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U.S. ENVIRONMENTAL PROTECTION AGENCY

CALCULATIONS FROM COMPLIANCE EMISSIONS OF LONG- AND SHORT-TERM SO_2 CONCENTRATIONS IN THE SOUTHWEST PENNSYLVANIA AIR QUALITY CONTROL REGION

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Abstract This report describes the results of dispersion-model calculations of maximum annual, 24-

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CALCULATIONS FROM COMPLIANCE EMISSIONS OF LONG- AND SHORT-TERM SO_2 CONCENTRATIONS IN THE SOUTHWEST PENNSYLVANIA AIR QUALITY CONTROL REGION

Prepared for:

U. S. Environmental Protection Agency

Under

Contract No. 68-02-2547
Task Order No. 2

H. E. Cramer company, inc.
UNIVERSITY OF UTAH RESEARCH PARK
POST OFFICE BOX 8049
SALT LAKE CITY, UTAH 84108

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ACKNOWLEDGEMENTS

We are especially indebted to Mr. Brian McClean and Mr. Alan J. Cimorelli, our EPA Region III Project Officers, for their technical assistance and guidance during this study. The emissions inventories and most of the air quality data used in the study were principally supplied by Mr. Wick Havens and Mr. Kenneth Bowman of the Pennsylvania Department of Environmental Resources and by Mr. William Muer and Dr. Roger Westman of the Allegheny County Bureau of Air Pollution Control. We also received valuable assistance from the Southwest Pennsylvania Planning Commission, from Mr. James Smallwood of the West Virginia Air Pollution Control Commission and from the Ohio Environmental Protection Agency.

EXECUTIVE SUMMARY

This report describes the results of dispersion-model calculations of maximum annual, 24-hour and 3-hour average ground-level SO_2 concentrations for selected areas in the Southwest Pennsylvania Air Quality Control Region (AQCR). The primary purpose of these calculations was to assist EPA Region III and the Pennsylvania Department of Environmental Resources in determining the attainment or non-attainment of the National Ambient Air Quality Standards (NAAQS) for SO_2 in the Beaver Valley and Monongahela Valley Air Basins outside of Allegheny County. Allegheny County was excluded from the dispersion-model calculations in this report because similar calculations were made in a study performed by TRC, Inc. for the Allegheny County Bureau of Air Pollution Control. However, because the SO_2 sources in Allegheny County affect the SO_2 concentration in the Beaver Valley and Monongahela Valley Air Basins, the major SO_2 sources in Allegheny County were included in the emissions inventories and dispersion-model calculations contained in this report. All of the dispersion-model calculations were made using the LONGZ and SHORTZ computer programs containing the long-term and short-term dispersion models described in Appendix A. In the annual average SO_2 concentration calculations for determining attainment or non-attainment of the NAAQS, the annual 1980 compliance emissions inventory in Appendix C.1 was used with the meteorological inputs given in Appendix B.1 which are based on the 1965 hourly surface weather observations made at the Greater Pittsburgh Airport and Greater Pittsburgh Airport mixing depth statistics for 1960 through 1964. The 1965 Greater Pittsburgh Airport data were selected as typical of a worst-case year in which the meteorological conditions were conducive to high ground-level SO_2 concentrations in the Southwest Pennsylvania AQCR. In the short-term concentration calculations for determing attainment or non-attainment of the NAAQS, the short-term 1980 compliance emissions inventory in Appendix C.2 was used with the hourly surface weather observations and twice-daily rawinsonde observations made at the Greater Pittsburgh Airport on 28 August 1976. This day was selected as the worst-case 24-hour period for high calculated SO_2 concentrations in the Southwest Pennsylvania AQCR on the basis of a detailed analysis of five years (1973 through 1977) of meteorological observations from the Greater Pittsburgh Airport. Specifically, the hourly wind observations for these five years were analyzed to isolate those cases in which wind directions from the southwest quadrant persisted for more than 12 hours with mean wind speeds greater than 2 meters per second. Previous dispersion-model calculations showed that these persistent wind conditions produced the highest 24-hour SO_2 concentrations in the Southwest Pennsylvania AQCR. Of the 20 cases found in the persistence analysis which satisfied the above criteria, the 28 August 1976 case resulted in the highest calculated 24-hour average SO_2 concentrations in the Southwest Pennsylvania AQCR.

The annual and short-term 1980 compliance emissions inventories in Appendix C.1 and Appendix C.2 contain 429 individual sources located within the Southwest Pennsylvania AQCR and along the Ohio River Valley near the western border of the Southwest Pennsylvania AQCR in eastern Ohio and West Virginia. The 1980 compliance emissions inventories used in the dispersion-model calculations were obtained from the following agencies:

- Allegheny County Bureau of Air Pollution Control - Sources in Allegheny County
- Pennsylvania Department of Environmental Resources - Sources in the Beaver and Monongehela River Air Basins and in other areas of Pennsylvania
- EPA Region III, the Ohio Environmental Protection Agency, and the West Virginia Air Pollution Control Commission - Sources in Ohio and West Virginia

The SO_2 emissions and other source parameters supplied by the above agencies were carefully evaluated by the H. E. Cramer Company for accuracy and completeness and were also reviewed and updated by the Pennsylvania DER and EPA Region III.

The results of the long-term and short-term dispersion-model calculations made using the 1980 compliance emissions inventories are presented in Table I which lists the maximum annual, 24-hour and 3-hour average SO_2 ground-level concentrations calculated for the New Castle, Beaver and Monessen grids. These grids, which are described in Section 5.1 and shown in Figure I, were selected as the areas within the Beaver Valley and Monongahela Valley Air Basins with the highest SO_2 ground-level concentrations on the basis of dispersion-model calculations made using the LONGZ computer program with the annual 1980 compliance emissions inventory and the gross calculation grid shown by the dashed lines in Figure I. The major SO_2 sources and SO_2 monitor sites shown in Figure I are identified in Tables II and III. The only calculated maximum which exceeds the NAAQS for SO_2 is the maximum annual average concentration for the Monessen grid which occurs at an isolated grid point located on high terrain about 1 kilometer north of the Monessen Plant of Wheeling-Pittsburgh Steel. The calculated concentrations at adjacent grid points, which are at a distance of 1 kilometer, range from 40 to 61.5 micrograms per cubic meter. The area in which the calculated annual average concentrations are above the NAAQS is therefore less than 0.25 square kilometers in extent. Emissions from the Monessen Plant of Wheeling-Pittsburgh Steel are responsible for approximately 58 percent of the maximum annual average concentration calculated for the Monessen grid.

An important feature of both the long-term and short-term model calculations for the New Castle and Beaver grids is the relatively large contributions from major SO_2 sources located along the Ohio River in eastern Ohio and West Virginia. For example, the combined emissions from all eastern Ohio and West Virginia sources account for 39 percent and 35 percent of the maximum annual average concentrations calculated for the New Castle and Beaver grids, respectively. According to the short-term model calculations, the combined emissions from all of the eastern Ohio and West Virginia sources account for about 60 percent of the maximum 24-hour and 3-hour average concentrations calculated for each of these grids. The air quality impact of the major SO_2 sources in

TABLE I

MAXIMUM ANNUAL, 24-HOUR AND 3-HOUR AVERAGE SO_2 CONCENTRATIONS CALCULATED USING THE 1980 COMPLIANCE EMISSIONS INVENTORIES

Calculation Grid	Maximum Concentration ($\mu g/m^3$)	UTM Coordinates of Maximum (km)	
		X	Y
Annual Average Concentration			
New Castle	37.3	558.0	4,525.0
Beaver	76.8	554.0	4,503.0
Monessen	86.2*	594.0	4,447.0
24-Hour Average Concentration			
New Castle	115.8	555.0	4,533.6
Beaver	251.6	554.0	4,503.0
Monessen	226.9	594.5	4,447.0
3-Hour Average Concentration			
New Castle	337.4	555.0	4,533.6
Beaver	835.5	554.0	4,503.0
Monessen	703.9	594.5	4,447.0

*Calculated maximum occurs at isolated grid point on elevated terrain.

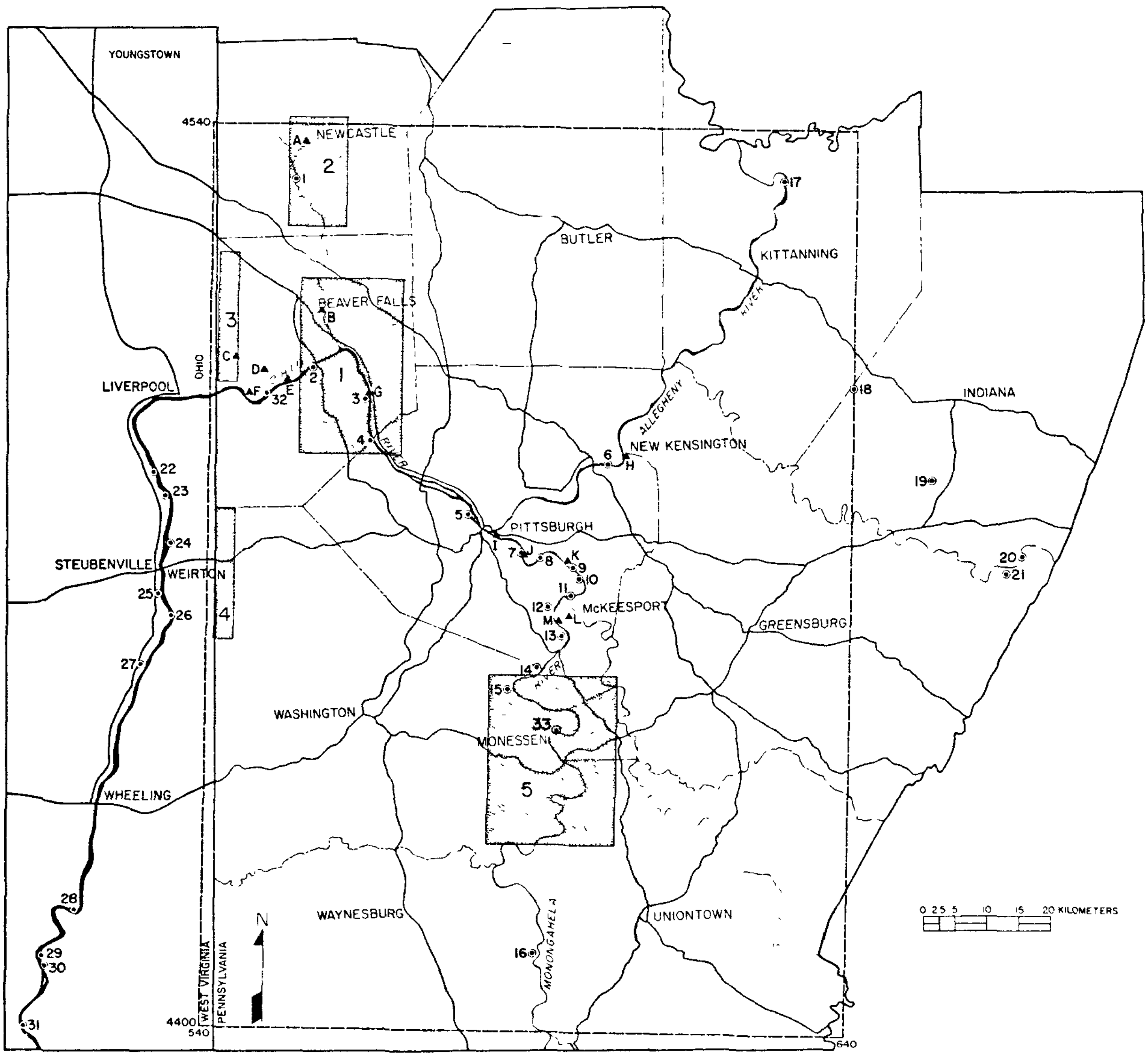

FIGURE I. Map of the Southwest Pennsylvania AQCR and surrounding areas. Dashed lines show the gross grid and shaded areas show the five smaller grids used for dispersion-model calculations. Major SO_2 sources and source complexes are indicated by the numbers 1 through 31 and SO_2 monitor locations used for model validation are indicated by the letters A through M.

TABLE II

LIST OF MAJOR SO_2 SOURCES IN FIGURE I

Source Number	Source Name	UTM Coordinates (m)	
		X	Y
1	Penn Power, West Pittsburgh	553,105	4,531,767
2	St. Joe Minerals	556,065	4,502,301
3	J & L Aliquippa	564,400	4,497,500
4	Duquesne Light, Phillips	565,260	4,491,020
5	Duquesne Light, Brunot Is.	580,680	4,479,680
6	Duquesne Light, Cheswick	602,330	4,487,800
7	J & L Pittsburgh	589,000	4,473,900
8	USS Homestead	592,100	4,473,100
9	USS Edgar Thomson	597,260	4,471,685
10	USS Duquesne	598,324	4,470,025
11	USS National	597,000	4,467,500
12	USS Irvin	593,180	4,465,700
13	USS Clairton	595,500	4,461,500
14	Duquesne Light, Elrama	592,000	4,456,200
15	Penn Power, Mitchell	587,340	4,452,810
16	Hatfield Power	591,570	4,412,040
17	Armstrong Power	628,979	4,531,996
18	Keystone Power	640,141	4,502,155
19	Homer City Power	652,756	4,486,147
20	Seward Power	666,882	4,474,602
21	Conemaugh Power	664,582	4,471,929
22	Ohio Ediwon, Sammis	531,700	4,485,500
23	Ohio Power, Toronto	533,500	4,481,800
24	National Steel, Wierton Div.	534,300	4,474,400
25	Wheeling-Pittsburgh (North)	532,500	4,466,700
26	Wheeling-Pittsburgh (South)	534,600	4,463,300
27	Cardinal Power	530,000	4,455,800
28	Ohio Edison, Burger	520,500	4,417,500
29	Kammer Power	515,320	4,410,320
30	Mitchell Power	515,800	4,408,670
31	PPG	512,600	4,399,600
32	Penn Power, Mansfield	549,049	4,498,067
33	Wheeling-Pittsburgh, Monessen	594,170	4,446,350

TABLE III

LIST OF SO_2 MONITOR SITES IN FIGURE I

Site Symbol	Site Name (Operator)	UTM Coordinates (m)		Site Elevation (m MSL)
		X	Y	
A	New Castle (DER)	554,830	4,537,240	257
B	Beaver Falls (DER)	557,750	4,510,785	220
C	Fairview (Penn Power)	544,820	4,504,390	390
D	Route 68 (Penn Power)	550,720	4,500,640	238
E	West Beaver (Penn Power)	548,950	4,502,000	375
F	Midland (DER)	546,330	4,498,340	249
G	Baden (DER)	565,090	4,498,380	230
H	Logans Ferry (BAPC)	605,154	4,489,115	268
I	Downtown (BAPC)	585,150	4,476,600	256
J	Hazelwood (BAPC)	589,762	4,473,952	284
K	North Braddock (BAPC)	596,680	4,472,835	275
L	Liberty Boro (BAPC)	596,210	4,464,150	340
M	Glassport (BAPC)	594,190	4,463,580	234

eastern Ohio and West Virginia is greatest at or near the western border of the Southwest Pennsylvania AQCR. To obtain preliminary estimates of this impact, we included the two border grids 3 and 4 shown in Figure I in both the annual and short-term model calculations using the 1980 compliance emissions inventories. The annual average calculations showed a maximum concentration of 101.4 micrograms per cubic meter on the Pennsylvania-West Virginia border about 10 kilometers northeast of Weirton, West Virginia. Calculated concentrations are above the annual NAAQS within a narrow border strip approximately 17 kilometers long and 4 kilometers wide extending north and south from the point of the calculated maximum. Sources in eastern Ohio and West Virginia respectively account for about 35 percent and 53 percent of the maximum annual concentration. However, there are some points located within the areas where the calculated concentrations are above the annual SO_2 standard at which sources located in Ohio account for more than 50 percent of the calculated concentrations. The short-term model calculations show a maximum 24-hour average concentration of 425.2 micrograms per cubic meter and a maximum 3-hour average concentration of 2375 micrograms per cubic meter at a point located about 4 kilometers east of the Pennsylvania-West Virginia border and about 10 kilometers southeast of Weirton, West Virginia. Sources in West Virginia account for 83 percent of the calculated 24-hour maximum and for virtually 100 percent of the calculated 3-hour maximum. We also found several other 3-hour cases in 1976 in which the calculated 3-hour maximums in this border area are greater than 2000 micrograms per cubic meter and are produced almost entirely by emissions from sources in West Virginia.

We point out that the model calculations for the border areas described above are preliminary values because they were made using worst-case meteorological conditions selected for other grid areas and therefore may not be representative of the worst-case situations for the border areas. In addition, there are questions about the accuracy of the emissions inventories for the West Virginia and Ohio sources used in the model. Therefore, while we believe the results of our model calculations for the border areas serve to point out potential SO_2 air quality problems, an additional effort beyond the scope of the present study is required to define the magnitude and areal extent of the annual and short-term SO_2 concentrations along the western border of the Southwest Pennsylvania AQCR.

