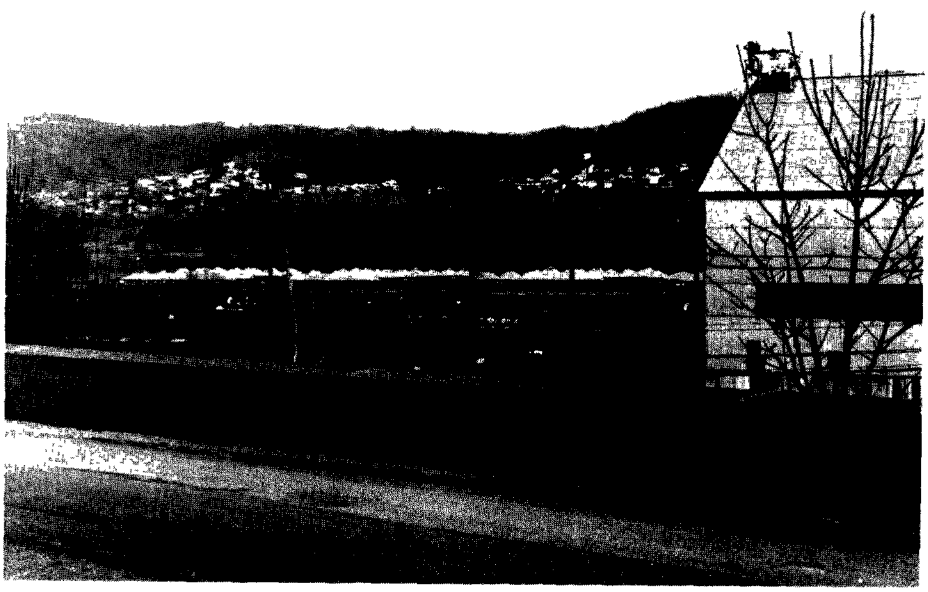


268-70

One-mile radius around Commercial Street, Mingo Junction site.



Commercial Street, Mingo Junction site, view to Southeast.

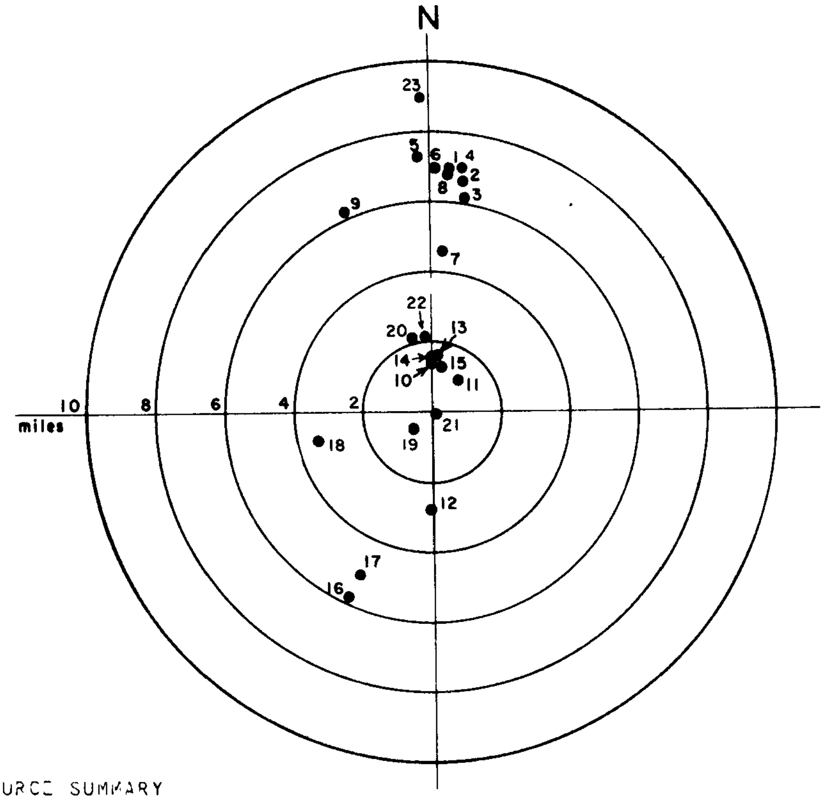


Commercial Street, Mingo Junction site, view to East from North of monitor site.

Site: Mingo Junction, Ohio UTM N 4463381 E 00533394

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	1,153 h.u.	2.9	neg	0.0	2.0	1.9	1.6	0.7	0.3	2.0	11.4
Comm/Ind fuel		0.1	neg	0.0	0.1	0.1	0.1	neg	neg	0.1	0.5
Incinerators											
Auto exhaust	26,154 VMT	neg			neg	neg			neg	neg	neg
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	146.0 A	0.6	0.3	0.3	0.3	0.0	1.0	0.7	0.8	0.4	4.4
Paved streets	26,152 VMT	neg			neg	neg			neg	neg	neg
Unpaved roads	1.5 VMT	neg									neg
Cleared areas	5.2 A	neg		0.1							0.1
Construction											
Storage areas	0.2								neg		neg
Unpaved pkg lots	3.33 A	0.3			0.3				0.9		1.5

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	3.0	4.1	4.8	11.9	115.7	25.6	7.9	149.2
IND PROCESSES	0.0	0.0	0.0	0.0	-	-	-	-
FUGITIVE DUST	0.9	1.3	3.8	6.0	34.7	8.1	6.2	49.0
Total	3.9	5.4	8.6	17.9	150.4	33.7	14.1	198.2

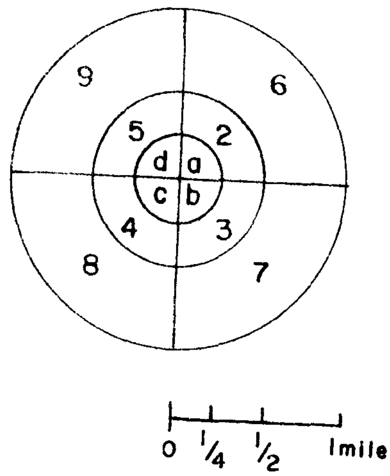


POINT SOURCE SUMMARY

SITE: MINGO JUNCTION UTM: 533.39 E , 4463.38 N

X (KM)	Y (KM)	MISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	& NAME
534.30	4474.40	3914.00	6.67	4.7	1	WEIRTON STEEL/NATION
535.00	4473.80	4786.00	6.55	8.8	2	WEIRTON STEEL/NATION
535.00	4473.00	415.00	6.06	9.5	3	WEIRTON STEEL/NATION
534.40	4474.10	1995.00	6.69	5.4	4	WEIRTON STEEL/NATION
533.00	4475.00	1463.00	7.22	358.1	5	WEIRTON STEEL/NATION
533.70	4474.50	2465.00	6.91	1.6	6	WEIRTON STEEL/NATION
534.00	4470.70	267.00	4.56	4.7	7	STANDARD SLAG COMPAN
534.20	4474.20	5.00	6.74	4.3	8	INTERNATIONAL MILL S
529.50	4472.50	10.00	6.16	336.9	9	IRON CITY SAND & GRA
533.40	4465.50	879.00	1.32	0.2	10	KOPPERS CO.
534.60	4464.80	17.00	1.16	40.4	11	INTERNATIONAL MILL S
533.30	4458.90	94.00	2.79	181.2	12	BANNER FIBERBOARD CO
533.60	4465.90	949.00	1.57	4.7	13	WHEELING PITTSBURGH
533.50	4465.80	3039.00	1.50	2.5	14	WHEELING PITTSBURGH
533.80	4465.30	645.00	1.22	12.0	15	WHEELING PITTSBURGH
529.40	4454.90	149.00	5.83	205.2	16	BUCKEYE POWER
530.00	4455.80	38007.00	5.16	204.1	17	CARDINAL OPER. COMP.
527.90	4462.00	6213.00	3.52	255.9	18	SATRALLOY INC.
532.50	4462.60	51.00	0.74	228.9	19	STANDARD SLAG CO.
532.50	4466.70	1963.00	2.13	344.9	20	WHEELING-PITTSBURGH
533.50	4463.20	2391.00	0.13	150.0	21	WHEELING-PITTSBURGH
532.70	4467.00	16.00	2.29	349.1	22	NATIONAL STEEL/WEIRT
533.00	4477.50	67.00	8.78	358.4	23	TITANIUM METALS

DESCRIPTION OF SITE



SAROAD Code - 36-3160-001

Location - 1004 Third Street,
Brilliant, Ohio

UTM - N-4456800 E-00531400

Monitor Height - 17 ft

Site Elevation - 700 ft MSL

Land Use by Sector:

1a.	Residential	4.	Industrial
1b.	River/School	5.	Rural
1c.	Residential/Industrial	6.	Rural
1d.	Rural/Residential	7.	Rural
2.	Residential	8.	Rural
3.	River	9.	Rural

Localized sources within 200 ft of monitor:

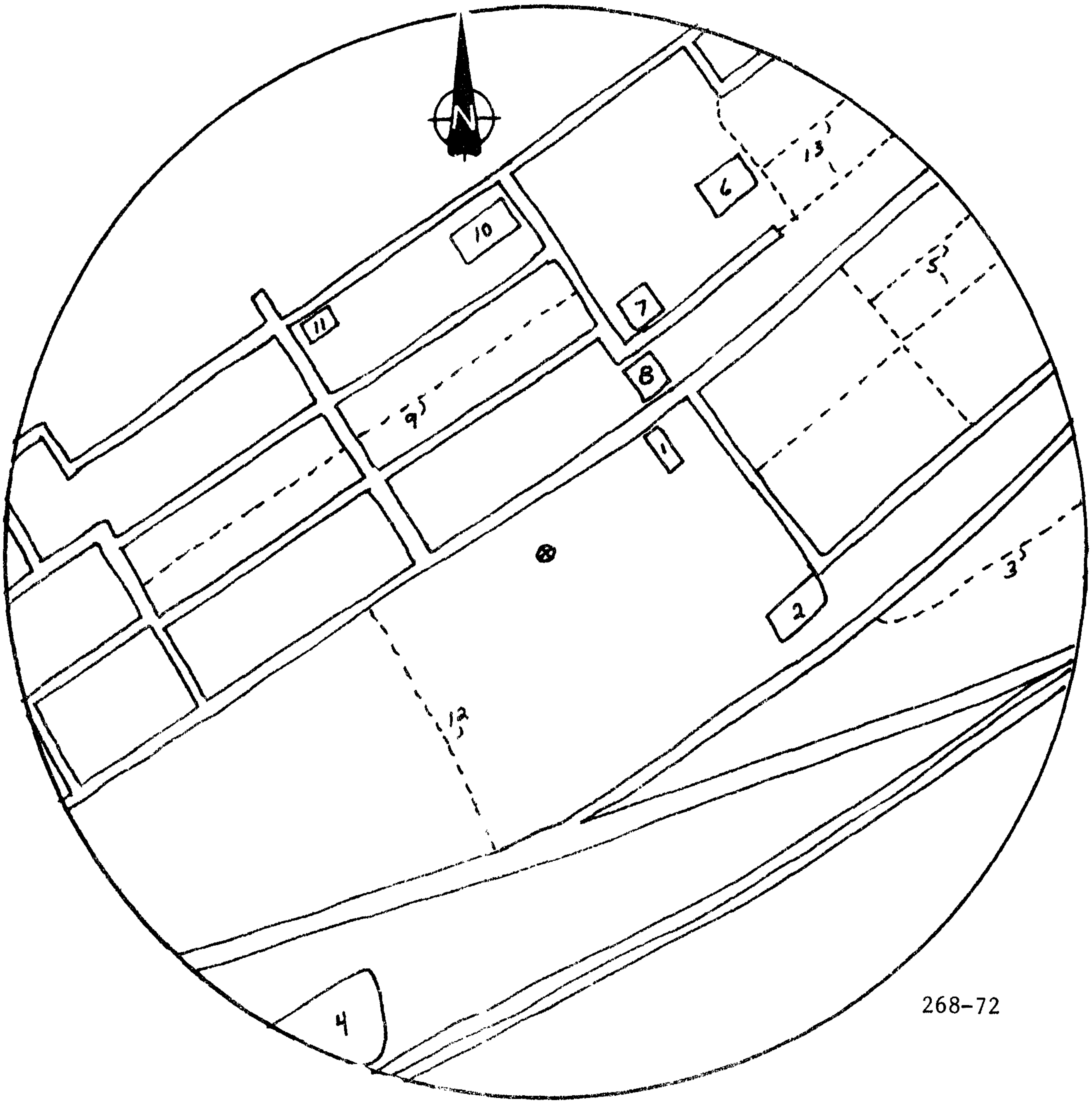
Source	Distance (feet)	Description
Third St.	175	1000* ADT, Dirty w/unpaved shoulder

Visible major local sources:

Source	Direction
Ohio Ferro-Alloy (closed)	225°
Cardinal Power	230°
Buckeye Power	225°

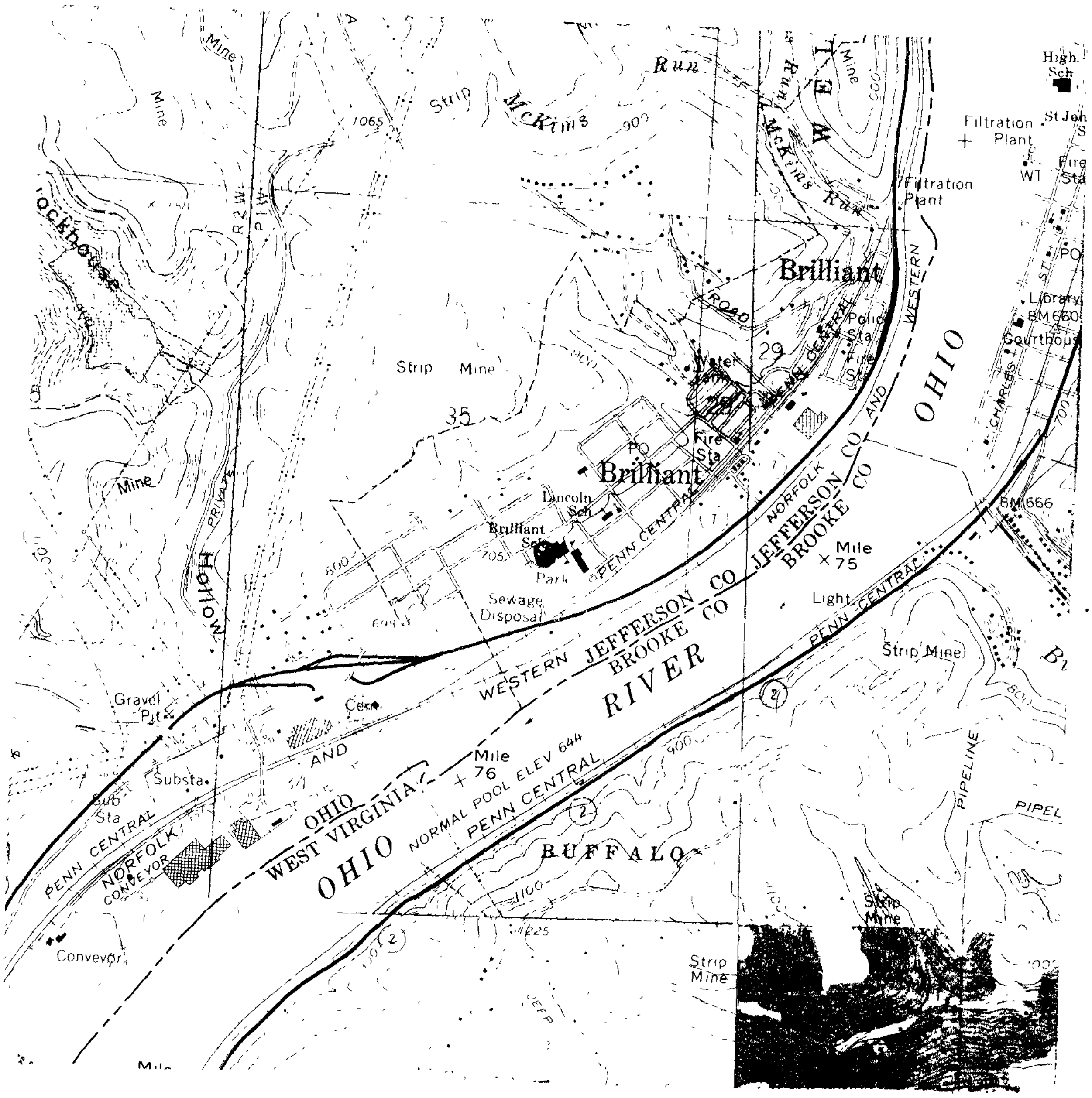
Air Quality Data:

Year	Geometric mean ($\mu g/m^3$)
1977	93
1978	75

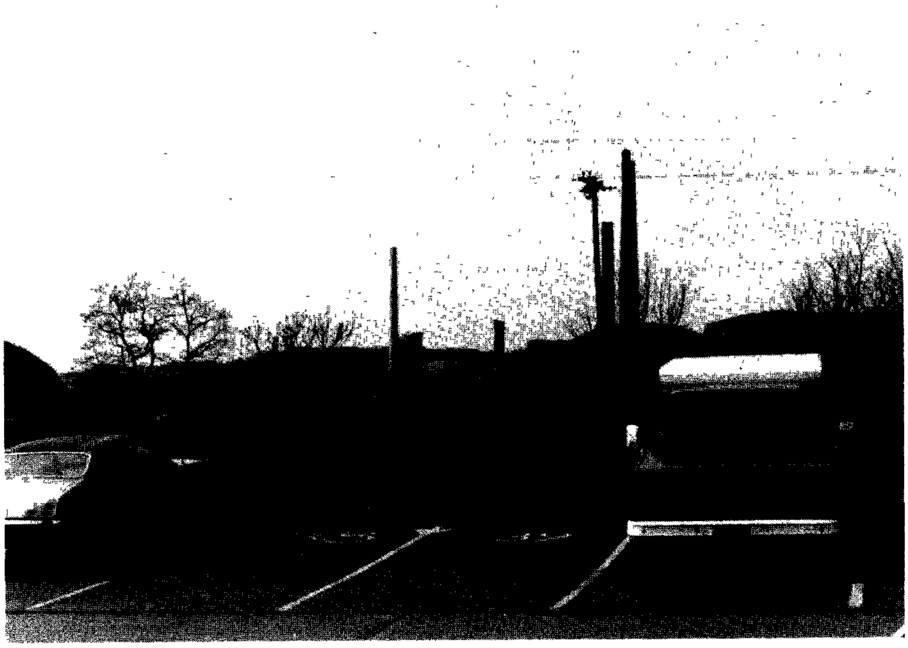


1. Unpaved lot 0.04 ac.
2. Unpaved lot 0.08 ac.
3. Unpaved road 300 ft.
4. Cleared area 0.5 ac.
5. Unpaved road 1200 ft.
6. Unpaved lot 0.04 ac.
7. Cleared area 0.08 ac.
8. Unpaved lot 0.08 ac.
9. Unpaved road 700 ft.
10. Construction 0.08 ac/yr.
11. Cleared area 0.04 ac.
12. Unpaved road 400 ft.
13. Unpaved road 500 ft.

One-quarter mile radius around Brilliant, Ohio site.



One-mile radius around Third Street, Brilliant Ohio site.



Third St., Brilliant, Ohio site, view to Southwest.

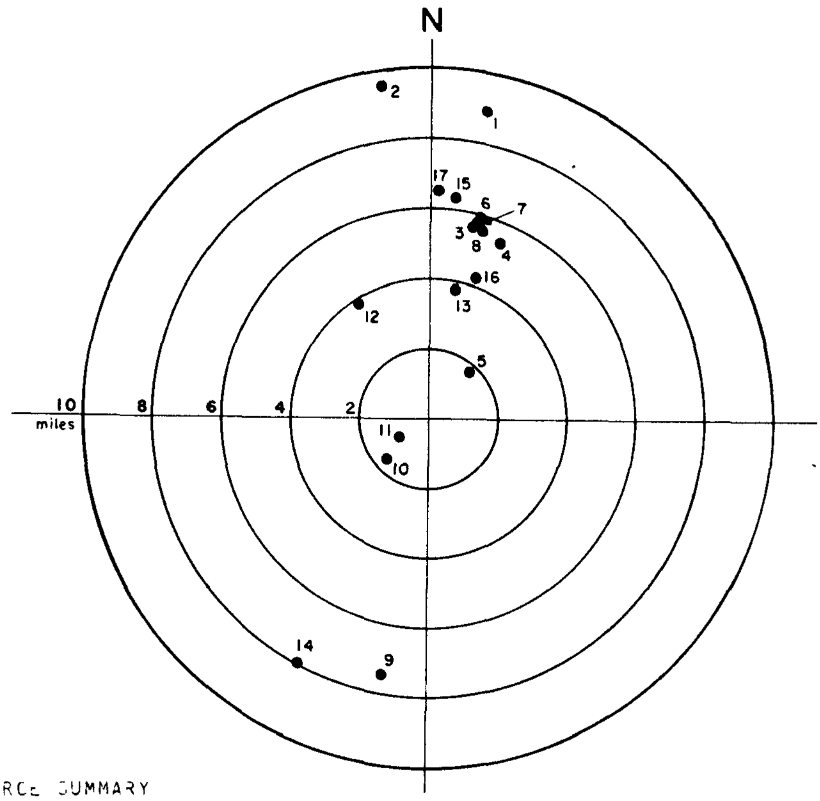
Third St., Brilliant, Ohio site, view to Southeast.

AREA SOURCE SUMMARY

Site: Brilliant, Ohio UTM N 4456800 E 00531400

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	491 h.u.	2.0	1.2	-	0.7	0.2	0.5	-	0.2	neg	4.8
Comm/Ind fuel		neg	neg	-	neg	neg	neg	-	neg	neg	neg
Incinerators											
Auto exhaust	20,706 VMT	neg	neg		neg		neg		neg		neg
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	50.0 A	0.2	0.1	0.1	0.1	0.0	0.3	0.1	0.4	0.0	1.3
Paved streets	20,701 VMT	neg	neg		neg		neg		neg		neg
Unpaved roads	5.3 VMT	neg									neg
Cleared areas	11.62 A	neg	neg		neg		0.1		0.1		0.2
Construction	0.8 A	0.2									0.2
Storage areas	2.0 A		0.2								0.2
Unpaved pkg lots	0.24 A	0.1									0.1
Aggregate Storage	0.5 A				0.7						0.7

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	2.0	2.1	0.7	4.8	90.8	13.1	1.2	105.1
IND PROCESSES	0.0	0.0	0.0	0.0	-	-	-	-
FUGITIVE DUST	0.5	1.2	1.0	2.7	22.7	7.5	1.6	31.8
Total	2.5	3.3	1.7	7.5	113.5	20.6	2.8	136.9



POINT SOURCE SUMMARY

SITE: BRILLIANT UTM: 531.40 E , 4456.80 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	& NAME
534.00	4470.70	267.00	8.79	10.6	1	STANDARD SLAG COMPAN
529.50	4472.50	10.00	9.83	353.1	2	IRON CITY SAND & GRA
533.40	4465.50	879.00	5.55	12.9	3	KOPPERS CO.
534.60	4464.80	17.00	5.35	21.8	4	INTERNATIONAL MILL S
533.30	4458.90	94.00	1.76	42.2	5	BANNER FIBERBOARD CO
533.60	4465.90	949.00	5.82	13.6	6	WHEELING PITTSBURGH
533.50	4465.80	3039.00	5.74	13.1	7	WHEELING PITTSBURGH
533.80	4465.30	645.00	5.49	15.8	8	WHEELING PITTSBURGH
529.30	4445.00	210.00	7.45	190.1	9	VALLEY CAMP COAL NO.
529.40	4454.90	149.00	1.72	226.4	10	BUCKEYE POWER
530.00	4455.80	38007.00	1.07	234.5	11	CARDINAL OPER. COMP.
527.90	4462.00	6213.00	3.69	326.1	12	SATRALLOY INC.
532.50	4462.60	51.00	3.67	10.7	13	STANDARD SLAG CO.
525.40	4445.40	1493.00	8.01	207.8	14	WHEELING-PITTSBURGH
532.50	4466.70	1963.00	6.19	6.3	15	WHEELING-PITTSBURGH
533.50	4463.20	2391.00	4.18	18.2	16	WHEELING-PITTSBURGH
532.70	4467.00	16.00	6.39	7.3	17	NATIONAL STEEL/WEIRT

DESCRIPTION OF SITE

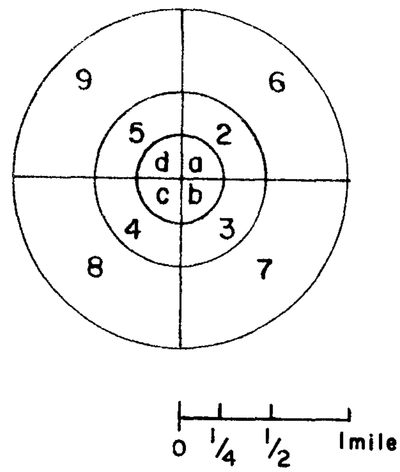
SAROAD Code - 36-3160-007

Location - Waterworks Building,
Tiltonsville, Ohio

UTM - N-4446267 E-00525693

Monitor Height - 18 ft

Site Elevation - 690 ft MSL



Land Use by Sector:

1a.	Commercial	4.	Industrial
1b.	River	5.	Rural
1c.	Residential	6.	Rural
1d.	Commercial/Residential	7.	Rural
2.	Industrial	8.	Residential/Industrial
3.	River/Industrial	9.	Rural

Localized sources within 200 ft of monitor:

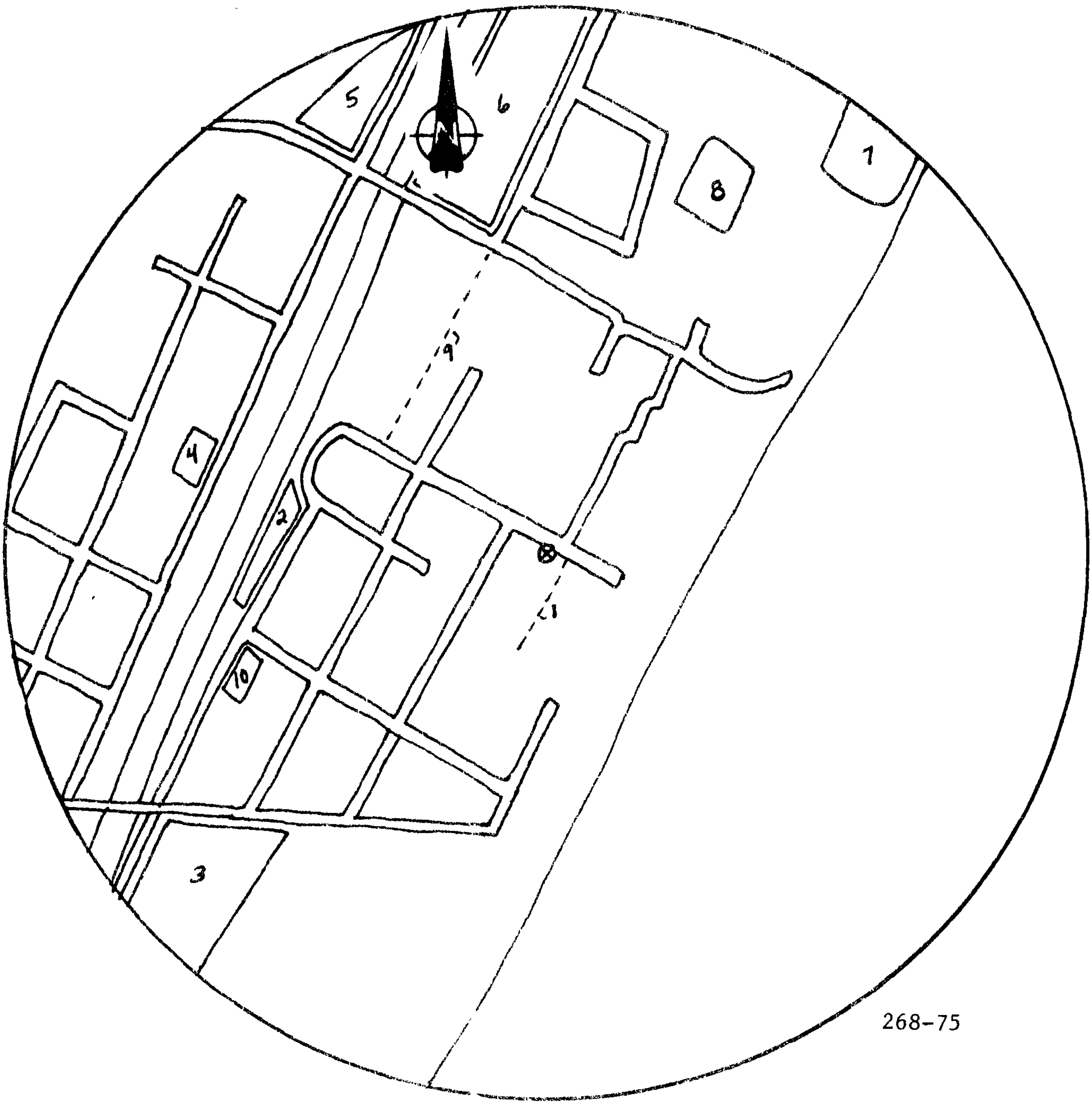
Source	Distance (feet)	Description
Market St.	32	1000 ADT
Grandview St.	82	500 ADT
Rte 7	250	2390 ADT

Visible major point sources:

Source	Direction
Wheeling/Pittsburgh Steel	200°

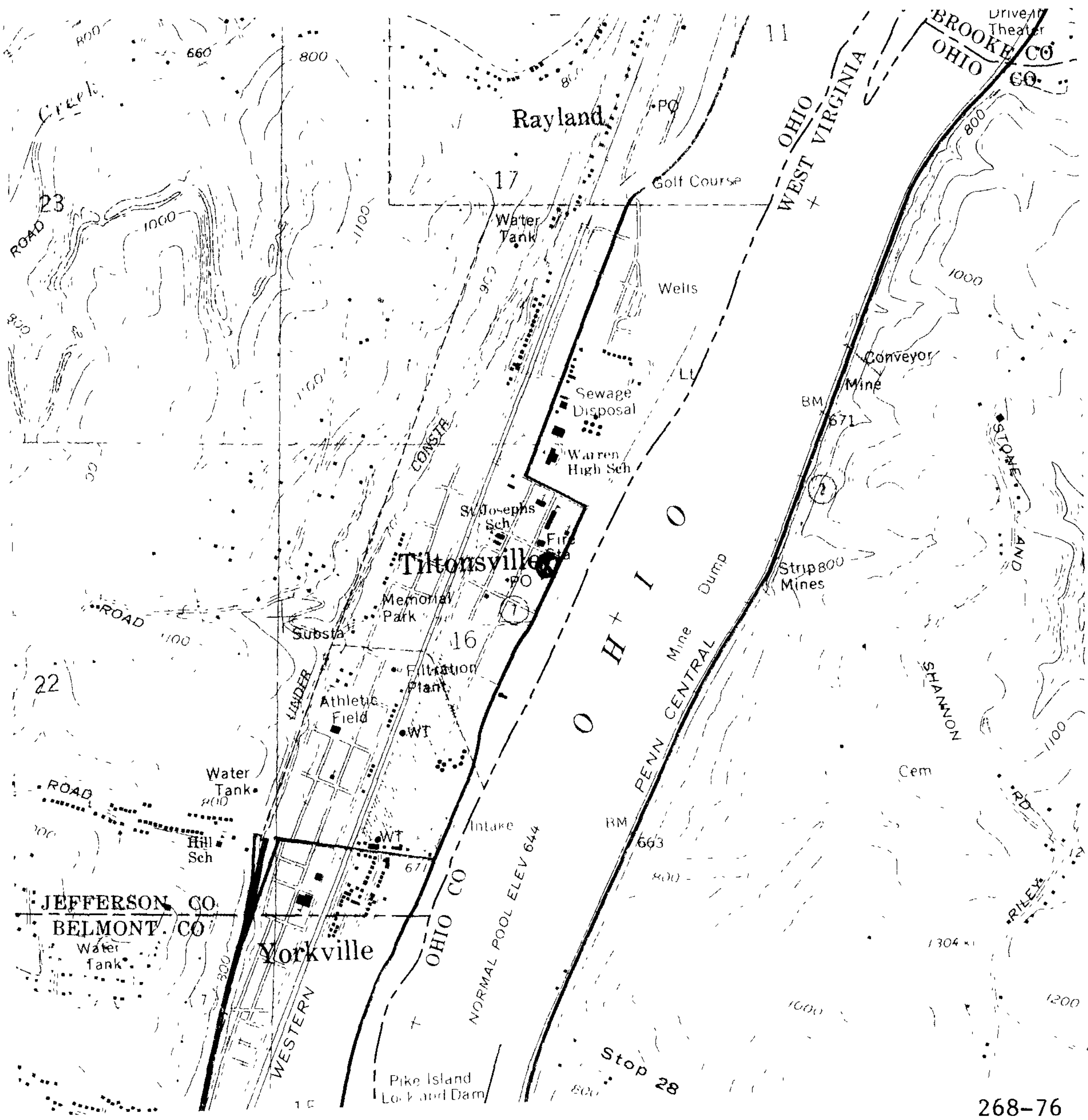
Air Quality Data:

Year	Geometric mean (μg/m^3)
1977	78
1978	77



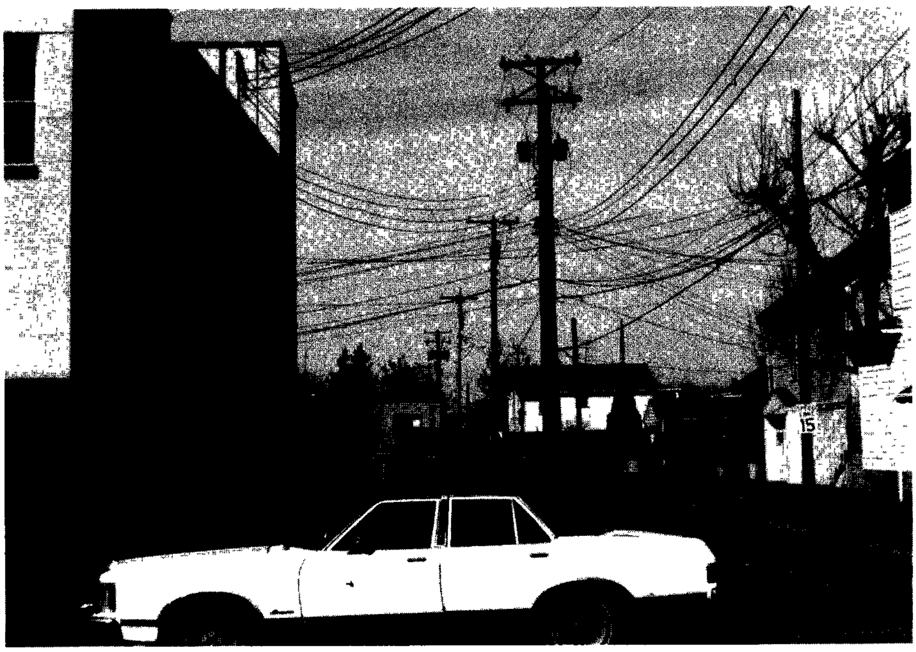
1. Unpaved road 100 ft.
2. Cleared area 0.20 ac.
3. Cleared area - piles 1.0 ac.
4. Cleared area 0.08 ac.
5. Cleared area 0.35 ac.
6. Cleared area 1.0 ac.
7. Cleared area 1.5 ac.
8. Cleared area 0.16 ac.
9. Unpaved road 300 ft.
10. Cleared area 0.04 ac.