For purposes of validating model calculations made by the LONGZ and SHORTZ computer programs for the Southwest Pennsylvania AQCR, we originally planned to use 1975 emissions inventory, meteorological data and SO_2 monitor data. However, because of deficiencies in the Pennsylvania DER and Allegheny County monitor data for 1975 and problems with emissions inventories, it was necessary to use the 1976/1977 emissions inventory in Appendix C.3 and meteorological data for 1976 and 1977 in combination with SO_2 monitor data for the years 1976 through 1979 in the model validation study. Table IV lists the observed annual average SO_2 concentrations at various monitor sites and the calculated annual average SO_2 concentrations at these monitor sites. The concentrations were calculated by using the LONGZ computer program with the 1976/1977 emissions inventory in Appendix C.3 and the meteorological inputs in Appendixes B.2 and B.3 developed from the 1976 and 1977 hourly observations at the Greater Pittsburgh Airport. As shown in the table, the observed concentrations are less than half of the concentrations calculated at the Baden monitor in 1976 and at the Hazelwood monitor in both 1976 and 1977. We believe the comparison of observed and calculated concentrations at the Baden monitor can probably be disregarded in view of the difference in time between the observation period and the period for which the calculations were made, as well as the 45.7-percent valid data recovery rate at the Baden monitor. We are unable to explain satisfactorily the large model overpredictions at the Hazelwood monitor, except to point out that a detailed analysis of the calculated concentrations in the vicinity of this monitor showed a very large spatial gradient of concentration over an area of about 1 square kilometer. Calculated concentrations equal to the observed concentrations are found within a distance of about 500 meters to the south and northwest of the monitor site.

TABLE IV

COMPARISON OF CALCULATED AND OBSERVED ANNUAL GROUND LEVEL SO_2 CONCENTRATIONS*

Monitor Site (Operator)	Observation Period	Observed Concentration ($\mu g/m^3$)	1976		1977	
			Calculated Concentration ($\mu g/m^3$))	Observed / Calculated	Calculated Concentration ($\mu g/m3$)	Observed / Calculated
Baden (DER)	9/78 - 8/79	81.2	153.5	0.53	243.3	0.33
Beaver (DER)	9/78 - 8/79	47.2	43.1	1.10	47.4	1.00
New Castle (DER)	9/78 - 8/79	39.3	29.1	1.35	33.9	1.16
Midland (DER)	1979	78.6	112.5	0.70	120.5	0.65
Fairview (Penn Power)	1977	109.4	77.4	1.41	69.7	1.57
Western Beaver (Penn Power)	1977	85.2	97.5	0.87	85.2	1.00
Route 68 (Penn Power)	1977	101.0	89.0	1.14	81.1	1.24
Liberty Boro (BAPC)	1976	104.0	133.3	0.78	141.1	0.74
Downtown (BAPC)	1976	73.0	75.5	0.97	69.9	1.04
Hazelwood (BAPC)	1976	141.5	354.2	0.40	406.8	0.35

TABLE IV (Continued)

Monitor Site (Operator)	Observation Period	Observed Concentration ($\mu g/m^3$)	1976		1977	
			Calculated Concentration ($\mu g/m^3$)	Observed / Calculated	Calculated Concentration ($\mu g/m^3$)	Observed / Calculated
Glassport (BAPC)	1976	96.0	91.6	1.05	97.7	0.98
North Braddock (BAPC)	1976	91.0	98.4	0.92	112.4	0.81
Logans Ferry (BAPC)	1976	73.0	57.5	1.27	66.8	1.09

*Calculations made using the 1976/1977 emissions inventory with 1976 and 1977 meteorological data.

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SECTION 1

INTRODUCTION

This study was originated under EPA Contract No. 68-02-2522 to provide dispersion-model calculations of the air quality impact of future SO_2 emissions in the Southwest Pennsylvania Air Quality Control Region (AQCR) for the years 1980, 1985 and 2000 for use in planning for industrial growth and regulatory activities. During the course of the study, in response to changes in the Clean Air Act, the Scope of Work of the contract was modified to provide for dispersion-model calculations to assist in evaluating changes in the Pennsylvania State Implementation Plan and the attainment or non-attainment of the National Ambient Air Quality Standards within the Beaver Valley and Monongahela Valley Air Basins. This work was continued under EPA Contract No. 68-02-2547, Task Order No. 2 which specifically addressed the requirement for dispersion-model calculations of worst-case annual, 24-hour and 3-hour ground-level SO_2 concentrations, using 1980 compliance emissions inventories, in the Beaver Valley and Monangahela Valley Air Basins.

All of the dispersion model calculations for the study were performed using the LONGZ and SHORTZ computerized models described in "Diffusion Model Calculations of Long-Term and Short-Term Ground-Level Sulfur Dioxide Concentrations in Allegheny County, Pennsylvania" (EPA-903/9-75-018). These models are fully documented in the "User's Instructions for the SHORTZ and LONGZ Computer Programs" (Bjorklund and Bowers, 1979). Figure 1-1 is a map of the Southwest Pennsylvania AQCR showing the various calculation grids used in the study. The dashed line defines the 100 x 140 kilometer gross grid which encloses most of the Southwest Pennsylvania AQCR. This gross grid was used for LONGZ dispersion-model calculations in the beginning of the study to isolate specific areas of high annual average SO_2 concentratiors in which more detailed model calculations were required to define the air quality impact of SO_2 emissions

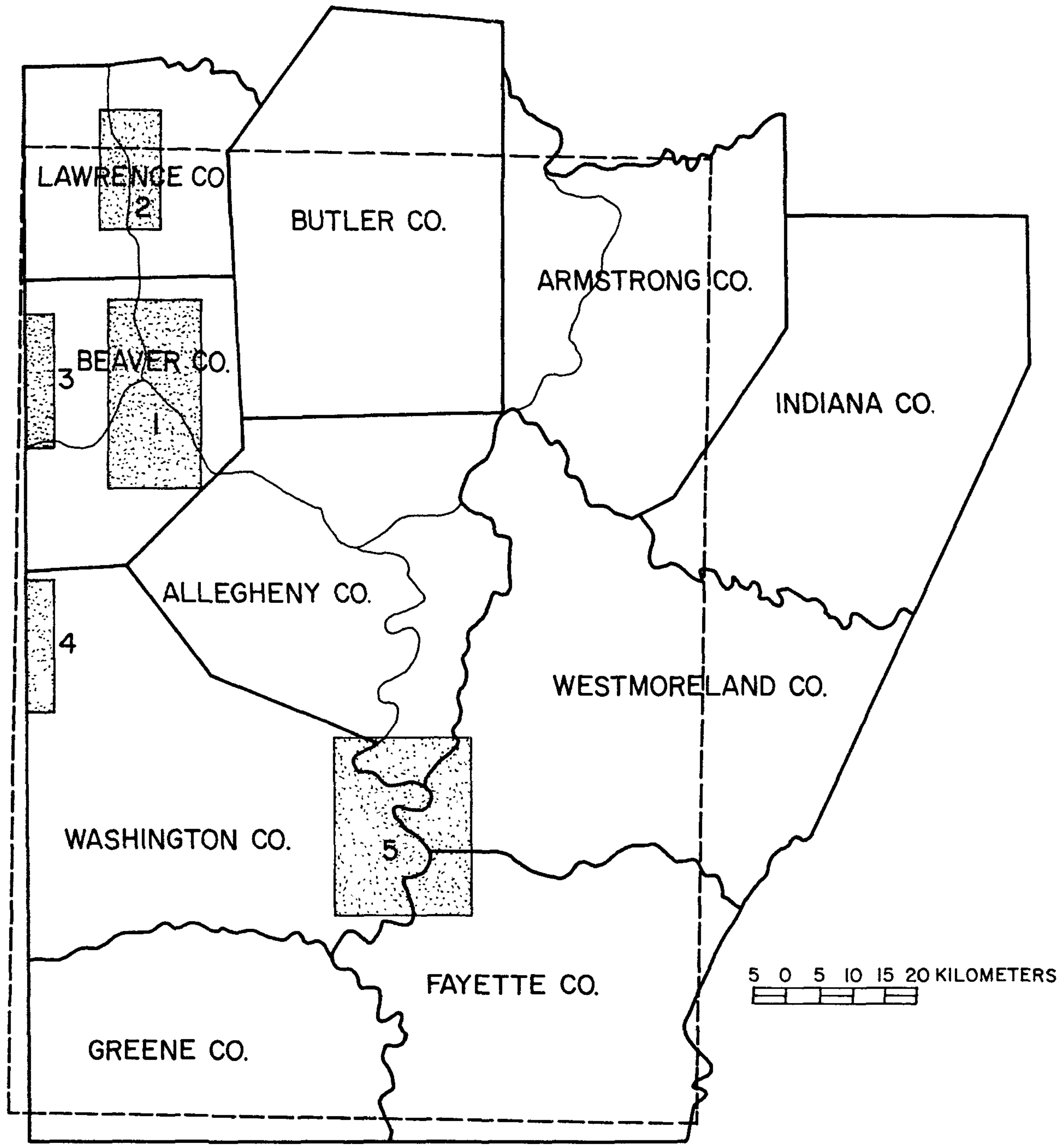

FIGURE 1-1. Southwest Pennsylvania AQCR showing the Beaver grid (1), New Castle grid (2), Northwest Border grid (3), Southwest Border grid (4) and the Monessen grid (5).

from major sources and source complexes. A 5-kilometer spacing of grid points was used for the central 60-by-100 kilometer area of the gross grid and a 10-kilometer spacing was used for the remaining outer portions of the grid. The five shaded areas in Figure 1-1 show the smaller grids used for the detailed dispersion-model calculations with the 1980 compliance emissions inventories in which a 1-kilometer spacing of grid points was employed. The terrain contours for each of the five smaller grids are presented in Figures 1-2 through 1-5. In areas of calculated high concentrations and steep gradients, the grid spacing was further reduced to improve the definition of the concentration field. For example, a 100-meter grid spacing was used in the Baden area and a 500-meter grid spacing was used in the Monessen area (see Figures 5-2 through 5-4).

Emissions inventories for SO_2 sources located within Allegheny County were supplied by the Allegheny County Bureau of Air Pollution Control (BAPC). Emissions inventories for all other SO_2 sources located within the Southwest Pennsylvania AQCR were provided by the Pennsylvania Department of Environmental Resources (DER). Emissions inventories for sources located in eastern Ohio and West Virginia near the western border of the Southwest Pennsylvania AQCR were obtained by EPA Region III from the responsible state agencies in Ohio and West Virginia.

Section 2 of this report contains a description of the 1976/1977 and 1980 SO_2 emissions inventories used in the dispersion-model calculations. Meteorological inputs used in the dispersion-model calculations are described in Section 3. Adjustments made in the model calculations for SO_2 decay and estimates of SO_2 background concentrations are discussed in Section 4. Results of the long-term and short-term dispersion-model calculations made using the 1980 compliance emissions inventories are presented in Sections 5 and 6, respectively. Model validation calculations and comparisons with SO_2 monitor data are discussed in Section 7. Section 8 contains a discussion of preliminary calculations of SO_2 concentrations along the western perimeter of the Southwest Pennsylvania AQCR. There are three appendices to this report. Appendix A contains a description of

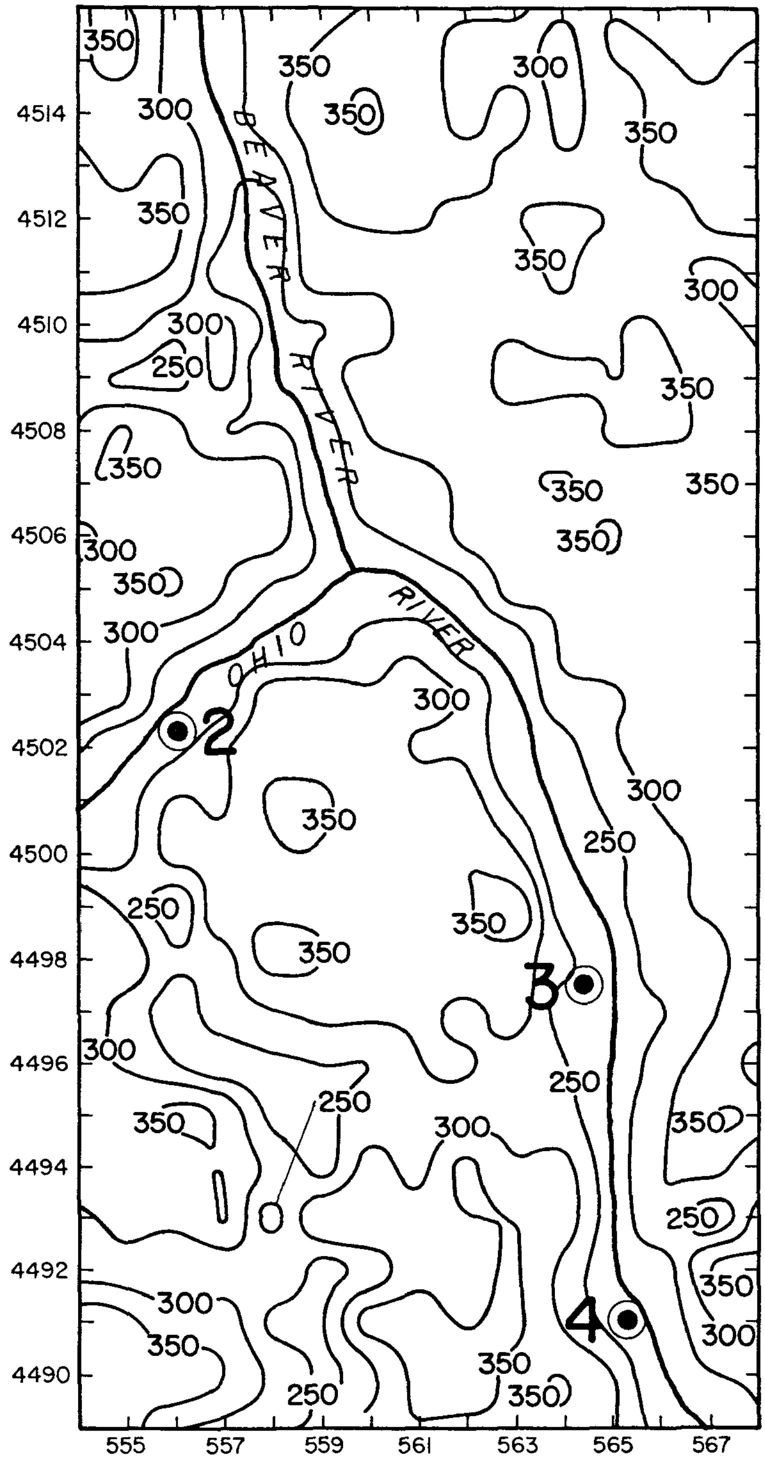

FIGURE 1-2. Terrain contours in meters above Mean Sea Level for the Beaver grid. The numbers 2, 3 and 4 respectively refer to the St. Joe Minerals, J & L Aliquippa and Duquesne Light, Phillips Plants.

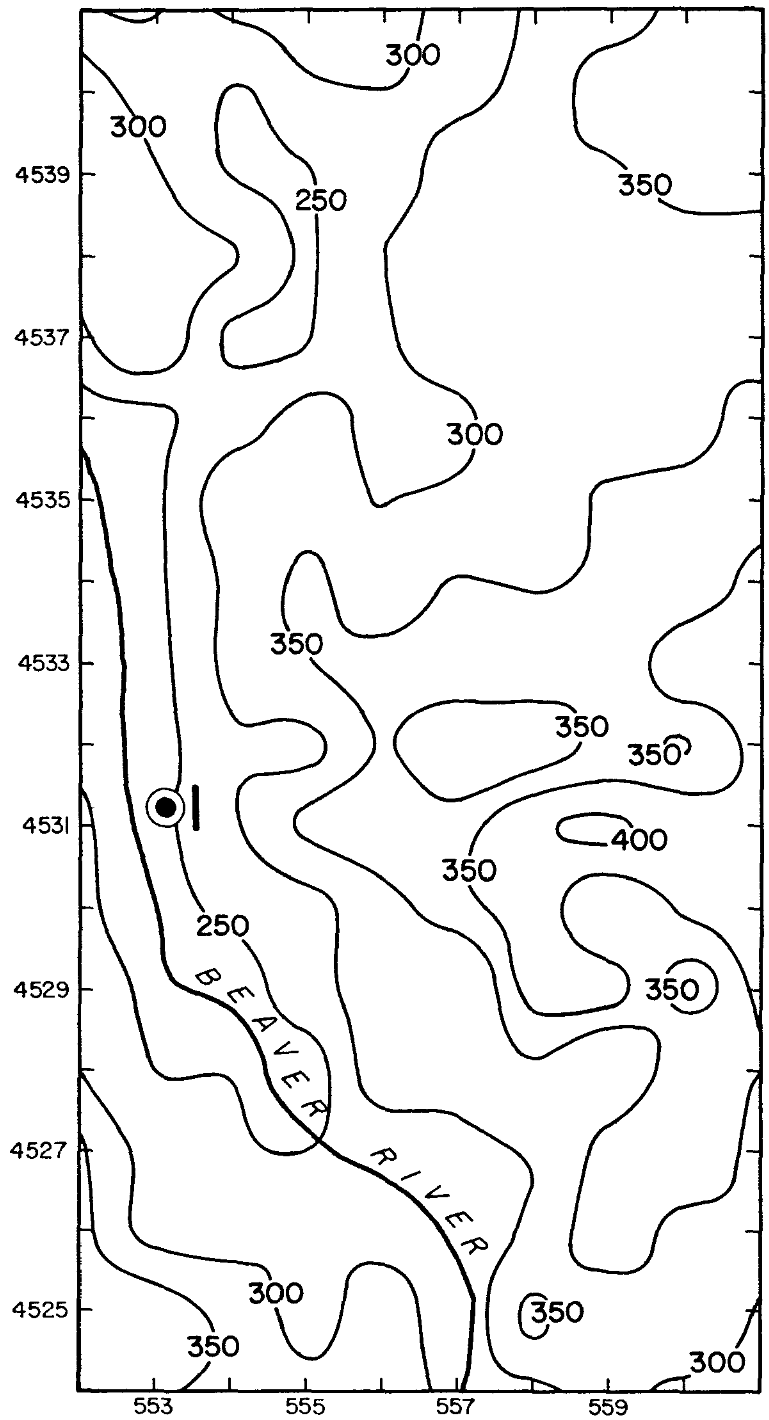

FIGURE 1-3. Terrain contours in meters above Mean Sea Level for the New Castle grid. The number 1 refers to the Penn Power, West Pittsburgh Plant.