One-quarter mile radius around Tiltonsville, Ohio site.



One-mile radius around Market Street, Tiltonsville site.

Tiltonsville Waterworks building site, view to East.



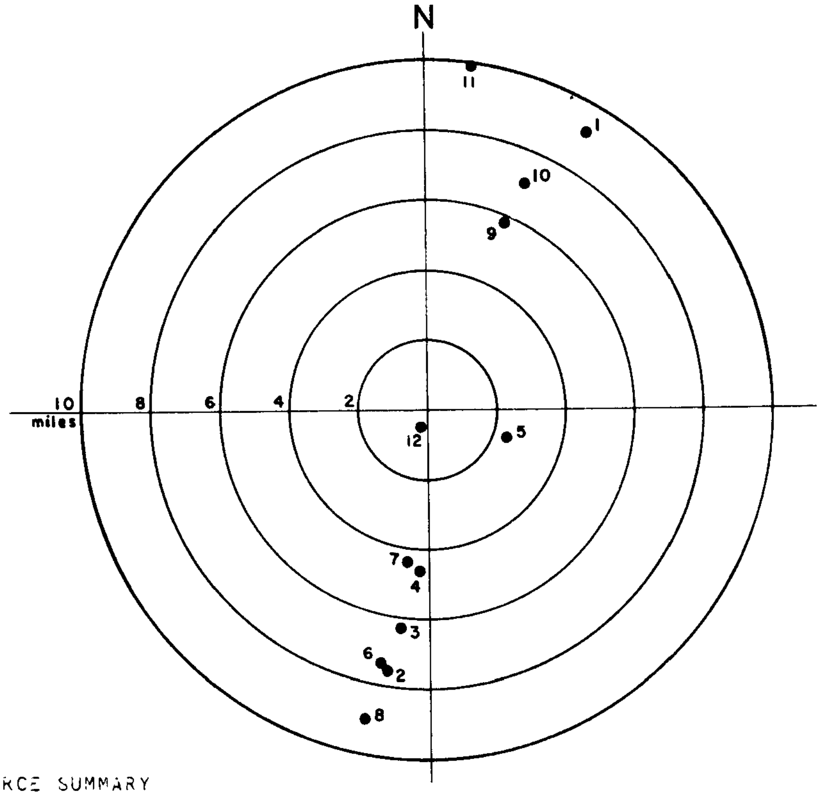
Tiltonsville Waterworks building site, view to North.

AREA SOURCE SUMMARY

Site: Tiltonsville, Ohio UTM N 4446267 E 00525693

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	785 h.u.	2.8	0.9	0.0	0.7	neg	1.1	0.0	1.8	0.3	7.6
Comm/Ind fuel		neg	neg	0.0	neg	neg	neg	0.0	neg	neg	neg
Incinerators											
Auto exhaust	9,282 VMT	neg	neg		neg	neg	neg				neg
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	39.5 A	0.1	neg		0.1	0.1	0.2	0.4	0.2	neg	1.1
Paved streets	9,282 VMT	neg	neg		neg	neg	neg				neg
Unpaved roads	1.5 VMT	neg									neg
Cleared areas	6.58 A	0.1	neg		neg						0.1
Construction											
Aggregate storage	2.25 A				0.4				2.8		3.2
Unpaved pkg lots											

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	2.8	1.6	3.2	7.6	120.0	10.0	5.3	135.3
IND PROCESSES	0.0	0.0	0.0	0.0	-	-	-	-
FUGITIVE DUST	0.2	0.6	3.6	4.4	8.6	3.8	5.9	18.3
Total	3.0	2.2	6.8	12.0	128.6	13.8	11.2	153.6



POINT SOURCE SUMMARY

SITE: TILTONSVILLE   UTM: 525.69 E , 4446.27 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	& NAME
533.30	4458.90	94.00	9.16	31.1	1	BANNER FIBERBOARD CO
523.70	4434.20	78.00	7.60	189.4	2	OHIO VALLEY HOSPITAL
524.30	4436.10	6.00	6.37	167.8	3	BLAW KNOX PENINSULA
525.20	4438.90	13.00	4.39	183.8	4	CENTRE FOUNDRY
529.30	4445.00	210.00	2.38	109.3	5	VALLEY CAMP COAL NO.
523.40	4434.60	96.00	7.39	191.1	6	VALLEY CAMP COAL NO.
524.70	4439.20	1265.00	4.43	188.0	7	WHEELING-PITTSBURGH
522.70	4431.90	4.00	9.12	191.8	8	TRI STATE ASPHALT
529.40	4454.90	149.00	5.64	23.2	9	BUCKEYE POWER
530.00	4455.80	38007.00	6.50	24.3	10	CARDINAL OPER. COMP.
527.90	4462.00	6213.00	9.87	8.0	11	SATRALLOY INC.
525.40	4445.40	1493.00	0.57	198.7	12	WHEELING-PITTSBURGH

DESCRIPTION OF SITE

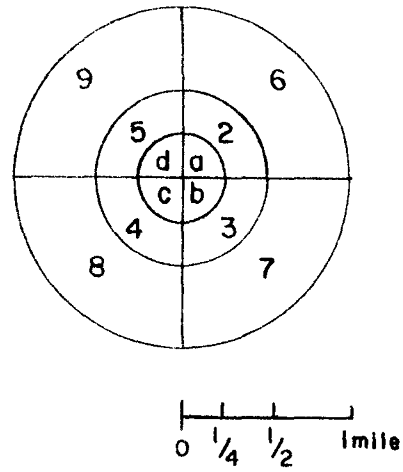
SAROAD Code - 36-3980-002

Location - South Fifth Street,
Martins Ferry, Ohio

UTM - N-4438221 E-00523385

Monitor Height - 30 ft on City Hall roof

Site Elevation - 700 ft MSL



Land Use by Sector:

1a.	Residential/Commercial	4.	Residential
1b.	Commercial	5.	Rural/Residential
1c.	Residential	6.	Industrial
1d.	Residential/Commercial	7.	Rural
2.	Residential/Commercial	8.	Residential/Rural
3.	Rural/Residential	9.	Rural/Residential

Localized sources within 200 ft of monitor:

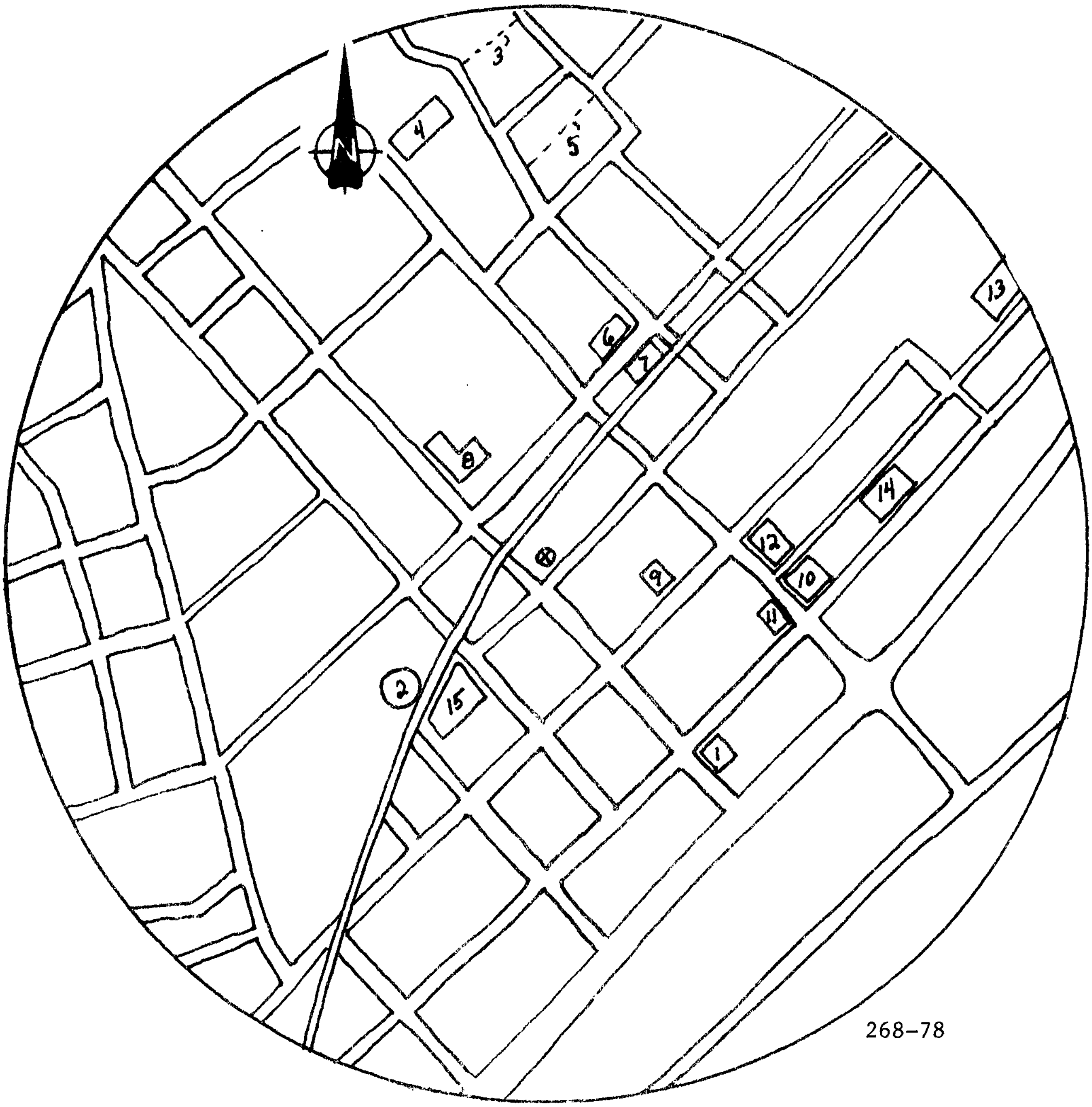
Source	Distance (feet)	Descritption
Fifth Street	47	3220 ADT, "Clean" Street
Walnut Street	55	1000* ADT, "Clean" Street
Zane Highway	192	5660 ADT, "Clean" Street

Visible major point sources:

Source	Direction
Wheeling/Pittsburgh Steel	055

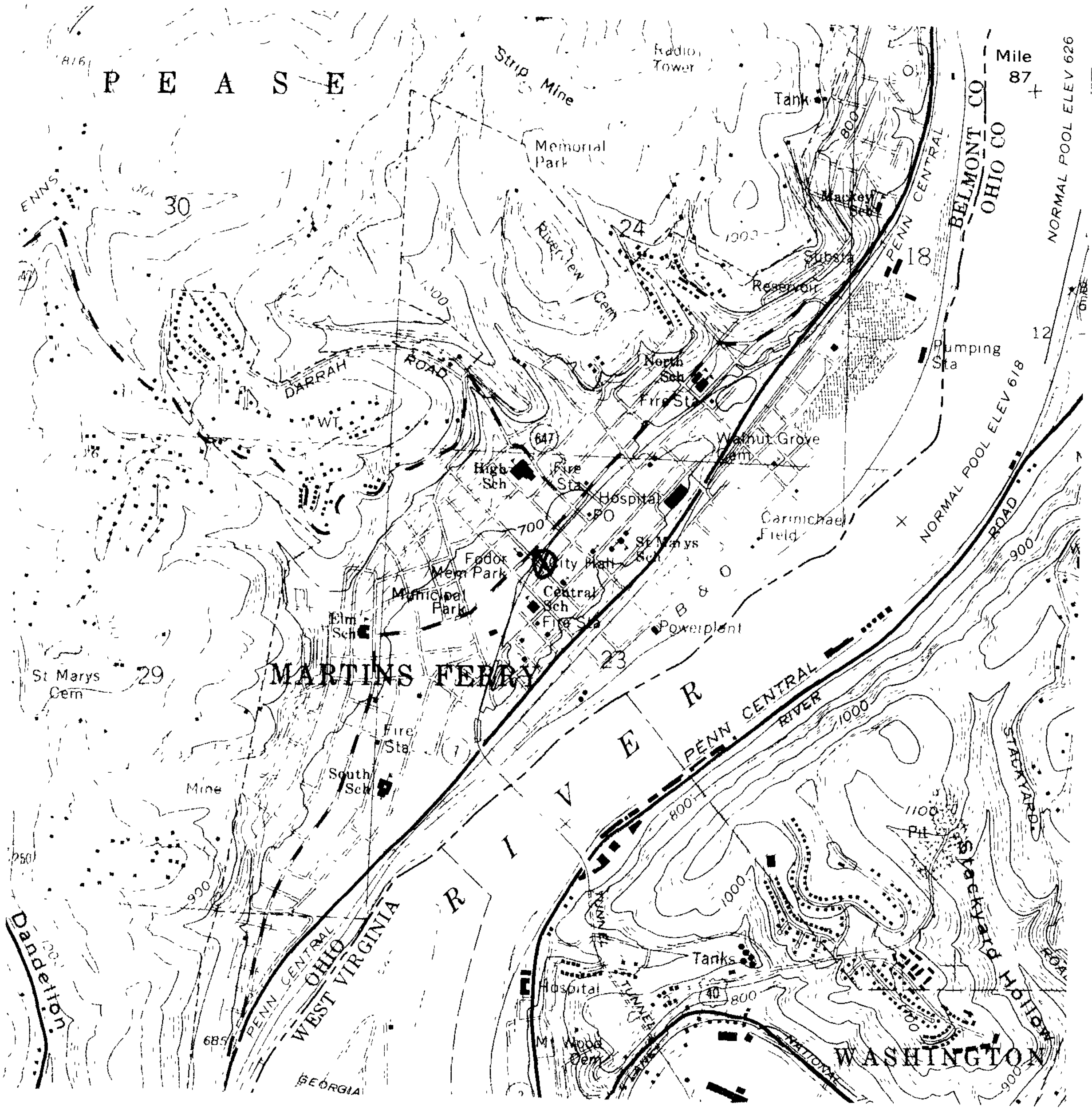
Air Quality Data:

Year	Geometric mean ($\mu g/m^3$)
1977	73
1978	76



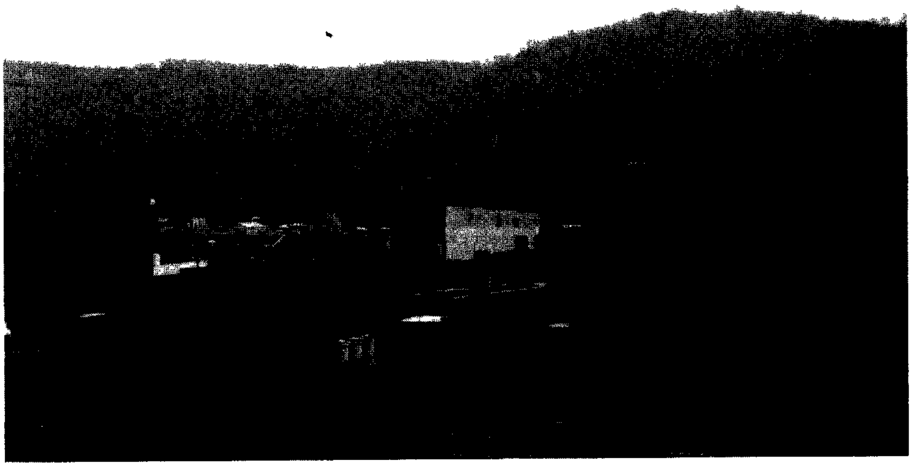
1. Unpaved lot 0.04 ac.
2. Cleared area 0.06 ac.
3. Unpaved road 100 ft.
4. Unpaved lot 0.08 ac.
5. Unpaved road 100 ft.
6. Unpaved lot 0.08 ac.
7. Unpaved lot 0.04 ac.
8. Unpaved lot 0.12 ac.
9. Unpaved lot 0.04 ac.
10. Cleared area 0.06 ac.
11. Cleared area 0.02 ac.
12. Cleared area 0.08 ac.
13. Unpaved lot 0.08 ac.
14. Unpaved lot 0.12 ac.
15. Construction 0.16 ac/yr.

One-quarter mile radius around Martins Ferry, Ohio site.

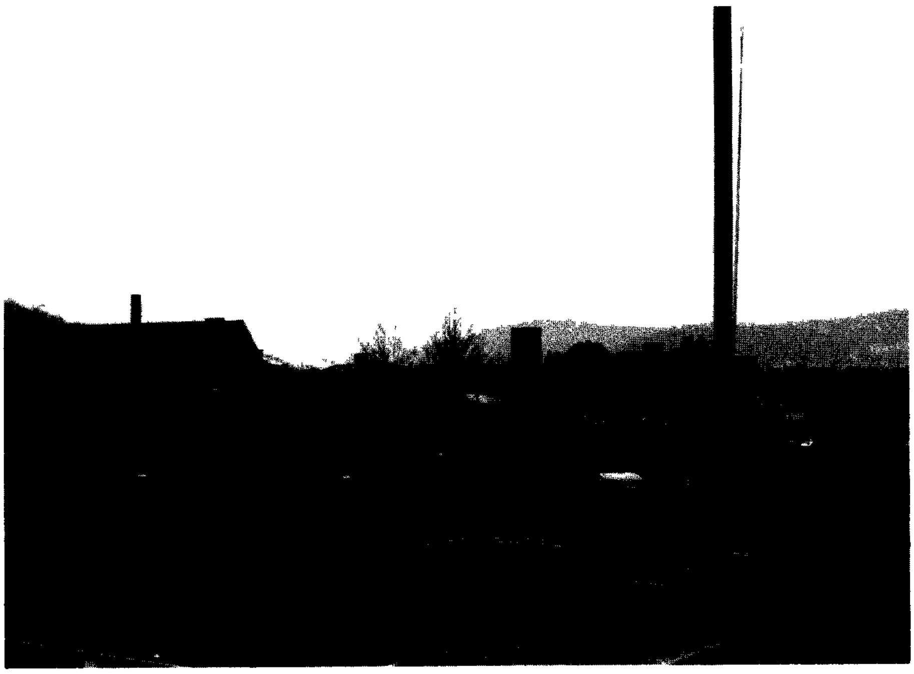


268-79

One-mile radius around South Fifth Street site, Martins Ferry, Ohio.



South Fifth Street, Martins Ferry, Ohio, view to East.

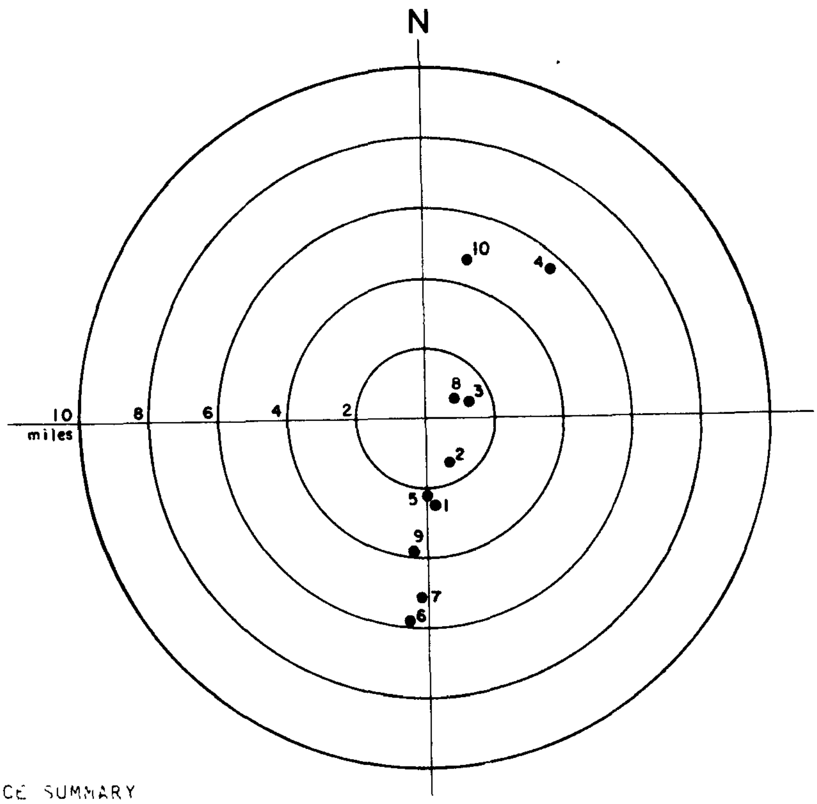


South Fifth Street, Martins Ferry, Ohio, view to South.

Site: Martins Ferry, Ohio UTM N 4438221 E 00523385

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	2,728 h.u.	7.1	3.4		7.4	2.2	3.8	1.3	8.0	1.8	35.0
Comm/Ind fuel		0.1	neg		0.1	neg	neg	neg	0.1	neg	0.3
Incinerators											
Auto exhaust	29,140 VMT	neg	neg	neg	neg	neg	neg		neg		neg
IND PROCESSES:											
Ind processes								0.5			0.5
FUGITIVE DUST:											
Railroad yards	75.5 A	0.3	0.1	0.3	0.2		0.4	0.5	0.3		2.1
Paved streets	29,139 VMT	0.1	neg	neg	neg	neg	neg		neg		0.1
Unpaved roads	0.75 VMT	neg									neg
Cleared areas	0.5 A	neg			neg	neg					neg
Construction	0.16 A	0.4									0.4
Storage areas											
Unpaved pkg lots	0.92 A	0.3	0.1								0.4

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	7.2	13.1	15.0	35.3	185.2	81.9	24.7	291.8
IND PROCESSES	0.0	0.0	0.5	0.5	-	-	0.8	0.8
FUGITIVE DUST	1.1	0.7	1.2	3.0	28.3	4.4	2.0	34.7
Total	8.3	13.8	16.7	38.8	213.5	86.3	27.5	327.3



POINT SOURCE SUMMARY

SITE: MARTINS FERRY   UTM: 523.39 E , 4438.22 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
523.70	4434.20	78.00	2.51	175.5	1	OHIO VALLEY HOSPITAL
524.30	4436.10	6.00	1.44	156.7	2	BLAW KNOX PENINSULA
525.20	4438.90	13.00	1.20	69.6	3	CENTRE FOUNDRY
529.30	4445.00	210.00	5.59	41.1	4	VALLEY CAMP COAL NO.
523.40	4434.60	36.00	2.25	179.8	5	VALLEY CAMP COAL NO.
522.50	4426.90	18.00	5.82	185.4	6	WHEELING-PITTSBURGH
523.10	4430.00	21.00	5.11	182.0	7	ELMWOOD LIMESTONE
524.70	4439.20	1265.00	1.02	53.4	8	WHEELING-PITTSBURGH
522.70	4431.90	4.00	3.95	186.2	9	TRI STATE ASPHALT
525.40	4445.40	1493.00	4.63	15.7	10	WHEELING-PITTSBURGH

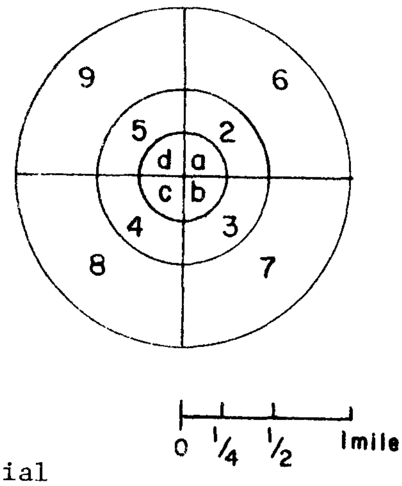
DESCRIPTION OF SITE

SAROAD Code - 36-6100-001

Location - East 39th Street,
Shadyside, Ohio

Monitor Height - 30 ft on fire station roof

Site Elevation - 690 ft MSL



Land Use by Sector:

1a.	Residential/Commercial	4.	Residential
1b.	Residential	5.	Rural/Residential
1c.	Residential/Commercial	6.	Rural
1d.	Residential	7.	Rural/Residential
2.	Rural	8.	Rural
3.	River/Rural	9.	Rural

Localized sources within 200 ft of monitor:

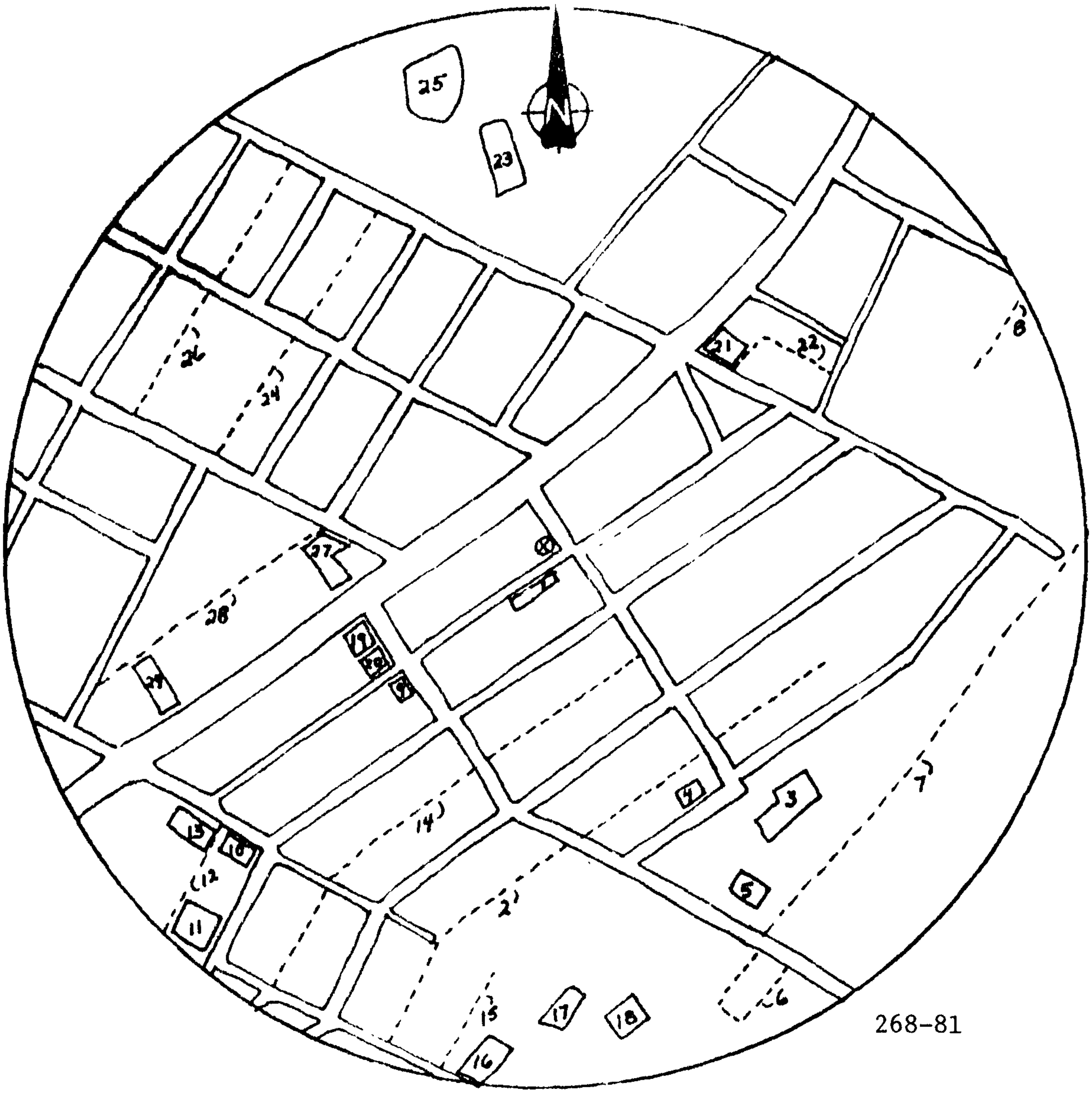
Source	Distance (feet)	Description
39th Street	31	1000* ADT, Side Street Uncurbed
Central Street	104	12,760 ADT, Commercial Clean

Visible major point sources:

Source	Direction
(None)	(None)

Air Quality Data:

Year	Geometric Mean (μg/m³)
1977	92
1978	80



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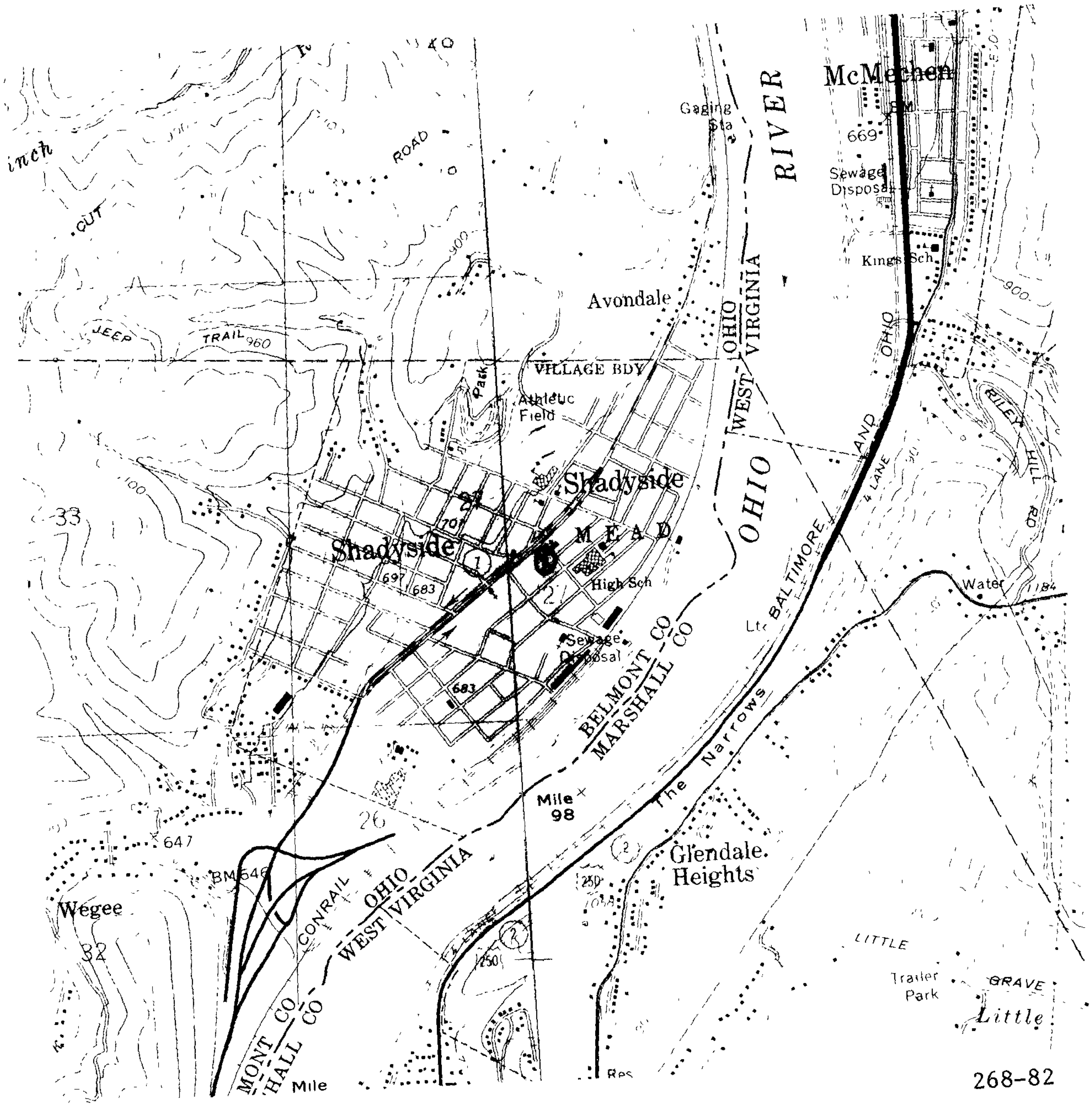
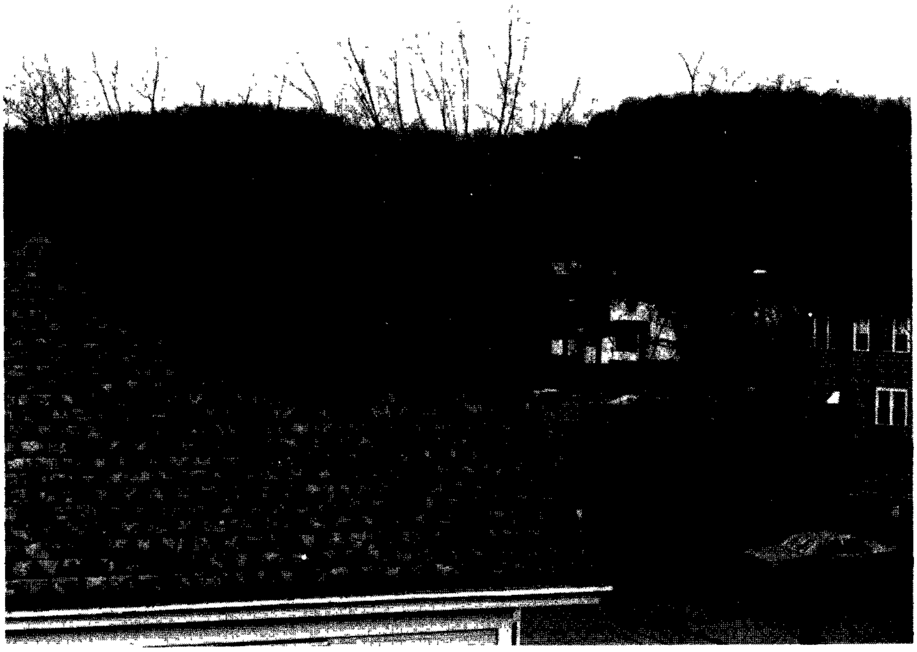
1. Unpaved lot 0.04 ac.
2. Unpaved road 800 ft.
3. Unpaved lot 0.08 ac.
4. Unpaved lot 0.04 ac.
5. Unpaved lot 0.04 ac.
6. Unpaved road 150 ft.
7. Unpaved road 600 ft.
8. Unpaved road 100 ft.
9. Unpaved lot 0.04 ac.
10. Unpaved lot 0.04 ac.
11. Cleared area 0.08 ac.
12. Unpaved road 200 ft.
13. Cleared area 0.04 ac.
14. Unpaved road 600 ft.
15. Unpaved road 100 ft.
16. Cleared area 0.06 ac.
17. Cleared area 0.04 ac.
18. Unpaved lot 0.04 ac.
19. Unpaved lot 0.04 ac.
20. Unpaved lot 0.02 ac.
21. Unpaved lot 0.04 ac.
22. Unpaved road 200 ft.
23. Unpaved lot 0.12 ac.
24. Unpaved road 400 ft.
25. Cleared area 0.16 ac.
26. Unpaved road 400 ft.
27. Unpaved lot 0.08 ac.
28. Unpaved road 300 ft.
29. Unpaved lot 0.08 ac.