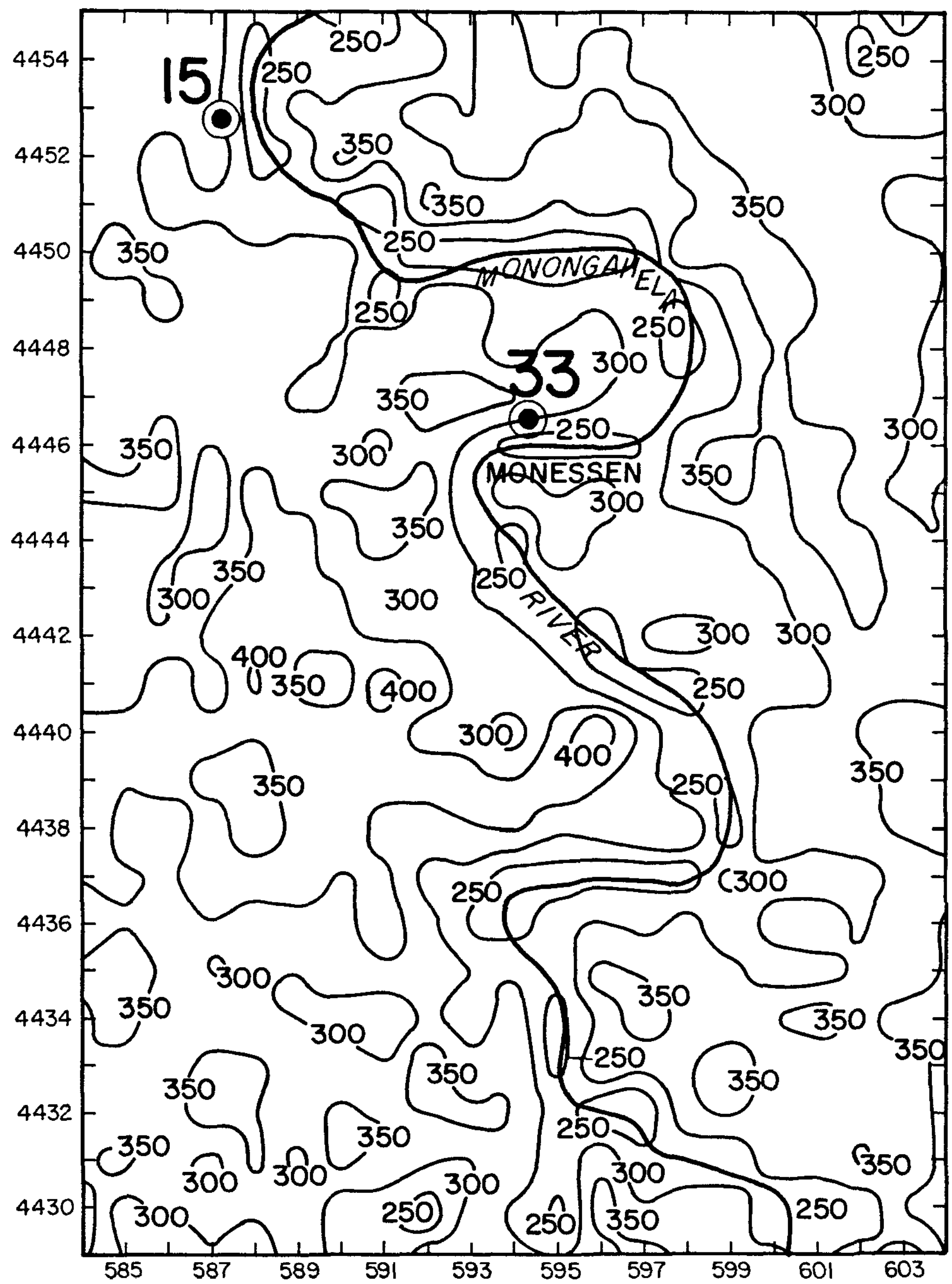

FIGURE 1-4. Terrain contours in meters above Mean Sea Level for the Monessen grid. The number 15 refers to the Penn Power, Mitchell Plant.

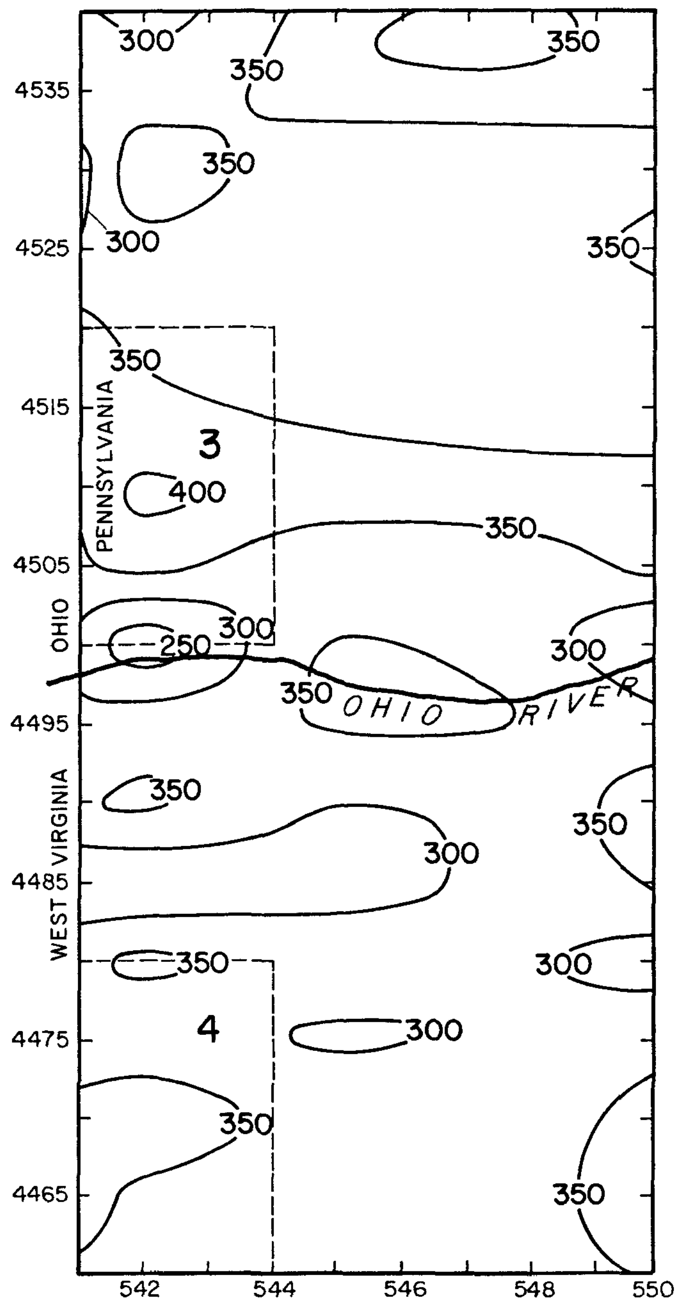

FIGURE 1-5. Terrain contours in meters above Mean Sea Level for the Northwest (3) and Southwest (4) Border grids.

the LONGZ and SHORTZ dispersion models used in the study. Tabular summaries of the meteorological inputs used in the LONGZ model calculations for the compliance cases and the validation study are contained in Appendix B. The SO_2 emissions inventories used in the study are given in Appendix C.

SECTION 2

SO_2 EMISSIONS INVENTORIES

The 1976/1977 and 1980 (compliance) SO_2 emissions inventories used with the LONGZ and SHORTZ dispersion models were developed from information supplied by the following agencies:

- Pennsylvania Department of Environmental Resources
- Allegheny County Bureau of Air Pollution Control
- West Virginia Air Pollution Control Commission
- Ohio Environmental Protection Agency
- EPA Region V
- EPA Region III

Information pertaining to industrial point sources located in the Beaver Valley Air Basin, the Monongahela Valley Air Basin and to other sources in Pennsylvania located outside Allegheny County was obtained from the automated emissions inventory files of the Pennsylvania Department of Environmental Resources. Emissions data for SO_2 sources located within Allegheny County were obtained from the Allegheny County Bureau of Air Pollution Control. Data pertaining to SO_2 sources located in the West Virginia Panhandle were obtained from the West Virginia Air Pollution Control Commission by EPA Region III. After reviewing the draft final report, the Pennsylvania Department of Environmental Resources and the West Virginia Air Pollution Control Commission made some revisions in the 1980 compliance emissions inventory. These revisions,which were received after the dispersion-model calculations had been completed, are listed in Appendix C.4 for reference. Emissions data for the SO_2 sources in Ohio along the Ohio River near the Pennsylvania border were obtained principally by EPA Region III from the Ohio Environmental Protection Agency and EPA Region V.

2.1 SO_2 INDUSTRIAL EMISSIONS INVENTORY FOR 1976/1977

The 1976 and 1977 SO_2 emissions inventory data for the Southwest Pennsylvania AQCR were reviewed by the H. E. Cramer Company and missing data, questionable parameter values and other potential problems were noted. The year 1976 was originally intended to be the base year for the initial modeling of SO_2 emissions. However, principally because of the lack of valid air quality measurements and to some extent the unavailability of emissions data, the emissions data for the two years 1976 and 1977 were combined to develop the SO_2 emissions inventory used with the initial executions of the models. The SO_2 emissions inventory parameters for each source that are required to execute the LONGZ and SHORTZ dispersion models are:

- Source Location (UTM coordinates)
- Plant Grade Elevation
- SO_2 Emission Rate
- Source Type (Stack)
    - Stack Exit Gas Temperature
    - Stack Exit Volume
    - Stack Exit Diameter
    - Stack Height
- Source Type (Building or Area)
    - Source Length
    - Source Width
    - Source Height

The SO_2 emissions inventories obtained from the various agencies were converted to standard metric units and forwarded with the list of questions and missing data to the originating agencies for their review as to accuracy and completeness. The short-term emissions inventory required additional work in developing appropriate emissions rates from the available data. This process took several months and required a number of iterations in order to determine whether plant operating levels, maximum allowable emissions or rated boiler capacities should be used in establishing short-term SO_2 emission rates.

2.2 SO_2 INDUSTRIAL COMPLIANCE EMISSIONS INVENTORY FOR 1980

Upon completion of the 1976/1977 emissions inventory, the various agencies involved started to develop an emissions inventory for the years 1980-1982 to be used in the dispersion modeling of future years for determining compliance with air quality standards and for developing control strategies. As this task was nearing completion, the goals of the study were modified to reflect the changes in the environmental regulations and the need for using dispersion-model calculations to define the areas of attainment and non-attainment for SO_2 within the Southwest Pennsylvania AQCR. Because of these modifications in the goals of the study, emphasis was placed on the development of an SO_2 emissions inventory for the year 1980 and a specific review of the inventory for 1980 was conducted by the Pennsylvania Department of Environmental Resources and the Allegheny County Bureau of Air Pollution Control. The 1980 emissions inventory for SO_2 sources located within Allegheny County presented a special problem for the Bureau in that SO_2 emissions are heavily dependent upon the operations of several integrated steel mills located within the County and the availability and mix of the fuels consumed by these mills. For example, an individual source may use fuels that vary from natural gas with a very low sulfur content to coal with a sulfur content of a few percent which results in a very wide range of possible SO_2 emissions. The regulations of the Allegheny County Bureau of Air Pollution Control allow individual sources to burn the mixed fuels available at any given time. For these reasons, considerable judgement is required in arriving at a reasonable estimate of the fuel mixture to be used in determining the SO_2 emission rates for both short-term and annual model calculations. Therefore, the 1980 compliance SO_2

emissions inventory for sources located within Allegheny County reflects the Allegheny County Bureau of Air Pollution Control's best estimate of the mixture of available fuels which would be consumed during 1980.

The 1980 compliance emissions inventory for SO_2 sources located in West Virginia is based upon the state's Regulation X and estimates by the West Virginia Air Pollution Control Commission of the actual operating levels for 1980.

The 1980 compliance emissions inventory for SO_2 sources located in Ohio is unchanged from the 1976/1977 SO_2 emission inventory as neither EPA Region III nor the H. E. Cramer Company, Inc. was able to obtain estimates of the SO_2 emissions from the Ohio sources for 1980. The 1976/1977 inventory was reviewed by the Ohio EPA and updated to reflect changes in operating levels and emissions.

2.3 SO_2 AREA SOURCE EMISSIONS INVENTORY

During the development of the industrial SO_2 emissions inventory, estimates of the area source SO_2 emissions inventory were also developed using the techniques described below. Area sources were divided into three major categories:

- Mobile sources
- Space heating
- Industrial and commercial sources excluded from the industrial emissions inventory

2.3.1 Mobile Sources

The four types of mobile sources that were considered in developing the area source emissions data were:

- Motor vehicles
- Railroads
- River vessels
- Aircraft

Daily motor vehicle mileage data for Pittsburgh and the six counties comprising the Southwest Pennsylvania AQCR were obtained from EPA Region III and the Southwest Pennsylvania Regional Planning Commission (RPC). Both sets of data are for calendar 1972. The EPA data are allocated by type of vehicle. The RPC data are in the form of total daily vehicle miles per traffic zone and traffic-zone area. Table 2-1 presents the EPA data and total daily vehicle mileage estimates developed from the RPC traffic zone data. The total daily mileage estimates in the table for the Southwest Pennsylvania AQCR given by the two data sets differ by less than 1 percent. Differences in the totals for the individual areas range from about 16 to 25 percent.

Estimates of the SO_2 emissions from the exhaust of motor vehicles were obtained by using the vehicle mileage data by vehicle types in Table 2-2 supplied by EPA Region III with the following emissions factors published by EPA (AP-42, Supplement No. 5, December 1975):

- 0.18 grams per mile for light duty vehicles
- 0.36 grams per mile for heavy duty gasoline powered vehicles
- 2.80 grams per mile for heavy duty diesel powered vehicles

Estimates thus obtained of the SO_2 emissions from motor vehicle exhaust for Pittsburgh and the six county areas are shown in Table 2-2.

SO_2 emissions from the operation of railroads and river vessels were obtained by using the emission factors published by EPA (AP-42 Supplement No. 4, December 1975) and fuel consumption data obtained from the Southwest Pennsylvania RPC. The reported annual fuel oil consumption is

TABLE 2-1

1972 DAILY VEHICLE MILEAGE FOR THE SOUTHWEST PENNSYLVANIA INTRASTATE AIR QUALITY CONTROL REGION

Area	EPA Region III Data				SWPRC Data
	Light Duty Vehicles	Heavy Duty Vehicles	Diesel Vehicles	Total All Vehicles	All Vehicles
Pittsburgh	3,458,169	177,722	66,646	3,702,537	3,110,004
Allegheny County	13,578,293	450,671	171,627	14,200,591	13,351,328
Butler County	2,086,405	34,133	12,800	2,133,338	2,187,730
Armstrong County	1,029,916	44,779	17,475	1,092,170	936,865
Westmoreland County	4,931,992	138,280	51,215	5,121,487	5,438,732
Washington County	3,015,601	62,049	24,820	3,102,470	3,263,532
Beaver County	1,905,955	80,675	30,253	2,016,883	2,347,737
TOTAL (All Areas)	26,548,162	810,587	308,190	27,666,939	27,498,927

TABLE 2-2

ANNUAL SO_2 EMISSIONS FROM VEHICLES FOR SELECTED AREAS OF THE SOUTHWEST PENNSYLVANIA AQCR ($g/sec/km^2$)

Area (km^2)	Light Duty Vehicles	Heavy Duty Vehicles	Diesel Vehicles	Total
Incorporated Pittsburgh (142)	0.051	0.005	0.015	0.071
Allegheny County (1886)	0.015	0.001	0.003	0.019
Butler County (2057)	0.002	0.000	0.000	0.002
Armstrong County (1689)	0.001	0.000	0.000	0.002
Westmoreland County (2652)	0.004	0.000	0.001	0.005
Washington County (2219)	0.002	0.000	0.000	0.003
Beaver County (1139)	0.003	0.000	0.001	0.005

$25x10^6$ gallons for railroads and $7x10^6$ gallons for river vessels. The EPA emission factor for railroad locomotives is 57 pounds of SO_2 per 1000 gallons of fuel; the corresponding factor for commercial steamships is 27 pounds of SO_2 per 1000 gallons of fuel oil. These data yield estimates of the total SO_2 emissions from railroads of 712.5 tons per year and 94.5 tons per year from river vessels. Assuming that the total combined railroad and river vessel SO_2 emissions of 807.0 tons per year occur in Allegheny County and Beaver County within a 1-kilometer corridor along the Ohio, Allegheny and Monongahela Rivers, the area-source SO_2 emissions from railroad and river vessels are approximately 4 tons per year per square kilometer.

2.3.2 Space Heating

SO_2 emissions from space heating were estimated using the emission factor of 0.6 pounds per 10^6 cubic feet of natural gas published by EPA (AP-42, February, 1973) and the estimated quantities of fuels being consumed within the Southwest Pennsylvania AQCR. According to the Brown Directory (Natural Gas, Operating Gas Companies, 1973), there are seven natural gas companies serving the region as shown in Table 2-3. Distributing the natural gas being used for residential and commercial heating on a population basis results in the SO_2 emission rates by counties given in Table 2-4. Heat for the large buildings in downtown Pittsburgh is provided by central steam plants. This area therefore uses relatively small amounts of natural gas for space heating.

Coal and oil are not considered to be primary fuels for residential or commercial space heating. According to the Minerals Industry Report, $64.5x10^6$ tons of bituminous and lignite coal were consumed in 1972 in the Commonwealth of Pennsylvania. The industrial/commercial SO_2 emissions inventory for the Southwest Pennsylvania AQCR accounts for $48.0x10^6$ tons of coal per year which is approximately 75 percent of the above 1972 annual coal consumption in the Commonwealth. The Minerals Industry report also estimates that $64.1x10^6$ tons of coal were consumed in

TABLE 2-3

SUMMARY OF NATURAL GAS SOLD IN THE SOUTHWEST PENNSYLVANIA AQCR IN 1973

Type of Customer	Number of Customers	Quantity of Gas (10^6 Cubic Feet)
Residences with Heat	876,182	154,327
Residences without Heat	74,316	1,639
Commercial	68,057	67,849
Industrial	1,031	182,258
Total	1,019,586	416,916

TABLE 2-4

SO_2 EMISSIONS FROM NATURAL GAS SPACE HEATING BY COUNTY

County	Population	Percent of Total Population	Natural Gas Consumed (10^6 cubic feet)	Emissions (tons/yr)
Allegheny	1,605,016	53.8	120,416	36.1
Lawrence	107,374	3.6	8,057	2.4
Beaver	208,418	7.0	15,667	4.7
Greene	36,090	1.2	2,686	0.8
Fayette	154,667	5.2	11.638	3.5
Indiana	79,451	2.7	6,043	1.8
Westmoreland	376,935	12.6	28,200	8.5
Butler	127,941	4.3	9.624	2.9
Washington	210,876	7.1	15,891	4.8
Armstrong	75,590	2.5	5,595	1.7
Totals	2,982,358	100.0	223,812	67.2

1972 by industry and utilities in the Commonwealth of Pennsylvania. The annual consumption of bituminous and lignite coal during 1972 by other users in the Commonwealth is therefore 0.4×10^6 tons. We assume that 75 percent of this coal (0.3×10^6 tons) is used in the Southwest Pennsylvania Region and that one-half of this amount (0.15×10^6 tons) is consumed in hand-fired burners used for space heating. The area included in the Southwest Pennsylvania Region is approximately 1.75×10^4 square kilometers. The total annual consumption of coal used for space heating is therefore about 9 tons per square kilometer. If the average sulfur content of this coal is 5 percent, the corresponding annual SO_2 emissions in the Southwest Pennsylvania Region due to the use of coal for space heating are about 0.8 tons per square kilometer.

The Bureau of Statistics, Research and Planning of the Commonwealth of Pennsylvania reports that $384,636 \times 10^3$ gallons of fuel oils were distributed in the Southwest Pennsylvania AQCR during 1974. The emissions inventory accounts for $254,019 \times 10^3$ gallons which leaves $130,344 \times 10^3$ gallons for consumption by residential and commercial users. The natural gas industry reports that they serve 74,316 customers who do not use gas for space heating. The assumption that all of these customers are using fuel oil for space heating in private dwellings leads to an estimated consumption of $68,464 \times 10^3$ gallons of fuel oil or approximately half of the unaccounted fuel. It is likely that there are additional consumers not included in the gas industries report and that some of the listed and unlisted non-natural gas consumers are classified as commercial users. Therefore, we have put all of the unaccounted fuel oil into area-source space heating. Using the emission factor of 71 pounds per 1,000 gallons of fuel oil with 0.5-percent sulfur for commercial burners published by EPA (AP-42 February, 1972) results in a total emission rate of 4627 tons per year or 0.39 tons per year per square kilometer.

2.3.3 Aircraft Emissions

SO_2 emissions were estimated for the Greater Pittsburgh Airport and the Allegheny County Airport using the emissions factors published by EPA (AP-42, April, 1973) and the aircraft operations by type reported for FAA operated towers during 1975. Table 2-5 gives the reported operation from each airport tower. Aircraft operations at the Greater Pittsburgh Airport were assumed to be allocated as follows:

- Air Carrier -- 10% Heavy Aircraft
  60% Long Range Aircraft
  30% Medium Range Aircraft

- Air Taxi -- 5% Helicopter
  47.5% General Aviation Turboprop
  47.5% General Aviation Piston

- General Aviation -- 20% Business Jet
  20% General Aviation Turboprop
  60% General Aviation Piston

- Military -- 80% Military Transport
  20% Military Jet

The estimated SO_2 emissions rate is 188.5 tons per year for aircraft operations at the Greater Pittsburgh Airport.

Aircraft operations at the Allegheny County Airport were assumed to be allocated as follows:

- Air Carrier -- 100% Medium Range Aircraft

TABLE 2-5

AIRCRAFT OPERATIONS REPORTED FOR 1975
(Takeoff/Landing Cycles)

Greater Pittsburgh Airport	
Air Carrier	172,331
Air Taxi	54,230
General Aviation	46,179
Military	12,425
Allegheny County Airport	
Air Carrier	5
Air Taxi	566
General Aviation	168,378
Military	1,497

- Air Taxi -- 50% General Aviation Turboprop
  50% General Aviation Piston

- General Aviation -- 80% General Aviation Single Engine Piston
  10% General Aviation Turboprop
  10% General Aviation Dual Engine Piston

- Military -- 50% Military Transport
  50% Helicopter

The estimated SO_2 emissions rate is 10.0 tons per year for aircraft operations at the Allegheny County Airport.

SECTION 3
METEOROLOGICAL INPUTS

3.1 METEOROLOGICAL INPUTS REQUIRED BY THE LONG-TERM MODEL (LONGZ)

Meteorological inputs required by the long-term dispersion model LONGZ described in Appendix A were principally obtained from the seasonal and annual distributions of wind speed and wind direction, classified according to the Pasquill stability categories, for the Greater Pittsburgh Airport. These distributions were developed from the surface observations using the definitions of Pasquill stability categories given by Turner (1964), which are based upon solar radiation (insolation) and wind speed. The thermal stratifications represented by the various Pasquill stability categories are:

- A -- Very unstable
- B -- Unstable
- C -- Slightly unstable
- D -- Neutral
- E -- Slightly stable
- F -- Stable

Figure 3-1 shows the 1965 annual frequency distribution of wind direction at the Greater Pittsburgh Airport. Inspection of the figure reveals that most frequent winds at the Greater Pittsburgh Airport are from the west. The 1965 seasonal wind distributions for the Greater Pittsburgh airport are presented in Appendix B.1.

In the dispersion models described in Appendix A, the variation with height of the wind speed in the surface mixing layer is assumed to follow a wind-profile exponent law of the form

$$\bar{u}\{z\} = \bar{u}\{z_R\}\left(\frac{z}{z_R}\right)^p \qquad (3\text{-}1)$$

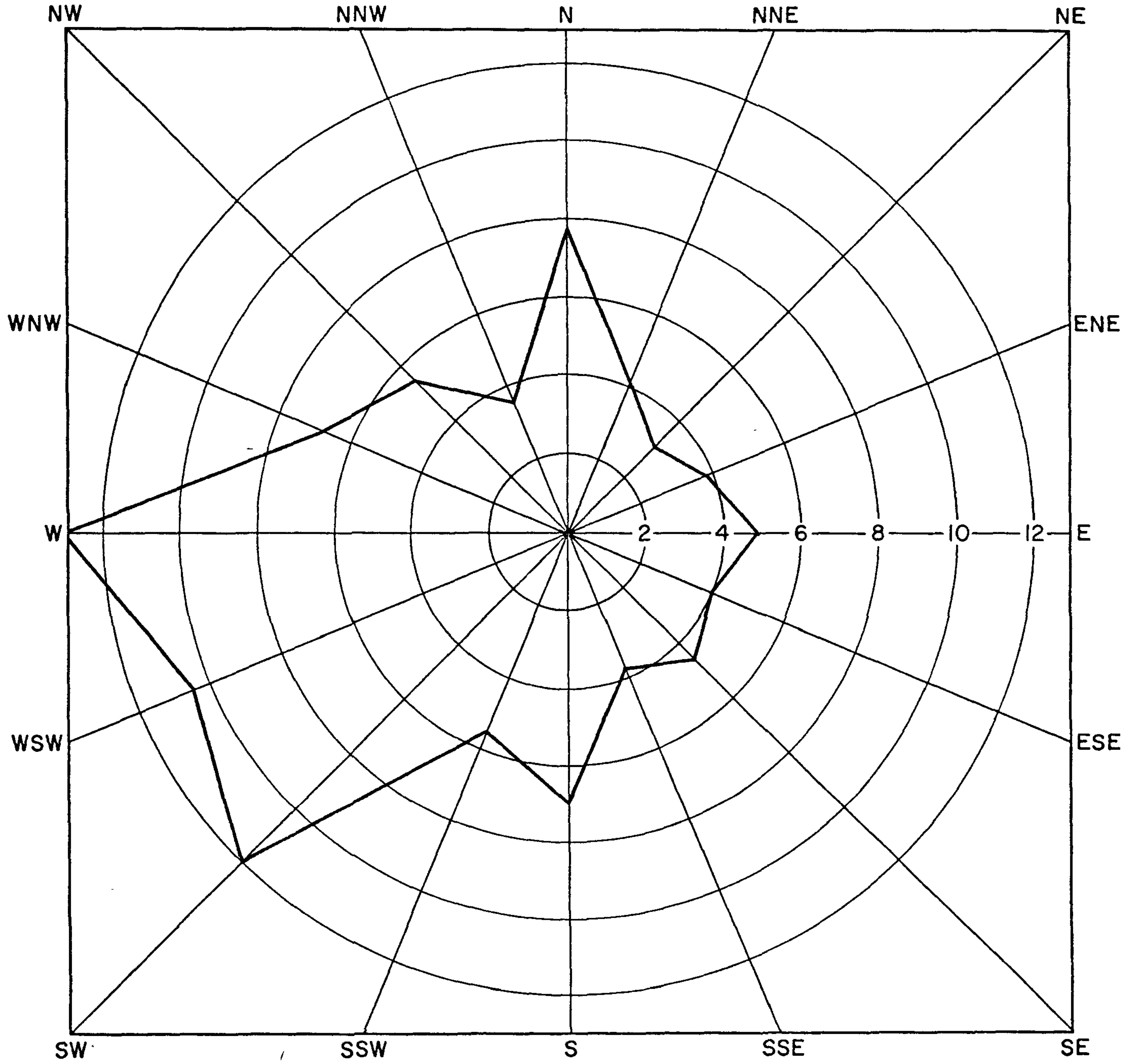

FIGURE 3-1. Annual frequency distribution of wind direction obtained from the 1965 surface observations at the Greater Pittsburgh Airport. Percent frequency scale is shown at right center.

where

$\bar{u}\{z\}$ = wind speed at height z above the surface

$\bar{u}\{z_R\}$ = wind speed at a reference height z_R above the surface

p = wind-profile exponent

In the case of discharges from tall stacks, as discussed in Sections A.3 and A.5 of Appendix A, the wind-profile exponent law is used to adjust the mean wind speed from the reference (airport) measurement height to the stack height for the plume rise calculations, and to the plume stabilization height for the concentration calculations. In the case of low-level emissions, which are generally treated as building sources, the wind-profile exponent law is similarly used to obtain the wind speed at the assigned source height which depends on the vertical dimensions of the buildings or other structures. If the assigned source height is below the reference height, the wind speed at the reference height is used in the model calculations. Values for the wind-profile exponent p assigned to the various combinations of wind speed and stability for the long-term calculations are listed in Table 3-1. These exponent values are based on the results obtained by DeMarrais (1959) and Cramer, et al., (1972).

Our vertical expansion (σ_z) curves, which include the effects of the initial vertical plume or building dimension, relate the vertical turbulent intensity directly to plume growth (see Equation (A-13) of Appendix A). Table 3-2 lists the values of the standard deviation of the wind elevation angle σ'_E corresponding to the Pasquill stability categories for rural and urban areas. The rural σ'_E values are based in part on the measurements of Luna and Church (1972) and are consistent with the σ'_E values implicit in the vertical expansion curves presented by Pasquill (1961). In order to adjust for the effects of surface roughness elements and heat sources, the σ_E' values for the stability category one step more unstable than the indicated stability category are used in the calculations for urban areas. (The entire Southwest Pennsylvania AQCR was considered to

TABLE 3-1

WIND-PROFILE EXPONENTS USED IN THE ANNUAL AVERAGE CONCENTRATION CALCULATIONS

Pasquill Stability Category	Wind-Speed Category (m/sec)*					
	0.0-1.5	1.6-3.1	3.2-5.1	5.2-8.2	8.3-10.8	>10.8
A	0.10	0.10	--	--	--	--
B	0.10	0.10	0.10	--	--	--
C	0.20	0.15	0.10	0.10	0.10	--
D	0.25	0.20	0.15	0.10	0.10	0.10
E	0.30	0.25	0.20	--	--	--

*Measurement height is 6.1 meters above the ground surface.

TABLE 3-2

VERTICAL TURBULENT INTENSITIES FOR RURAL AND URBAN AREAS

Pasquill Stability Category	σ'_E (radians)	
	Rural	Urban
A	0.1745	0.1745
B	0.1080	0.1745
C	0.0735	0.1080
D	0.0465	0.0735
E	0.0350	0.0465
F	0.0235	--

be an urban area in the dispersion model calculations described in this report) A procedure of this type is suggested by Calder (1971), Bowne (1974) and others. The E and F stability categories are combined in urban areas because we believe that the effects of surface roughness elements and heat sources are incompatible with the minimal turbulent mixing associated with the Pasquill stability category F.

The height of the top of the surface mixing layer is defined as the height at which the vertical intensity of turbulence becomes effectively zero. This condition is fulfilled when the vertical turbulent intensity is of the order of 0.01 radians or smaller. Because direct measurements of the intensity of turbulence are not routinely made, indirect indicators such as discontinuities in the vertical wind and temperature profiles must be used to estimate the depth of the surface mixing layer. In the simplest case, the base of an elevated inversion layer is usually assumed to represent the top of the surface mixing layer. However, even with a surface-based inversion, a shallow mechanical mixing layer will always be present due to surface roughness elements and, in urban areas, surface heat sources.

Holzworth (1972) has developed a procedure for estimating early morning and afternoon mixing depths for urban areas from rawinsonde observations and surface temperature measurements. Tabulations of daily observations of the depth of the surface mixing layer, developed by using the Holzworth (1972) procedures, are available for most rawinsonde stations operated by the National Weather Service. For the annual and seasonal concentration calculations, we analyzed seasonal tabulations of daily observations of mixing depth and average surface wind speed at the Greater Pittsburgh Airport for the period 1960 through 1964 (Environmental Data Service, 1966) in order to determine seasonal median early morning and afternoon mixing depths for each wind-speed category. The median afternoon mixing depths were assigned to the A, B and C stability categories; the median early-morning mixing depths were assigned to the combined E and F stability categories and the median early morning and afternoon mixing depths were averaged and assigned to the D stability category. Table 3-3 gives

TABLE 3-3

MIXING-LAYER DEPTHS IN METERS USED IN THE ANNUAL CONCENTRATION CALCULATIONS

Pasquill Stability Category	Wind-Speed Category (m/sec)					
	0.0-1.5	1.6-3.1	3.2-5.1	5.2-8.2	8.3-10.8	>10.8
(a) Winter						
A	500	650	--	--	--	--
B	500	650	710	--	--	--
C	500	650	710	710	710	--
D	320	470	670	710	710	710
E	140	290	630	--	--	--
(b) Spring						
A	1530	1530	--	--	--	--
B	1530	1530	1530	--	--	--
C	1530	1530	1530	1530	1530	--
D	825	920	1030	1415	1530	1530
E	120	310	530	--	--	--
(d) Summer						
A	1730	1730	--	--	--	--
B	1730	1730	1730	--	--	--
C	1730	1730	1730	1730	1730	--
D	960	1025	1235	1295	1295	1295
E	190	320	740	--	--	--
(d) Fall						
A	1230	1230	--	--	--	--
B	1230	1230	1230	--	--	--
C	1230	1230	1230	1230	1230	--
D	685	740	970	1190	1230	1230
E	140	250	710	--	--	--

the seasonal median mixing depths for the joint combinations of the wind-speed and stability categories determined for the Pittsburgh area.