One-quarter mile radius around Shadyside, Ohio site.



One-mile radius around East 39^{th} Street site, Shadyside, Ohio.

East 39th Street, Shadyside, Ohio, view to East.



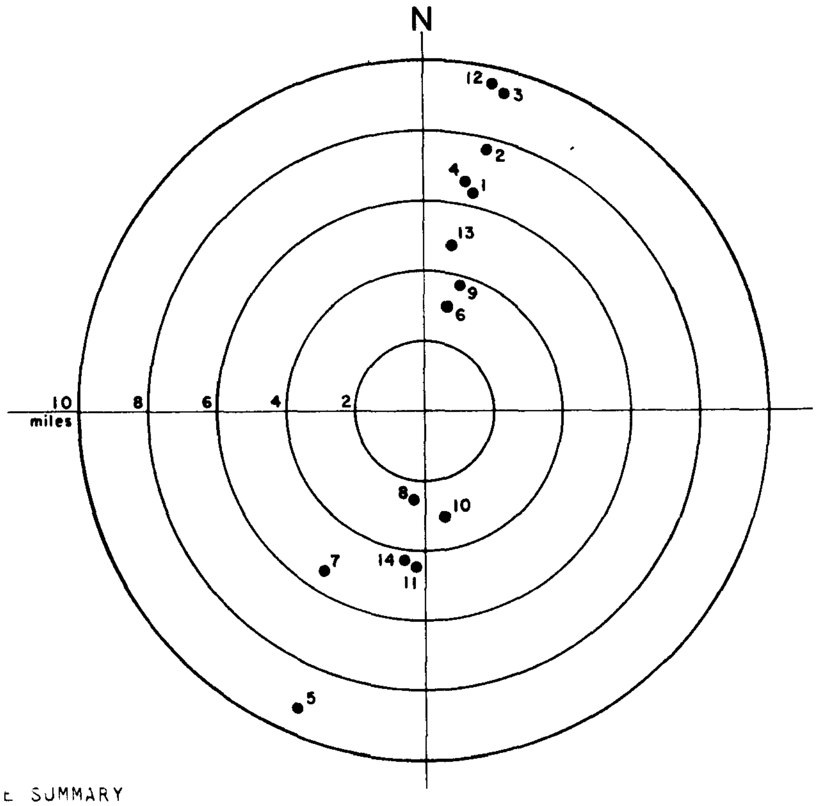
East 39th Street, Shadyside, Ohio, view to North.

AREA SOURCE SUMMARY

Site: Shadyside, Ohio UTM N 4424385 E 00521461

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	1,875 h.u.	6.7	2.1	-	5.7	2.8	1.2	1.5	2.8	1.4	24.2
Comm/Ind fuel		0.1	neg	-	0.1	neg	neg	neg	neg	neg	0.2
Incinerators											
Auto exhaust	17,196 VMT	neg	neg		neg		neg		neg		neg
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	52.6 A	0.1	0.1	0.1	0.1	-	0.4	0.3	0.3	-	1.4
Paved streets	17,196 VMT	neg	neg		neg		neg		neg		neg
Unpaved roads	25.7 VMT	neg	neg							neg	neg
Cleared areas	0.62 A	neg			neg						neg
Construction											
Storage areas											
Unpaved pkg lots	0.7 A	0.3									0.3

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	6.8	10.7	6.9	24.4	174.9	66.9	11.3	253.1
IND PROCESSES	0.0	0.0	0.0	0.0	-	-	-	-
FUGITIVE DUST	0.4	0.3	1.0	1.7	10.3	1.9	1.6	13.8
Total	7.2	11.0	7.9	26.1	185.2	68.8	12.9	266.9

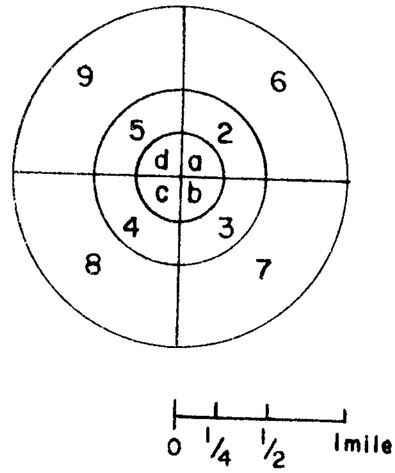


POINT SOURCE SUMMARY

SITE: SHADYSIDE   UTM: 521.46 E , 4424.39 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	NAME
523.70	4434.20	78.00	6.25	12.9	1	OHIO VALLEY HOSPITAL
524.30	4436.10	6.00	7.49	13.6	2	BLAW KNOX PENINSULA
525.20	4438.90	13.00	9.31	14.4	3	CENTRE FOUNDRY
523.40	4434.60	96.00	6.46	10.7	4	VALLEY CAMP COAL NO.
515.50	4410.50	13840.00	9.39	203.2	5	KAMMER POWER STATION
522.50	4426.90	18.00	2.68	13.0	6	WHEELING-PITTSBURGH
516.70	4417.00	313.00	5.46	212.8	7	ALLIED CHEMICAL-SOUT
520.90	4420.30	50.00	2.56	187.8	8	TRIANGLE P.W.C. INC.
523.10	4430.00	21.00	3.63	16.3	9	BENWOOD LIMESTONE
522.30	4419.40	7.00	3.14	170.5	10	FOSTORIA GLASS
521.00	4417.20	23.00	4.49	183.7	11	TRI-STATE ASPHALT
524.70	4439.20	1265.00	9.42	12.3	12	WHEELING-PITTSBURGH
522.70	4431.90	4.00	4.73	9.4	13	TRI STATE ASPHALT
520.50	4417.50	23125.00	4.32	187.9	14	OHIO EDISON/R.E.BURG

DESCRIPTION OF SITE



SAROAD Code - 36-0540-002

Location - Second Street,
Powhatan Point, Ohio

UTM - N-4411916 E-00516535

Monitor Height - 20 ft on Elementary school roof

Site Elevation - 640 ft MSL

Land Use by Sector:

1a. Commercial/Residential

1b. Commercial

1c. Commercial/Industrial

1d. Commercial

2. Residential

3. River/Rural

4. Slag Dump

5. Residential

6. Residential

7. Rural

8. Industrial/Residential

9. Rural

Localized sources within 200 ft of monitor:

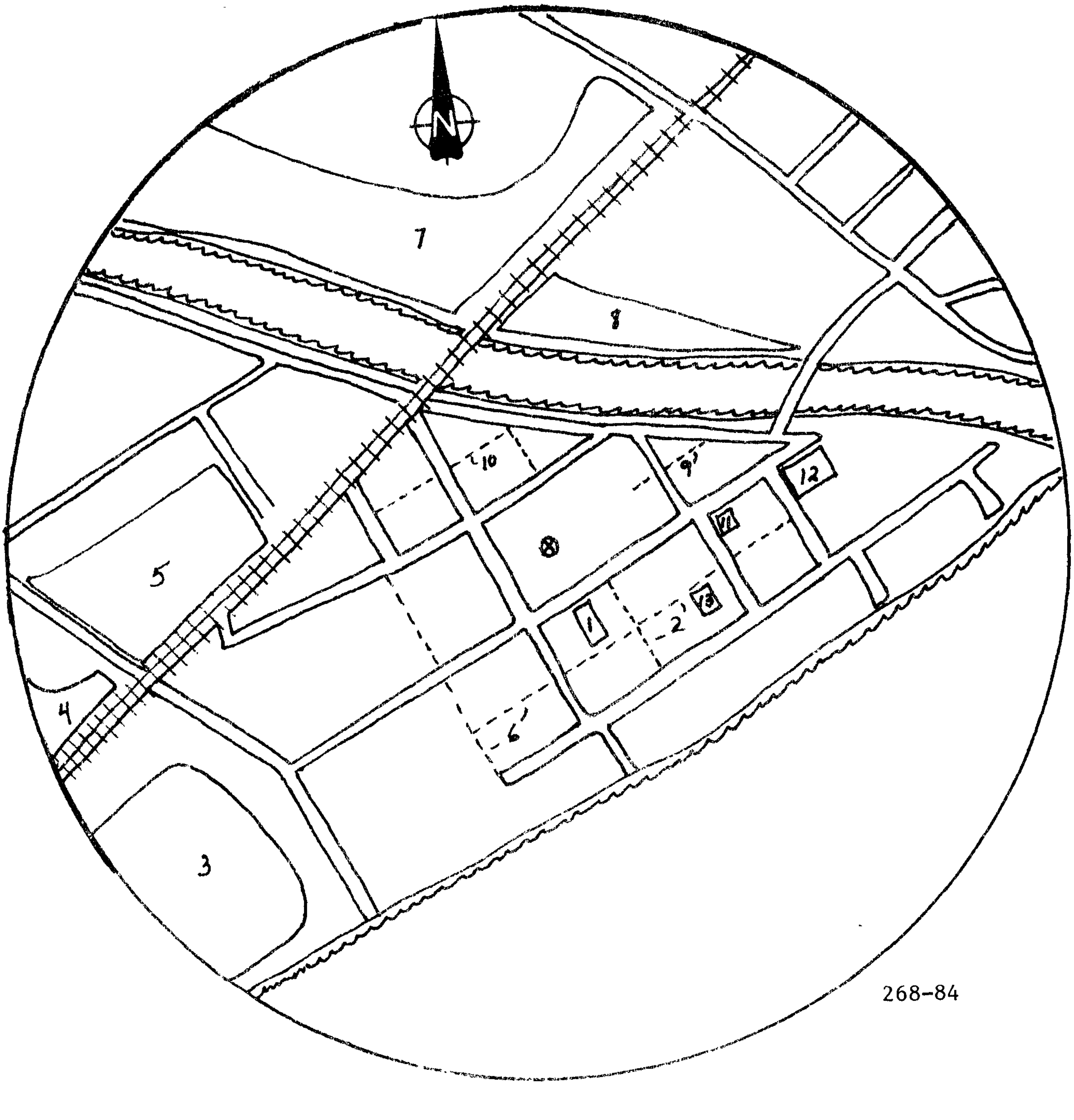
Source	Distance (feet)	Description
Second Street	83	1000* ADT, Dirty, Uncurbed
Rte 7	200	5880 ADT

Visible major point sources:

Source	Direction
Kammer Power	215
Mountineer Carbon	205
Mitchell Power	185

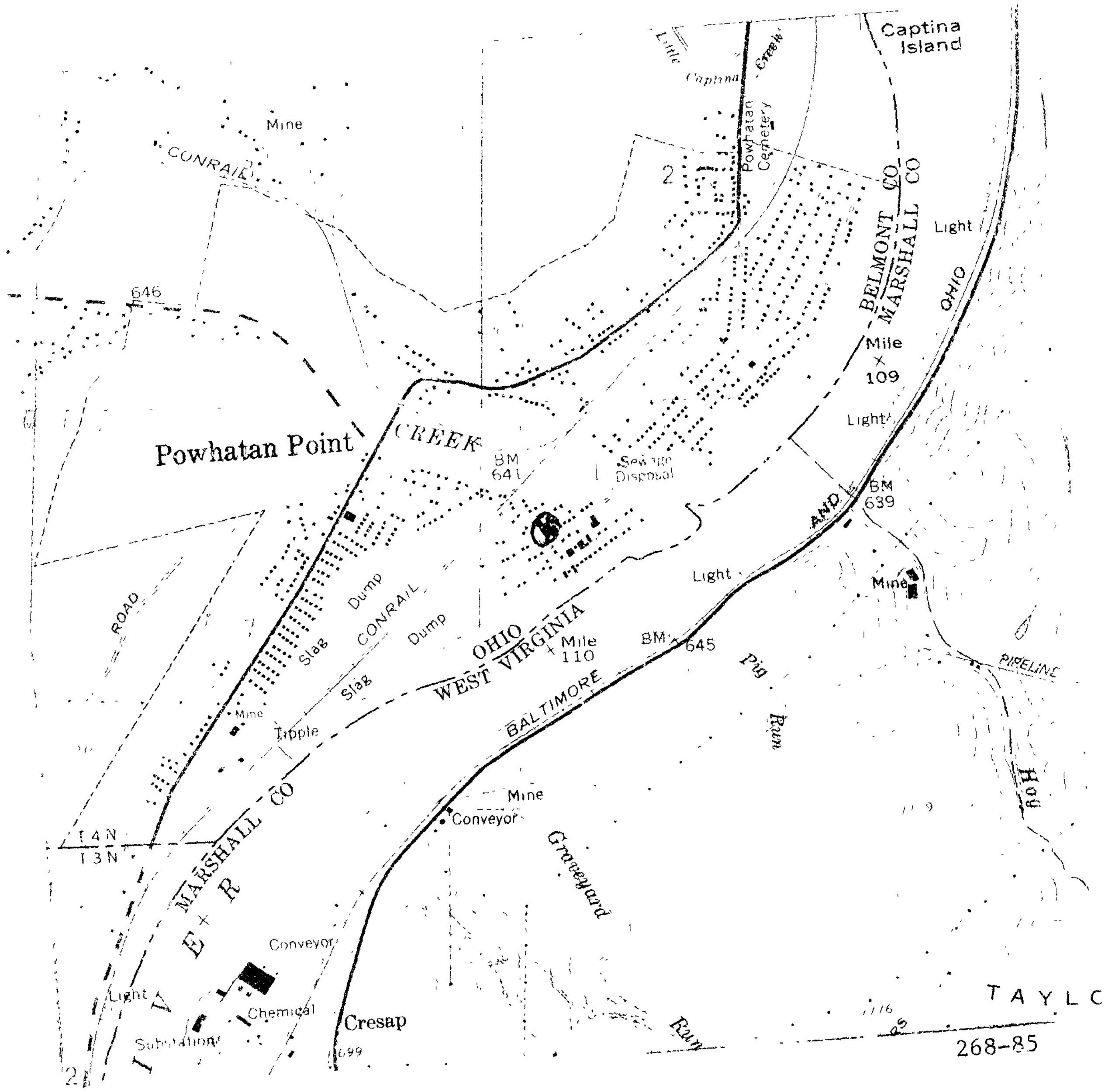
Air Quality Data:

Year	Geometric mean (μg/m^3)
1977	100
1978	97



1. Cleared area 0.04 ac.
2. Unpaved road 150 ft.
3. Cleared area 1.5 ac.
4. Sand piles 0.16 ac.
5. Cleared area 1.5 ac.
6. Unpaved road 700 ft.
7. Cleared area 2.5 ac.
8. Cleared area 0.32 ac.
9. Unpaved road 100 ft.
10. Unpaved road 250 ft.
11. Unpaved lot 0.02 ac.
12. Cleared area 0.04 ac.
13. Unpaved lot 0.02 ac.

One-quarter mile radius around Powhatan Point, Ohio site.



One-mile radius around Second Street, Powhatan Point site.

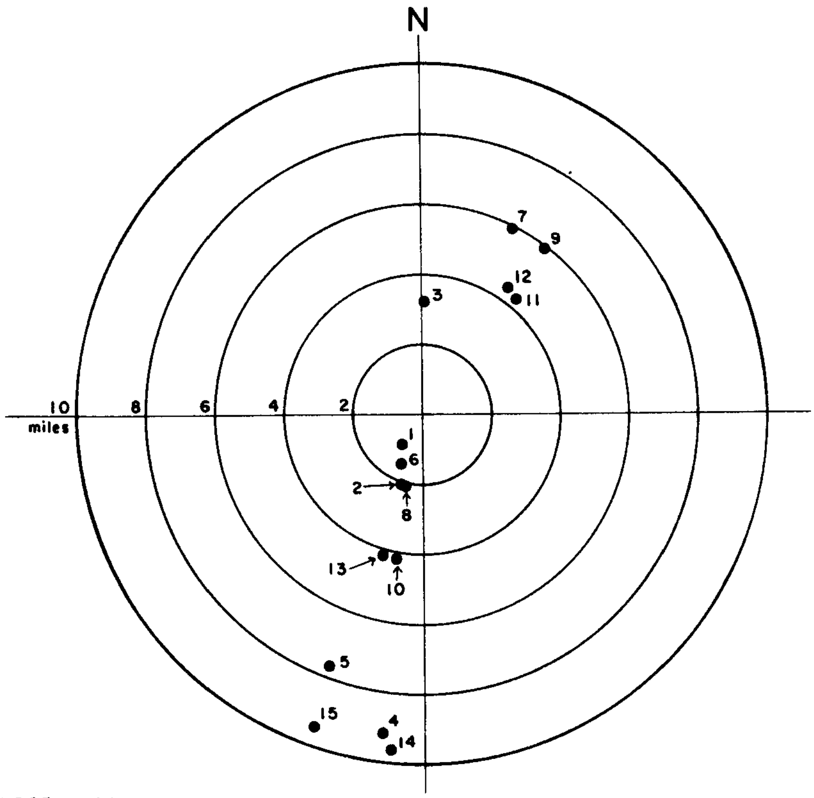
Second Street, Powhatan Point site, view to West

Second Street, Powhatan Point site, view to South.

Site: Powhattan Point, Ohio UTM N 4411916 E 00516536

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	567 h.u.	1.1	1.3		0.2	1.3	1.9	0.1	1.3	0.4	7.6
Comm/Ind fuel		neg	neg		neg	neg	neg	neg	neg	neg	neg
Incinerators											
Auto exhaust	14,791 VMT	neg	neg		neg	neg	neg		neg	neg	neg
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	56.0	0.1	0.1	0.2	0.2	0.1	0.2	0.1	0.4	0.2	1.6
Paved streets	14,787 VMT	0.1	neg		neg	neg	neg		neg	neg	0.1
Unpaved roads	4.54 Com VMT	neg									neg
Cleared areas	15.4 A	0.1			0.1	neg			neg		0.2
Construction	1.0 A				2.5						2.5
Aggregate storage	2.16 A	0.2			1.4				1.4		3.0
Unpaved pkg lots	0.04 A	neg									neg

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	1.1	2.8	3.7	7.6	42.4	17.5	6.1	66.0
IND PROCESSES	0.0	0.0	0.0	0.0	–	–	–	–
FUGITIVE DUST	0.5	4.6	2.3	7.4	19.3	28.8	3.8	51.9
Total	1.6	7.4	6.0	15.0	61.7	46.3	9.9	117.9



POINT SOURCE SUMMARY

SITE: POWHATAN POINT UTM: 516.54 E , 4411.91 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	NAME
515.50	4410.50	13840.00	1.09	216.2	1	KAMMER POWER STATION
515.70	4408.70	12834.00	2.06	194.6	2	MITCHELL POWER PLANT
516.70	4417.00	313.00	3.16	1.8	3	ALLIED CHEMICAL-SOUT
514.70	4397.20	31.00	9.21	187.1	4	MOBAY CHEMICAL CORP.
512.20	4400.20	297.00	7.76	200.3	5	PPG INDUSTRIES
515.50	4409.50	94.00	1.63	203.2	6	MOUNTAINEER CARBON C
520.90	4420.30	50.00	5.87	27.5	7	TRIANGLE P.W.C. INC.
515.70	4408.60	189.00	2.12	194.2	8	H.B. REED CO.
522.30	4419.40	7.00	5.87	37.6	9	FOSTORIA GLASS
515.30	4405.30	28.00	4.18	190.6	10	CITES SERVICE CO.
521.00	4417.20	23.00	4.30	40.2	11	TRI-STATE ASPHALT
520.50	4417.50	23125.00	4.26	35.4	12	OHIO EDISON/R.E.BURG
514.70	4405.40	54.00	4.21	195.7	13	OHIO FERRO ALLOYS
515.00	4396.50	556.00	9.63	185.7	14	CONSOLIDATED ALUMINU
511.50	4397.50	44.00	9.49	199.3	15	QUARTO MINING CO.

DESCRIPTION OF SITE

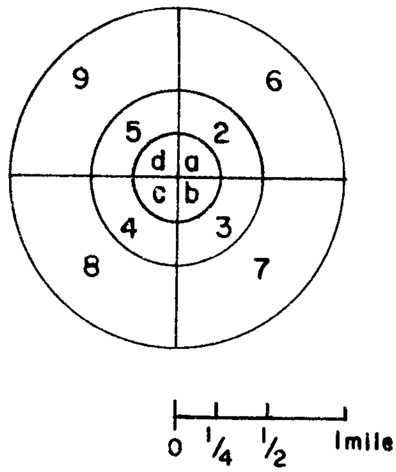
SAROAD Code - 36-4460-001

Location - State Rd No. 7,
Clarington, Ohio

UTM - N4401654 E-00511674

Monitor Height - 20 ft

Site Elevation - 640 ft MSL



Land Use by Sector:

1a. Industrial

1b. Industrial/River

1c. Residential

1d. Rural

2. Commercial/Residential

3. Industrial

4. Residential

5. Rural

6. Residential

7. Residential

8. Rural/Residential

9. Rural

Localized sources within 200 ft of monitor:

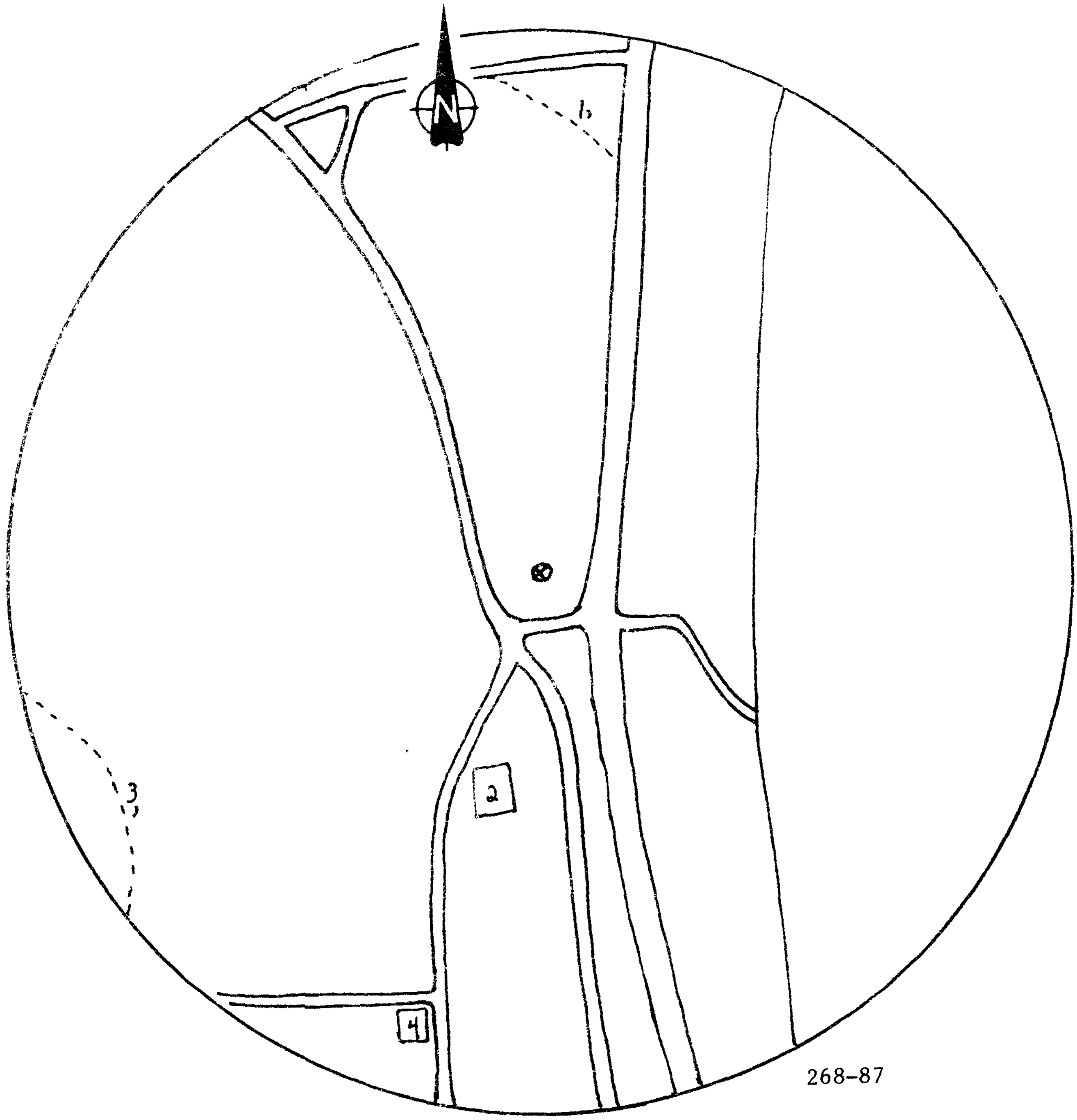
Source	Distance (feet)	Description
Rt. 7	90	3880 Dirty, unpaved shoulders
Rt. 556	77	520 Dirty, unpaved shoulders

Visible major point sources:

Source	Direction
PPG Industries	145
Ohio Ferro-Alloy	045
Mitchell Power	360

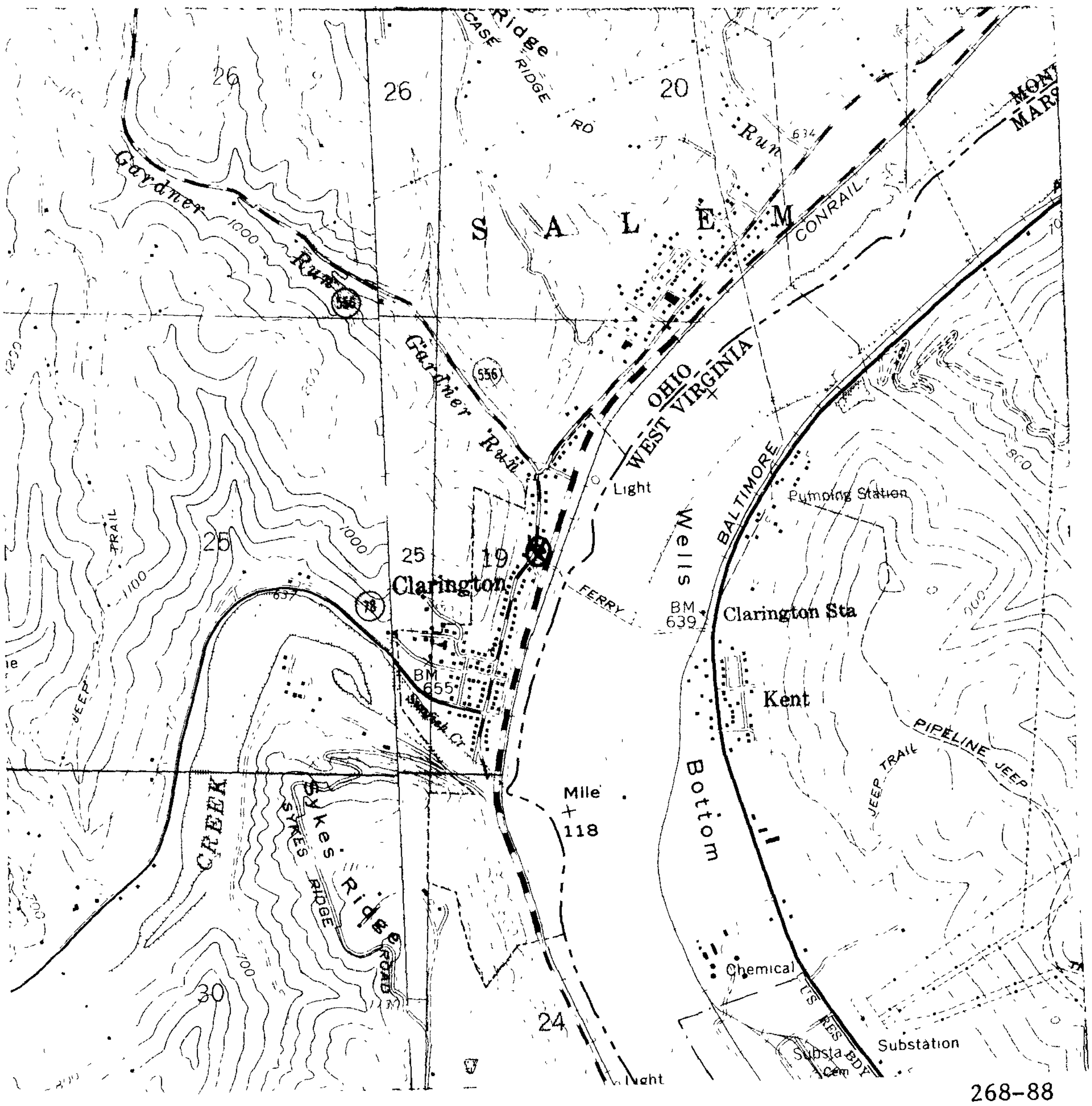
Air Quality Data:

Year	Geometric mean ($\mu g/m^3$)
1977	86
1978	83



1. Unpaved road 200 ft.
2. Cleared area 0.2 ac.
3. Unpaved road 300 ft.
4. Cleared area 0.12 ac.

One-quarter mile radius around Clarington, Ohio site.



One-mile radius around State Rt. No. 7, Clarington site.

State Route No. 7, Clarington site, view to North.

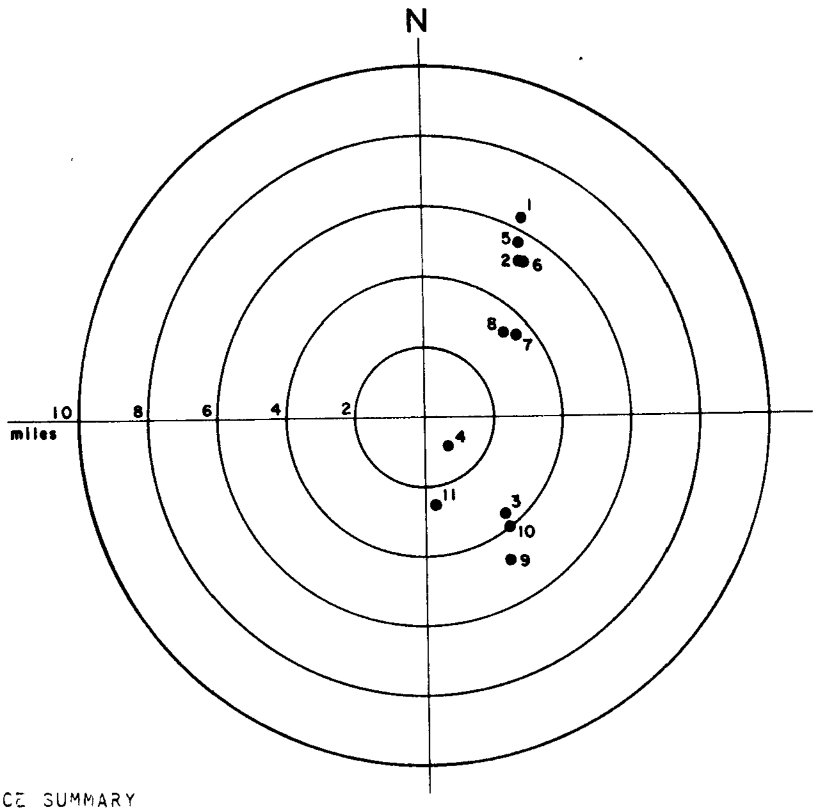
State Route No. 7, Clarington site, view to South.

AREA SOURCE SUMMARY

Site: Clarington, Ohio UTM N 4401654 E 00511077

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	292 h.u.	0.3	0.1	0.1	0.4	neg	0.5	0.2	0.1	neg	1.7
Comm/Ind fuel											
Incinerators											
Auto exhaust	9,225 VMT	neg	neg		neg		neg		neg		neg
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	42.9 A	0.2	0.1	0.1	0.1		0.4	0.2	0.1		1.2
Paved streets	9,225 VMT	neg	neg		neg		neg		neg		neg
Unpaved roads	1.89 VMT	neg									neg
Cleared areas	5.32 A	neg					0.1				0.1
Construction											
Storage areas											
Unpaved pkg lots											

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	0.3	0.6	0.8	1.7	11.6	3.7	1.3	16.6
IND PROCESSES	0.0	0.0	0.0	0.0	–	–	–	–
FUGITIVE DUST	0.2	0.3	0.8	1.3	7.8	1.9	1.3	11.0
Total	0.5	0.9	1.6	3.0	19.4	5.6	2.6	27.6

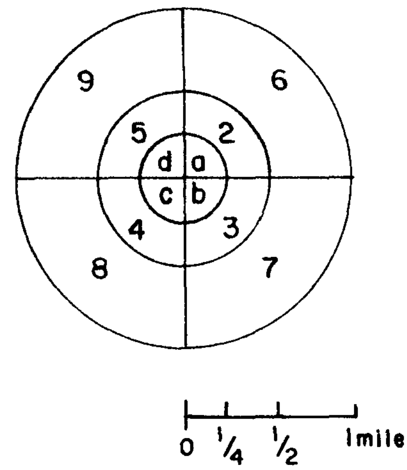


POINT SOURCE SUMMARY

SITE: CLARINGTON UTM: 511.08 E , 4401.65 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
515.50	4410.50	13840.00	6.15	26.6	1	KAMMER POWER STATION
515.70	4408.70	12834.00	5.24	33.3	2	MITCHELL POWER PLANT
514.70	4397.20	91.00	3.57	140.9	3	MORAY CHEMICAL CORP.
512.20	4400.20	297.00	1.14	142.3	4	PPG INDUSTRIES
515.50	4409.50	94.00	5.60	29.4	5	MOUNTAINEER CARBON C
515.70	4408.60	139.00	5.19	33.6	6	H.P. REED CO.
515.30	4405.30	28.00	3.47	49.2	7	CITES SERVICE CO.
514.70	4405.40	54.00	3.24	44.0	8	OHIO FERRO ALLOYS
515.00	4395.00	1855.00	4.[illegible]0	149.5	9	ORMET CORP.
515.00	4396.50	556.00	4.02	142.7	10	CONSOLIDATED ALUMINU
511.50	4397.50	44.00	2.59	174.2	11	QUARTO MINING CO.