The Briggs (1971) plume-rise formulas given in Section A.2 of Appendix A require the ambient air temperature as an input. For the seasonal concentration calculations, seasonal average afternoon temperatures measured at the Greater Pittsburgh Airport during the period 1963 through 1972 were assigned to the A, B and C stability categories; average morning and evening temperatures were assigned to the D stability category; and average nighttime temperatures were assigned to the combined E and F categories. Table 3-4 lists the ambient air temperatures used in the long-term calculations.

The Briggs (1971) plume-rise formulas given in Section A.2 of Appendix A also require the vertical potential temperature gradient as an input. Table 3-5 lists the vertical potential temperature gradients used in the long-term concentration calculations. The potential temperature gradients in Table 3-5 were assigned on the basis of the Turner (1964) and Pasquill (1961) definitions of the Pasquill stability categories, the measurements of Luna and Church (1972), and our own previous experience.

3.2 METEOROLOGICAL INPUTS REQUIRED BY THE SHORT-TERM MODEL (SHORTZ)

Meteorological inputs required by the short-term dispersion model SHORTZ were principally obtained from the hourly surface observations and the twice-daily rawindsonde data for the Greater Pittsburgh Airport. The Pasquill stability categories were determined using the Turner (1964) procedures. Table 3-6 lists the lateral turbulent intensities for rural and urban areas by Pasquill stability category which were used in the short-term model calculations. The actual hourly values of all meteorological inputs used with the short-term model are described in Section 6.1.

TABLE 3-4

AMBIENT AIR TEMPERATURES USED IN THE ANNUAL AVERAGE CONCENTRATION CALCULATIONS

Pasquill Stability Category	Ambient Air Temperature (^{o}K)			
	Winter	Spring	Summer	Fall
A	273.2	287.0	298.3	289.5
B	273.2	287.0	298.3	298.5
C	273.2	287.0	298.3	298.5
D	271.2	283.7	294.4	286.3
E	269.7	280.3	290.7	282.4

TABLE 3-5

VERTICAL POTENTIAL TEMPERATURE GRADIENTS IN DEGREES KELVIN PER METER USED IN THE ANNUAL AVERAGE CONCENTRATION CALCULATIONS

Pasquill Stability Category	Wind-Speed Category (m/sec)					
	0.0-1.5	1.6-3.1	3.2-5.1	5.2-8.2	8.3-10.8	>10.8
A	0.000	0.000	--	--	--	--
B	0.000	0.000	0.000	--	--	--
C	0.000	0.000	0.000	0.000	0.000	--
D	0.015	0.010	0.005	0.003	0.003	0.003
E	0.030	0.020	0.015	--	--	--

TABLE 3-6

LATERAL TURBULENT INTENSITIES FOR RURAL AND URBAN AREAS

Pasquill Stability Category	σ'_A (radians)	
	Rural	Urban
A	0.2495	0.2495
B	0.1544	0.2495
C	0.1051	0.1544
D	0.0665	0.1051
E	0.0501	0.0665
F	0.0336	--

SECTION 4

SO_2 DECAY AND BACKGROUND

4.1 ADJUSTMENT OF THE MODEL CONCENTRATION CALCULATIONS FOR SO_2 DECAY

During atmospheric transport and dispersion, some of the SO_2 initially emitted from stacks and other sources is oxidized to form sulfates. Because the oxidation process reduces the total amount of SO_2, it is necessary to make allowance for this depletion in the model calculations to preclude overestimation of the ground-level SO_2 concentrations. This is accomplished through the use of an exponential decay term as a direct multiplier of the source strength used in the model calculations. The mathematical expression for SO_2 decay is of the form

$$Q\{t\} = Q\{t=0\}\, e^{-\lambda t} \tag{4-1}$$

where

$Q\{t\}$ = adjusted source strength at time t

t = $x/\bar{u}$

x = downwind distance from the source

$\bar{u}$ = mean wind speed

$Q\{t=0\}$ = initial source strength

λ = SO_2 decay rate

In the above expression, the decay or loss of SO_2 through oxidation is assumed to be represented by a first order reaction (Alkezwenny and Powell, 1977). The decay of SO_2 is also expressed in terms of the SO_2 half-life or the time required to reduce the amount of SO_2 initially contained in a plume by 50 percent. If the decay rate λ is in units of percent per hour, the SO_2 half-life is equal to $(100 \ell n\ 2)/\lambda$ hours.

Measurements of the rate at which SO_2 is transformed to sulfates in plumes from coal-fired power plants show an extremely wide range of values depending principally on the time of day, season of the year, geographical location and level of pollutant concentrations (Sidebottom, 1972; Tesche, et al., 1976; Lusis and Wiebe, 1976; Forest and Newman, 1976; Wilson, et al., 1977; Gillani, et al., 1978). From the data presented in the above references, we believe that the values of the decay coefficient λ most likely to apply to the Southwest Pennsylvania AQCR range from 1 to 6 percent per hour with an average value of about 3.5 percent per hour. The SO_2 half-life values corresponding to the above range in λ are 11 to 69 hours with an average value of about 20 hours. An average SO_2 half-life of 20 hours was used for all of the calculations of ground-level SO_2 concentrations in this study. This half-life is consistent with the decay rate used by TRC, Inc. in a study of the impact of SO_2 emissions in Allegheny County, Pennsylvania recently conducted for the Allegheny County Bureau of Air Pollution Control.

Table 4-1 shows the annual average ground-level SO_2 concentrations calculated at selected monitor sites using SO_2 half-life values of 3, 12, 20 and 30 hours. These calculations indicate that a change in the SO_2 half-life from 12 to 30 hours produces a change of about 10 percent in the annual average concentrations. The observed annual average SO_2 concentration for each of the monitoring sites is also given in Table 4-1. With the exception of the Midland monitor site, the observed concentrations tend to support the use of a relatively long SO_2 half-life.

TABLE 4-1

THE EFFECTS OF SO_2 HALF-LIFE ON THE CALCULATED ANNUAL-AVERAGE GROUND-LEVEL SO_2 CONCENTRATION AT SELECTED MONITOR LOCATIONS

Monitor Location	SO_2 Concentration ($\mu g/m^3$)				
	SO_2 Half-Life (Hours)				Observed Concentration
	3	12	20	30	
Beaver Falls	24.5	39.5	43.1	45.2	47.2
New Castle	13.1	25.3	29.1	31.4	39.3
Midland	87.4	107.1	112.5	114.2	78.6
Hazelwood	124.2	146.7	149.7	154.6	141.5
Logans Ferry	36.9	53.5	57.5	60.1	73.0
Downtown	48.2	70.5	75.5	78.3	73.0

4.2 ESTIMATES OF SO_2 BACKGROUND CONCENTRATION

The SO_2 background concentration is defined as the concentration contributed by all SO_2 sources not included in the emissions inventory used for the dispersion-model calculations. In this study, many of the difficulties associated with obtaining accurate background estimates were eliminated by the inclusion of the emissions inventory of all SO_2 sources located within the Southwest Pennsylvania Air Quality Control Region with annual emissions of 10 or more tons, as well as the major SO_2 sources in the West Virginia Panhandle and along the eastern border of Ohio. To the best of our knowledge, the emissions inventory used in the model calculations includes all the large SO_2 sources located within 30 kilometers of the three principal grid areas (New Castle, Beaver and Monessen) for which model calculations were made.

The SO_2 sources not included in the emissions inventory, and thus the sources most likely to contribute to the background concentration in the study area, are:

- Emissions from classical area sources located within the study area

- Emissions from major point sources located outside the area included in the emission inventory

The area-source emissions inventory discussed in Section 2 was used with the long-term dispersion model for area sources in Appendix A to calculate the impact of area sources on ambient SO_2 air quality in the Beaver Valley. Emissions from the following specific types of area sources were included in the calculations:

- Vehicle traffic in the Beaver Valley area which was represented by 18 area sources

- Home-heating in the Baden area

- Aircraft operations at the Greater Pittsburgh Airport

- Rail and barge traffic in a 1-kilometer corridor along the Ohio River and extending along the Beaver River to Beaver Falls which was represented by 131 area sources

Figure 4-1 shows the SO_2 concentration isopleths resulting from the long-term area source calculations. The maximum calculated annual average concentration for the combined effects of emissions from home heating, rail traffic and barge traffic is 2.7 micrograms per cubic meter which occurs in Baden near the J & L Aliquippa Plant. Figure 4-2 shows the isopleth pattern of SO_2 concentration calculated for the single home-heating area source in Baden. The dimensions of the Baden area source are 1.6- x 1.6-kilometers and the SO_2 emission rate for home heating is 0.1 grams per second which is equivalent to 1.36 tons of SO_2 per square kilometer per year. The air quality impact of all the above area source emissions calculated for the Beaver Valley by means of the short-term dispersion model for area sources is very similar to that calculated by the corresponding long-term dispersion model. Specifically, the calculated short-term concentration contributions from area sources are approximately equal to the calculated long-term concentration contributions. The only significant difference is a displacement of the isopleth pattern reflecting the specific wind-direction distributions used in the short-term calculations. We conclude that the maximum contribution of area-source emissions to the short-term and annual SO_2 background concentrations is less than 5 micrograms per cubic meter. The results discussed in the following sections of this report do not include any estimates or calculations of the contribution of area sources to the total SO_2 concentrations.

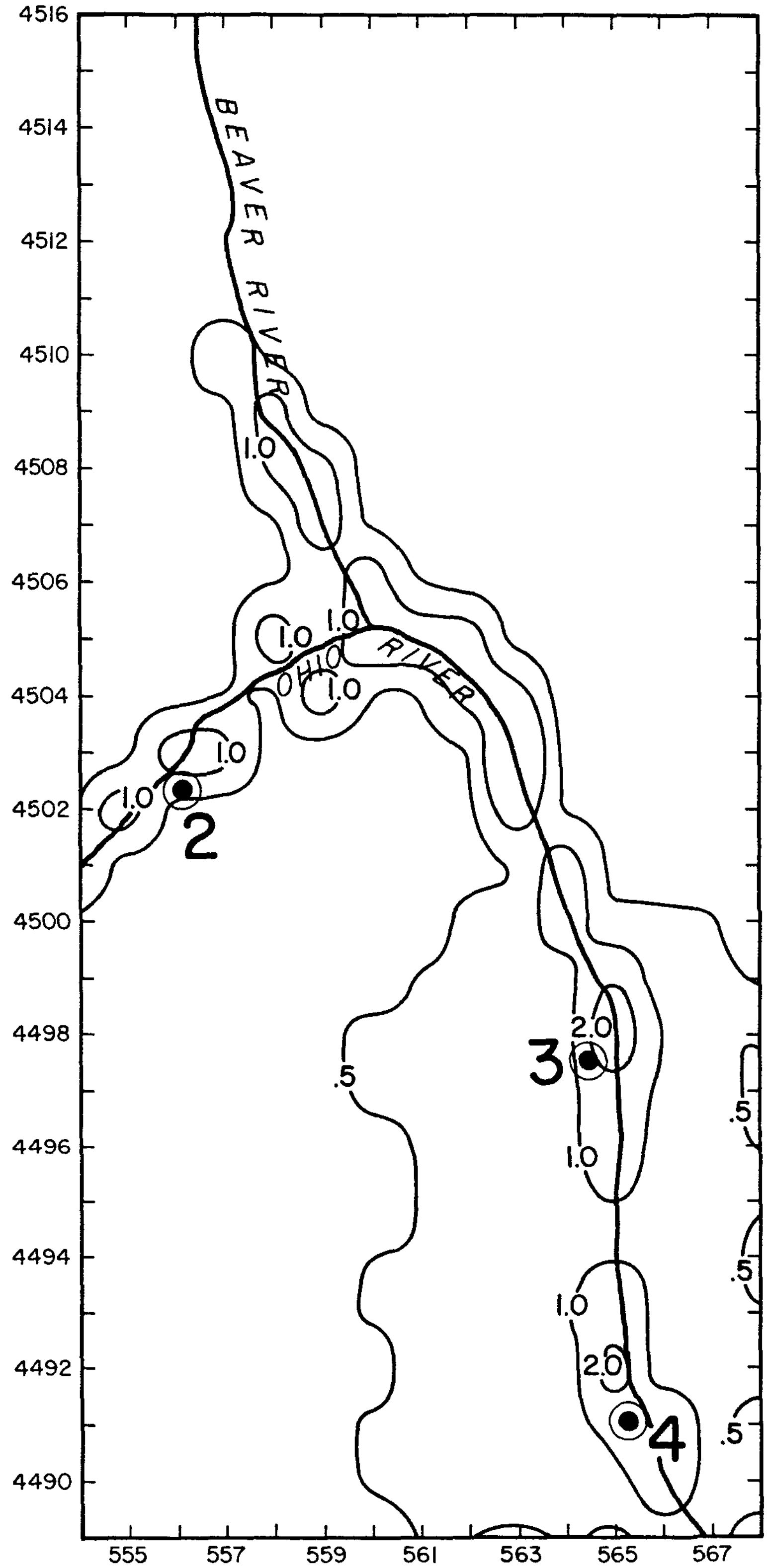

FIGURE 4-1. Isopleths of annual average SO_2 ground-level concentration in micrograms per cubic meter calculated for the Beaver Valley using the long-term area source model. The numbers 2, 3 and 4 respectively refer to the St. Joe Minerals, J & L Aliquippa and Duquesne Light, Phillip Plants.

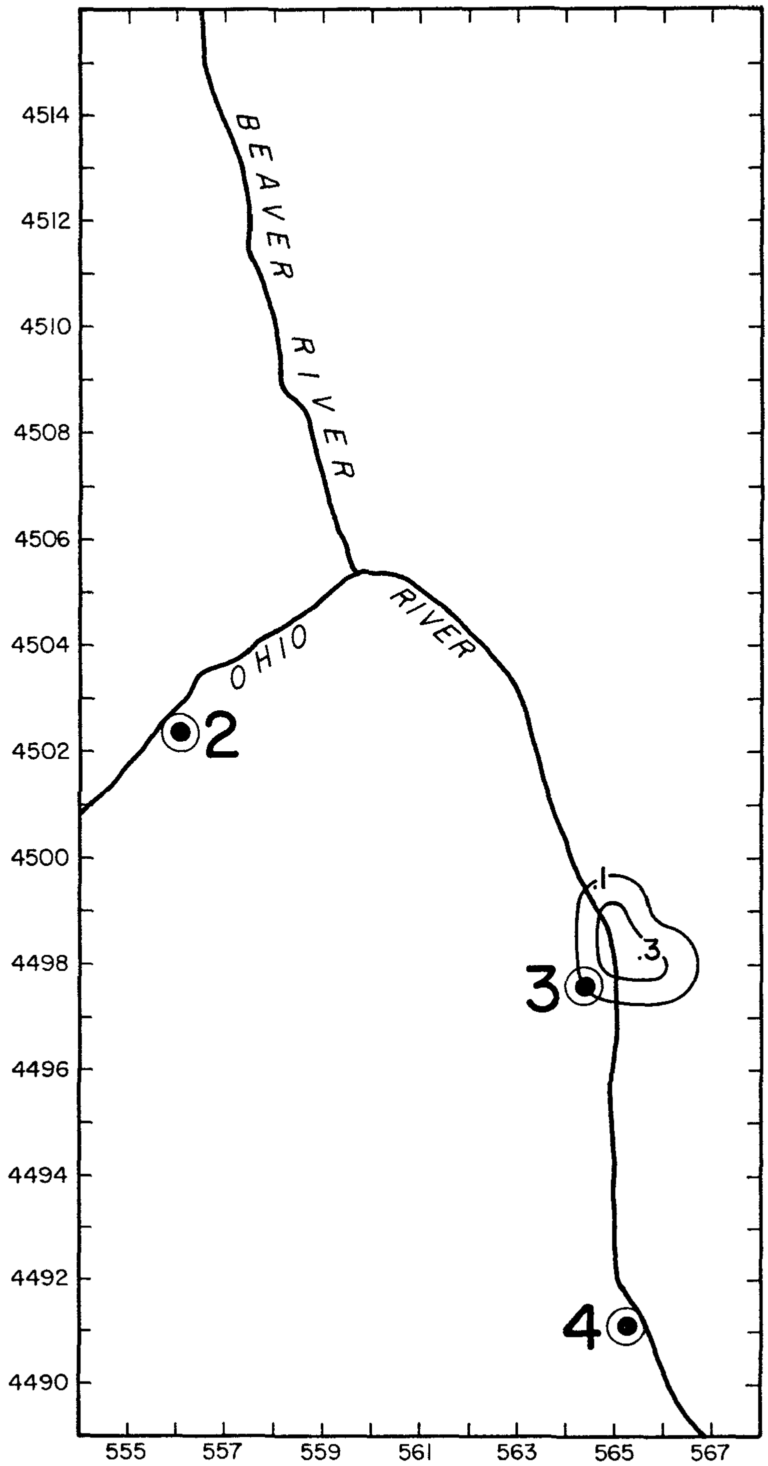

FIGURE 4-2. Isopleths of annual average SO_2 ground-level concentration in micrograms per cubic meter calculated for the single home-heating area source in Baden. The numbers 2, 3 and 4 respectively refer to the St. Joe Minerals, J & L Aliquippa and Duquesne Light, Phillip Plants.

The potential contribution to the background SO_2 concentration from the atmospheric transport or advection into the study area from major point sources located beyond the area included in the emissions inventory was estimated as follows. According to the results of the annual average concentration calculations described in Section 5 below, the combined contribution of the Ohio and West Virginia sources in the New Castle area, which is approximately 50 kilometers from these sources, is about 15 micrograms per cubic meter. Similarly, the combined contribution of these sources in the Beaver area, which is at a distance of approximately 20 kilometers, is about 27 micrograms per cubic meter. The contribution of the Ohio and West Virginia sources is thus approximately inversely related to the distance from the sources to the receptors or grid points. If we assume that a similar number of other major SO_2 sources are located at a distance of 50 to 100 kilometers, it follows that the maximum contribution of these sources to the annual average background concentration in the study area would be about 10 micrograms per cubic meter. However, the number of major SO_2 sources not included in the emissions inventory used in this study which are located within 100 kilometers of the New Castle and Beaver areas is very small. Therefore, we believe that the annual average SO_2 background concentration contributed by distant major SO_2 sources not included in the inventory is insiginificant compared to the contributions of the sources contained in the inventory. The same reasoning leads to the conclusion that the short-term background concentration from distant sources not included in the emissions inventory is also insignificant.

SECTION 5
LONG-TERM CALCULATIONS

5.1 CALCULATION PROCEDURES

Figure 5-1 is a map of the Southwest Pennsylvania AQCR and adjacent areas in Ohio and West Virignia showing the locations of the various calculation grids as well as the large SO_2 sources and source complexes used in the long-term model calculations. The SO_2 monitor sites used in the long-term model validation calculations are also shown. The dashed lines in the figures define the limits of the gross calculation grid used in the early part of the study to determine the areas within the Beaver Valley and Monongahela Valley Air Basins in which high ground-level SO_2 concentrations would most likely occur. The overall dimensions of the gross calculation grid are 100 x 140 kilometers. A regular 5-kilometer spacing between grid points was used within a central 60 x 100 kilometer section of the gross grid which included most of the major SO_2 sources in the Southwest Pennsylvania AQCR. A 10-kilometer spacing of grid points was used in the portion of the gross grid outside this central section.

The five shaded areas in Figure 5-1 were selected for detailed dispersion-model calculations with a 1-kilometer spacing of grid points, using the annual 1980 compliance emissions inventory. The selection of the five smaller calculation grids was based on the results of model calculations made with the LONGZ computer program using the annual 1980 compliance emissions inventory in Appendix C.1 with the meteorological inputs in Appendix B.1 developed from the 1965 hourly observations made at the Greater Pittsburgh Airport. The Beaver calculation grid (Number 1 in Figure 5-1) measures 17 x 27 kilometers and is approximately centered on the confluence of the Beaver and Ohio Rivers. The New Castle calculation grid (Number 2 in Figure 5-1) measures 7 x 10 kilometers and encloses

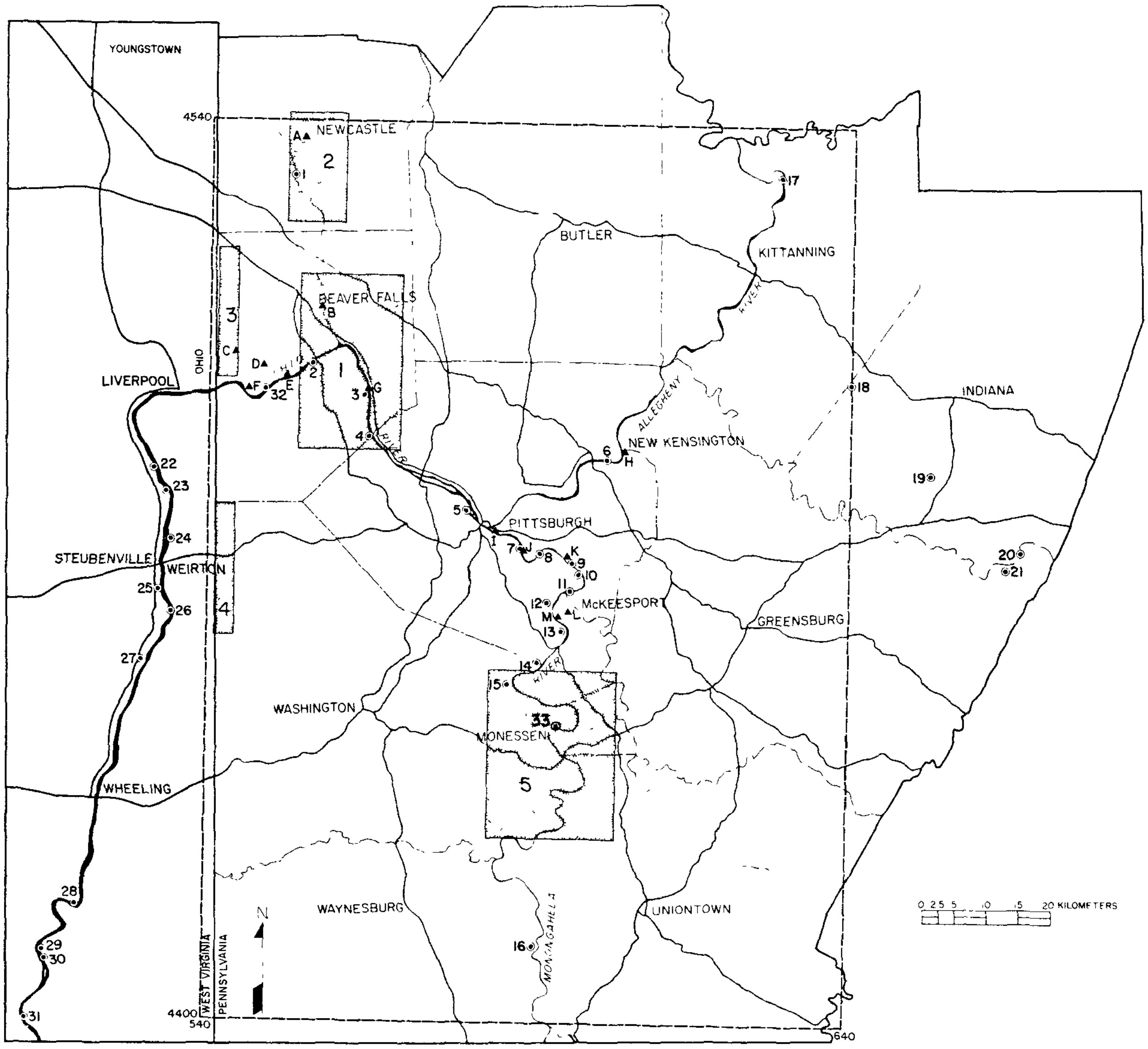

FIGURE 5-1. Map of the Southwest Pennsylvania AQCR and surrounding area. Dashed lines show the gross grid and shaded areas show the five smaller grids used for dispersion-model calculations. Major SO_2 sources and source complexes are indicated by the numbers 1 through 33 and SO_2 monitor locations used for model validation are indicated by the letters A through M.

the heavily populated area around the city of New Castle. The two western border calculation grids (Number 3 and Number 4 in Figure 5-1) are each 4 x 17 kilometers and are located along sections of the border of the Southwest Pennsylvania AQCR likely to be heavily impacted by the large SO_2 sources across the border in eastern Ohio and in West Virginia. The Monessen calculation grid (Number 5 in Figure 5-1) measures 21 x 27 kilometers and is approximately centered on the Monengahela River Valley near Charleroi. The major SO_2 sources and the SO_2 monitor locations in Figure 5-1 are identified in Tables 5-1 and 5-2.

The meteorological inputs for the long-term calculations of ground-level SO_2 concentrations were developed from observations made at the Greater Pittsburgh Airport (See Section 3). We used annual and seasonal statistical summaries of the wind speed and direction observations for the years 1964 and 1973 through 1977 in an attempt to define a worst-case year (i.e., a year in which the meteorology would lead to the highest calculated annual average SO_2 concentrations). As might be expected, the definition of a worst-case year is very complicated because the calculated maximum SO_2 ground-level concentrations are critically dependent on both the source-receptor geometry and the meteorology. Consequently, the worst-case meteorology varies with receptor location. Because of these difficulties, we decided to use 1965 as the worst-case meteorological year on the basis of a study by Rubin (1974). In this study, Rubin defined 1965 as the worst-case meteorological year for SO_2 concentrations in Allegheny County from the results of annual SO_2 model calculations made using a fixed set of point-source emissions data for Allegheny County with various sets of meteorological inputs developed from the annual wind distributions for the Greater Pittsburgh Airport.

The annual 1980 compliance emissions Inventory given in Appendix C.1 was used with the LONGZ computer program containing the long-term dispersion model described in Appendix A to calculate annual ground-level SO_2 concentrations in the five grid areas shown in Figure 5-1. The results of these calculations are described below and in Section 8.

TABLE 5-1

LIST OF MAJOR SO_2 SOURCES IN FIGURE 5-1

Source Number	Source Name	UTM Coordinates (m)	
		X	Y
1	Penn Power, West Pittsburgh	553,105	4,531,767
2	St. Joe Minerals	556,065	4,502,301
3	J & L Aliquippa	564,400	4,497,500
4	Duquesne Light, Phillips	565,260	4,491,020
5	Duquesne Light, Brunot Is.	580,680	4,479,680
6	Duquesne Light, Cheswick	602,330	4,487,800
7	J & L Pittsburgh	589,000	4,473,900
8	USS Homestead	592,100	4,473,100
9	USS Edgar Thomson	597,260	4,471,685
10	USS Duquesne	598,324	4,470,025
11	USS National	597,000	4,467,500
12	USS Irvin	593,180	4,465,700
13	USS Clairton	595,500	4,461,500
14	Duquesne Light, Elrama	592,000	4,456,200
15	Penn Power, Mitchell	587,340	4,452,810
16	Hatfield Power	591,570	4,412,040
17	Armstrong Power	628,979	4,531,996
18	Keystone Power	640,141	4,502,155
19	Homer City Power	652,756	4,486,147
20	Seward Power	666,882	4,474,602
21	Conemaugh Power	664,582	4,471,929
22	Ohio Ediwon, Sammis	531,700	4,485,500
23	Ohio Power, Toronto	533,500	4,481,800
24	National Steel, Wierton Div.	534,300	4,474,400
25	Wheeling-Pittsburgh (North)	532,500	4,466,700
26	Wheeling-Pittsburgh (South)	534,600	4,463,300
27	Cardinal Power	530,000	4,455,800
28	Ohio Edison, Burger	520,500	4,417,500
29	Kammer Power	515,320	4,410,320
30	Mitchell Power	515,800	4,408,670
31	PPG	512,600	4,399,600
32	Penn Power, Mansfield	549,049	4,498,067
33	Wheeling-Pittsburgh, Monessen	594,170	4,446,350

TABLE 5-2

LIST OF SO_2 MONITOR SITES IN FIGURE 5-1

Site Symbol	Site Name (Operator)	UTM Coordinates (m)		Site Elevation (m MSL)
		X	Y	
A	New Castle (DER)	554,830	4,537,240	257
B	Beaver Falls (DER)	557,750	4,510,785	220
C	Fairview (Penn Power)	544,820	4,504,390	390
D	Route 68 (Penn Power)	550,720	4,500,640	238
E	West Beaver (Penn Power)	548,950	4,502,000	375
F	Midland (DER)	546,330	4,498,340	249
G	Baden (DER)	565,090	4,498,380	230
H	Logans Ferry (BAPC)	605,154	4,489,115	268
I	Downtown (BAPC)	585,150	4,476,600	256
J	Hazelwood (BAPC)	589,762	4,473,952	284
K	North Braddock (BAPC)	596,680	4,472,835	275
L	Liberty Boro (BAPC)	596,210	4,464,150	340
M	Glassport (BAPC)	594,190	4,463,580	234

5.2 LONG-TERM CALCULATION RESULTS

The maximum annual average SO_2 concentration calculated for the Beaver grid of 76.8 micrograms per cubic meter occurs at a grid point on the western boundary of the Beaver grid with UTM X and Y coordinates of 554 and 4,503 kilometers respectively. As shown in Figure 5-2, which presents the annual average SO_2 isopleth pattern calculated for the Beaver grid, this maximum is located approximately 2.5 kilometers west-northwest of the St. Joe Minerals Plant, which is indicated by the number 2 in the figure. Additional calculations made at grid points located 1 kilometer southwest, west and northwest of the point of maximum concentration on the western boundary show annual average SO_2 concentrations which are less than the maximum calculated on the boundary.

The contributions of individual sources and source complexes in the 1980 compliance emissions inventory to the maximum annual average concentration calculated for the Beaver grid are given in Table 5-3. Sources in the Beaver Valley contributed 38.5 micrograms per cubic meter or about 50 percent of the calculated maximum concentration. Of the 38.5 micrograms per cubic meter contributed by the Beaver Valley sources, 27.7 micrograms per cubic is contributed by St. Joe Minerals. The combined Eastern Ohio and West Virginia sources contribute 26.7 micrograms per cubic meter or about 35 percent of the total maximum annual average SO_2 concentration calculated for the Beaver grid. Sources located in Allegheny County contribute 7.2 micrograms per cubic meter, other Pennsylvania sources contribute 3.8 micrograms per cubic meter and sources located in the Monongahela River Valley contribute 0.6 micrograms per cubic meter. These source contributions account for the remaining 15 percent of the total calculated maximum concentration. Additional calculations were made using a 100-meter spacing of the grid points within the small Baden grid shown in Figure 5-2. The maximum concentration shown by these calculations of 72.2 micrograms per cubic meter occurs at the grid point located east of the J & L Aliquippa Plant with UTM X and Y coordinates of 565.6 and 4,497.8 kilometers, respectively.

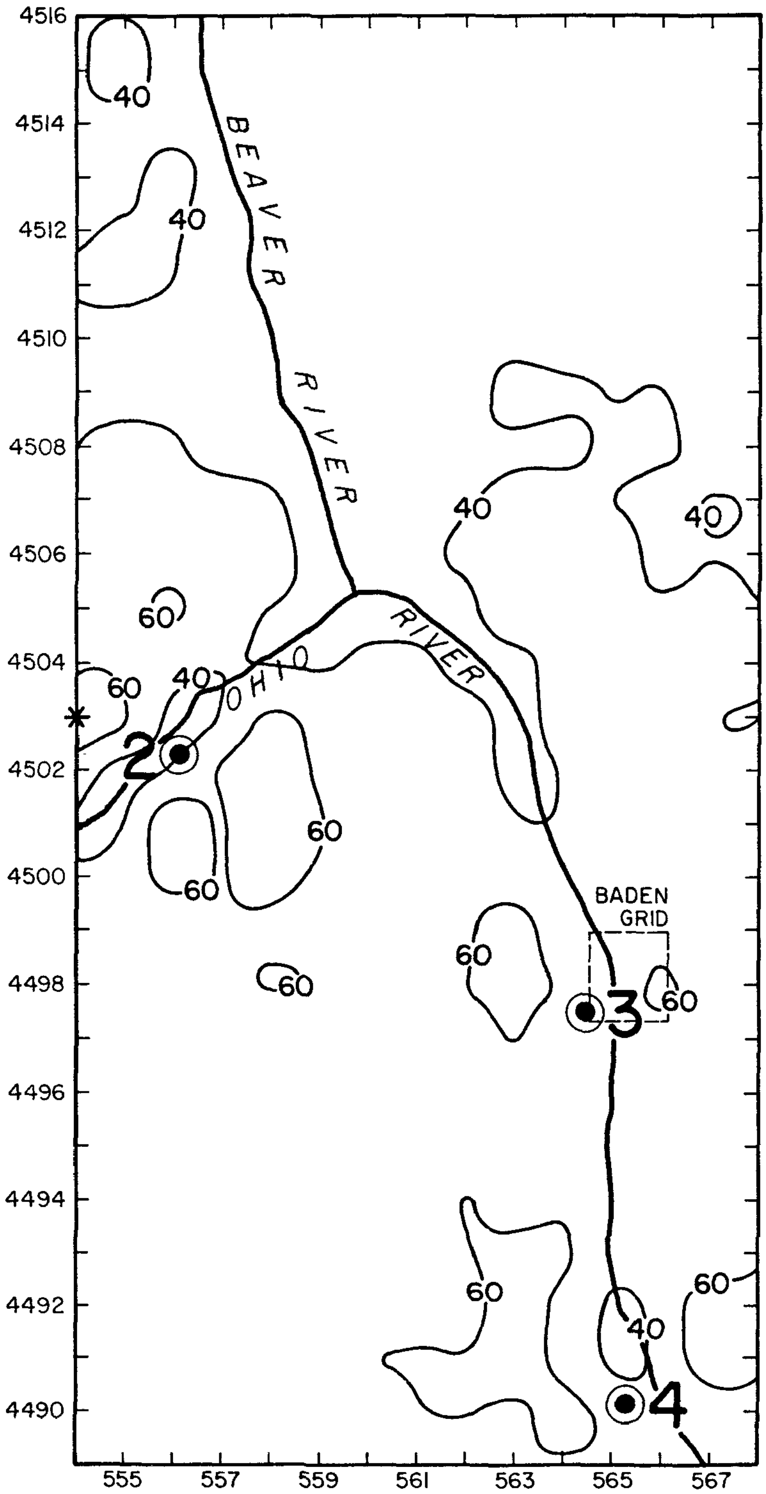

FIGURE 5-2. Isopleths of annual ground-level SO_2 concentration in $\mu g/m^3$ calculated for the Beaver grid using the 1980 compliance emissions inventory. The numbers 2, 3 and 4 respectively show the locations of the St. Joe Minerals, J & L Aliquippa and Duquesne Light, Phillips Sources. The asterisk symbol incicates the point of maximum concentration and the dashed lines show the small Baden calculation grid.