DESCRIPTION OF SITE



SAROAD Code - 36-4460-002

Location - High School,
Hannibal, Ohio

UTM - N-4391423 E-00511077

Monitor Height - 20 ft

Site Elevation - 700 ft MSL

Land Use by Sector:

1a.	Residential	4.	Residential
1b.	Residential	5.	Rural
1c.	Residential	6.	Residential/Commercial
1d.	Rural	7.	Residential
2.	River	8.	Residential
3.	Residential/River	9.	Rural

Localized sources within 200 ft of monitor:

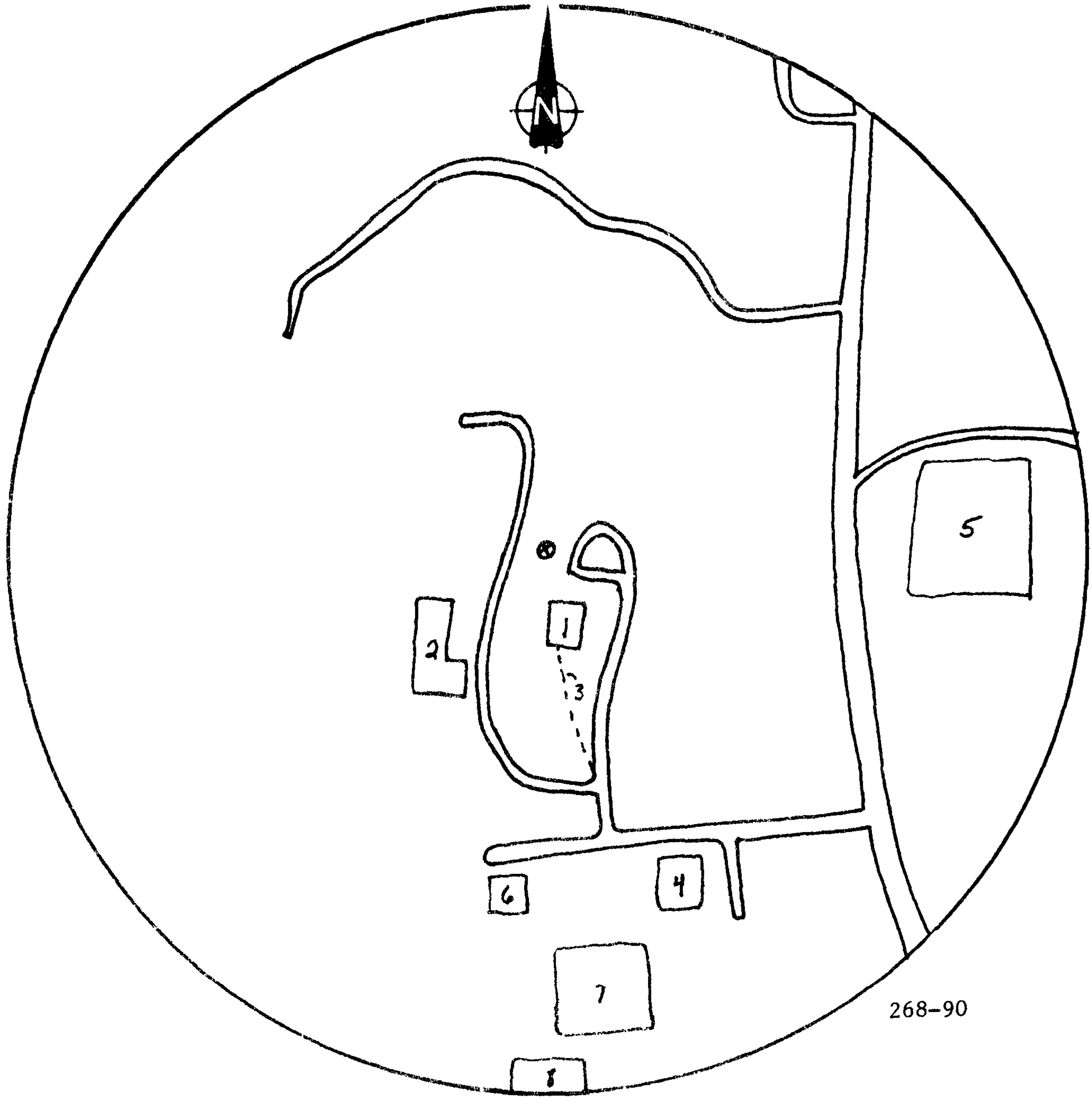
Source	Distance (feet)	Description
High School Hill Rd.	100	*200 ADT

Visible major point sources:

Source	Direction
Canalco Aluminum	360^o
Ormet Corp.	050^o
PPG	360^o

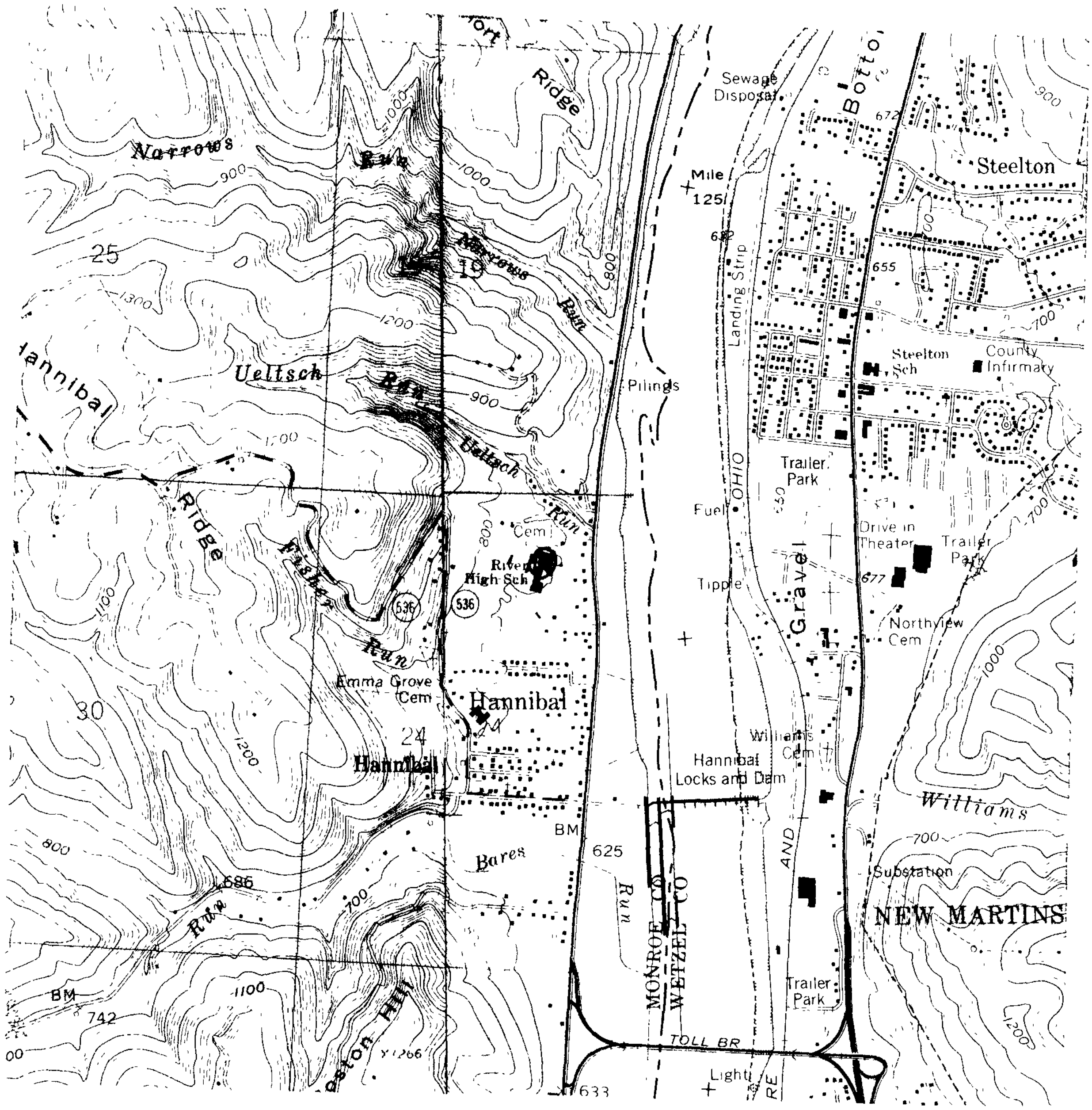
Air Quality Data:

Year	Geometric mean ($\mu g/m^3$)
1977	54
1978	61



1. Cleared area 0.12 ac.
2. Cleared area 0.20 ac.
3. Unpaved road 200 ft.
4. Unpaved lot 0.16 ac.
5. Cleared area 1.0 ac.
6. Construction 0.25 ac.
7. Cleared area 0.75 ac.
8. Construction 0.12 ac.

One-quarter mile radius around Hannibal, Ohio site.



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Mile radius around High School Hill Rd., Hannibal site.

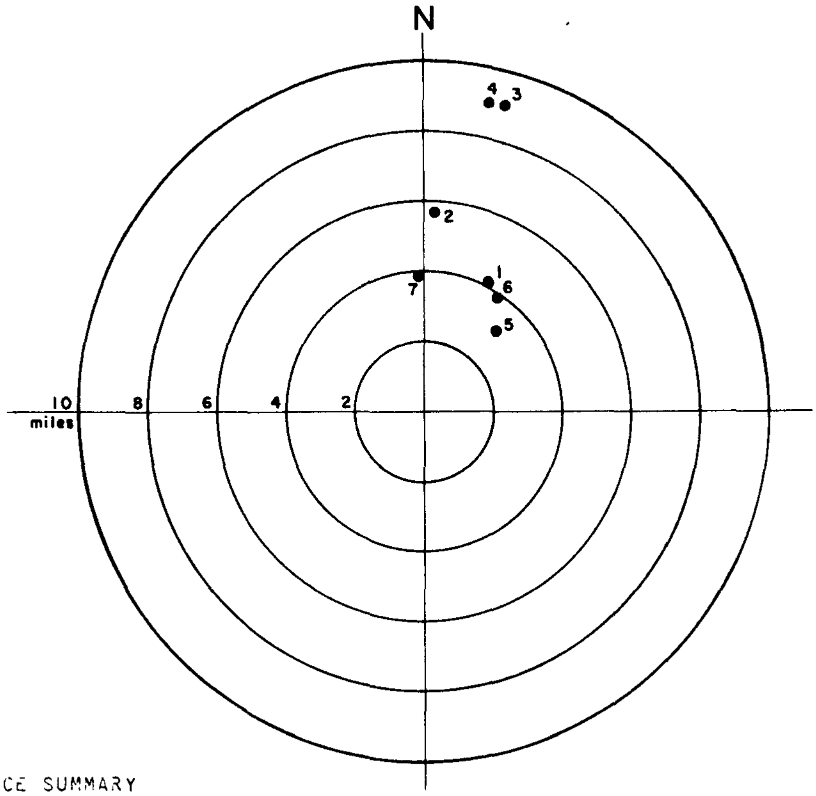
Hannibal High School site, view to East.

Hannibal High School site, view to West.

Site: Hannibal, Ohio UTM N 4391423 E 00511077

Source Category	Activity rate	Emissions by sector, ton/yr 1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	455 h.u.	0.3		0.2	0.3	neg	1.1	0.3	0.3	neg	2.5
Comm/Ind fuel											
Incinerators											
Auto exhaust	20,000 VMT	neg	neg	neg			neg	neg			neg
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	22.7 A		0.1	0.1			0.2	0.3			0.7
Paved streets	20,000 VMT	neg	neg	neg			neg	neg			neg
Unpaved roads	0.75 VMT	neg									neg
Cleared areas	2.57 A	neg	neg	neg							neg
Aggregate storage	0.75 A	0.9			1.0						1.9
Storage areas	1.0 A		1.4								1.4
Unpaved pkg lots	0.16 A	0.1									0.1

Recap	Emissions by sector, t/yr 1	2 to 5	6 to 9	Total	Variable value 1	2 to 5	6 to 9	Total
COMBUSTION	0.3	0.5	1.7	2.5	11.6	3.1	2.8	17.5
IND PROCESSES	0.0	0.0	0.0	0.0	-	-	-	-
FUGITIVE DUST	1.0	2.6	0.5	4.1	38.6	16.3	0.8	55.7
Total	1.3	3.1	2.2	6.6	50.2	19.4	3.6	73.2

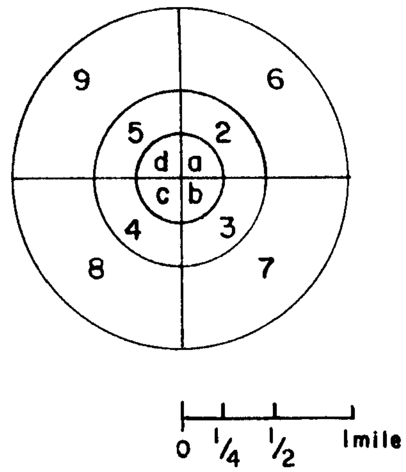


POINT SOURCE SUMMARY

SITE: HANNIBAL UTM: 511.67 E , 4391.42 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
514.70	4397.20	91.00	4.05	27.6	1	MOBAY CHEMICAL CORP.
512.20	4400.20	297.00	5.46	3.4	2	PPG INDUSTRIES
515.30	4405.30	28.00	8.91	14.6	3	CITIES SERVICE CO.
514.70	4405.40	54.00	8.89	12.2	4	OHIO FERRO ALLOYS
515.00	4395.00	1655.00	3.04	42.9	5	ORMET CORP.
515.00	4396.50	556.00	3.77	33.2	6	CONSOLIDATED ALUMINU
511.50	4397.50	44.00	3.78	358.4	7	QUARTO MINING CO.

DESCRIPTION OF SITE



SAROAD Code - 50-1240-001

Location - 7th and Tomlinson Ave,
Moundsville, West Virginia

UTM - N-4418500 E-00521850

Monitor Height - 25 ft on grade school roof

Site Elevation - 690 ft MSL

Land Use by Sector:

1a.	Commercial/Residential	4.	Commercial
1b.	Residential/Prison	5.	Commercial/Residential
1c.	Residential/Commercial	6.	Residential
1d.	Commercial/Residential	7.	Rural/Prison Farms
2.	Residential	8.	Industrial/River
3.	Residential	9.	Rural/Mine/Tipples

Localized sources within 200 ft of monitor:

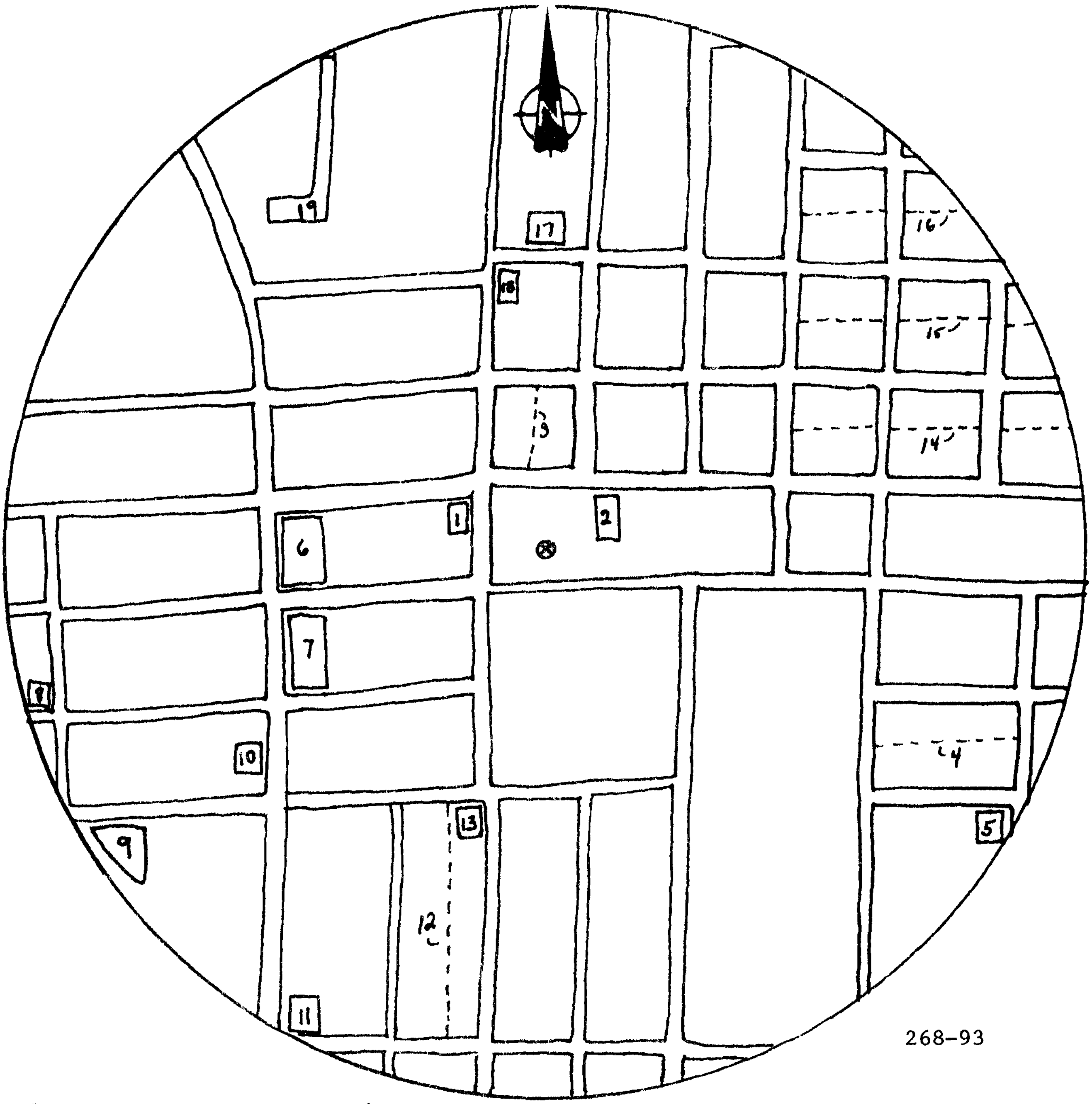
Source	Distance (feet)	Description
Tomlinson Street	136	2000* ADT, Dirty but Curbed
Seventh Street	152	5398 ADT, Dirty but Curbed

Visible major point sources:

Source	Direction
Mine, Tipples	310°
Ohio Edison, Burger Plant	235°

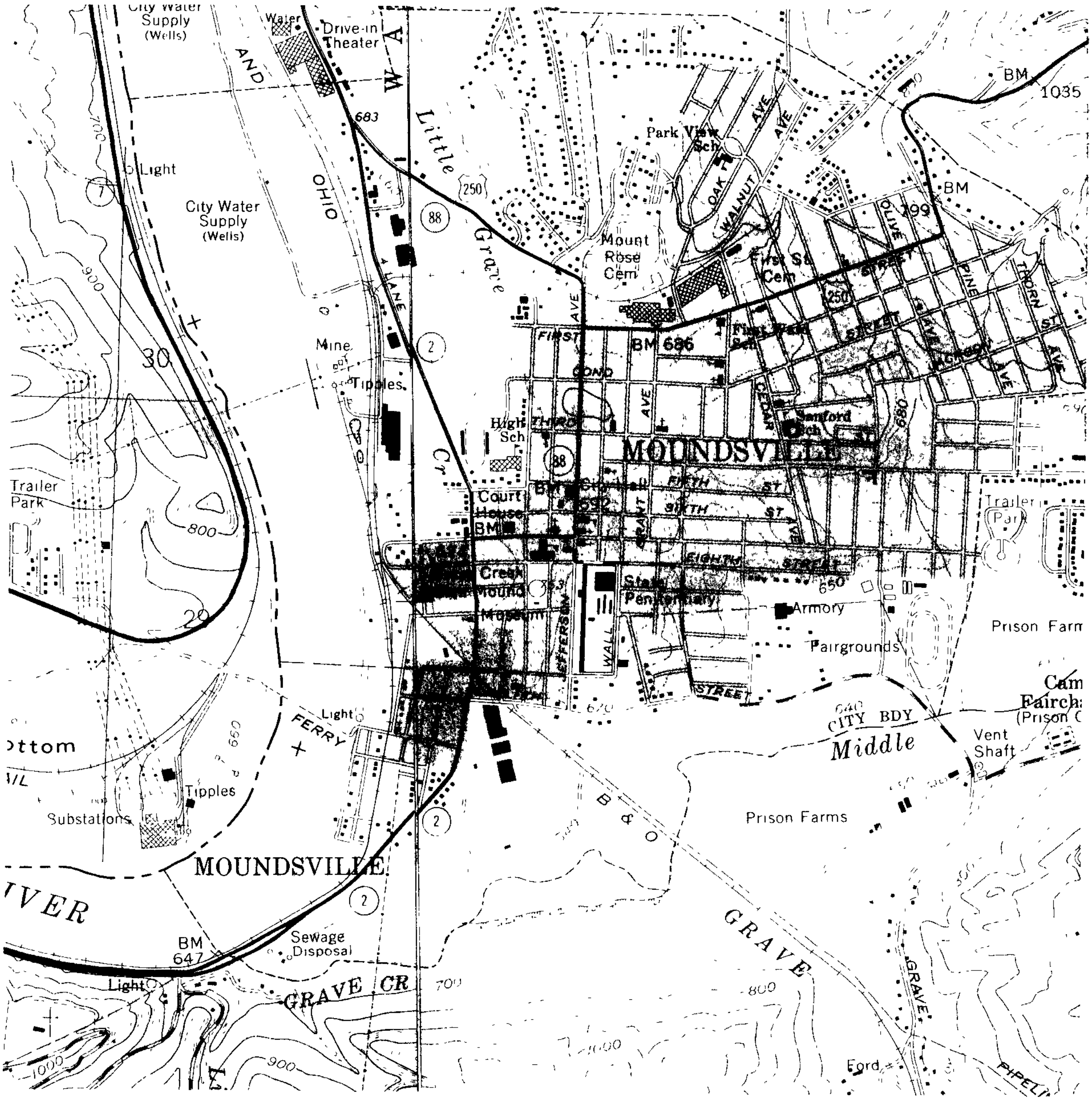
Air Quality Data:

Year	Geometric mean (μg/m^3)
1977	76
1978	114



1.	Construction 0.04 ac/yr.	10.	Cleared area 0.04 ac.
2.	Unpaved lot 0.08 ac.	11.	Cleared area 0.08 ac.
3.	Unpaved road 100 ft.	12.	Unpaved road 300 ft.
4.	Unpaved road 200 ft.	13.	Unpaved lot 0.04 ac.
5.	Unpaved lot 0.04 ac.	14.	Unpaved road 300 ft.
6.	Unpaved lot 0.16 ac.	15.	Unpaved road 300 ft.
7.	Cleared area 0.16 ac.	16.	Unpaved road 200 ft.
8.	Cleared area 0.04 ac.	17.	Unpaved lot 0.04 ac.
9.	Cleared area 0.12 ac.	18.	Unpaved lot 0.04 ac.
		19.	Unpaved lot 0.24 ac.

One-quarter mile radius around Moundsville, West Virginia site.



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One-mile radius around Seventh and Tomlinson Avenue site, Moundsville, West Virginia.

Moundsville grade school site, view to East.

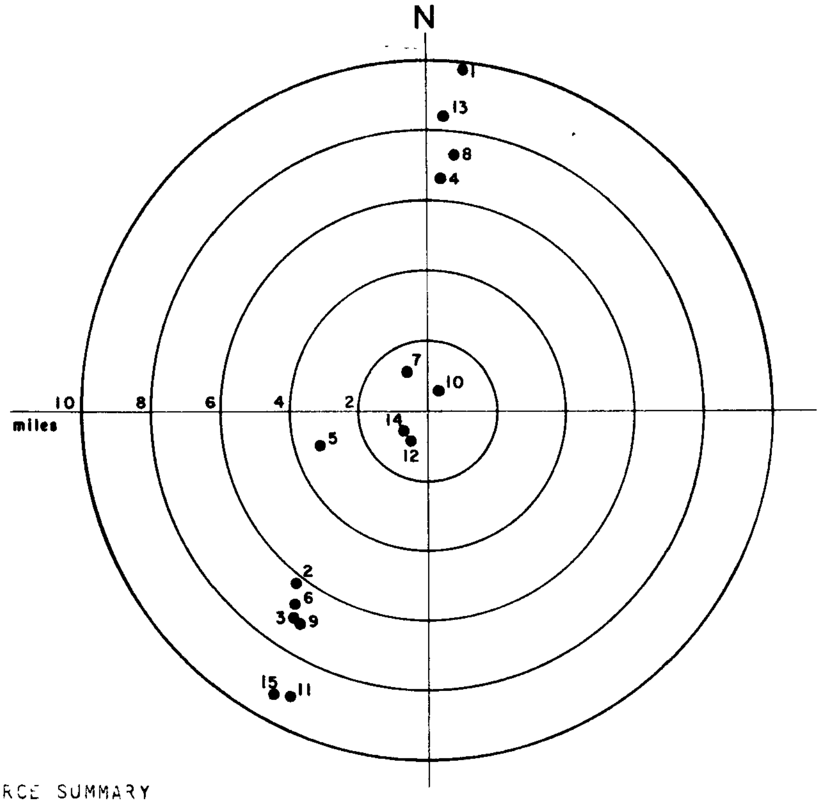
Moundsville grade school site, view to South.

AREA SOURCE SUMMARY

Site: Moundsville, West Virginia UTM N 4418500 E 00521850

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	1,967 h.u.	2.3	2.1	0.9	0.3	0.3	2.1	0.2	0.2	0.2	8.6
Comm/Ind fuel		1.6	1.4	0.7	0.2	0.2	1.4	0.1	0.1	0.1	5.8
Incinerators											
Auto exhaust	8,056 VMT	neg		neg				neg		neg	neg
IND PROCESSES:											
Ind processes		11.0					21.5			20.0	52.5
FUGITIVE DUST:											
Railroad yards	53.3 A			0.1	0.3	0.2		0.2	0.4	0.5	1.7
Paved streets	8,056 VMT	neg		neg				neg		neg	neg
Unpaved roads	8.7 VMT	neg		neg		neg					neg
Cleared areas	5.28 A	neg						neg	neg	neg	neg
Construction	0.04 A	0.1									0.1
Aggregate storage	0.5 A							0.4		0.4	0.8
Unpaved pkg lots	6.96 A	0.3	1.4	neg	neg	neg	0.5	0.9			3.1

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	3.9	6.1	4.4	14.4	120.4	38.1	7.2	165.7
IND PROCESSES	11.0	0.0	41.5	52.5	339.5	-	68.2	407.7
FUGITIVE DUST	0.4	2.0	3.3	5.7	12.3	12.5	5.4	30.2
Total	15.3	8.1	49.2	72.6	472.2	50.6	80.8	603.6



POINT SOURCE SUMMARY

SITE: MOUNDSVILLE   UTM: 521.85 E , 4418.50 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	NAME
523.70	4434.20	78.00	9.62	6.7	1	OHIO VALLEY HOSPITAL
515.50	4410.50	13840.00	6.35	218.4	2	KAMMER POWER STATION
515.70	4408.70	12834.00	7.19	212.1	3	MITCHELL POWER PLANT
522.50	4428.90	16.00	6.47	3.6	4	WHEELING-PITTSBURGH
516.70	4417.00	313.00	3.33	253.8	5	ALLIED CHEMICAL-SOUT
515.50	4409.50	94.00	6.84	215.2	6	MOUNTAINEER CARBON C
520.90	4420.30	50.00	1.27	332.2	7	TRIANGLE P.W.C. INC.
523.10	4430.00	21.00	7.19	6.2	8	BENWOOD LIMESTONE
515.70	4408.60	189.00	7.24	211.9	9	H.F. REED CO.
522.30	4419.40	7.00	0.62	26.6	10	FOSTORIA GLASS
515.30	4405.30	28.00	9.16	206.4	11	CITES SERVICE CO.
521.00	4417.20	23.00	0.97	213.2	12	TRI-STATE ASPHALT
522.70	4431.90	4.00	6.34	3.6	13	TRI STATE ASPHALT
520.50	4417.50	23125.00	1.04	233.5	14	OHIO EDISON/R.E.BURG
514.70	4405.40	54.00	9.27	208.6	15	OHIO FERRO ALLOYS

DESCRIPTION OF SITE

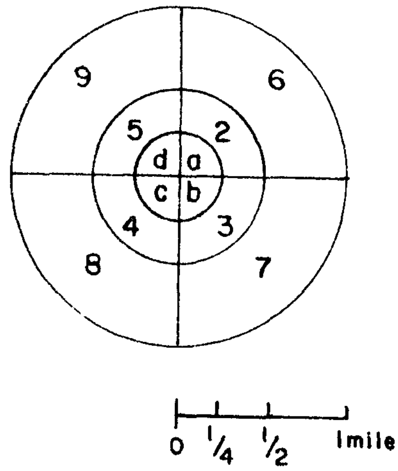
SAROAD Code - 50-2040-003

Location - Route No. 2,
Wellsburg, West Virginia

UTM - N-4460000 E-00533215

Monitor Height - 20 ft

Site Elevation - 680 ft MSL



Land Use by Sector:

1a.	Rural/Residential	4.	Industrial/River
1b.	Residential/Commercial	5.	Industrial/River
1c.	Residential/Industrial	6.	Rural
1d.	River	7.	Rural/Residential
2.	Rural/Residential	8.	Industrial/Commercial
3.	Residential/Commercial	9.	Industrial/Residential

Localized sources within 200 ft of monitor:

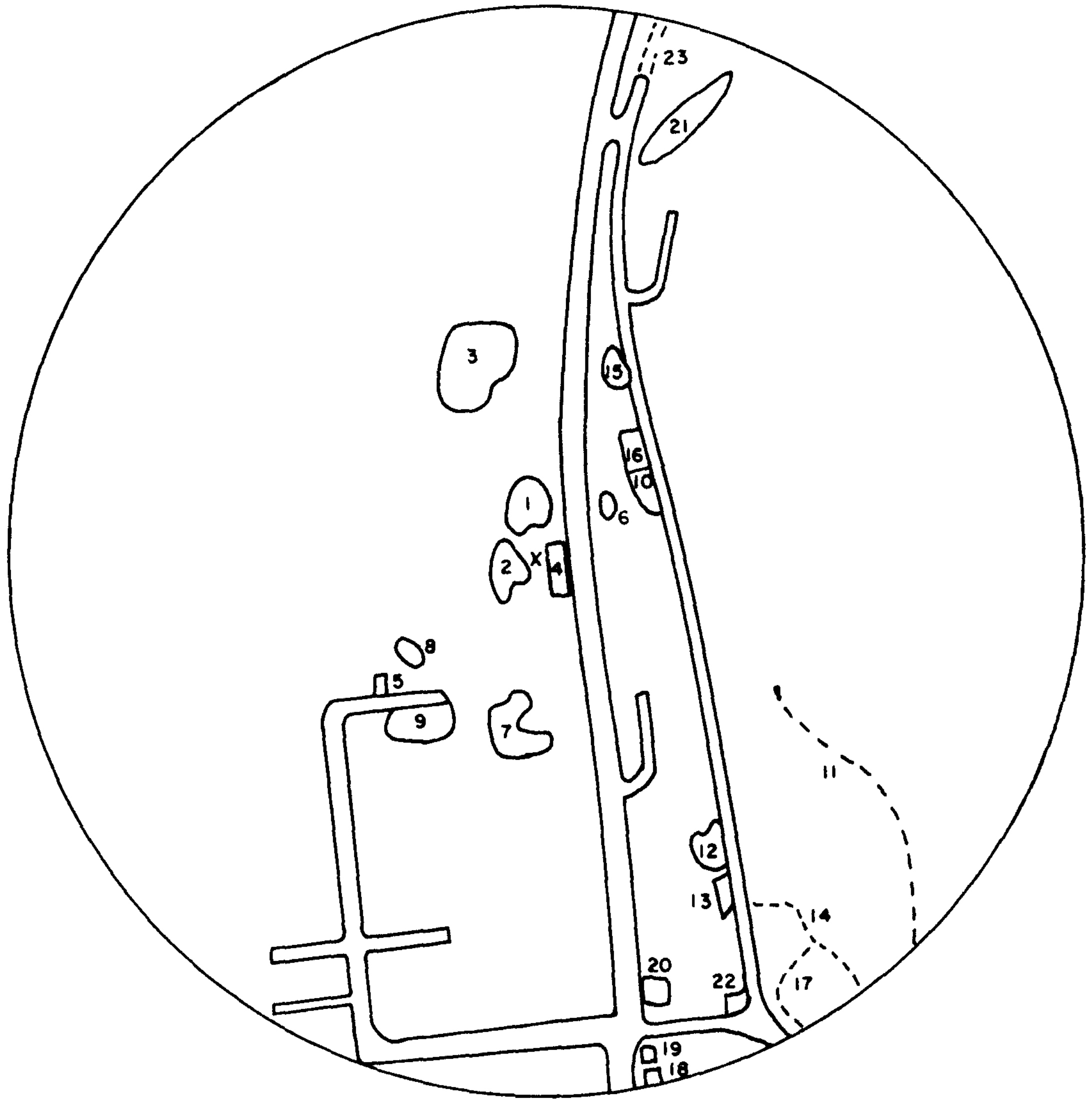
Source	Distance (feet)	Description
Route No. 2	162	11,752 ADT, Unpaved Shoulders

Visible major point sources:

Source	Direction
Banner Fibre Board	180^{o}
Ohio Power - Tidd Station (closed)	215^{o}

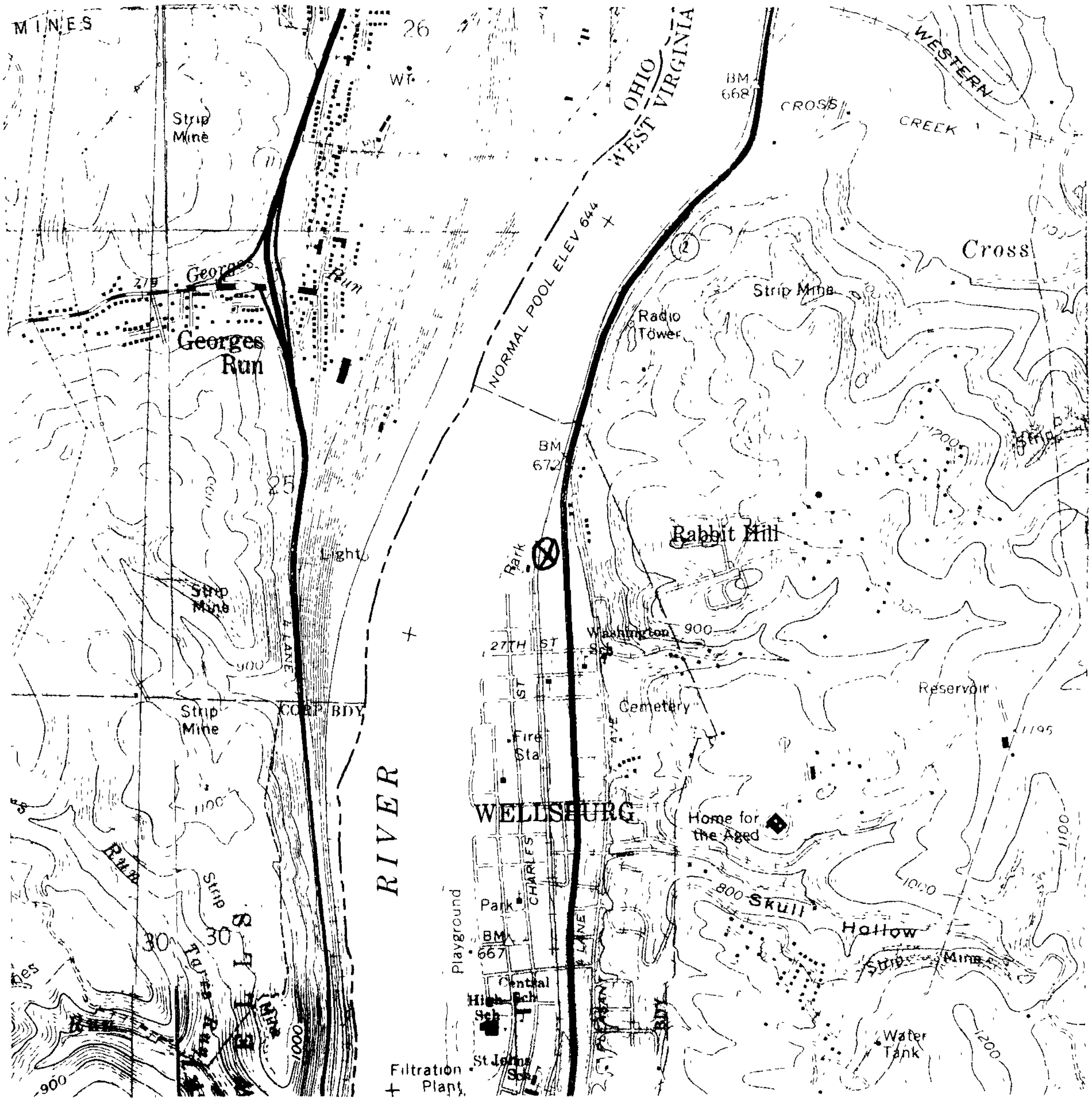
Air Quality Data:

Year	Geometric mean ($\mu g/m^3$)
1977	91
1978	82



1. Cleared area (gravel piles) 0.28 ac.
2. Cleared area 0.12 ac.
3. Cleared area and coal and sand storage 1.0 ac.
4. Unpaved lot 0.16 ac.
5. Unpaved lot 0.04 ac.
6. Cleared area 0.08 ac.
7. Construction 0.12 ac/yr.
8. Unpaved lot 0.12 ac.
9. Unpaved lot 0.16 ac.
10. Unpaved lot 0.06 ac.
11. Unpaved road 200 ft.
12. Unpaved lot 0.04 ac.
13. Unpaved lot 0.04 ac.
14. Unpaved road 100 ft.
15. Construction 0.12 ac/yr.
16. Unpaved lot 0.08 ac.
17. Unpaved road 100 ft.
18. Unpaved lot 0.04 ac.
19. Unpaved lot 0.04 ac.
20. Unpaved lot 0.04 ac.
21. Cleared area 0.6 ac.
22. Unpaved lot 0.04 ac.
23. Unpaved road 200 ft.