TABLE 5-3

CONTRIBUTIONS OF INDIVIDUAL SOURCES AND SOURCE COMPLEXES TO THE MAXIMUM ANNUAL AVERAGE SO_2 CONCENTRATION CALCULATED FOR THE BEAVER GRID USING THE 1980 COMPLIANCE EMISSIONS INVENTORY

Source	Annual Average SO_2 Concentration* ($\mu g/m^3$)	
Beaver Valley Sources		
J & L Aliquipa	1.5	
Medusa Cement	0.1	
ARCO	4.7	
B & W Wallace Run	0.1	
B & W Tubular Products	0.1	
Shenango China	**	
Ashland Oil	0.1	
Westinghouse Electric	**	
Penn Power, West Pittsburgh	0.3	
Penn Power, Mansfield	4.1	
St. Joe Minerals	27.4	
Bessemer Cement	0.1	
Total		38.5
Allegheny County Sources		7.2
Monongahela Valley Sources		0.6
Other Pennsylvania Sources		3.8
Eastern Ohio Sources		16.7
West Virginia Sources		10.0
Total		76.8

* Occurs at a grid point with the UTM coordinates X=554 kilometers and and Y=4,503 kilometers.

** Less than 0.05 $\mu g/m^3$.

Figure 5-3 shows the annual average SO_2 isopleth pattern calculated for the New Castle grid using the 1980 compliance emissions inventory. The calculated maximum annual average SO_2 concentration resulting from the emissions of all sources combined is 37.3 micrograms per cubic meter and occurs at a point near the southern boundary of the New Castle Grid with the UTM X and Y coordinates of 558 and 4,525 kilometers, respectively. Contributions of the individual sources and source complexes to the maximum annual average SO_2 concentration calculated for the New Castle grid are given in Table 5-4. The calculated contribution of the Beaver Valley sources to the maximum concentration is 14.0 micrograms per cubic meter or about 38 percent of the total. Of the 14.0 micrograms per cubic meter contributed by the Beaver Valley sources, the Medusa Cement Plant contributed 9.3 micrograms per cubic meter. The combined sources in Eastern Ohio and West Virginia contributed 14.4 micrograms per cubic meter to the maximum or about 39 percent of the total.

The contribution of the Penn Power, West Pittsburgh Plant to the annual average SO_2 concentrations in the New Castle area was calculated by using an operating level of 75 percent of capacity and a GEP (Good Engineering Practive) stack height of 145 meters in place of the actual stack height of 229 meters. The maximum annual average SO_2 concentration produced by the West Pittsburgh Plant occurs at a grid point with the UTM X and Y coordinates of 556 and 4,532 kilometers, respectively. The calculated total annual average SO_2 concentration at this point produced by all sources combined is 31.2 micrograms per cubic meter. Of this, 5.8 micrograms per cubic meter or 18.6 percent is contributed by the West Pittsburgh Plant emissions; 4.4 micrograms per cubic meter or 14.1 percent, is contributed by the sources in the Beaver Valley; 7.7 micrograms per cubic meter or 24.7 percent is due to the eastern Ohio sources; 5.2 micrograms per cubic meter or 16.7 percent is contributed by the West Virginia sources; 4.2 micrograms per cubic meter or 13.5 percent is due to the other Pennsylvania sources; and 3.5 micrograms per cubic meter or 11.2 percent is contributed by sources located in Allegheny County. Additional concentration calculations

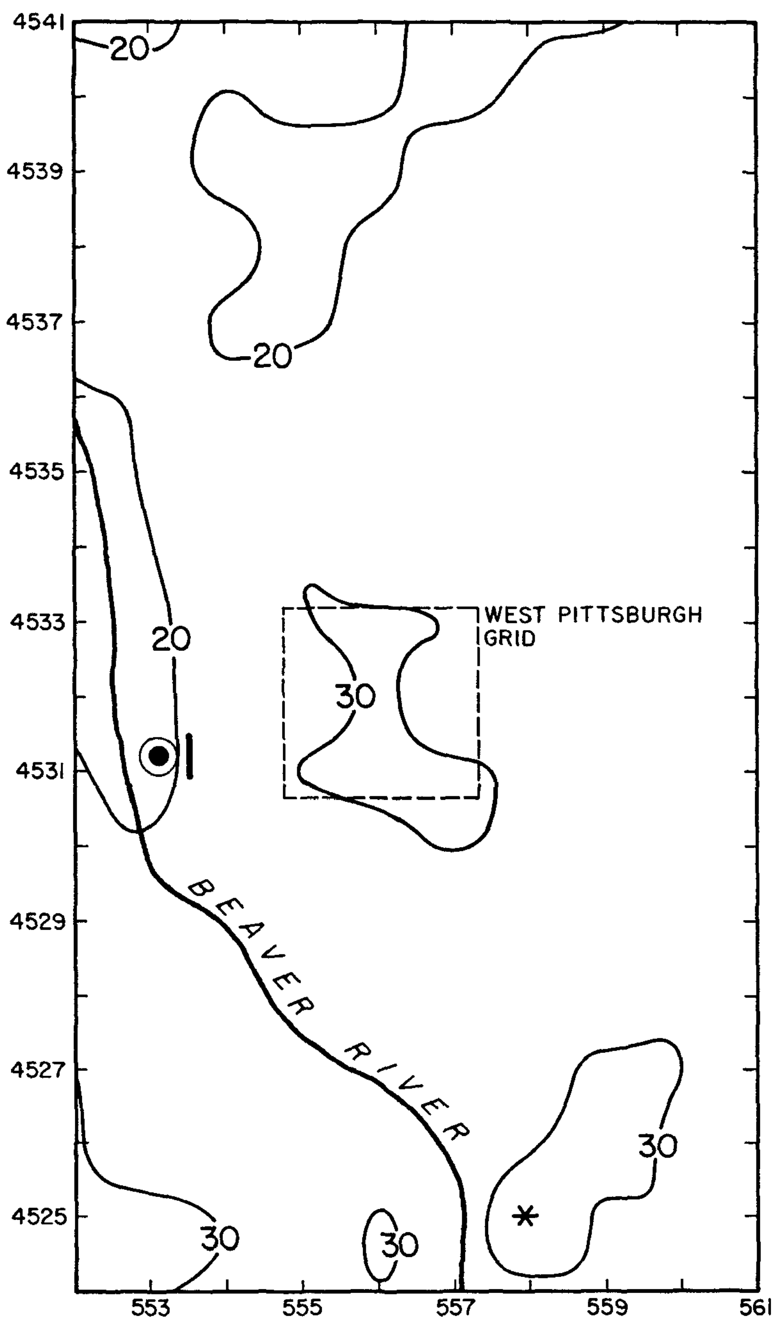

FIGURE 5-3. Isopleths of annual ground-level SO_2 concentration in $\mu g/m^3$ calculated for the New Castle grid using the 1980 compliance emissions inventory. The number 1 refers to the Penn Power, West Pittsburgh Plant. The asterisk symbol indicates the point of maximum concentration and the dashed lines show the small West Pittsburgh calculation grid.

TABLE 5-4

CONTRIBUTIONS OF INDIVIDUAL SOURCES AND SOURCE COMPLEXES TO THE MAXIMUM ANNUAL AVERAGE SO_2 CONCENTRATION CALCULATED FOR THE NEW CASTLE GRID USING THE 1980 COMPLIANCE EMISSIONS INVENTORY

Source	Annual Average SO_2 Concentration* ($\mu g/m^3$)	
Beaver Valley Sources		
J & L Aliquipa	0.6	
Medusa Cement	9.3	
ARCO	0.3	
B & W Wallace Run	0.1	
B & W Tubular Products	0.1	
Shenango China	**	
Ashland Oil	0.1	
Westinghouse Electric	**	
Penn Power, West Pittsburgh	0.9	
Penn Power,	0.6	
St. Joe Minerals	1.7	
Bessemer Cement	0.3	
Total		14.0
Allegheny County Sources		4.3
Monongahela Valley Sources		0.3
Other Pennsylvania Sources		4.3
Eastern Ohio Sources		8.8
West Virginia Sources		5.6
Total		37.3

* Occurs at a grid point with the UTM coordinates X=558 kilometers and Y=4,525 kilometers.

** Less than 0.05 $\mu g/m^3$.

were also made at grid points spaced at 250 meters within the small West Pittsburgh grid shown in Figure 5-3. The location and magnitude of the maximum concentration were unchanged from the values given above.

The maximum annual average SO_2 concentration calculated for the Monessen grid is 86.2 micrograms per cubic meter at a grid point with the UTM X and Y coordinates of 594 and 4,447 kilometers, respectively. This point which is located approximately 1 kilometer north of the Wheeling Pittsburgh Steel Plant at Monessen, is an isolated point of high concentration with the calculated concentrations at the surrounding grid points ranging from 40.0 to 61.5 micrograms per cubic meter. Figure 5-4 shows the annual average SO_2 isopleth pattern calculated for the Monessen grid. The contributions from individual sources and source complexes to the maximum annual average concentration calculated for the Monessen grid are given in Table 5-5. Sources in the Monongahela Valley contribute 53.6 micrograms per cubic meter or approximately 62 percent of the maximum. Allegheny County sources contribute 6.4 micrograms per cubic meter (7.6%). Other Pennsylvania sources contribute 9.0 micrograms per cubic meter (10.4%). Ohio sources 9.9 micrograms per cubic meter (11.5%) and West Virginia Sources contribute 7.1 micrograms per cubic meter (8.2%). Additional concentration calculations were made using a grid spacing of 500 meters within the detail Monessen grid shown in Figure 5-4. The location and magnitude of the maximum concentration were unchanged for the values given above.

The results of the long-term model calculations for the two western border grids are presented in Section 8.1.

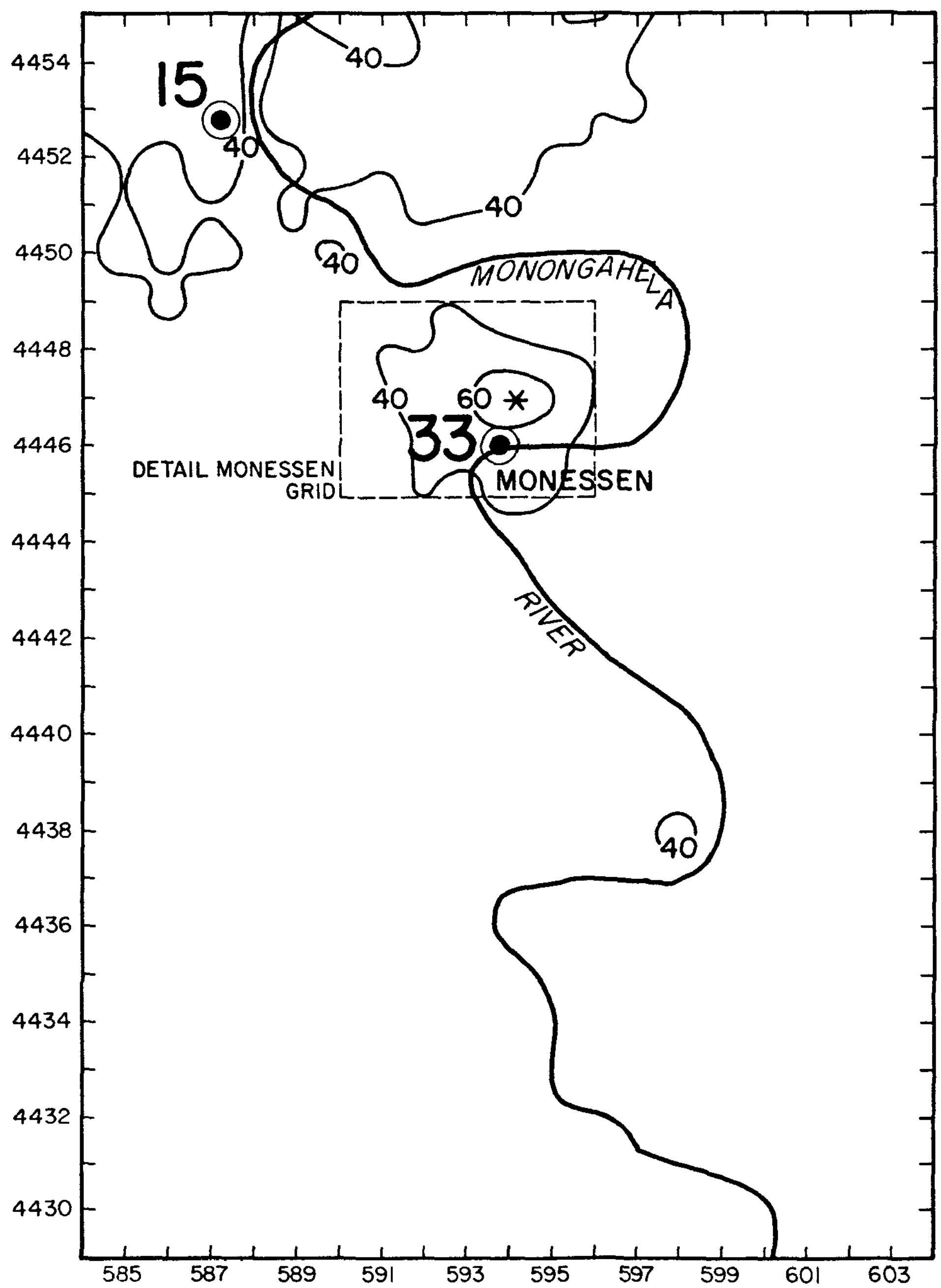

FIGURE 5-4. Isopleths of annual ground-level SO_2 concentrations in $\mu g/m^3$ calculated for the Monessen grid using the 1980 compliance emissions inventory. The number 15 identifies the Penn Power, Mitchell Plant and number 33 identifies the Wheeling-Pittsburgh, Monessen Plant. The asterisk symbol indicates the point of maximum concentration and the dashed lines show the detail Monessen calculation grid.

TABLE 5-5

CONTRIBUTIONS OF INDIVIDUAL SOURCES AND SOURCE COMPLES TO THE MAXIMUM ANNUAL AVERAGE SO_2 CONCENTRATION CALCULATED FOR THE MONESSEN GRID USING THE 1980 COMPLIANCE EMISSIONS INVENTORY

Source	Annual Average SO_2 Concentration* ($\mu g/m^3$)	
Monongahela Valley Sources		
ARMCO	**	
Mitchell	1.0	
Elrama	1.9	
Wheeling Pittsburgh, Monessen	50.3	
Wheeling Pittsburgh, Allenport	0.2	
Allied Chemical	0.2	
Total		53.8
Allegheny County Sources		6.4
Beaver Valley Sources		0.8
Other Pennsylvania Sources		8.2
Eastern Ohio Sources		9.9
West Virginia Sources		7.1
Total		86.2

* Occurs at a grid point with the UTM coordinates X=594 kilometers and Y=4,747 kilometers.

** Less than 0.05 $\mu g/m^3$.

SECTION 6

SHORT-TERM MODEL CALCULATIONS

6.1 CALCULATION PROCEDURES

The short-term 1980 compliance emissions inventory given in Appendix C.2 was used with the SHORTZ computer program containing the short-term dispersion model described in Appendix A and worst-case 3-hour and 24-hour meteorological inputs, developed from hourly meteorological observations made at the Greater Pittsburgh Airport, to calculate short-term concentrations within the five calculation grids described in Section 5.1. In addition to the regular 1-kilometer grid point spacing, a 200-meter spacing was used for the New Castle grid in a small area around the Penn Power, West Pittsburgh Plant and a 500-meter spacing was used for the Monessen grid in a small area of high terrain north of the Monessen Plant of Wheeling-Pittsburgh Steel. The locations of high terrain elevations and SO_2 monitor sites were also included as discrete points in the short-term calculations. To reduce the number of requisite computer calculations, portions of the calculation grids which the meteorological observations indicated would be clearly unaffected by the transport and dispersion of relevant source emissions were excluded from the executions of the SHORTZ computer program.