One-quarter mile radius around Wellsburg, West Virginia site.



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One-mile radius around Route No. 2, Wellsburg site.

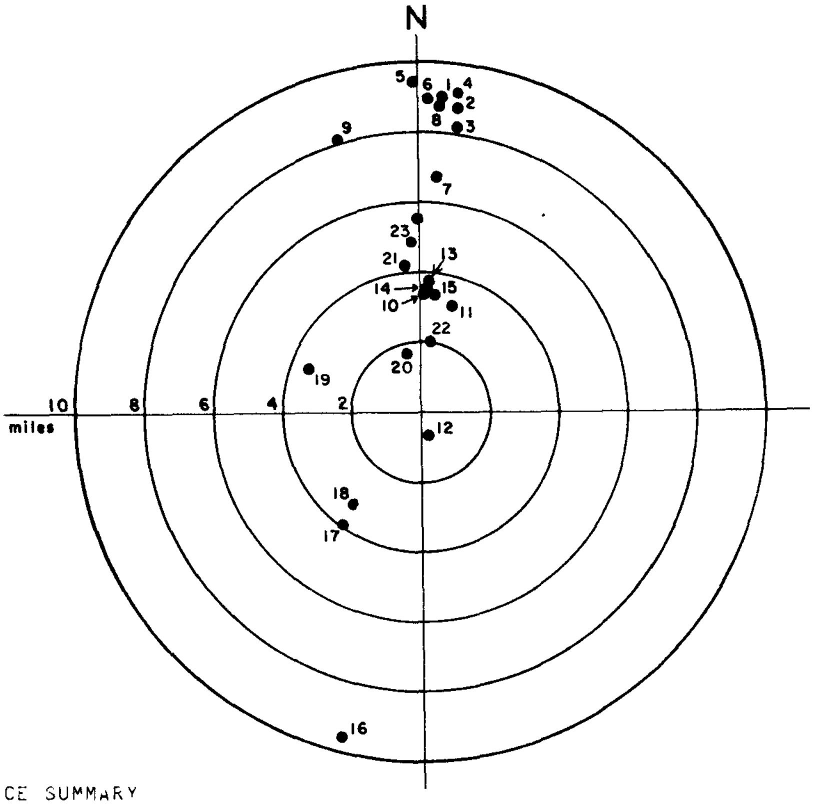
Wellsburg highway department garage site, view to East.

Wellsburg highway department garage site, view to North.

Site: Wellsburg, West Virginia UTM N 4460000 E 00533215

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	945 h.u.	1.2	0.5	1.1	2.0		0.4	1.4	1.4	1.2	9.2
Comm/Ind fuel		0.7	0.4	0.5	1.1		0.2	0.7	0.7	0.7	5.0
Incinerators											
Auto exhaust											
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	125.1 A	0.2	0.1		0.2	0.7	0.3	0.2	0.7	1.4	3.8
Paved streets											
Unpaved roads	6.06 VMT	neg		neg							neg
Cleared areas	2.08 A	neg									neg
Construction	0.24 A	0.6									0.6
Storage areas											
Unpaved pkg lots	0.86 A	0.4									0.4

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	1.9	5.6	6.7	14.2	73.3	35.0	11.0	119.3
IND PROCESSES	0.0	0.0	0.0	0.0	-	-	-	-
FUGITIVE DUST	1.2	1.0	2.6	4.8	46.3	6.2	4.3	56.8
Total	3.1	6.6	9.3	19.0	119.6	41.2	15.3	176.1



POINT SOURCE SUMMARY

SITE: WELLSBURG UTM: 533.22 E , 4460.00 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
534.30	4474.40	3914.00	8.97	4.3	1	WEIRTON STEEL/NATION
535.00	4473.80	4788.00	8.65	7.4	2	WEIRTON STEEL/NATION
535.00	4473.00	415.00	8.15	7.8	3	WEIRTON STEEL/NATION
534.40	4474.10	1995.00	8.79	4.8	4	WEIRTON STEEL/NATION
533.00	4475.00	1463.00	9.32	359.2	5	WEIRTON STEEL/NATION
533.70	4474.50	2465.00	9.02	1.9	6	WEIRTON STEEL/NATION
534.00	4470.70	267.00	6.67	4.2	7	STANDARD SLAG COMPAN
534.20	4474.20	5.00	8.84	4.0	8	INTERNATIONAL MILL S
529.50	4472.50	10.00	8.10	343.4	9	IRON CITY SAND & GRA
533.40	4465.50	879.00	3.42	1.9	10	KOPPERS CO.
534.60	4464.80	17.00	3.10	16.1	11	INTERNATIONAL MILL S
533.30	4458.90	94.00	0.69	175.6	12	BANNER FIBERBOARD CO
533.60	4465.90	949.00	3.67	3.7	13	WHEELING PITTSBURGH
533.50	4465.80	3039.00	3.61	2.8	14	WHEELING PITTSBURGH
533.80	4465.30	645.00	3.31	6.3	15	WHEELING PITTSBURGH
529.30	4445.00	210.00	9.63	194.6	16	VALLEY CAMP COAL NO.
529.40	4454.90	149.00	3.96	216.8	17	BUCKEYE POWER
530.00	4455.80	38007.00	3.29	217.4	18	CARDINAL OPER. COMP.
527.90	4462.00	6213.00	3.53	290.6	19	SATRALLOY INC.
532.50	4462.60	51.00	1.68	344.6	20	STANDARD SLAG CO.
532.50	4466.70	1963.00	4.15	353.9	21	WHEELING-PITTSBURGH
533.50	4463.20	2391.00	2.00	5.1	22	WHEELING-PITTSBURGH
532.70	4467.00	16.00	4.36	355.8	23	NATIONAL STEEL/WEIRT

DESCRIPTION OF SITE

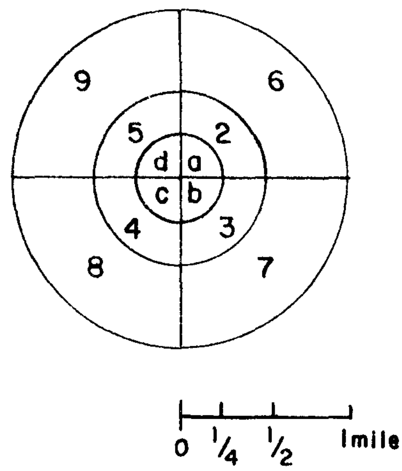
SAROAD Code - 50-0500-004

Location - Main Street,
Follansbee, West Virginia

UTM - N-4465120 E-00534380

Monitor Height - 50 ft

Site Elevation - 740 ft MSL



Land Use by Sector:

1a. Rural

1b. Residential

1c. Residential/Industrial

1d. Rural/Industrial

2. Rural

3. Rural/Commercial

4. Commercial/Industrial

5. Industrial

6. Rural/Residential

7. Rural/Residential

8. Industrial

9. Industrial

Localized sources witnin 200 ft of monitor:

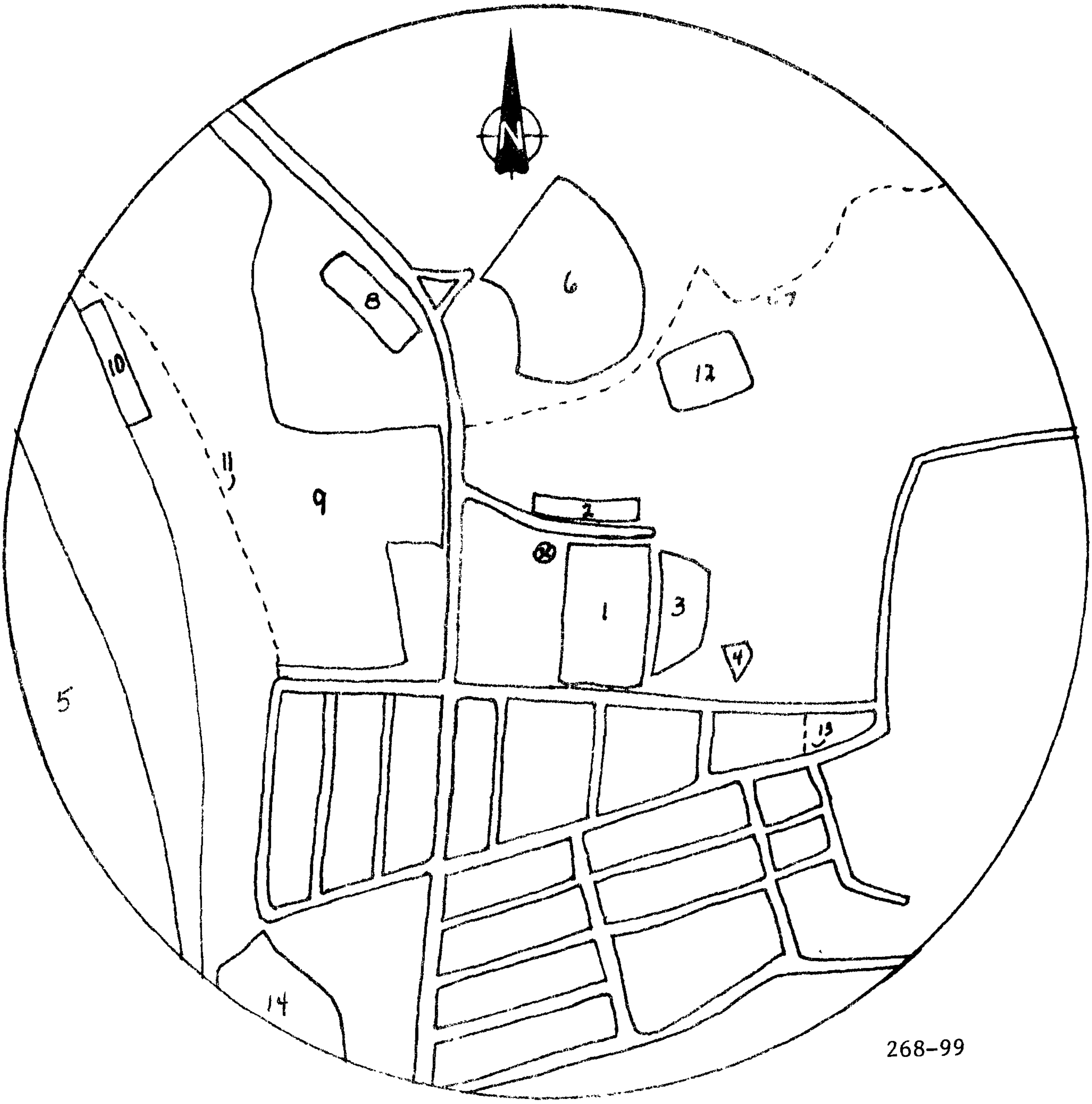
Source	Distance (feet)	Description
Main St.	235	14,003 ADT

Visible major point sources:

Source	Direction
Wheeling/Pittsburgh Steel	300°
Koppers Co.	290°

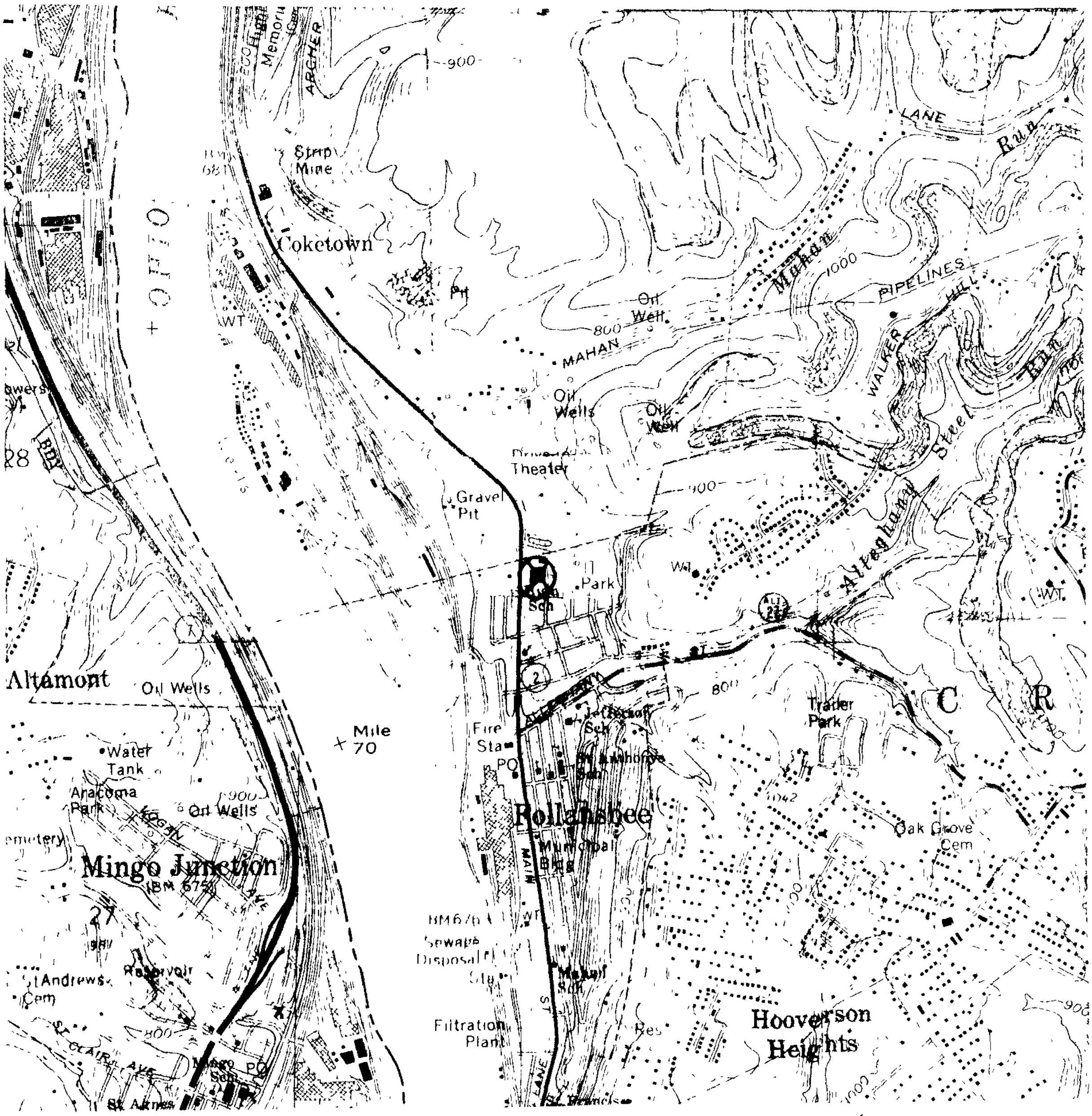
Air Quality Data:

Year	Geometric mean (μg/m³)
1977	107
1978	95



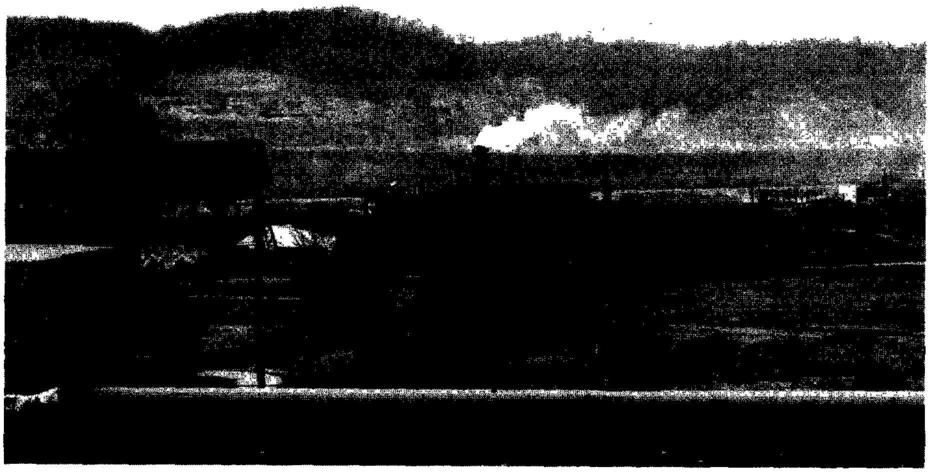
1. Cleared area 0.5 ac.
2. Unpaved lot 0.12 ac.
3. Cleared area 0.25 ac.
4. Cleared area 0.04 ac.
5. Cleared area 2.0 ac.
6. Unpaved lot 1.25 ac.
7. Unpaved road 600 ft.
8. Cleared area 0.16 ac.
9. Cleared area 4 ac.
10. Coal piles 0.12 ac.
11. Unpaved road 600 ft.
12. Cleared area 0.25 ac.
13. Unpaved road 100 ft.
14. Cleared area 0.5 ac.

One-quarter mile radius around Follansbee, West Virginia site.



268-100

One-mile radius around Main Street, Follansbee site.



Follansbee middle school site, view to West.

Follansbee middle school site, view to South.

AREA SOURCE SUMMARY

Site: Follansbee, West Virginia UTM N 4465120 E 00534380

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:	1,285 h.u.	2.7	0.4	3.0	1.6	0.2	1.1	3.0	1.1	neg	13.1
Residential fuel		1.4	0.2	1.6	0.9	neg	0.5	1.6	0.5	neg	6.7
Comm/Ind fuel											
Incinerators	4,822 VMT	neg	neg	neg	neg			neg	neg		neg
Auto exhaust											
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	76.3 A	0.1			0.3	0.3			0.9	0.7	2.3
Paved streets	4,822 VMT	neg	neg	neg	neg			neg	neg		neg
Unpaved roads	4.92 VMT	neg									neg
Cleared areas	31.9 A	0.2			0.2	0.2				0.1	0.7
Construction	1.0 A			2.5							2.5
Storage areas	1.0 A				0.1						0.1
Unpaved pkg lots	2.37 A	0.6								0.5	1.1

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	4.1	7.9	7.8	19.8	63.3	49.4	12.8	125.5
IND PROCESSES	0.0	0.0	0.0	0.0	-	-	-	-
FUGITIVE DUST	0.9	3.6	2.2	6.7	13.9	22.5	3.6	40.0
Total	5.0	11.5	10.0	26.5	77.2	71.9	16.4	165.5

DESCRIPTION OF SITE

SAROAD Code - 502000003F02

Location - Fire Station, Weirton, W.V.

UTM - N-4472080 E-0534900

Monitor Height - 45 ft AGL

Site Elevation - 670 ft MSL

Land Use by Sector:

1a.	Industrial	4.	Residential
1b.	Industrial	5.	Rural/Residential
1c.	Industrial/Residential	6.	Rural/Residential
1d.	Residential/Industrial	7.	Rural
2.	Industrial/Rural	8.	Rural/Industrial
3.	Rural	9.	Rural/Residential

Localized sources within 200 ft of monitor:

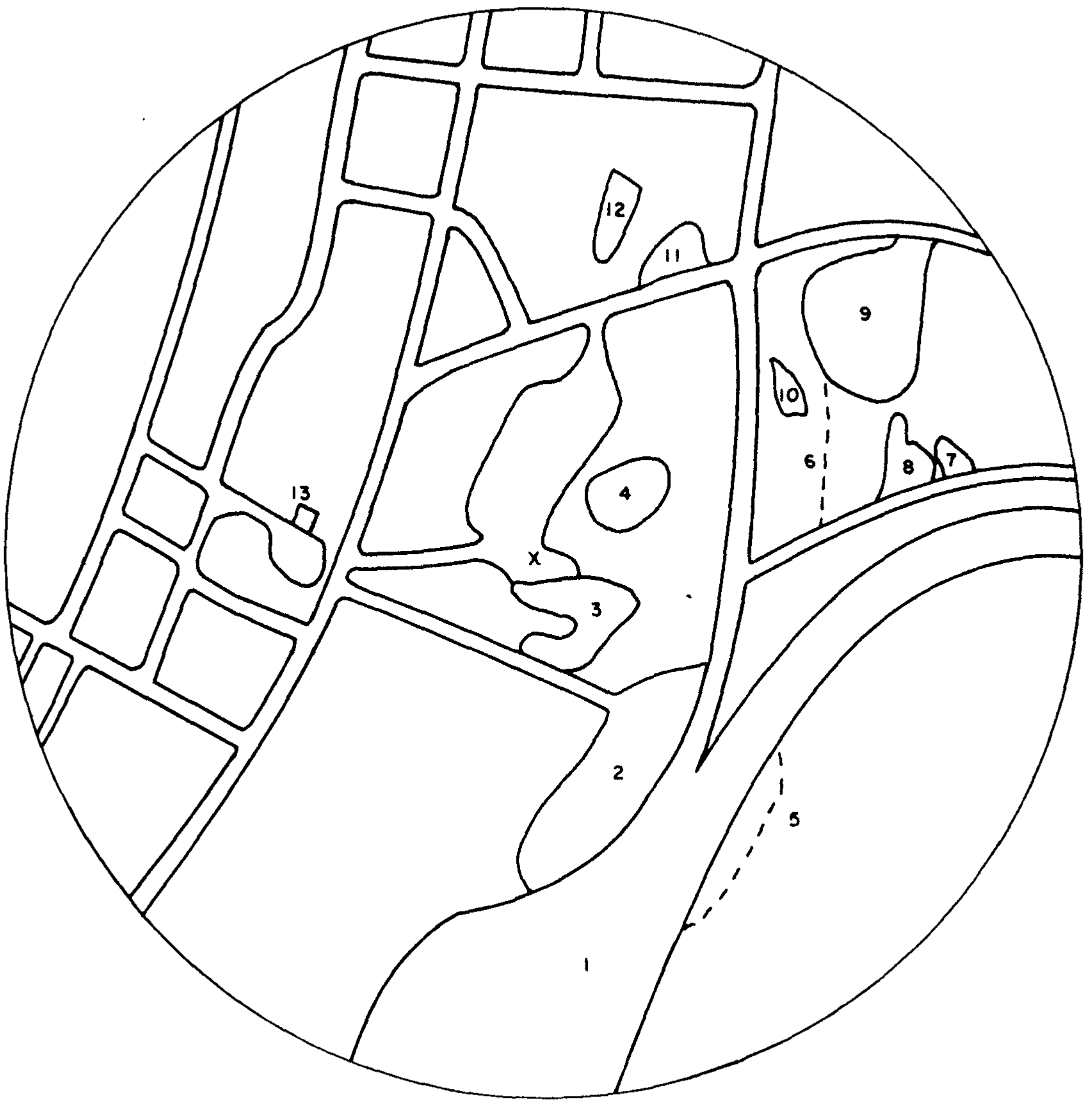
Source	Distance (feet)	Description
Parking Lot	Adjacent	Paved

Visible major point sources:

Source	Direction
Weirton Steel	327^{o} - 006^{o}

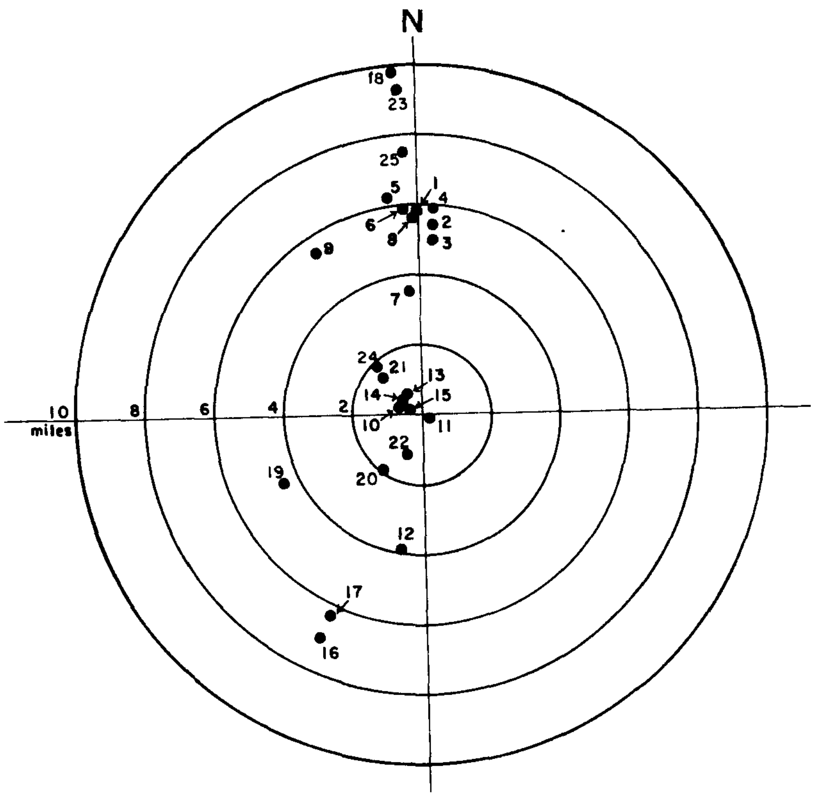
Air Quality Data:

Year	Geometric Mean ($\mu g/m^3$)
1977	94
1978	96



1. Railroad yard 10.25A
2. Cleared area 2.3A
3. Cleared area 1.0A
4. Cleared area (baseball diamond) 0.7A
5. Unpaved road 150 ft
6. Unpaved road 100 ft
7. Cleared area 0.2A
8. Cleared area 0.3A
9. Unpaved lot 1.3A
10. Cleared area 0.2A
11. Unpaved lot 0.6A
12. Unpaved lot 0.6A
13. Unpaved lot 0.05A

One-quarter mile radius around the Weirton, West Virginia, site.



POINT SOURCE SUMMARY

SITE: FOLLANSBEE UTM: 534.38 E , 4465.12 N

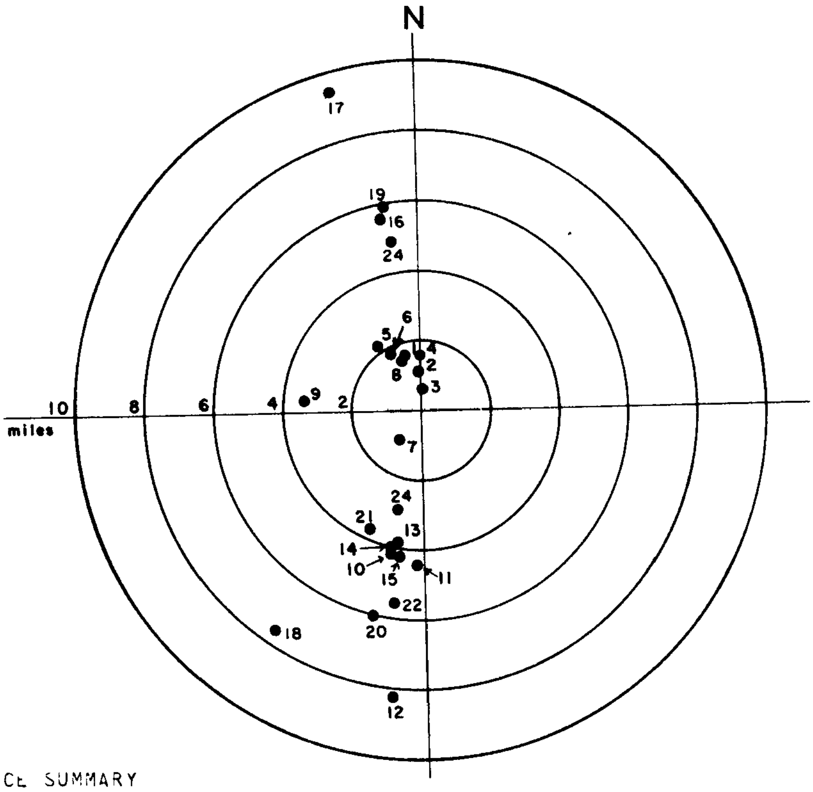
X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
534.30	4474.40	3914.00	5.77	359.5	1	WEIRTON STEEL/NATION
535.00	4473.80	4786.00	5.41	4.1	2	WEIRTON STEEL/NATION
535.00	4473.00	415.00	4.91	4.5	3	WEIRTON STEEL/NATION
534.40	4474.10	1995.00	5.58	0.1	4	WEIRTON STEEL/NATION
533.00	4475.00	1463.00	6.20	352.0	5	WEIRTON STEEL/NATION
533.70	4474.50	2465.00	5.84	355.9	6	WEIRTON STEEL/NATION
534.00	4470.70	267.00	3.47	356.1	7	STANDARD SLAG COMPAN
534.20	4474.20	5.00	5.64	358.9	8	INTERNATIONAL MILL S
529.50	4472.50	10.00	5.50	326.5	9	IRON CITY SAND & GRA
533.40	4465.50	679.00	0.65	291.1	10	KOPPERS CO.
534.60	4464.80	17.00	0.24	145.5	11	INTERNATIONAL MILL S
533.30	4458.90	94.00	3.92	189.8	12	BANNER FIBERBOARD CO
533.60	4465.90	949.00	0.68	314.9	13	WHEELING PITTSBURGH
533.50	4465.80	3039.00	0.69	307.7	14	WHEELING PITTSBURGH
533.80	4465.30	645.00	0.38	287.2	15	WHEELING PITTSBURGH
529.40	4454.90	149.00	7.07	206.0	16	BUCKEYE POWER
530.00	4455.80	38007.00	6.40	205.2	17	CARDINAL OPER. COMP.
533.30	4480.70	42.00	9.70	356.0	18	KAUL CLAY CO.
527.90	4462.00	6213.00	4.47	244.3	19	SATRALLOY INC.
532.50	4462.60	51.00	1.95	216.7	20	STANDARD SLAG CO.
532.50	4466.70	1963.00	1.53	310.0	21	WHEELING-PITTSBURGH
533.50	4463.20	2391.00	1.31	204.6	22	WHEELING-PITTSBURGH
533.70	4480.00	1451.00	9.26	357.4	23	TORONTO PAPERBOARD C
532.70	4467.00	16.00	1.57	318.2	24	NATIONAL STEEL/WEIRT
533.00	4477.50	67.00	7.74	353.6	25	TITANIUM METALS

AREA SOURCE SUMMARY

Site: Weirton, West Virginia UTM N 4472080 E 00534900

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	1,500 h.u.	1.0	0.5	neg	1.5	1.2	1.0	0.3	4.3	0.8	10.6
Comm/Ind fuel		0.8	0.5	neg	1.5	1.2	0.8	0.3	4.0	0.7	9.8
Incinerators											
Auto exhaust	22,728 VMT	neg		neg		neg		neg		neg	neg
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	75.8 A	0.3	0.2	0.3	0.2		0.2	0.2	0.5	0.3	2.2
Paved streets	22,728 VMT	neg		neg		neg		neg		neg	neg
Unpaved roads	1.3 VMT	neg									neg
Cleared areas	14.12 A	0.1			0.1				0.1	neg	0.3
Construction											
Aggregate storage	1.0 A								1.4		1.4
Unpaved pkg lots	3.4 A	1.2	0.2			0.2					1.6

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	1.8	6.4	12.2	20.4	30.9	40.0	20.1	91.0
IND PROCESSES	0.0	0.0	0.0	0.0	-	-	-	-
FUGITIVE DUST	1.6	1.2	2.7	5.5	27.4	7.5	4.4	39.3
Total	3.4	7.6	14.9	25.9	58.3	47.5	24.5	130.3



POINT SOURCE SUMMARY

SITE: WEIRTON UTM: 534.90 E , 4472.08 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO. & NAME	
534.30	4474.40	3914.00	1.49	345.5	1	WEIRTON STEEL/NATION
535.00	4473.80	4798.00	1.07	3.3	2	WEIRTON STEEL/NATION
535.00	4473.00	415.00	0.58	6.2	3	WEIRTON STEEL/NATION
534.40	4474.10	1995.00	1.30	346.1	4	WEIRTON STEEL/NATION
533.00	4475.00	1463.00	2.17	327.0	5	WEIRTON STEEL/NATION
533.70	4474.50	2465.00	1.68	333.6	6	WEIRTON STEEL/NATION
534.00	4470.70	267.00	1.02	213.1	7	STANDARD SLAG COMPAN
534.20	4474.20	5.00	1.39	341.7	8	INTERNATIONAL MILL S
529.50	4472.50	10.00	3.37	274.5	9	IRON CITY SAND & GRA
533.40	4465.50	879.00	4.19	192.8	10	KOPPERS CO.
534.60	4464.80	17.00	4.53	182.4	11	INTERNATIONAL MILL S
533.30	4458.90	94.00	8.25	186.9	12	BANNER FIBERBOARD CO
533.60	4465.90	949.00	3.92	191.9	13	WHEELING PITTSBURGH
533.50	4465.80	3039.00	4.00	192.6	14	WHEELING PITTSBURGH
533.80	4465.30	645.00	4.27	189.2	15	WHEELING PITTSBURGH
533.30	4480.70	42.00	5.45	349.5	16	KAUL CLAY CO.
531.10	4486.70	55191.00	9.39	345.4	17	OHIO EDISON CO./SAMM
527.90	4462.00	6213.00	7.62	214.8	18	SATRALLOY INC.
533.50	4481.50	5135.00	5.92	351.5	19	OHIO EDISON CO./TORO
532.50	4462.60	51.00	6.07	194.2	20	STANDARD SLAG CO.
532.50	4466.70	1963.00	3.66	204.0	21	WHEELING-PITTSBURGH
533.50	4463.20	2391.00	5.59	189.0	22	WHEELING-PITTSBURGH
533.70	4480.00	1451.00	4.98	351.4	23	TORONTO PAPERBOARD C
532.70	4467.00	16.00	3.44	203.4	24	NATIONAL STEEL/WEIRT
533.00	4477.50	67.00	3.57	340.7	25	TITANIUM METALS

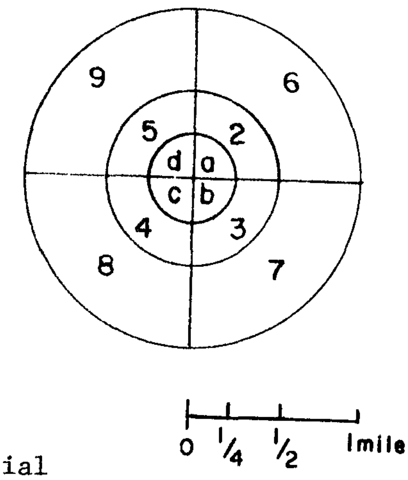
DESCRITPION OF SITE

SAROAD Code - 50-0620-006

Location - County Court House,
New Cumberland, West Virginia

Monitor Height - 55 ft.

Site Elevation - 720 ft MSL



Land Use by Sector:

1a.	Rural	4.	Commercial
1b.	Residential	5.	River
1c.	Commercial	6.	Rural/Residential
1d.	Residential	7.	Rural
2.	Rural	8.	Industrial
3.	Rural/Residential	9.	Rural

Localized sources within 200 ft of monitor:

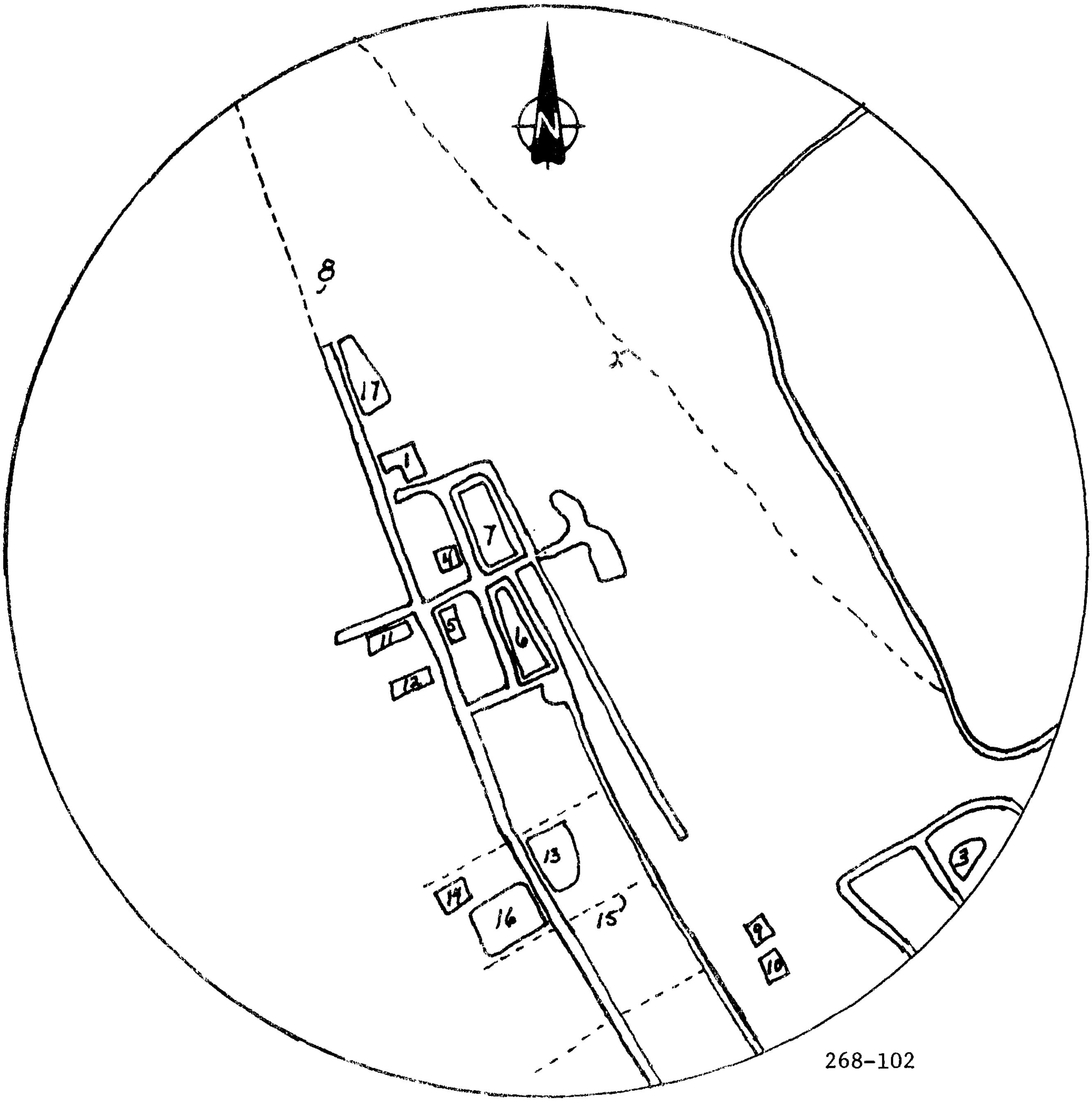
Source	Distance (feet)	Description
Road	52	10,828 ADT, Clean, Curbed

Visible major point sources:

Source	Direction
Ohio Edison, Toronto	165°
Kaul Clay Co.	175°
Toronto Paperboard	185°

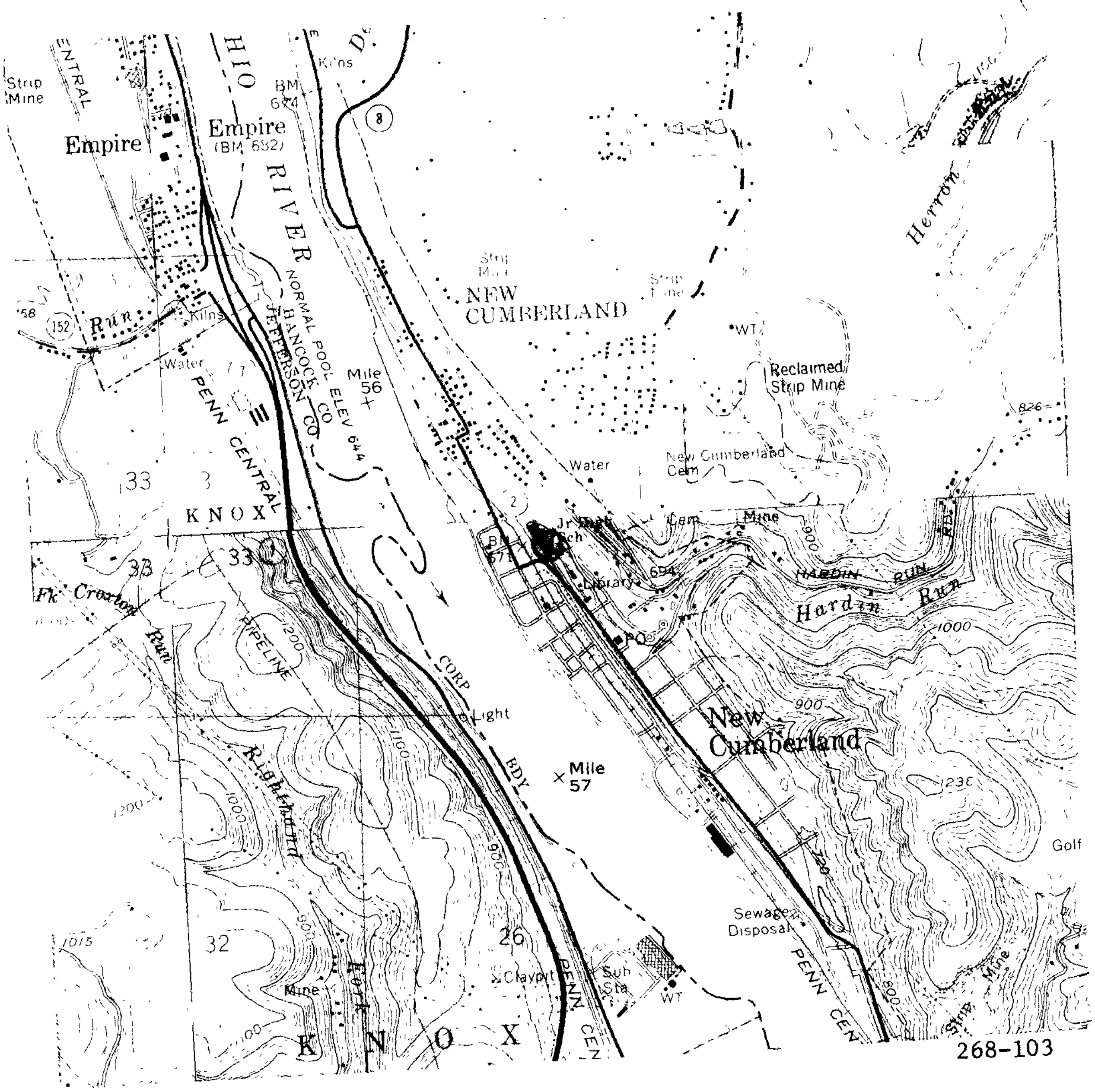
Air Quality Data:

Year	Geometric mean (μg/m^3)
1977	72
1978	78



1. Unpaved lot 0.08 ac.
2. Unpaved road 1300 ft.
3. Cleared area 0.08 ac.
4. Unpaved lot 0.04 ac.
5. Unpaved lot 0.04 ac.
6. Unpaved lot 0.12 ac.
7. Unpaved lot 0.12 ac.
8. Unpaved road 500 ft.
9. Unpaved lot 0.04 ac.
10. Unpaved lot 0.04 ac.
11. Unpaved lot 0.04 ac.
12. Unpaved lot 0.04 ac.
13. Cleared area 0.12 ac.
14. Unpaved lot 0.04 ac.
15. Unpaved road 1200 ft.
16. Cleared area 0.16 ac.
17. Cleared area 0.12 ac.

One-quarter mile radius around New Cumberland, West Virginia site.



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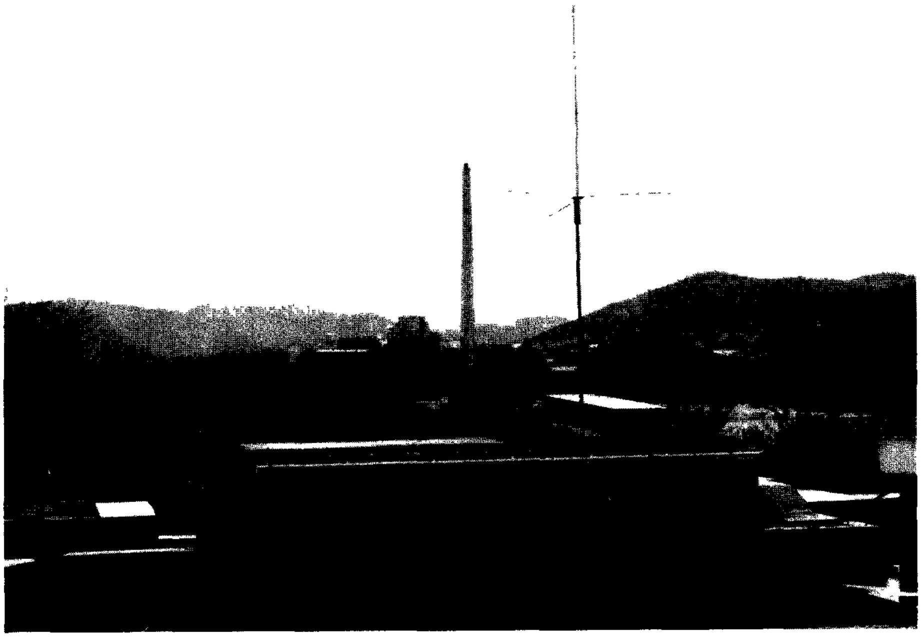
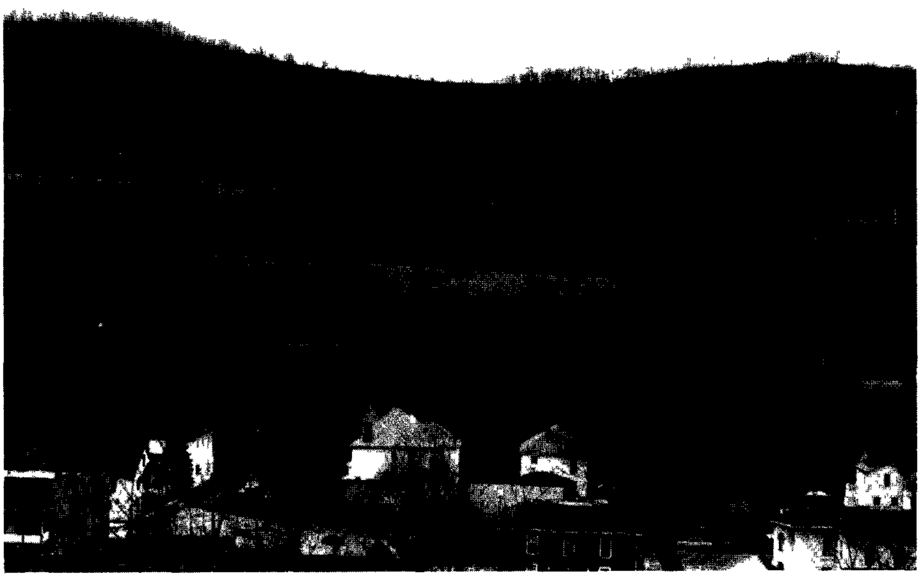
One-mile radius around New Cumberland court house site.



New Cumberland court house site, view to South.

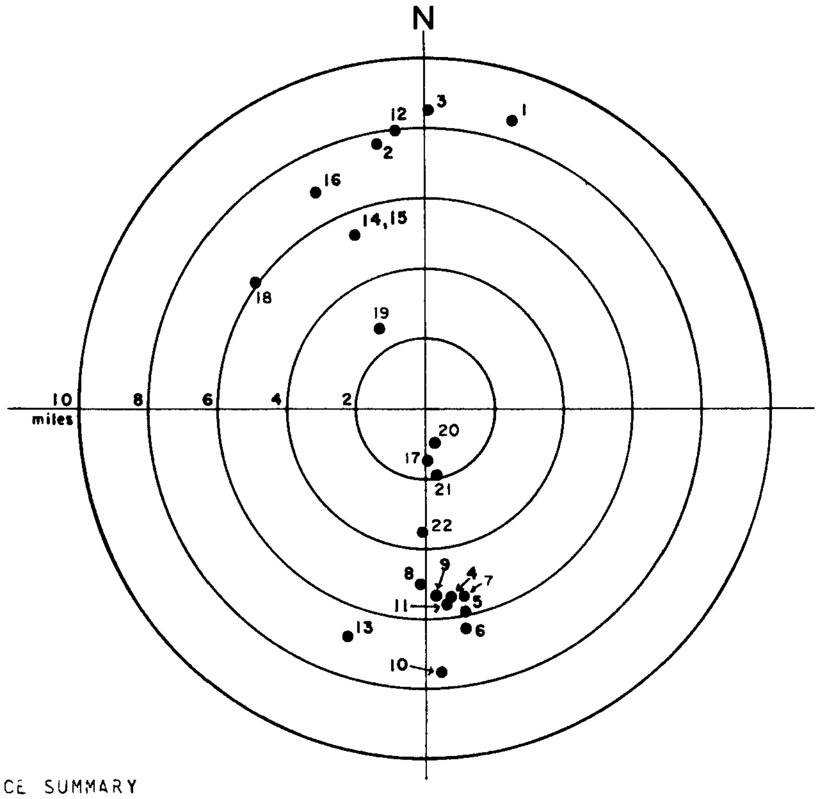


New Cumberland court house site, view to West.

Site: New Cumberland, West Virginia UTM N 4483119 E 00533119

Source Category	Activity rate	Emissions by sector, ton/yr									
		1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel	575 h.u.	0.5	0.5	0.5		0.3	0.2	0.3		0.7	3.0
Comm/Ind fuel		0.3	0.5	0.5		0.3	0.2	0.3		0.5	2.6
Incinerators											
Auto exhaust	1,301 VMT	neg		neg		neg		neg		neg	neg
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards	49.1 A	0.1		0.1	0.2	0.1		0.2	0.1	0.5	1.3
Paved streets	1,301 VMT	neg		neg		neg		neg		neg	neg
Unpaved roads	16.3 VMT	neg	neg	neg	neg						neg
Cleared areas	0.85 A	neg		neg							neg
Aggregate storage	1.0 A			1.4							1.4
Storage areas	1.0 A							0.5			0.5
Unpaved pkg lots	3.22 A	0.3	0.1					0.9	0.2		1.5

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	0.8	2.6	2.2	5.6	11.2	16.2	3.6	31.0
IND PROCESSES	0.0	0.0	0.0	0.0	-	-	-	-
FUGITIVE DUST	0.4	1.9	2.4	4.7	5.6	11.9	3.9	21.4
Total	1.2	4.5	4.6	10.3	16.8	28.1	7.5	52.4

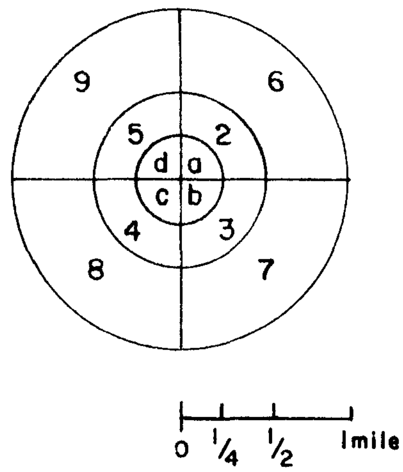


POINT SOURCE SUMMARY

SITE: NEW CUMBERLAND   UTM: 533.12 E , 4483.12 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	NAME
537.30	4496.20	34.00	8.53	17.7	1	TAYLOR,SMITH,&TAYLOR
531.00	4495.20	35.00	7.62	350.1	2	QUAKER STATE OIL
533.40	4496.60	233.00	8.39	1.2	3	HOMER LAUGHLIN CHINA
534.30	4474.40	3914.00	5.47	172.3	4	WEIRTON STEEL/NATION
535.00	4473.80	4768.00	5.91	168.6	5	WEIRTON STEEL/NATION
535.00	4473.00	415.00	6.39	169.5	6	WEIRTON STEEL/NATION
534.40	4474.10	1995.00	5.66	171.9	7	WEIRTON STEEL/NATION
533.00	4475.00	1463.00	5.04	180.8	8	WEIRTON STEEL/NATION
533.70	4474.50	2465.00	5.37	176.1	9	WEIRTON STEEL/NATION
534.00	4470.70	267.00	7.74	175.9	10	STANDARD SLAG COMPAN
534.20	4474.20	5.00	5.58	173.1	11	INTERNATIONAL MILL S
531.90	4495.70	169.00	7.86	354.5	12	GLOBE REFRACTORIES S
529.50	4472.50	10.00	6.97	198.8	13	IRON CITY SAND & GRA
530.00	4491.00	57.00	5.27	338.4	14	TRI-STATE ASPHALT #3
530.00	4491.00	59.00	5.27	338.4	15	TRI-STATE ASPHALT #4
528.10	4493.10	172.00	6.94	333.3	16	SWANK REFACTORIES
533.30	4480.70	42.00	1.51	175.7	17	KAUL CLAY CO.
525.30	4488.90	43.00	6.04	306.5	18	F.J. DANDO CO.
531.10	4486.70	55191.00	2.56	330.6	19	OHIO EDISON CO./SAMM
533.50	4481.50	5135.00	1.03	166.7	20	OHIO EDISON CO./TORO
533.70	4480.00	1451.00	1.97	169.4	21	TORONTO PAPERBOARD C
533.00	4477.50	67.00	3.49	181.2	22	TITANIUM METALS

DESCRIPTION OF SITE



SAROAD Code - 50-0620-005

Location - Elementary School,
New Manchester, West Virginia

UTM - N-4486350 E-00535840

Monitor Height - 15 ft

Site Elevation - 1170 ft MSL

Land Use by Sector:

1a.	Rural	4.	Rural
1b.	Rural	5.	Rural/Residential
1c.	Agriculature	6.	Rural
1d.	Residential	7.	
2.	Rural	8.	Rural/Agriculture
3.	Rural	9.	Rural/Agriculture

Localized sources within 200 ft of monitor:

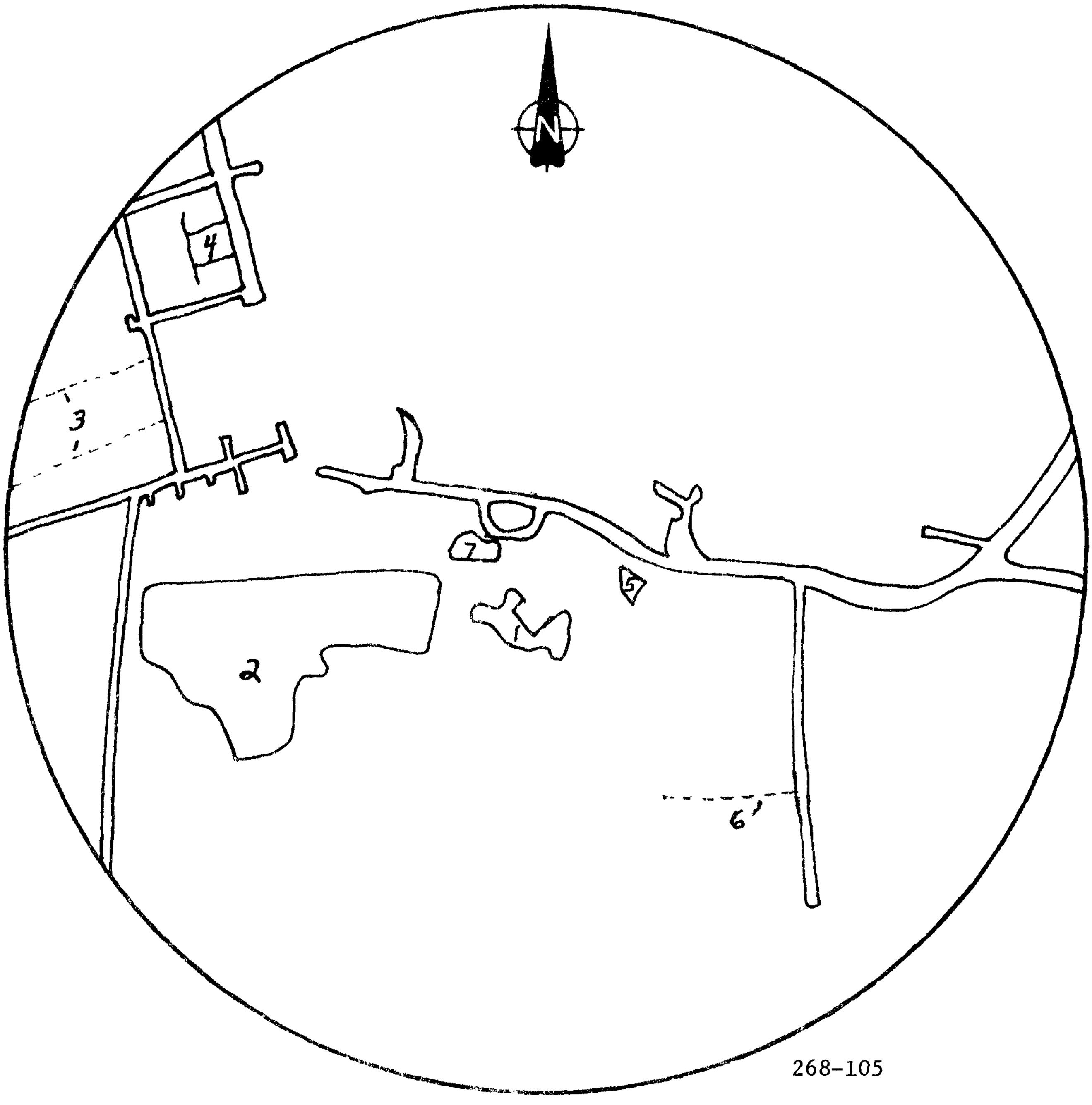
Source	Distance (feet)	Description
Main St.	58	1000* ADT, Unpaved Shoulder

Visible major point sources:

Source	Direction
Sammis Power	275°

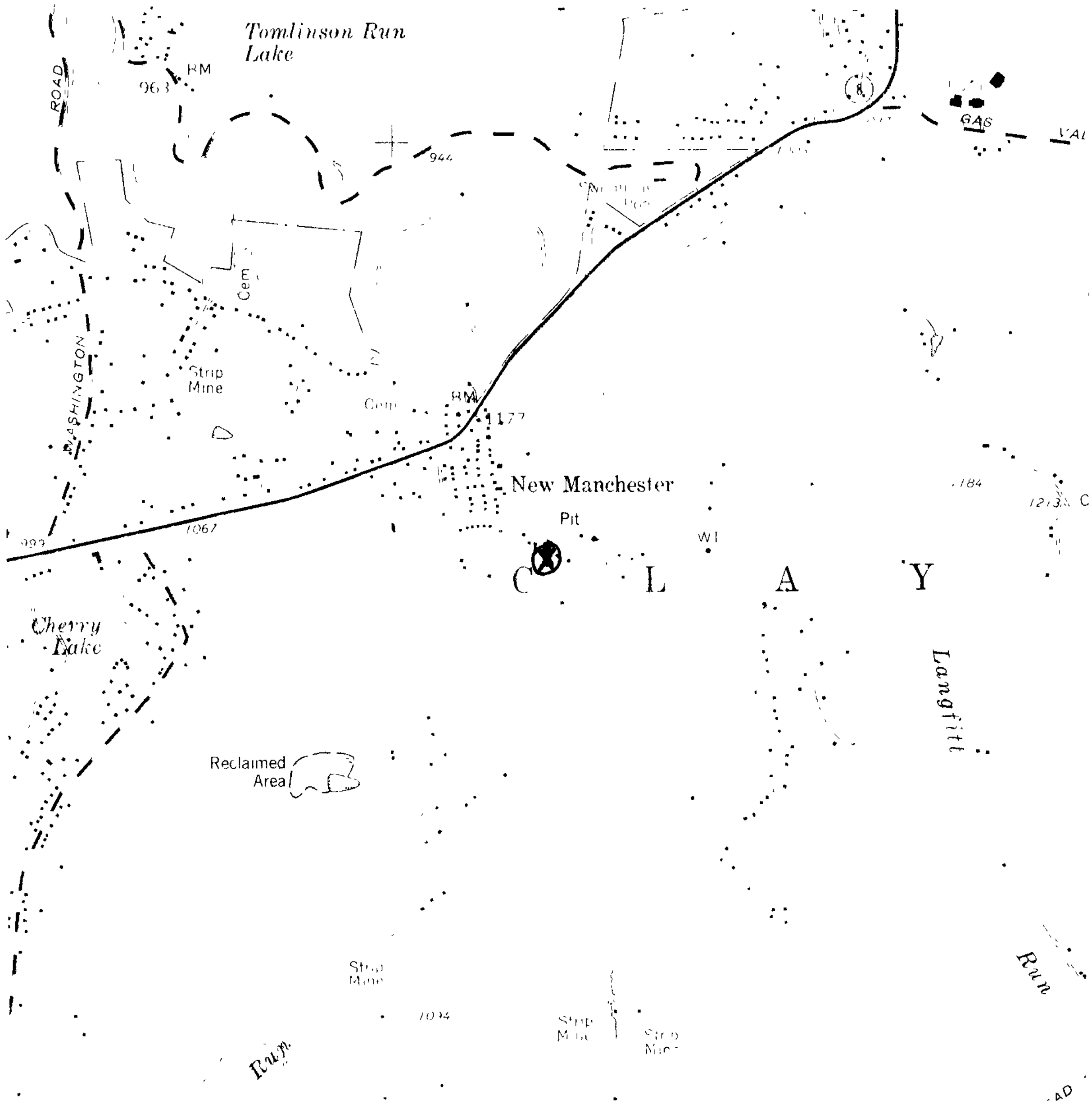
Air Quality Data:

Year	Geometric mean (μg/m³)
1977	80
1978	86



1.	Unpaved lot 0.12 ac.	5.	Unpaved road 300 ft.
2.	Unpaved road 900 ft.	6.	Cleared area 0.0r ac.
3.	Agriculture 1.5 ac	7.	Unpaved road 600 ft.
4.	Unpaved road 300 ft.	8.	Cleared area 0.12 ac.

One-quarter mile radius around New Manchester, West Virginia site.



One-mile radius around New Manchester elementary school site.

New Manchester elementary school site, view to South.

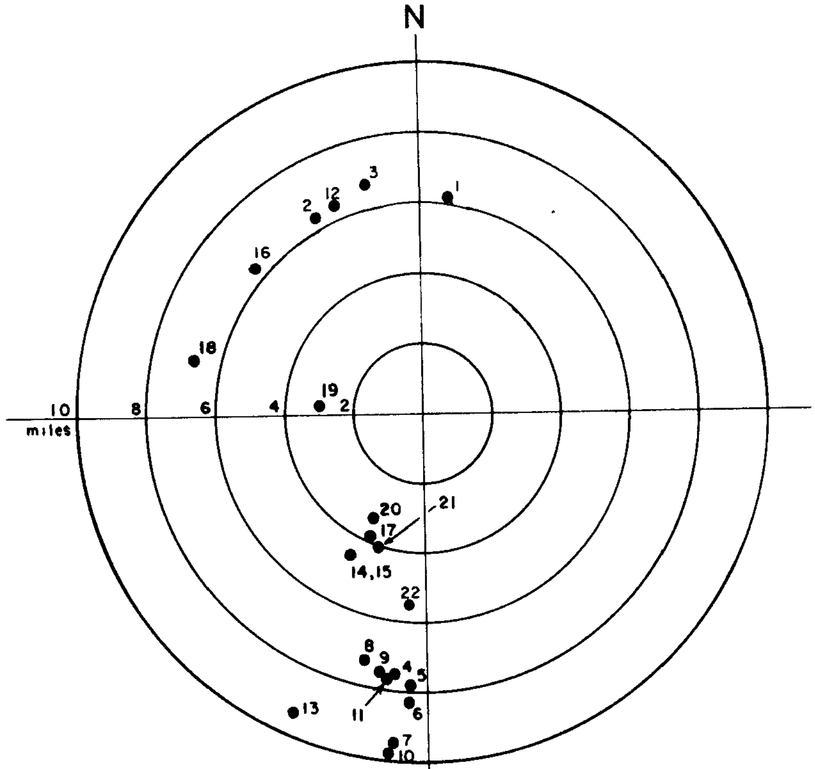
New Manchester elementary school site, view to East.

AREA SOURCE SUMMARY

Site: New Manchester, West Virginia UTM N 4486350 E 00535840

Source Category	Activity rate	Emissions by sector, ton/yr 1	2	3	4	5	6	7	8	9	Total
COMBUSTION:											
Residential fuel		0.2	neg	neg	neg	0.2	0.2	0.2	0.3	0.3	1.4
Comm/Ind fuel		0.2		neg		0.2	0.2	0.2	0.3	0.3	1.4
Incinerators											
Auto exhaust	1,001 VMT	neg	neg		neg		neg		neg		neg
IND PROCESSES:											
Ind processes											
FUGITIVE DUST:											
Railroad yards											
Paved streets	1,001 VMT	neg	neg		neg		neg		neg		neg
Unpaved roads	18.56 VMT	neg		neg	neg	neg		neg			neg
Cleared areas		neg			neg	neg					neg
Construction											
Agriculture	1.5 A	neg									neg
Unpaved pkg lots	0.12 A	0.1									0.1

Recap	Emissions by sector, t/yr				Variable value			
	1	2 to 5	6 to 9	Total	1	2 to 5	6 to 9	Total
COMBUSTION	0.4	0.4	2.0	2.8	20.6	2.5	3.3	26.4
IND PROCESSES	0.0	0.0	0.0	0.0	-	-	-	-
FUGITIVE DUST	0.1	0.0	0.0	0.1	5.1	-	-	5.1
Total	0.5	0.4	2.0	2.9	25.7	2.5	3.3	31.5



POINT SOURCE SUMMARY

SITE: NEW MANCHESTER UTM: 535.84 E , 4486.35 N

X (KM)	Y (KM)	EMISSION (T/YR)	DISTANCE (MI)	ANGLE (DEG)	SOURCE NO.	& NAME
537.30	4496.20	94.00	6.19	8.4	1	TAYLOR,SMITH,&TAYLOR
531.00	4495.20	35.00	6.27	331.3	2	QUAKER STATE OIL
533.40	4496.60	233.00	6.55	346.6	3	HOMER LAUGHLIN CHINA
534.30	4474.40	3914.00	7.49	187.3	4	WEIRTON STEEL/NATION
535.00	4473.80	4786.00	7.82	183.8	5	WEIRTON STEEL/NATION
535.00	4473.00	415.00	8.31	183.6	6	WEIRTON STEEL/NATION
534.40	4474.10	1995.00	7.66	186.7	7	WEIRTON STEEL/NATION
533.00	4475.00	1463.00	7.27	194.0	8	WEIRTON STEEL/NATION
533.70	4474.50	2465.00	7.48	190.2	9	WEIRTON STEEL/NATION
534.00	4470.70	267.00	9.79	166.7	10	STANDARD SLAG COMPAN
534.20	4474.20	5.00	7.62	187.7	11	INTERNATIONAL MILL S
531.90	4495.70	169.00	6.30	337.1	12	GLOBE REFRACTORIES S
529.50	4472.50	10.00	9.47	204.6	13	IRON CITY SAND & GRA
530.00	4491.00	57.00	4.64	308.5	14	TRI-STATE ASPHALT #3
530.00	4491.00	59.00	4.64	308.5	15	TRI-STATE ASPHALT #4
528.10	4493.10	172.00	6.38	311.1	16	SWANK REFACTORIES
533.30	4480.70	42.00	3.85	204.2	17	KAUL CLAY CO.
525.30	4488.90	43.00	6.74	283.6	18	F.J. DANDO CO.
531.10	4486.70	55191.00	2.95	274.2	19	OHIO EDISON CO./SAMM
533.50	4481.50	5135.00	3.35	205.7	20	OHIO EDISON CO./TORO
533.70	4480.00	1451.00	4.16	198.6	21	TORONTO PAPERBOARD C
533.00	4477.50	67.00	5.78	197.8	22	TITANIUM METALS

APPENDIX C

FILTER ANALYSIS RESULTS

GCA Filter No. 6405

Site: BRILLIANT Date: 1/2/78

43	-	9.9	-	1.81	=	31.3
Total Concentration		Sulfates		Nitrates		Primary

Iron 0.71 μg/m^3 Arsenic 0.04 μg/m^3

Classification	Weight (μg/m^3)	(% of Primary)
Minerals	9	29
Combustion		
Flyash	7	23
Coal Fragments and Flyash	7	24
Soot	3	9
Iron Oxide	2	5
Other		
Pollen and Spores	2	6
Glass	1	4
Total	31	100

GCA Filter No. 6425

Site: TILTONSVILLE Date: 1/2/78

152	-	21.4	-	3.66	=	126.9
Total Concentration		Sulfates		Nitrates		Primary

Iron 2.22 $\mu g/m^3$ Arsenic 0.07 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	24	19
Combustion		
Flyash	36	28
Coal Fragments and Flyash	29	23
Soot	23	18
Iron Oxide	14	11
Other		
Pollen and Spores	1	1
Glass		
Total	127	100

GCA Filter No. 6416

Site: MARTINS FERRY Date: 1/2/78

36 Total Concentration - 9.6 Sulfates - 1.74 Nitrates = 24.7 Primary

Iron 0.44 $\mu g/m^3$ Arsenic 0.07 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	10	41
Combustion		
Flyash	5	20
Coal Fragments and Flyash	5	19
Soot	3	14
Iron Oxide	-	--
Other		
Pollen and Spores	2	6
Glass		
Total	25	100

GCA Filter No. 6412

Site: FOLLANSBEE Date: 1/14/78

73	-	12.0	-	1.48	=	59.5
Total Concentration		Sulfates		Nitrates		Primary

Iron — $\mu g/m^3$ Arsenic — $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	20	33
Combustion		
Flyash	16	27
Coal Fragments and Flyash	8	14
Soot	5	9
Iron Oxide	7	11
Other		
Pollen and Spores	4	6
Glass		
Total	60	100

GCA Filter No. 6429

Site: WEIRTON Date: 1/4/79

152	-	12 (est)	-	1.5 (est)	=	138.5
Total Concentration		Sulfates		Nitrates		Primary

Iron - $\mu g/m^3$ Arsenic - $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	22	16
Combustion		
Flyash	30	22
Coal Fragments and Flyash	36	26
Soot	18	13
Iron Oxide	31	22
Other		
Pollen and Spores	3	2
Glass		
Total	138	100

GCA Filter No. 6423

Site: STEUBENVILLE (ADAMS ST) Date: 2/8/78

37	-	9.0	-	3.7	=	24.3
Total Concentration		Sulfates		Nitrates		Primary

Iron 0.43 $\mu g/m^3$ Arsenic 0.017 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	9	38
Combustion		
Flyash	6	24
Coal Fragments and Flyash	6	24
Soot	2	10
Iron Oxide	-	--
Other		
Pollen and Spores	1	3
Glass	-	1
Total	24	100

GCA Filter No. 6414

Site: STEUBENVILLE (COURTHOUSE) Date: 2/7/78

178	-	44.5	-	1.7	=	131.8
Total Concentration		Sulfates		Nitrates		Primary

Iron 2.7 $\mu g/m^3$ Arsenic 0.03 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	33	25
Combustion		
Flyash	32	24
Coal Fragments and Flyash	49	37
Soot	12	9
Iron Oxide	6	5
Other		
Pollen and Spores		—
Glass		
Total	132	100

GCA Filter No. 6417

Site: MINGO JUNCTION Date: 2/7/78

57	-	13.0	-	0.77	=	43.2
Total Concentration		Sulfates		Nitrates		Primary

Iron 0.70 $\mu g/m^3$ Arsenic 0.12 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	16	36
Combustion		
Flyash	7	17
Coal Fragments and Flyash	16	36
Soot	2	4
Iron Oxide	2	6
Other		
Pollen and Spores		
Glass		
Stellate Hairs	—	1
Total	43	100

Note: Sample based on 10 hours of monitoring

GCA Filter No. 6411

Site: EAST LIVERPOOL (FIRE STATION) Date: 4/2/78

75 (Total Concentration) - 7.5 (Sulfates) - 1.45 (Nitrates) = 66.0 (Primary)

Iron 1.2 μg/m^3 Arsenic 0.02 μg/m^3

Classification	Weight (μg/m^3)	(% of Primary)
Minerals	16	24
Combustion		
Flyash	15	23
Coal Fragments and Flyash	12	18
Soot	9	14
Iron Oxide	5	7
Other		
Pollen and Spores	2	3
Glass	7	11
Total	66	100

GCA Filter No. 6409

Site: EAST LIVERPOOL (CITY HALL) Date: 4/2/78

52	-	6.7	-	1.74	=	43.6
Total Concentration		Sulfates		Nitrates		Primary

Iron 0.90 μg/m³ Arsenic 0.07 μg/m³

Classification	Weight (μg/m³)	(% of Primary)
Minerals	12	27
Combustion		
Flyash	10	23
Coal Fragments and Flyash	8	18
Soot	4	9
Iron Oxide	5	11
Other		
Pollen and Spores	3	6
Glass	3	6
Total	44	100

GCA Filter No. 6420

Site: POWHATTAN POINT   Date: 4/2/78

180	-	10.8	-	3.42	=	165.8
Total Concentration		Sulfates		Nitrates		Primary

Iron 3.78 $\mu g/m^3$ Arsenic 0.10 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	55	33
Combustion		
Flyash	36	22
Coal Fragments and Flyash	30	18
Soot	22	13
Iron Oxide	18	11
Burned Wood	3	2
Other		
Pollen and Spores	2	1
Glass		
Total	166	100

GCA Filter No. 6407

Site: CLARINGTON Date: 4/2/78

68	-	8.0	-	2.4	=	57.6
Total Concentration		Sulfates		Nitrates		Primary

Iron 1.05 μg/m³ Arsenic 0.03 μg/m³

Classification	Weight (μg/m³)	(% of Primary)
Minerals	19	32
Combustion		
Flyash	16	28
Coal Fragments and Flyash	5	9
Soot	8	14
Iron Oxide	6	11
Other		
Pollen and Spores	4	6
Glass		
Total	58	100

GCA Filter No. 6419

Site: NEW MANCHESTER Date: 4/8/78

38 (Total Concentration) − 4.4 (Sulfates) − 1.92 (Nitrates) = 31.7 (Primary)

Iron 0.8 $\mu g/m^3$ Arsenic 0.05 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	13	40
Combustion		
Flyash	6	18
Coal Fragments and Flyash	7	23
Soot	4	14
Iron Oxide	2	5
Other		
Pollen and Spores	—	—
Glass		
Total	32	100

GCA Filter No. 6418

Site: NEW CUMBERLAND Date: 4/8/78

169 (Total Concentration) - 6.5 (Sulfates) - 0.5 (Nitrates) = 162.0 (Primary)

Iron 2.2 μg/m³ Arsenic 0.07 μg/m³

Classification	Weight (μg/m³)	(% of Primary)
Minerals	45	28
Combustion		
Flyash	44	27
Coal Fragments and Flyash	29	18
Soot	15	9
Iron Oxide	19	12
Other		
Pollen and Spores	10	6
Glass		
Total	162	100

GCA Filter No. 6426

Site: TORONTO Date: 4/8/78

155 (Total Concentration) - 6.5 (Sulfates) - 3.05 (Nitrates) = 145.4 (Primary)

Iron 1.7 μg/m³ Arsenic 0.02 μg/m³

Classification	Weight (μg/m³)	(% of Primary)
Minerals	41	28
Combustion		
Flyash	48	33
Coal Fragments and Flyash	27	19
Soot	13	9
Iron Oxide	10	7
Burned Wood	3	2
Other		
Pollen and Spores	3	2
Glass		
Total	145	100

GCA Filter No. 6430

Site: WEIRTON Date: 4/8/78

208 (Total Concentration) - 10.4 (Sulfates) - 1.52 (Nitrates) = 196.1 (Primary)

Iron 5.93 $\mu g/m^3$ Arsenic 0.008 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	41	21
Combustion		
Flyash	59	30
Coal Fragments and Flyash	33	17
Soot	15	8
Iron Oxide	41	21
Other		
Pollen and Spores	6	3
Glass		
Total	196	100

GCA Filter No. 6424

Site: STEUBENVILLE (ADAMS ST) Date: 4/9/78

106	-	8.6	-	2.4	=	95
Total Concentration		Sulfates		Nitrates		Primary

Iron 2.83 μg/m^3 Arsenic 0.081 μg/m^3

Classification	Weight (μg/m^3)	(% of Primary)
Minerals	24	25
Combustion		
Flyash	24	25
Coal Fragments and Flyash	16	17
Soot	7	8
Iron Oxide	20	21
Burned Wood	1	1
Other		
Pollen and Spores	3	3
Glass		
Total	95	100

GCA Filter No. 3429

Site: NEW MANCHESTER Date: 4/26/78

67 Total Concentration − 5.2 Sulfates − 2.44 Nitrates = 59.4 Primary

Iron 1.36 $\mu g/m^3$ Arsenic 0.005 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	29	49
Combustion		
Flyash	8	13
Coal Fragments and Flyash	11	18
Soot	8	13
Iron Oxide	3	5
Burned Wood	—	1
Other		
Pollen and Spores	—	1
Glass		
Total	59	100

GCA Filter No. 6415

Site: STEUBENVILLE (COURT HOUSE) Date: 4/26/78

81	−	9.6	−	6.0	=	65.4
Total Concentration		Sulfates		Nitrates		Primary

Iron 1.98 $\mu g/m^3$ Arsenic 0.10 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	25	38
Combustion		
Flyash	12	18
Coal Fragments and Flyash	18	28
Soot	6	9
Iron Oxide	3	5
Other		
Pollen and Spores	1	2
Glass		
Total	65	100

GCA Filter No. 6413

Site: FOLLANSBEE Date: 4/26/78

Total Concentration		Sulfates		Nitrates		Primary
75	-	6.4	-	2.52	=	66.1

Iron 1.88 $\mu g/m^3$ Arsenic 0.08 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	24	37
Combustion		
Flyash	12	18
Coal Fragments and Flyash	15	22
Soot	6	9
Iron Oxide	7	11
Other		
Pollen and Spores	2	3
Glass		
Total	66	100

GCA Filter No. 6406

Site: BRILLIANT Date: 4/26/78

95	-	7.2	-	3.68	=	84.1
Total Concentration		Sulfates		Nitrates		Primary

Iron 1.92 $\mu g/m^3$ Arsenic 0.04 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	34	40
Combustion		
Flyash	15	18
Coal Fragments and Flyash	16	19
Soot	8	9
Iron Oxide		
Other		
Pollen and Spores	2	3
Glass	9	11
Total	84	100

GCA Filter No. 3663

Site: MINGO JCT Date: 4/26/78

177 Total Concentration - 7 (est) Sulfates - 2.5 (est) Nitrates = 167.5 Primary

Iron - $\mu g/m^3$ Arsenic - $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	40	24
Combustion		
Flyash	30	18
Coal Fragments and Flyash	38	18
Soot	23	14
Iron Oxide	18	11
Burned Wood	2	1
Other		
Pollen and Spores	5	3
Glass	0	0
Cellulose Fibers	2	1
Carbon	8	5
Total	167	100

GCA Filter No. 3417

Site: WELLSBURG Date: 4/26/80

140	- 7 (est)	- 2.5 (est)	= 130.5
Total Concentration	Sulfates	Nitrates	Primary

Iron - $\mu g/m^3$ Arsenic - $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	31	24
Combustion		
Flyash	23	18
Coal Fragments and Flyash	23	18
Soot	23	18
Iron Oxide	14	11
Fine Carbonaceous Material	6	5
Other		
Pollen and Spores	4	3
Glass	4	3
Total	131	100

GCA Filter No. 6422

Site: SHADYSIDE Date: 7/25/78

72 (Total Concentration) - 17.4 (Sulfates) - 3.78 (Nitrates) = 50.8 (Primary)

Iron 1.2 $\mu g/m^3$ Arsenic 0.06 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	15	29
Combustion		
Flyash	15	29
Coal Fragments and Flyash	10	19
Soot	5	10
Iron Oxide	3	5
Burned Wood	—	1
Other		
Pollen and Spores	3	6
Glass		
Starch	—	1
Total	51	100

GCA Filter No. 6421

Site: POWHATTAN POINT Date: 7/25/78

179	-	23.0	-	1.52	=	154.5
Total Concentration		Sulfates		Nitrates		Primary

Iron 1.12 $\mu g/m^3$ Arsenic 0.28 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	39	25
Combustion		
Flyash	28	18
Coal Fragments and Flyash	65	42
Soot	14	9
Iron Oxide	8	5
Other		
Pollen and Spores	—	—
Glass		
Starch	—	—
Total	154	100

Note: Sample based on only 5 hours of monitoring

GCA Filter No. 6408

Site: CLARINGTON Date: 7/25/78

35	-	12.0	-	3.54	=	19.5
Total Concentration		Sulfates		Nitrates		Primary

Iron 0.66 $\mu g/m^3$ Arsenic 0.02 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	5	25
Combustion		
Flyash	5	24
Coal Fragments and Flyash	5	24
Soot	3	14
Iron Oxide	1	7
Other		
Pollen and Spores	1	6
Glass		
Total	20	100

GCA Filter No. 6427

Site: WELLSVILLE Date: 9/11/78

269	-	24.3	-	2.5	=	232.2
Total Concentration		Sulfates		Nitrates		Primary

Iron 3.4 $\mu g/m^3$ Arsenic 0.03 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	76	33
Combustion		
Flyash	44	19
Coal Fragments and Flyash	53	23
Soot	42	18
Iron Oxide	12	5
Other		
Pollen and Spores	5	2
Glass		
Total	232	100

GCA Filter No. 6410

Site: EAST LIVERPOOL (CITY HALL) Date: 9/17/78

175 (Total Concentration) − 23.4 (Sulfates) − 2.4 (Nitrates) = 149.2 (Primary)

Iron 1.32 $\mu g/m^3$ Arsenic 0.04 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	43	29
Combustion		
Flyash	43	29
Coal Fragments and Flyash	28	19
Soot	15	10
Iron Oxide	8	5
Other		
Pollen and Spores	9	6
Glass	3	2
Total	149	100

GCA Filter No. 6428

Site: WELLSVILLE Date: 9/17/78

93	-	27.6	-	3.3	=	62.1
Total Concentration		Sulfates		Nitrates		Primary

Iron 1.2 $\mu g/m^3$ Arsenic 0.06 $\mu g/m^3$

Classification	Weight ($\mu g/m^3$)	(% of Primary)
Minerals	19	31
Combustion		
Flyash	17	28
Coal Fragments and Flyash	16	25
Soot	6	10
Iron Oxide	-	-
Other		
Pollen and Spores	4	6
Glass	-	-
Total	62	100

GCA 3422, Weirton (Fire Station), 138 μg/m^3

The combustion product particulate shows a wide range in grain size probably representing a coking or steelmaking source rather than a utility boiler.

Composition

Phase	Weight percent
Rubber particles	10
Flyash (coal particulate)*	50
Bituminous coal (highly angular fragments)	25
Quartz, carbonate and rare gypsum laths	10
Biological (spores)	5

*Includes some irregular soot particles.

CUMULATIVE FREQUENCY DISTRIBUTION

	Particle size (μm)							
	1	3	5	10	15	20	25	50
	Percent (less than)							
Coal								
	60	65	70	85	90	95	95	100
	-	55	55	60	75	80	90	100
	60	65	65	70	85	90	100	100
	-	60	70	75	85	90	95	100
	-	60	65	70	80	90	95	100
avg.	-	61	65	72	83	89	95	100
Flyash								
	90	95	95	100	100			
	60	65	80	85	100			
	70	80	85	95	100			
	70	75	80	100	100			
	75	75	80	90	100			
avg.	73	78	84	94	100			
Soot								
	80	80	85	95	100	100		
	-	70	75	95	100	100		
	-	75	80	90	95	100		
	-	80	90	100	100	100		
	-	75	85	95	100	100		
avg.	-	76	83	95	99	100		

Notes: Largest particles sized: coal = 45 μm; flyash = 15.5 μm; soot = 15.0 μm.

GCA 3662, Mingo Junction, 141 μg/m^3

Uniformly small grain size of opaque particulate possibly represents a source from a utility boiler using crushed coal. Grain size relatively smaller than GCA 3663.

Composition

Phase	Weight Percent
Coal flyash (including soot)	50
Bituminous coal (pulverized feed)	10
Carbonate (fine-grained euhedral)	
feldspar (very fine grained)	
quartz (minor of three minerals)	10
Biological (spores)	30

CUMULATIVE FREQUENCY DISTRIBUTION

	Particle size (μm)							
	1	3	5	10	15	20	25	50
	Percent (less than)							
Coal								
	90	90	95	95	100	100	100	100
	-	70	75	80	90	90	95	100
	70	75	85	95	100	100	100	100
	80	85	90	100	100	100	100	100
	75	80	85	100	100	100	100	100
avg.	-	80	86	94	98	98	99	100
Flyash								
	80	80	85	100	100			
	75	80	90	95	100			
	90	95	95	100	100			
	95	95	100	100	100			
	80	80	85	100	100			
avg.	84	86	91	99	100			
Soot								
	70	80	85	95	100	100		
	-	80	90	100	100	100		
	-	75	80	90	95	100		
	80	85	90	100	100	100		
	85	85	90	95	100	100		
avg.	-	81	87	96	99	100		

Notes: Largest particle sized: coal fragments = 50 μm; flyash = 14 μm; soot = 17 μm.

GCA 3645, Clarington, 148 μg/m^3

Hi-vol filter a uniform light gray reflecting the extremely fine grain size of all particulate. Overall, combustion products comprise about 15 to 25 percent of the filter and the remainder is mostly biological matter.

Composition

Phase	Weight percent
Coal (unburned)	10
Soot	10
Coal flyash	5
Carbonate (very fine-grained)	10
Biological	65

CUMULATIVE FREQUENCY DISTRIBUTION

	Particle size (μm)					
	1	3	5	10	15	20
	Percent (less than)					
Coal						
	75	85	95	100	100	
	-	50	70	90	100	
	60	75	80	95	100	
	70	80	95	100	100	
	-	75	90	100	100	
avg.	-	73	86	97	100	
Flyash						
	85	90	95	100		
	80	90	95	100		
	90	95	100	100		
	85	95	95	100		
	85	90	100	100		
avg.	85	92	97	100		
Soot						
	80	80	95	100	100	
	50	60	70	100	100	
	75	80	95	100	100	
	60	70	85	95	100	
	-	70	90	95	100	
avg.	-	72	87	98	100	

Notes: Largest particle sized: coal fragments = 14 μm; flyash = 7 μm; soot = 12 μm.

GCA 3417, Wellsburg (State Road Yard), 140 μg/m^3

Filter is very similar to filter from Brilliant (GCA 3642) and Mingo Junction (GCA 3662 and 3663).

Composition

Phase	Weight percent
Bituminous coal particulate	40
Coal flyash (spherical)	5
Glassy (isotropic) spheres	10
Feldspar laths and quartz	5
Biological particulate (spores)	40

CUMULATIVE FREQUENCY DISTRIBUTION

	Particle size (μm)							
	1	3	5	10	15	20	25	50
	Percent (less than)							
Coal								
	65	65-70	70	75	85	85	90	95*
	50	55	65	70	85	90	95	100
	40	45	50	70	80	85	90	100
	60	65	85	90	95	100	100	100
	55	60	70	80	90	95	100	100
avg.	54	58	68	77	87	91	95	99
*100 percent of material is below 60 μm.								
Flyash								
	85	90	100	100				
	90	95	100	100				
	90	95	100	100				
	75	80	95	100				
	80	80	85	100				
avg.	84	88	96	100				
Soot								
	-	60	75	80	90	95	95	100
	50	55	70	75	85	90	95	100
	-	40	50	75	95	95	95	100
	-	40	50	80	85	95	100	100
	50	50	60	75	90	95	100	100
avg.	-	49	61	77	89	94	97	100

Notes: Largest particle sized: coal = 55.5 μm; flyash = 10.5 μm; soot = 29.5 μm.

GCA 3652, East Liverpool, Fire Station, 130 $\mu g/m^3$

Coal particles show considerable clumping and aggregation on filter. May be due to condensation on larger liquid droplets (rain?).

Composition

Phase	Weight percent
Bituminous coal flyash	30
Coal (bituminous) particles	25
Glassy (vitreous) flyash	15
Carbonate (very fine-grained)	15
Biological (spores)	15

CUMULATIVE FREQUENCY DISTRIBUTION

	Particle size (μm)							
	1	3	5	10	15	20	25	50
	Percent (less than)							
Coal	–	50	55	85	90	95	95	100
	70	75	75	80	95	95	100	100
	–	60	65	75	90	90	95	100
	60	60	65	70	85	90	90	95*
	65	65	70	80	85	100	100	100
avg.	–	62	66	78	89	94	96	99
Flyash	60	70	75	85	90	95	100	
	65	70	80	85	100	100	100	
	75	80	90	90	95	100	100	
	65	70	75	85	100	100	100	
	70	75	80	95	100	100	100	
avg.	67	73	80	88	97	99	100	
Soot	60	75	80	95	100	100		
	50	55	75	80	95	100		
	75	75	80	95	100	100		
	–	65	70	80	100	100		
	–	70	75	85	95	100		
avg.	–	68	76	87	98	100		

*100 percent of all coal particles in this field are below.

Notes: Largest particle sized: coal = 51.5 μm; flyash = 20.5 μm; soot = 17.0 μm.

GCA 3663, Mingo Junction, 177 μg/m³

Filter dominated by particulate from combustion sources. Carbonate from terrigenous sources. Many of the coal particles are unburned. Combustion products show great variation in size suggesting a steel mill or related industry as source rather than a utility boiler.

Composition

Phase	Weight percent
Bituminous coal fragments	50
Carbonate (fine-grained, well-formed crystals)	20
Quartz	10
Glassy flyash	10
Soot	10

CUMULATIVE FREQUENCY DISTRIBUTION

	Particle size (μm)							
	3	5	10	15	20	25	30	50
	Percent (less than)							
Coal	80	100	100	100	100	100	100	100
	20	50	80	95	100	100	100	100
	60	80	85	85	85	90	90	100
	50	80	85	90	90	100	100	100
	50	50	90	95	100	100	100	100
	50	50	90	90	100	100	100	100
	40	40	75	90	100	100	100	100
	40	50	85	90	95	100	100	100
	60	80	80	100	100	100	100	100
	60	80	90	95	100	100	100	100
avg.	51	66	86	93	97	99	99	100
Flyash	80	90	90	95	100			
	90	95	100	100	100			
	90	90	95	95	100			
	95	100	100	100	100			
	80	90	100	100	100			
	80	85	90	100	100			
	70	80	85	90	100			
	75	90	100	100	100			
	90	100	100	100	100			
	80	90	95	100	100			
avg.	83	91	95	98	100			

(continued)

	Particle size (μm)					
	3	5	10	15	20	25
	Percent (less than)					
Soot						
	75	80	85	90	95	100
	80	80	95	100	100	100
	50	50	80	100	100	100
	30	30	80	95	100	100
	30	30	80	80	95	100
avg.	53	54	84	93	98	100

GCA 3413, Moundsville, 173 μg/m^3

Fine grain size of combustion products indicates a pulverized feed source for the coal.

Composition

Phase	Weight percent
Biological (spores)	20
Coal (bituminous) fragments, highly angular	30
Coal flyash (spherical)	30
Wood fiber	trace
Quartz	10
Carbonate	10

CUMULATIVE FREQUENCY DISTRIBUTION

	Particle size (μm)							
	1	3	5	10	15	20	25	50
	Percent (less than)							
Coal								
	-	45	50	65	80	80	85	100
	-	50	70	75	75	80	90	100
	50	55	65	70	85	90	100	100
	50	55	60	75	80	85	100	100
	-	50	60	75	80	90	95	100
avg.	-	51	61	72	80	85	94	100
Flyash								
	60	65	65	95	100	100		
	-	30	55	95	95	100		
	65	70	75	90	100	100		
	60	65	70	95	100	100		
	-	60	80	90	95	100		
avg.	-	58	69	93	98	100		
Soot								
	-	40	55	80	80	80	100	
	-	50	55	75	80	100	100	
	-	45	50	75	85	95	100	
	-	60	70	75	95	100	100	
	50	75	80	100	100	100	100	
avg.	-	54	62	81	88	95	100	

Notes: Largest particle sized: coal = 48 μm; flyash = 16.5 μm; soot = 23.5 μm.

GCA 3431, Steubenville (Adams), 141 μg/m^3

Heavy industrial source(s) nearby plus some "urban" (tire rubber) contribution.

Composition

Phase	Weight percent
Biological (spores)	50
Rubber particles	10
Coal (bituminous) particles	20
Rounded slag particles (glass) nonmagnetic	10
Coal flyash	5
Soot	5

CUMULATIVE FREQUENCY DISTRIBUTION

	Particle size (μm)							
	1	3	5	10	15	20	25	50
	Percent (less than)							
Coal	-	55	70	85	85	90	100	100
	-	55	60	80	85	95	95	100
	-	50	60	65	70	80	95	100
	55	60	70	75	90	100	100	100
	50	55	60	75	80	90	90	95*
avg.	-	55	64	76	82	91	96	99
*All particles below 60 μm.								
Flyash	65	70	85	90	100			
	70	75	85	100	100			
	60	70	90	100	100			
	70	80	95	100	100			
	65	70	85	95	100			
avg.	66	73	88	97	100			
Soot	-	60	75	80	90	95	100	100
	55	60	70	75	85	90	95	100
	60	65	70	80	85	95	100	100
	50	65	70	75	90	95	100	100
	50	65	70	80	90	100	100	100
avg.	-	63	71	78	88	95	99	100

(continued)

Notes: Largest particle sized: coal = 58 μm; flyash = 13 μm; soot = 29.5 μm.

Additional material that may be a combustion product is seen as an orange-colored, isotropic, angular to sub-angular particulate. Very small percentage of these particles. Rough site distribution of the few particles seen is:

(Less than size stated)

10	15	20	25	40	60	(μm)
50	60	70	95	95	100	(percent)

GCA 3642, Brilliant, 203 μg/m^3

Particles similar to that found in Mingo Junction filters. Overall, there seems to be a high concentration of combustion products from the Brilliant-Mingo Junction area. Particulate from these areas is highly angular, with large variation in grain size and much coarser generally. Probable that source is from adjacent steelmaking operations.

Composition

Phase	Weight percent
Coal (bituminous) particles	30
Coal flyash	20
Glassy flyash (incinerator?)	20
Iron oxide particles	Less than 0.5
Slag particles	Trace
Biological particles	30

CUMULATIVE FREQUENCY DISTRIBUTION

	Particle size (μm)								
	1	3	5	10	15	20	25	50	110
	Percent (less than)								
Coal	45	50	65	70	80	95	95	100	100
	40	50	55	70	80	85	90	95	100
	30	40	60	75	75	85	95	100	100
	45	50	65	70	80	85	95	100	100
	50	55	65	70	85	85	95	100	100
avg.	42	49	62	71	80	87	94	99	100
Flyash	70	75	75	85	95	100			
	60	65	80	85	95	100			
	70	75	75	80	100	100			
	50	65	75	100	100	100			
	65	70	80	85	95	100			
avg.	63	70	77	87	97	100			
Soot	45	50	55	70	80	90	95	100	
	-	60	65	75	80	90	100	100	
	-	50	60	65	80	85	100	100	
	-	50	60	70	75	90	95	100	
	50	55	65	70	75	85	90	100	
avg.	-	53	61	70	78	88	96	100	

Notes: Largest particles sized: coal = 107 μm; flyash = 18 μm; soot = 46 μm; iron oxide* = 16 μm.

*Iron oxide particles were only rarely seen, most are probably less than 5 μm.

GCA 3659, Martins Ferry, 146 μg/m^3

Composition

Phase	Weight percent
Coal (bituminous) particles	30
Coal flyash	30
Glassy flyash	20
Carbonate	5
Quartz	5
Biological particles	10

Mineral particles all less than 1 μm

CUMULATIVE FREQUENCY DISTRIBUTION

	Particle size (μm)						
	3	5	10	15	20	25	50
	Percent (less than)						
Coal fragments							
	–	75	80	90	95	100	100
	40	55	65	80	85	85	100
	–	60	65	75	80	85	100
	50	60	65	75	85	100	100
	50	55	75	80	85	85	100
avg.	–	61	70	80	86	91	100
Coal flyash							
	75	80	85	90	100	100	
	–	75	80	100	100	100	
	50	65	70	90	95	100	
	60	75	80	90	100	100	
	70	75	85	90	95	100	
avg.	–	74	80	92	98	100	
Glassy flyash							
	75	75	75	80	90	100	
	–	60	75	80	80	100	
	–	50	65	75	85	100	
	–	75	80	90	100	100	
	–	60	70	75	80	100	
avg.	–	64	73	80	87	100	

(continued)

	Particle size (μm)						
	3	5	10	15	20	25	50
	Percent (less than)						
<u>Soot</u>							
	-	75	80	80	75	85	100
	-	30	30	35	60	100	100
	-	35	50	60	60	80	100
	-	50	60	65	80	85	100
	-	40	50	60	75	90	100
avg.	-	46	54	60	72	88	100

Notes: Largest particle sized: coal fragments = 48 μm; coal flyash = 23 μm; glassy flyash = 26 μm; soot = 41 μm.

TABLE 3. SUMMARY OF PHASE COMPOSITION AND PARTICLE SIZE DATA

Date	Location	Concentration ($\mu g/m^3$)	Phase: Coal particulate Weight (%)	Coal particulate 90 percentile (μm)	Flyash Weight (%)	Flyash 90 percentile (μm)	Soot Weight (%)	Minerals Weight (%)	Biologicals Weight (%)	Rubber Weight (%)
21 March 1978	Weirton	138	25	20	50	8.5	-	10	5	10
21 March 1978	Mingo Junction	141	10	7	50	4.5	-	10	30	-
21 March 1978	Clarington	148	10	6	5	2.5	10	10	65	-
26 April 1978	Wellsburg	140	40	18	15	3.5	-	5	40	-
26 April 1978	E. Liverpool (F.S.)	130	25	16	45	10.5	-	15	15	-
26 April 1978	Mingo Junction	177	50	12	10	5.5	10	30	-	-
1 June 1978	Moundsville	123	30	23	30	8.5	-	20	20	-
1 June 1978	Steubenville	141	20	19	15	5.5	5	-	50	10
1 June 1978	Brilliant	203	30	22	40	11.0	-	-	30	-
1 June 1978	Martins Ferry	146	30	24	50	18.0	-	10	10	-

BRILLIANT 1/2/78 43 µg/m³

GCA/TECHNOLOGY DIVISION ●●▲

HI-VOL FILTER ANALYSIS SHEET

Sample: 6405 **Date:** 4-1-80 **Analyst:** S. Branchetti

Component	Vol. %	Wt. %	Size Range (in µm) and Remarks
MINERALS			
Quartz	5	6	
Calcite	20	23	1.0-21.0 µm
Gypsum			
Feldspar			
Clay			
Mica:			
~~Other:~~ glass	<5	4	
COMBUSTION PRODUCTS			
Spherical Flyash	10	9	1.5-11.0 µm
Irregular, Lacy Flyash	15	14	2.0-42.0 µm
Coal Fragments & Flyash	25	24	1.0-26.0 µm
Soot (oil or other)	10	9	2.5-56.0 µm
Burned Wood			
Iron Oxide	<5	5	
BIOLOGICAL			
Pollen and Spores	10	6	1.0-10.0 µm
Stellate Hairs	TRACE	-	
Cellulose Fibers	TRACE	-	
Starch	TRACE	-	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

M... ..ERRY 1/2/7? 36... /...

GCA/TECHNOLOGY DIVISION

HI–VOL FILTER ANALYSIS SHEET

Sample: 6416	Date: 4-3-80	Analyst: [illegible signature]

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz			
Calcite	35	41	2.0 - 12.9 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	10	10	2.5 - 20.0 μm
Irregular, Lacy Flyash	10	10	2.0 - 25.0 μm
Coal Fragments & Flyash	20	19	1.0 - 34.4 μm
Soot (oil or other)	15	14	6.5 - 17.5 μm
Burned Wood			
Iron Oxide	TRACE	–	
BIOLOGICAL			
Pollen and Spores	10	6	3.0 - 17.2 μm
Stellate Hairs			
Cellulose Fibers	TRACE	–	
Starch	TRACE	–	
Insect Parts	TRACE	–	
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

WEIRTON 1/14/73

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6429 | Date: 4 16 80 | Analyst: [illegible signature]

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz			
Calcite	15	16	1.0 - 15.0 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	10	7	2.0 - 24.0 μm
Irregular, Lacy Flyash	15	13	20 - 107.0 μm
Coal Fragments & Flyash	30	26	1.5 - 47.0 μm
Soot (oil or other)	15	13	4.0 - 30.0 μm
Burned Wood			
Iron Oxide	10	22	1 - 4.0 μm
BIOLOGICAL			
Pollen and Spores	5	2	
Stellate Hairs			
Cellulose Fibers	Trace	–	
Starch	Trace	–	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

Follansbee 1/4/76 43 μg/m³

OCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6412 | Date: 4-2-80 | Analyst: J. Bianchetti

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	TRACE	-	
Calcite	30	33	1.1 - 15.0 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	20	18	3.3 - 21.0 μm
Irregular, Lacy Flyash	10	9	2.0 - 81.0 μm
Coal Fragments & Flyash	15	14	2.0 - 77.0 μm
Soot (oil or other)	10	9	3.0 - 28.0 μm
Burned Wood			
Iron Oxide	5	11	
BIOLOGICAL			
Pollen and Spores	10	6	2.2 - 15.0 μm
Stellate Hairs	TRACE	-	
Cellulose Fibers	TRACE	-	
Starch	TRACE	-	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

STEUBENVILLE (ADAMS STA.) 2/8/7? 47 μg/m³

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6423 **Date:** 4-14-80 **Analyst:** J. Bianchetti

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	<5	3	
Calcite	25	29	1.0 - 11.0 μm
Gypsum			
Feldspar			
Clay	5	6	
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	15	14	3.0 - 28.0 μm
Irregular, Lacy Flyash	10	10	2.0 - 30.0 μm
Coal Fragments & Flyash	25	24	2.0 - 35.0 μm
Soot (oil or other)	10	10	3.0 - 40.0 μm
Burned Wood			
Iron Oxide	TRACE	-	
BIOLOGICAL			
Pollen and Spores	5	3	
Stellate Hairs			
Cellulose Fibers	TRACE		
Starch	<5	1	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

(STEUBENVILLE) 178 µg/m³

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6414 | Date: 4380 | Analyst: [illegible signature]

Component	Vol. %	Wt. %	Size Range (in µm) and Remarks
MINERALS			
Quartz	<5	2	
Calcite	20	23	2.1 - 25.8 µm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	5	5	
Irregular, Lacy Flyash	20	19	5.0 - 27.9 µm
Coal Fragments & Flyash	40	37	6.5 - 43.0 µm
Soot (oil or other)	10	9	4.0 - 34.0 µm
Burned Wood			
Iron Oxide	<5	5	
BIOLOGICAL			
Pollen and Spores	TRACE	-	
Stellate Hairs			
Cellulose Fibers	TRACE	-	
Starch	TRACE	-	
Insect Parts (Wing)	TRACE	-	
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

MINGO JUNCTION 2/7/78 57 µg/m³

GCA/TECHNOLOGY DIVISION ●●▲

HI-VOL FILTER ANALYSIS SHEET

Sample: 6417 **Date:** 4-4-80 **Analyst:** S L Brunetti

Component	Vol. %	Wt. %	Size Range (in µm) and Remarks
MINERALS			
Quartz	5	5	
Calcite	30	31	2.2 - 17.0 µm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	5	4	
Irregular, Lacy Flyash	15	13	6.5 - 43.0 µm
Coal Fragments/Flyash	35	36	2.0 - 51.0 µm
Soot (oil or other)	5	4	
Burned Wood			
Iron Oxide	<5	6	
BIOLOGICAL			
Pollen and Spores	TRACE	—	
Stellate Hairs	<5	1	
Cellulose Fibers	TRACE	-	
Starch	TRACE	-	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6411 | Date: 4-2-80 | Analyst: [illegible signature]

Component	Vol. %	Wt. %	Size Range (in µm) and Remarks
MINERALS			
Quartz	<5	2	
Calcite	20	22	1.1-12.5 µm
Gypsum			
Feldspar			
Clay			
Mica:			
~~Other:~~ Glass	10	11	2.0-19.0 µm
COMBUSTION PRODUCTS			
Spherical Flyash	15	14	2.5-13.0 µm
Irregular, Lacy Flyash	10	9	2.0-43.0 µm
Coal Fragments & Flyash	20	18	1.1-30.0 µm
Soot (oil or other)	15	14	1.5-28.0 µm
Burned Wood			
Iron Oxide	<5	7	
BIOLOGICAL			
Pollen and Spores	5	3	
Stellate Hairs	TRACE		
Cellulose Fibers	TRACE		
Starch	TRACE		
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

EAST LIVERMORE (CITY HALL) 4/2/7? 58 µg/m³

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6409 **Date:** 4-2-80 **Analyst:** S. Bianchetti

Component	Vol. %	Wt. %	Size Range (in µm) and Remarks
MINERALS			
Quartz	TRACE		
Calcite	25	27	1.0 - 9.0 µm
Gypsum			
Feldspar			
Clay			
Mica:			
~~Other:~~ Glass	5	6	
COMBUSTION PRODUCTS			
Spherical Flyash	10	9	1.0 - 11.0 µm
Irregular, Lacy Flyash	15	14	3.0 - 26.0 µm
Coal Fragments (Flyash)	20	18	2.2 - 39.0 µm
Soot (oil or other)	10	9	2.0 - 34.0 µm
Burned Wood			
Iron Oxide	5	11	
BIOLOGICAL			
Pollen and Spores	10	6	1.6 - 13.0 µm
Stellate Hairs			
Cellulose Fibers	TRACE		
Starch	TRACE	-	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles	TRACE	-	
Auto Emissions			

P..HATTAN Pt NT 4/2/[illegible] 150 μg/m³

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6420 | Date: 4-4-80 | Analyst: S. Branchetti

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	<5	1	
Calcite	30	32	1.0 - 22.0 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	15	13	2.0 - 13.0 μm
Irregular, Lacy Flyash	10	9	4.0 - 36.0 μm
Coal Fragments & Flyash	20	18	2.0 - 65.0 μm
Soot (oil or other)	15	13	3.0 - 43.0 μm
Burned Wood	<5	2	
Iron Oxide	5	11	
BIOLOGICAL			
Pollen and Spores	<5	1	
Stellate Hairs			
Cellulose Fibers	TRACE	-	
Starch	TRACE	-	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

(illegible) 4/2/7(illegible) 6(illegible)

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6407 | **Date:** 4-1-80 | **Analyst:** [illegible signature]

Component	Vol. %	Wt. %	Size Range (in µm) and Remarks
MINERALS			
Quartz	5	5	
Calcite	25	27	1.0 - 30.0 µm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	15	14	1.0 - 22.0 µm
Irregular, Lacy Flyash	15	14	2.0 56.0 µm
Coal Fragments & Flyash	10	9	1.5 - 17.0 µm
Soot (oil or other)	15	14	2.5 - 28.0 µm
Burned Wood	TRACE	--	
Iron Oxide	5	11	
BIOLOGICAL			
Pollen and Spores	10	6	1.5 34.0 µm
Stellate Hairs			
Cellulose Fibers	TRACE	--	
Starch			
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

[illegible] 4/9/76 43 µg/m³

OCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6424 | Date: 4-14-80 | Analyst: [illegible signature]

Component	Vol. %	Wt. %	Size Range (in µm) and Remarks
MINERALS			
Quartz			
Calcite	25	25	
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	20	17	1.0 - 22.0 µm.
Irregular, Lacy Flyash	10	8	3.0 - 43.0 µm
Coal Fragments [illegible]	20	17	1.0 - 42.0 µm
Soot (oil or other)	10	8	2.0 28.0 µm
Burned Wood	<5	1	
Iron Oxide	10	21	1.0 40 µm
BIOLOGICAL			
Pollen and Spores	<5	3	
Stellate Hairs			
Cellulose Fibers	TRACE		
Starch			
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

WILSON 4/6/70 208 μg/m³

QCA/TECHNOLOGY DIVISION ●●▲

HI-VOL FILTER ANALYSIS SHEET

Sample: 6430 **Date:** 4-16-80 **Analyst:** S.J. Branchetti

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz			
Calcite	20	21	1.0 - 30.0 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	20	17	2.0 - 33.0 μm
Irregular, Lacy Flyash	15	13	2.0 - 69.0 μm
Coal Fragments & [illegible]	20	17	1.0 - 58.0 μm
Soot (oil or other)	10	8	3.0 - 33.0 μm
Burned Wood			
Iron Oxide	10	21	1.0 - 5.0 μm
BIOLOGICAL			
Pollen and Spores	5	3	
Stellate Hairs			
Cellulose Fibers	TRACE	—	
Starch			
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

[illegible] μg/m³

OCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6419	Date: 4-4-80	Analyst: [signature]

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	<5	2	
Calcite	35	38	10 - 12.9 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	10	9	1.5 - 20.0 μm
Irregular, Lacy Flyash	10	9	2.0 - 27.9 μm
Coal Fragments / Flyash	25	23	2.2 - 25.0 μm
Soot (oil or other)	15	14	4.4 - 26.0 μm
Burned Wood			
Iron Oxide	<5	5	
BIOLOGICAL			
Pollen and Spores	Trace	–	
Stellate Hairs			
Cellulose Fibers	Trace	–	
Starch	Trace		
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

NEW CUMBERLAND 4/18/78 169 µg/m³

OCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6418 | **Date:** 4-4-80 | **Analyst:** [illegible] Blanchette

Component	Vol. %	Wt. %	Size Range (in µm) and Remarks
MINERALS			
Quartz			
Calcite	25	28	1.0 - 8.6 µm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	20	18	2.0 - 19.0 µm
Irregular, Lacy Flyash	10	9	5.0 - 98.0 µm
Coal Fragments & Flyash	20	18	1.0 - 23.7 µm
Soot (oil or other)	10	9	4.4 107.0 µm
Burned Wood			
Iron Oxide	5	12	
BIOLOGICAL			
Pollen and Spores	10	6	2.0 - 21.0 µm
Stellate Hairs			
Cellulose Fibers	TRACE	—	
Starch			
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

'ar... Fe ... ./. / /   153 μg/m³

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6426 | **Date:** 4-15-80 | **Analyst:** [signature]

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	TRACE	-	
Calcite	25	28	1.0 - 30.0 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	25	24	1.0 - 39.0 μm
Irregular, Lacy Flyash	10	9	2.0 - 64.0 μm
Coal Fragments & Flyash	20	19	4.0 86.0 μm
Soot (oil or other)	10	9	2.5 - 28.0 μm
Burned Wood	<5	2	
Iron Oxide	<5	7	
BIOLOGICAL			
Pollen and Spores	5	2	
Stellate Hairs			
Cellulose Fibers	TRACE	-	
Starch			
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

Milwaukee 4/26/77 64 μ

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 3429 **Date:** 4 16 80 **Analyst:** [illegible signature]

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz			
Calcite	20	22	1.0 - 17.0 μm
Gypsum			
Feldspar			
Clay	25	27	2.0 - 43.0 μm
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	5	4	
Irregular, Lacy Flyash	10	9	3.0 - 39.0 μm
Coal Fragments & Flyash	20	18	2.0 - 49.0 μm
Soot (oil or other)	15	13	4.0 - 86.0 μm
Burned Wood	<5	1	
Iron Oxide	<5	5	
BIOLOGICAL			
Pollen and Spores	<5	1	
Stellate Hairs			
Cellulose Fibers	Rare	--	
Starch			
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

(Steubenville) 4/26/78 81μg/m³

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6415 | Date: 4-3-80 | Analyst: J.J. Bianchetti

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	5	5	
Calcite	30	33	1.0 - 27.0 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	10	9	3.0 - 21.0 μm
Irregular, Lacy Flyash	10	9	3.3 - 47.0 μm
Coal Fragments & Flyash	30	28	1.5 - 26.0 μm
Soot (oil or other)	10	9	3.3 - 43.0 μm
Burned Wood			
Iron Oxide	<5	5	
BIOLOGICAL			
Pollen and Spores	<5	2	
Stellate Hairs			
Cellulose Fibers	Trace		
Starch	Trace		
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6413 | **Date:** 4-3-80 | **Analyst:** [illegible]

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	5	5	
Calcite	30	32	2.1 12.9 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	10	9	5.5 - 15.4 μm
Irregular, Lacy Flyash	10	9	6.0 40.8 μm
Coal Fragments, Flyash	25	22	4.0 - 39.0 μm
Soot (oil or other)	10	9	4.4 - 17.0 μm
Burned Wood			
Iron Oxide	5	11	
BIOLOGICAL			
Pollen and Spores	5	3	
Stellate Hairs			
Cellulose Fibers	TRACE	-	
Starch	TRACE	-	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

BRILLIANT 4/26/79 95 μg/m³

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6406 | **Date:** 4-1-80 | **Analyst:** S. J. Bianchetti

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	5	6	
Calcite	30	34	1.0 - 21.0 μm
Gypsum	TRACE	-	
Feldspar			
Clay			
Mica:			
~~Other~~: Glass	10	11	2.5 - 15.0 μm
COMBUSTION PRODUCTS			
Spherical Flyash	10	9	2.5 - 12.0 μm
Irregular, Lacy Flyash	10	9	2.0 - 34 μm
Coal Fragments & Flyash	20	19	2.5 - 21.0 μm
Soot (oil or other)	10	9	3.3 - 30.0 μm
Burned Wood	TRACE	-	
Iron Oxide		-	
BIOLOGICAL			
Pollen and Spores	5	3	
Stellate Hairs			
Cellulose Fibers	TRACE	-	
Starch			
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 3663	Date: 5-28-80	Analyst: [illegible signature]

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	<5	2	
Calcite	20	22	
Gypsum	T	-	
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	10	9	
Irregular, Lacy Flyash	10	9	
Coal Fragments & Flyash	25	23	
Soot (oil or other)	15	14	
Burned Wood	<5	1	
Iron Oxide	5	11	
BIOLOGICAL			
Pollen and Spores	5	3	
Stellate Hairs			
Cellulose Fibers	<5	1	
Starch			
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			
[illegible] carbonaceous material	5	5	

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 3417 | **Date:** 5-28-80 | **Analyst:** J. Bianchetti

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	<5	2	
Calcite	20	22	
Gypsum			
Feldspar			
Clay			
Mica:			
~~Other~~: Glass	<5	3	
COMBUSTION PRODUCTS			
Spherical Flyash	10	9	
Irregular, Lacy Flyash	10	9	
Coal Fragments & Flyash	20	18	
Soot (oil or other)	20	18	
Burned Wood			
Iron Oxide	5	11	
BIOLOGICAL			
Pollen and Spores	5	3	
Stellate Hairs			
Cellulose Fibers	T	–	
Starch	T	–	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			
Fine carbonaceous material	5	5	

CH OUTSIDE 7/12 1:12 12 ...

GCA/TECHNOLOGY DIVISION ●●▲

HI-VOL FILTER ANALYSIS SHEET

Sample: 6422 | Date: 4-14-80 | Analyst: [signature]

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz			
Calcite	25	29	1.0 50 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	20	19	4.0 - 28.0 μm
Irregular, Lacy Flyash	10	10	3.0 - 33.0 μm
Coal Fragments & Flyash	20	19	2.0 - 40.0 μm
Soot (oil or other)	10	10	3.0 25.0 μm
Burned Wood	<5	1	
Iron Oxide	<5	5	
BIOLOGICAL			
Pollen and Spores	10	6	1.0 - 12.0 μm
Stellate Hairs			
Cellulose Fibers	Trace	-	
Starch	<5	1	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

POWHATTEN POINT 7/25/78 179 μg/m³

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6421 | **Date:** 4-14-80 | **Analyst:** [signature]

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	<5	2	
Calcite	20	23	1.0 - 15.0 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	10	9	2.0 - 15.0 μm
Irregular, Lacy Flyash	10	9	3.0 - 47.0 μm
Coal Fragments & Flyash	45	42	1.0 - 43.0 μm
Soot (oil or other)	10	9	5.0 13.0 μm
Burned Wood			
Iron Oxide	<5	5	
BIOLOGICAL			
Pollen and Spores			
Stellate Hairs			
Cellulose Fibers	TRACE		
Starch	<5	1	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

[illegible] 4/25/[illegible] 33 µg/m³

OCA/TECHNOLOGY DIVISION ●●▲

HI-VOL FILTER ANALYSIS SHEET

Sample: 6408 | Date: 4-1 80 | Analyst: [illegible]

Component	Vol. %	Wt. %	Size Range (in µm) and Remarks
MINERALS			
Quartz	<5	2	
Calcite	20	23	1.0 - 24.0 µm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	20	19	3.0 - 45.0 µm
Irregular, Lacy Flyash	5	5	
Coal Fragments [illegible]	25	24	2.0 - 21.0 µm
Soot (oil or other)	15	14	4.0 - 24.0 µm
Burned Wood			
Iron Oxide	<5	7	
BIOLOGICAL			
Pollen and Spores	10	6	2.0 47.0 µm
Stellate Hairs			
Cellulose Fibers	Trace	—	
Starch			
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

WELLSVILLE

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6427 | **Date:** 4-15-80 | **Analyst:** [illegible]

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz			
Calcite	30	33	1.0 - 21.5 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	15	14	1.0 - 14.0 μm
Irregular, Lacy Flyash	5	5	
Coal Fragments & Flyash	25	23	4.0 - 114.0 μm
Soot (oil or other)	20	18	2.0 - 30.0 μm
Burned Wood			
Iron Oxide	<5	5	
BIOLOGICAL			
Pollen and Spores	<5	2	
Stellate Hairs			
Cellulose Fibers	Trace	-	
Starch			
Insect Parts	Trace		
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

WELLSVILLE 9/17/78 93 μg/m³

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6428 | Date: 4-15-80 | Analyst: [signature]

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	<5	1	
Calcite	25	30	1.0 - 30.0 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	25	25	1.0 - 12.9 μm
Irregular, Lacy Flyash	<5	3	3.0 27.0 μm
Coal Fragments, Flyash	25	25	2.0 - 28.0 μm
Soot (oil or other)	10	10	4.0 - 21.0 μm
Burned Wood			
Iron Oxide	Trace	-	
BIOLOGICAL			
Pollen and Spores	10	6	1.5 - 15.0 μm
Stellate Hairs			
Cellulose Fibers	Trace	-	
Starch	T	T	
Insect Parts	Trace	-	
Other:			
MISCELLANEOUS			
Rubber Particles	Trace	-	
Auto Emissions			

EAST LIVERPOOL (CITY HALL) 9/17/78 175 µg/m³

GCA/TECHNOLOGY DIVISION			HI-VOL FILTER ANALYSIS SHEET
Sample: 6410	**Date:** 4-2-80		**Analyst:** S. Branchetta
Component	**Vol. %**	**Wt. %**	**Size Range (in µm) and Remarks**
MINERALS			
Quartz			
Calcite	25	29	1.1 - 32.0 µm
Gypsum			
Feldspar			
Clay			
Mica:			
~~Other:~~ Glass	<5	2	
COMBUSTION PRODUCTS			
Spherical Flyash	20	19	4.4 - 39.0 µm
Irregular, Lacy Flyash	10	10	6.0 - 61.0 µm
Coal Fragments & flyash	20	19	1.5 - 66.0 µm
Soot (oil or other)	10	10	2.2 - 200 µm
Burned Wood	T	T	
Iron Oxide	<5	5	
BIOLOGICAL			
Pollen and Spores	10	6	1.0 - 13.0 µm
Stellate Hairs			
Cellulose Fibers	TRACE	-	
Starch	TRACE	-	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

GCA/TECHNOLOGY DIVISION

HI-VOL FILTER ANALYSIS SHEET

Sample: 6425 | **Date:** 4-15-80 | **Analyst:** S. Brarchetto

Component	Vol. %	Wt. %	Size Range (in μm) and Remarks
MINERALS			
Quartz	<5	3	
Calcite	15	16	1.0 - 20.0 μm
Gypsum			
Feldspar			
Clay			
Mica:			
Other:			
COMBUSTION PRODUCTS			
Spherical Flyash	15	14	1.0 - 24.0 μm
Irregular, Lacy Flyash	15	14	3.0 - 82.0 μm
Coal Fragments & Flyash	25	23	10 - 86.0 μm
Soot (oil or other)	20	18	3.0 - 20.0 μm
Burned Wood			
Iron Oxide	5	11	
BIOLOGICAL			
Pollen and Spores	<5	1	
Stellate Hairs			
Cellulose Fibers	TRACE	-	
Starch	TRACE	-	
Insect Parts			
Other:			
MISCELLANEOUS			
Rubber Particles			
Auto Emissions			

APPENDIX D

SUMMARIES OF SYNOPTIC WEATHER CONDITIONS ON SAMPLING DAYS

2 January 1978

Rapidly moving cold front just east of study area at start of period. A 1010 mb low north of area deepens and moves northeastward. High pressure ridge dominates western part of U.S. Light-moderate westerly surface winds indicated. Overcast with light snow showers most of day. Little accumulation.

14 January 1978

A 999 mb low near Cape Hatteras at start of period. Moves up Atlantic Coast during day. Light-moderate northerly winds indicated. Overcast with snow throughout day. 1.8 inches accumulation.

1 February 1978

A 1033 high centered west of study area at start of period drifts slowly eastward during day. Ill-defined high pressure area breaks in two with main center near Cape Hatteras at end of period. Winds very light and variable. Overcast much of period. Snow showers early in period. Little accumulation.

7 February 1978

A 984 mb low centered off the coast just east of Philadelphia at the start of period moves rapidly northeastward during the day. Large high pressure wedge dominates central part of country. Moderate northwesterly winds early in a.m. decreasing during the day. Overcast much of period. Light snow and snow showers morning and evening. Light accumulation.

13 February 1978

A 1020 col over area at start of period. Very weak gradient. A 1002 low developing in Oklahoma moves east-northeastward during day and is just to the southwest of study area at end of period. Winds shift to northeasterly and increase in speed during day. Overcast by midmorning. Snow breaks out in early afternoon; 1 in. accumulation.

19 February 1978

A 1005 low east of Cape Hatteras at start of period with cold front crossing Florida. Low deepens and moves east-northeasterly during day. Weak and poorly defined pressure gradient throughout period. Few snow showers early a.m. Very little accumulation. Skies clear by 10 a.m. Some midday cloudiness.

9 March 1978

Eastern U.S. dominated by 1027 high centered over northwest Iowa during the start of the period, plus 3 weak lows in the southwest. Low on Gulf Coast deepens to 1005 mb and extends northwestward to the remains of low in Kentucky during day. Weak gradient over study area throughout period. No precipitation.

21 March 1978

At the start of the period, a very weak frontal system extends from the Atlantic onshore at Hatteras, northwestward to point just south of study area, then westward, then southwestward to Texas. Also, a weak cold front extends from a 1006 mb low in northern Minnesota to northern Texas. During the day the two fronts merge and pass the study area. Wind shifts from southerly to westerly. Brief rain showers from 1 to 6 p.m.

14 April 1978

High pressure ridge extends from North Dakota and Minnesota to the Carolinas throughout the period. Gradient weakens as Atlantic low moves off to the northeast. Light westerly flow indicated. No precipitation.

26 April 1978

Extensive low pressure area (1008 mb) extends from Florida northwestward into Tennessee at start of period with north-south ridge further west. Low intensifies, moves northeastward, and is over Hatteras at end of day. Northeasterly winds indicated. Overcast, but no precipitation.

20 May 1978

A 1020 high to south of study area with weak cold front extending from Lake Superior southwestward at start of period. During the day, a 1005 mb low forms on the front, moves eastward north of the Great Lakes, and the cold front approaches the study area. Southerly winds increase in speed as front approaches. Increasing clouds. Light rain in evening.

26 May 1978

High centered near study area all of period. Light, variable winds. No precipitation.

1 June 1978

A 1008 mb low centered in North Dakota at start of period moves to northern Lake Superior during day. Cold front from this low approaches study area from west. Associated warm front extends eastward through Great Lakes, moves southward as a weak cold front and reaches Pittsburgh at 1300 EST. Light, variable winds indicated.

7 June 1978

Remmants of low in northern Texas, dissapating east-west front through Carolinas and Tennessee, and a cold front along the Canadian border at start of period. During the day this cold front moves southward and extends from Lake Huron to Oklahoma at end of the day. Light, variable winds at start. Gradient tightens as front approaches and winds become southwesterly. Precipitation from 6 a.m. to 4 p.m. Overcast throughout.

7 July 1978

Study area on back side of high centered just off Atlantic Coast at start of period. Weak frontal system moves eastward during day reaching Chicago area by end of period. Light south-southwesterly flow indicated throughout. Haze.

13 July 1978

A 1021 high centered over study area at start of period moves eastward during day. Cold front approaching from the west reaches northwestern Ohio by end of period. Light, variable winds at start of period become southerly and increase in speed. Becomes overcast by midday.

19 July 1978

Study area between two frontal systems throughout period. Weak gradient and variable winds. Southeast to southwest flow indicated.

25 July 1978

A 1023 mb high centered near study area and remains of stationary front to the south at start of period. Light southeasterly flow. Cloudy but no precipitation. During the period the high moves northeastward and the flow becomes southerly with the approach of frontal system from the northwest. Weak low forming along Atlantic Coast.

31 July 1978

East-west frontal system south of study area at start of period. Overcast with rain showers, fog and haze. Weak low forms on front and moves eastward. Showers over by midmorning. Variable winds.

6 August 1978

High pressure ridge extends northeasterly from Missouri to the Great Lakes at the start of the period. Stationary front just south of study area. Rain showers, fog and haze. Cold front approaches from the northwest and weakens. Low forms on stationary front southwest of study area during period. Winds light and variable.

12 August 1978

Weak stationary front extends from eastern Pennsylvania westward below study area to low in Kansas at start of period. Little activity along front during day. Mostly overcast with haze and fog. No precipitation. Variable winds.

18 August 1978

North-south ridge line over study area at start of period moves slowly eastward during the day. Withs its passage, light variable winds become southerly, but remain light. Clouds increase but no precipitation.

24 August 1978

A 1023 high centered over Virginia at start of period with east-west front north of study area. Front moves southward but remains north of the area thoughout the period. Light southwesterly flow indicated. Increasing clouds, but no precipitation.

30 August 1978

At the start of the period, tropical storm Debbra is located over southeast Arkansas. Cone frontal system extends northwestward from southeast Texas to the Atlantic Coast near Washington, passing slightly below the study area. Also, a cold front over Lake Superior is moving rapidly southeastward. During the period the remains of Debbra merges with the first frontal system and approaches the study area, and the cold front reaches northwest Ohio. Rain and fog throughout the day. Variable winds.

5 September 1978

A 1020 high centered west of study area at start of period with east-west cold front north of Great Lakes. Region of high pressure remains over area throughout period. Light, variable winds. Clear skies.

17 September 1978

At start of period an east-west front extends from Massachusetts through study area, then westward. Influenced by the remains of a north-south cold front advancing from the west, a weak low forms west of the study area. Flow remains southerly but increases slightly in speed. Overcast, fog and haze. No precipitation.

11 October 1978

High pressure ridge extends southward along east coast throughout period. Light southerly flow indicated. Increasing cloudiness during the day with rain shower in evening.

4 November 1978

High pressure ridge extends southwestward over study area throughout the period. Very light, variable winds. Some fog, smoke, and haze.

10 November 1978

Very weak pressure gradient over study area throughout period. Light, variable winds. Fog until early afternoon. Some haze. No precipitation.

28 December 1978

Axis of large high pressure ridge moves eastward over study area during the period. Light, variable winds.

APPENDIX E

CHEMICAL ANALYTICAL METHODS

ANALYTICAL METHODS

All samples for atomic absorption analysis were prepared by a hot acid extraction; the procedure used is outlined in "General Atomic Absorption Procedure For Trace Metals In Airborne Material Collected On Membrane Filters" (Section 822 in Methods Of Air Sampling And Analysis, 2nd Edition, American Public Health Association). Lead and iron analysis was done by direct flame AA; Mercury was analyzed by the Cold Vapor method; graphite furnace AA was used for arsenic and vanadium analysis.

Samples to be analyzed by ion chromatography were prepared by extraction in hot water.

QUALITY CONTROL RESULTS

All atomic absorption and ion chromatography analyses included quality control samples. The results of these analyses are shown in the following sections.

Lead

EPA performance survey samples were analyzed in August 1979, using the same preparation and analysis procedures used for the samples from this project. The performance survey samples are hi-vol filters spiked with a known concentration of lead. The target range for acceptability set by EPA for these samples is ±10 percent. The results of the performance survey follow.

Sample number	GCA value ($\mu g/m^3$)	EPA value ($\mu g/m^3$)	% difference
1	3.230	3.530	-8.50
2	12.380	12.860	-3.73
3	5.330	5.830	-8.89
4	7.800	7.930	-1.64

Iron

Spiked samples were prepared and analyzed. The results of this analysis follow.

Sample number	Reported value (μg/ml)	Spike (μg/ml)	% difference
1	10.1	10.1	+1.00
2	6.6	7.0	-5.71
3	32.5	30.0	+8.33
4	480.0	500.0	-4.0

Vanadium, Arsenic and Mercury

EPA trace metal samples were included with the samples to be analyzed for Vanadium, Arsenic and Mercury. The trace metal samples were prepared in the laboratory from EPA concentrates. The trace metal concentrations in the diluted sample are certified by EPA.

	Reported value (μg/l)	EPA value (μg/l)
Arsenic (1)	33.0	26.0
Arsenic (2)	35.0	40.0
Mercury	<1.0	0.8
Vanadium	70.0	52.0

In addition, a laboratory quality control sample was analyzed for Vanadium. This sample had an accepted concentration value of 3.0 μg/ml; the value reported by the lab was 2.5 μg/ml. Some difficulty was experienced with the analysis of the EPA Trace Metal Sample for Vanadium since its concentration was near the detection limit for that element.

Arsenic analysis by AA presents numerous difficulties; the agreement shown above between the reported value and EPA value is acceptable in view of the interferences associated with arsenic analysis by AA.

All atomic absorption analysis was done in duplicate; the precision was quite good. There was insufficient sample to do duplicate extractions.

ION CHROMATOGRAPHY ANALYSIS

EPA performance survey samples for nitrate and sulfate were analyzed with the samples from this project. The results of this analysis have not yet been received from EPA. However, the results of the March 1979 Sulfate-Nitrate Performance Survey are available. These audit samples were analyzed using the same methods used on this project. The target range for acceptability established by EPA for this analysis is ±15 percent.

Sulfate Results

Sample number	GCA value (μg/m^3)	EPA value (μg/m^3)	% difference
1185	33.150	33.000	0.45
2243	11.700	12.000	-2.50
4157	20.460	20.400	0.29
7228	23.910	24.000	-0.38

Nitrate Results

Sample number	GCA value (μg/m^3)	EPA value (μg/m^3)	% difference
0045	1.35	1.50	-10.00
1095	3.96	3.60	+10.00
3095	10.35	12.0	-13.75
5095	8.85	9.90	-10.61

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA 905/4-80-007	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE INTERREGIONAL TSP STUDY FOR THE STEUBENVILLE-WEIRTON-WHEELING INTERSTATE AQCR		5. REPORT DATE October 1980 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Kenneth W. Wiltsee, Jr., Frank A. Record Susan E. Pultz, Frederick M. Sellars		8. PERFORMING ORGANIZATION REPORT NO. GCA-TR-80-53-G
9. PERFORMING ORGANIZATION NAME AND ADDRESS GCA CORPORATION GCA/TECHNOLOGY DIVISION Bedford, Massachusetts		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO. 68-02-2538
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency Region V 230 South Dearborn St. Chicago, Illinois 60604		13. TYPE OF REPORT AND PERIOD COVERED Final Report 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

The objective of this effort is to assist the states of Ohio and West Virginia in defining the causes of nonattainment of TSP standards in the Steubenville-Weirton-Wheeling Interstate AQCR. This effort was carried out using microinventories, microscopic and chemical analysis, meteorological studies, and dispersion modeling.

The conclusion of this study is that 24-hour violations of the NAAQS for suspended particulates often occur as a result of emissions from a specific plant or plants; bringing these plants into compliance with existing regulations should result in attainment of the short-term secondary standard. Attainment of the annual primary standard, however, is not likely to occur based only on enforcement of existing regulations. Control of fugitive emissions and fugitive dust, in addition to compliance of point source stack emissions, is reguired to meet the annual NAAQS.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Total Suspended Particulates Fugitive Dust Polynuclear Aromatic Hydrocarbons Particulate Composition		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)* Release Unlimited	21. NO. OF PAGES 297
	20. SECURITY CLASS *(This page)* Release Unlimited	22. PRICE

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