The following rationale was used in selecting the meteorological conditions most likely to cause the highest short-term ground-level concentrations in the New Castle, Beaver and Western Border calculation grids. As shown in Figure 5-1, there are a very large number of major SO_2 sources located in the Ohio River Valley to the west and south-southwest of these calculation grids. According to short-term 1980 compliance emissions inventory in Appendix C.2, approximately 51 percent of the total emissions for all SO_2 sources combined is from sources located in Ohio and West Virginia. Emissions from sources located in the Beaver Valley account for about 4 percent of the total emissions from all sources; emissions from sources in Allegheny County and the Monongahela River Valley account for about 9 percent of the total emissions and the remaining 36 percent of the total emissions are contributed by other Pennsylvania sources. We analyzed the hourly surface observations from the Greater Pittsburgh Airport for the five-year period from 1973 through 1977, using the PRSIST computer program, to determine the occurrence frequency and time duration of persistent wind directions required to transport emissions from the sources in Ohio, West Virginia, Allegheny County and the Monongahela River Valley to the New Castle and Beaver calculation grids. The results of the PRSIST analysis showed that there were a number of cases during the five-year period of record of 24-hour or longer persistence of wind directions within the 60-degree angular sector from 180 to 240 degrees. These are the wind directions required to transport emissions from the major SO_2 sources in Ohio and West Virginia to the New Castle and Beaver calculation grids, as well as the two Western Border grids shown in Figure 5-1. On the other hand, the PRSIST analysis revealed that wind directions within the sector required to transport emissions from sources located in Allegheny County and the Monongahela River Valley to the New Castle and Beaver calculation grids persisted for only a few hours. We therefore concluded from the results of the PRSIST analysis that the worst-case short-term meteorological conditions for the New Castle, Beaver and Western Border calculation grids were most likely to occur with persistent wind directions from the south-southwest and southwest. Model calculations were made using the short-term 1980 compliance emissions inventory with the SHORTZ computer program and the Greater Pittsburgh Airport hourly meteorological observations and mixing heights for the cases of maximum persistence of these wind directions obtained from the PRSIST analysis. These calculations showed maximum hourly plume-centerline concentrations of approximately 800 micrograms per cubic meter at the western edge of the New Castle grid when the mixing heights were between 190 and 250 meters. However, according to the results of the PRSIST analysis, these mixing heights did not persist in any case for as long as 10 hours, which is the minimum time duration required to yield calculated 24-hour average concentrations equal to or greater than 24-hour SO_2 NAAQS. The maximum hourly plume-centerline concentrations calculated for the western border of the Beaver grid for the selected wind-persistence cases were approximately 1000 micrograms per cubic meter under the same meteorological conditions as those specified for the New Castle grid.

Because of the relatively long transport distances (30 to 60 kilometers) from some of the sources in Ohio and West Virginia to the New Castle and Beaver calculation grids as well as possible terrain channeling and trapping effects, we reviewed the assumption made in the model calculations that meteorological observations made at the Greater Pittsburgh Airport could be used to estimate plume trajectories, wind speeds and mixing heights over these distances. Terrain elevations in the Ohio River Valley are approximately 200 meters (650 feet) above mean sea level (MSL). The average elevation of the high terrain at the sides of the valley and beyond is about 300 meters (1000 feet) MSL with a few isolated points that are 400 meters (1300 feet) MSL. The stack heights associated with the major SO_2 sources located in the Ohio River Valley are generally greater than 150 meters. Assuming that the plume rise is approximately equivalent to the stack height, the plume stabilization heights are thus about 500 meters MSL which is well above the highest terrain elevations. Therefore, we conclude it is unlikely that the plumes would be trapped within the river valley during periods with an established wind flow with minimum speeds of a few meters per second. Under these conditions, the plumes would be well above the local terrain features and would thus not be subject either to terrain channeling or trapping. Emissions from low-level sources will generally be channeled by the terrain when the mixing heights are at or below the terrain heights. When the mixing heights exceed the terrain heights, these emissions will be transported in the same general direction as the tall stack emissions.

There is a question whether the hourly Greater Pittsburgh Airport meteorological observations are representative of the concurrent meteorological conditions in the Ohio River Valley and in the western part of the Southwest Pennsylvania AQCR. It has been our experience that the measurements at the Greater Pittsburgh Airport are most likely to be representative of the meteorological conditions over this area when the measured hourly wind directions persist within a 30- or 60-degree sector for periods of 6 hours or longer. These persistent wind directions occur only when the large scale circulation pattern is well established with mean surface speeds greater than 3 meters per second. Using the results of the PRSIST analysis of the 1973-1977 Greater Pittsburgh Airport meteorological data in combination with dispersion-model calculations, we selected 28 August 1976 as the case most likely to produce maximum short-term SO_2 concentrations in the New Castle and Beaver areas. Table 6-1 lists the hourly meteorological input parameters used with short-term dispersion model computer program SHORTZ to calculate SO_2 ground-level concentrations in the New Castle and Beaver grids produced by the short-term 1980 compliance emissions inventory (see Appendix C.2). In these calculations, we assumed an SO_2 half-life of 20 hours (see Section 4.1).

We performed dispersion-model calculations using the gross grid and the hourly meteorological observations from the Greater Pittsburgh Airport for 6 April 1975 and 16 August 1976 when persistent winds were observed from the north and west, respectively. The purpose of these calculations was to determine if these wind directions were likely to result in maximum short-term concentrations that exceeded those calculated for 28 August 1976. The calculated maximum concentrations for both of the cases were significantly lower than those calculated for 28 August 1976.

6.2 SHORT-TERM CALCULATION RESULTS

Figure 6-1 shows the calculated 24-hour average SO_2 isopleth pattern for the Beaver grid. The maximum 24-hour average SO_2 concentration

TABLE 6-1

HOURLY METEOROLOGICAL INPUT PARAMETERS USED IN THE SHORT-TERM MODEL CALCULATIONS FOR 28 AUGUST 1976

Hour (LST)	Wind Direction (deg)	Wind Speed (m/sec)	H_m (m)	T_a (^oK)	$\Delta\theta/\Delta Z$ ($^oK/m$)	P	σ'_E (rad)	σ'_A (rad)	Pasquill Stability Category
00	201	2.57	340	292	.006	.13	.0465	.0665	E
01	231	2.57	340	292	.006	.13	.0465	.0665	E
02	223	2.06	340	292	.006	.13	.0465	.0665	E
03	171	1.54	340	290	.006	.13	.0465	.0665	E
04	157	2.06	340	290	.006	.13	.0735	.1051	D
05	237	2.57	340	291	.006	.13	.0735	.1051	D
06	225	3.09	340	291	.006	.13	.0735	.1051	D
07	224	2.57	405	291	.005	.13	.0735	.1051	D
09	197	2.57	470	293	.005	.13	.0735	.1051	D
09	173	2.57	535	294	.004	.13	.0735	.1051	D
10	205	3.6	600	295	.004	.13	.0735	.1051	D
11	174	4.12	665	295	.003	.13	.0735	.1051	D
12	196	4.63	730	297	.002	.13	.0735	.1051	D
13	226	6.68	795	298	.002	.13	.0735	.1051	D
14	208	6.17	860	299	.001	.13	.0735	.1051	D
15	234	5.14	860	299	.001	.13	.0735	.1051	D
16	224	5.66	807	298	.001	.13	.0735	.1051	D
17	190	4.12	754	296	.001	.13	.0735	.1051	D
18	218	5.14	700	296	.001	.13	.0735	.1051	D
19	232	4.63	700	295	.001	.13	.0735	.1051	D
20	213	4.12	700	294	.001	.13	.0735	.1051	D
21	214	4.12	700	294	.001	.13	.0735	.1051	D
22	271	3.60	700	294	.001	.13	.0735	.1051	D
23	305	3.60	700	294	.001	.13	.0735	.1051	D

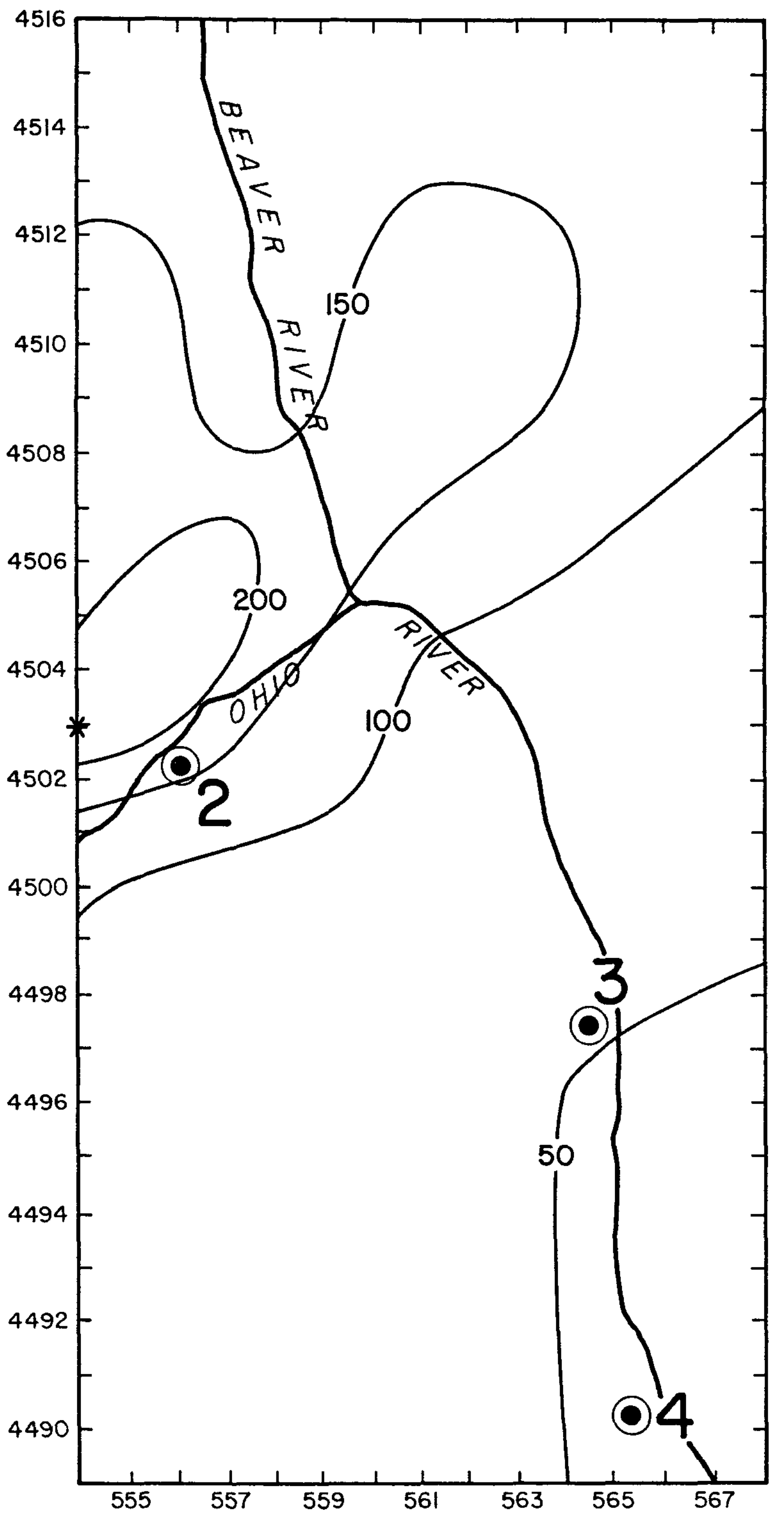

FIGURE 6-1. Isopleths of 24-hour average SO_2 ground-level concentrations in $\mu g/m^3$ calculated for the Beaver grid using the short-term 1980 Compliance Emissions Inventory. The numbers 2, 3 and 4 respectively refer to the St. Joe Minerals, J & L Aliquippa and Duquesne, Phillips sources. The asterisk symbol indicates the point of maximum concentration.

calculated for the Beaver grid, using the 1980 short-term compliance emissions inventory, is 251.6 micrograms per cubic meter, which is approximately 70 percent of the 24-hour NAAQS of 365 micrograms per cubic meter. This maximum occurs at the grid point on the western edge of the Beaver grid with the UTM X and Y coordinates of 554 and 4,503 kilometers, respectively.

The contributions of individual sources and source complexes to the maximum concentration calculated on the Beaver grid are given in Table 6-2. The sources in the Beaver Valley contributed 104 micrograms per cubic meter or about 41 percent of the calculated maximum concentration. Of the 104 micrograms per cubic meter contributed by the Beaver Valley sources, 89 micrograms per cubic meter are due to the Penn Power, Mansfield Plant and 15 micrograms per cubic meter are due to the ARCO Plant. The Ohio sources and the West Virginia sources respectively contributed 127.5 and 20.1 micrograms per cubic meter (51 and 8 percent) to the maximum 24-hour average SO_2 concentration calculated for the Beaver grid.

The maximum 3-hour average SO_2 concentration calculated for the Beaver grid, using the short-term 1980 compliance emissions inventory, is 835.5 micrograms per cubic meter, which is 64 percent of the NAAQS of 1300 micrograms per cubic meter. The Beaver Valley sources contributed 289 micrograms per cubic meter or about 35 percent of the calculated maximum concentration. The eastern Ohio sources and the West Virginia sources respectively contributed 468.5 and 78 micrograms per cubic meter (56 and 9 percent) to the calculated maximum 3-hour average concentration which occurred at the same grid point as the calculated maximum 24-hour concentration.

The maximum 24-hour average SO_2 concentration calculated for the New Castle grid, using the short-term 1980 compliance emissions

TABLE 6-2

CONTRIBUTIONS FROM INDIVIDUAL SOURCES AND SOURCE COMPLEXES TO THE MAXIMUM 24-HOUR AVERAGE SO_2 CONCENTRATION CALCULATED FOR THE BEAVER GRID USING THE 1980 SHORT-TERM COMPLIANCE EMISSIONS INVENTORY

Source	24-Hour Average SO_2 Concentration* ($\mu g/m^3$)
Beaver Valley Sources:	
J & L Aliquipa	**
Medusa Cement	**
ARCO	15.0
B & W Wallace Run	**
B & W Tubular Products	**
Shenango China	**
Ashland Oil	**
Westinghouse Electric	**
Penn Power,	89.0
West Pittsburgh	**
Penn Power, Mansfield	
St. Joe Minerals	**
Bessemer Cement	**
Total	104.0
Eastern Ohio Sources	127.5
West Virginia Sources	20.1
Total	251.6

* Occurs at a grid point with the UTM coordinates X=554 kilometers and Y=4,503 kilometers.

** Less than 0.05 micrograms per cubic meter.

inventory, is 115.8 micrograms per cubic meter which is about 32 percent of the NAAQS of 365 micrograms per cubic meter. This occurs at a grid point at the northwest corner of the grid with the UTM X and Y coordinates of 555.0 and 4,533.6 kilometers, respectively.

The contributions of individual sources and source complexes to the maximum concentration calculated on the New Castle grid are given in Table 6-3. The combined sources in West Virginia and eastern Ohio contributed 69.4 micrograms per cubic meter or about 60 percent of the calculated maximum concentration. With respect to the Beaver Valley sources, the Penn Power, West Pittsburgh Plant contributed 46.3 micrograms per cubic meter (approximately 40 percent of the total concentration) and the other Beaver Valley sources contributed less than 0.01 micrograms per cubic meter.

The maximum 3-hour SO_2 concentration calculated for the New Castle grid is 337.4 micrograms per cubic meter which occurs at the same grid point as the calculated maximum 24-hour average concentration. The Penn Power, West Pittsburgh Plant contributed 163.4 micrograms per cubic meter or 48 percent of the total. Sources in Ohio and West Virginia respectively contributed 109.4 and 64.6 micrograms per cubic meter (32 percent and 19 percent). The contributions from all other sources are insignificant.

The meteorological data for 28 August 1976 in Table 6-1 were used with the short-term 1980 compliance emissions inventory in Appendix C.2 and the SHORTZ computer program to calculate 3-hour and 24-hour SO_2 concentrations for the Monessen grid. Because the wind directions on 28 August 1976 were from the south and southwest, the Monessen Plant of Wheeling-Pittsburgh Steel is only major SO_2 source contributing significantly to the ground-level concentrations calculated for the Monessen grid. The calculated maximum 24-hour average SO_2 concentration for the Monessen grid is 226.9 micrograms per cubic meter and the calculated maximum 3-hour average SO_2 concentration is 703.9 micrograms per cubic meter. Both of

TABLE 6-3

CONTRIBUTIONS FROM INDIVIDUAL SOURCES AND SOURCE COMPLEXES TO THE MAXIMUM 24-HOUR AVERAGE SO_2 CONCENTRATION CALCULATED FOR THE NEWCASTLE GRID USING THE SHORT-TERM 1980 COMPLIANCE EMISSION INVENTORY

Source	24-Hour Average SO_2 Concentration* ($\mu g/m^3$)
Penn Power, West Pittsburgh	46.3
Other Beaver Valley Sources	<0.1
West Virginia Sources	23.8
Eastern Ohio Sources	45.6
TOTAL	115.8

* Occurs at a grid point with the UTM coordinates X=555 kilometers and y=4,533.6 kilometers.

these calculated maximums occur at the same grid point which is located on high terrain about 100 meters above plant grade at a distance of about 1.5 kilometers from the plant. The UTM X and Y coordinates of this grid point are 594.4 and Y=4,447.0 kilometers, respectively. Emissions from the Monessen Plant of Wheeling-Pittsburgh Steel contribute all but a few micrograms per cubic meter to the calculated 24-hour maximum concentration and are entirely responsible for the calculated 3-hour maximum. Figures 6-2 and 6-3 show the isopleths of calculated 24-hour and 3-hour SO_2 concentrations for the Monessen grid.

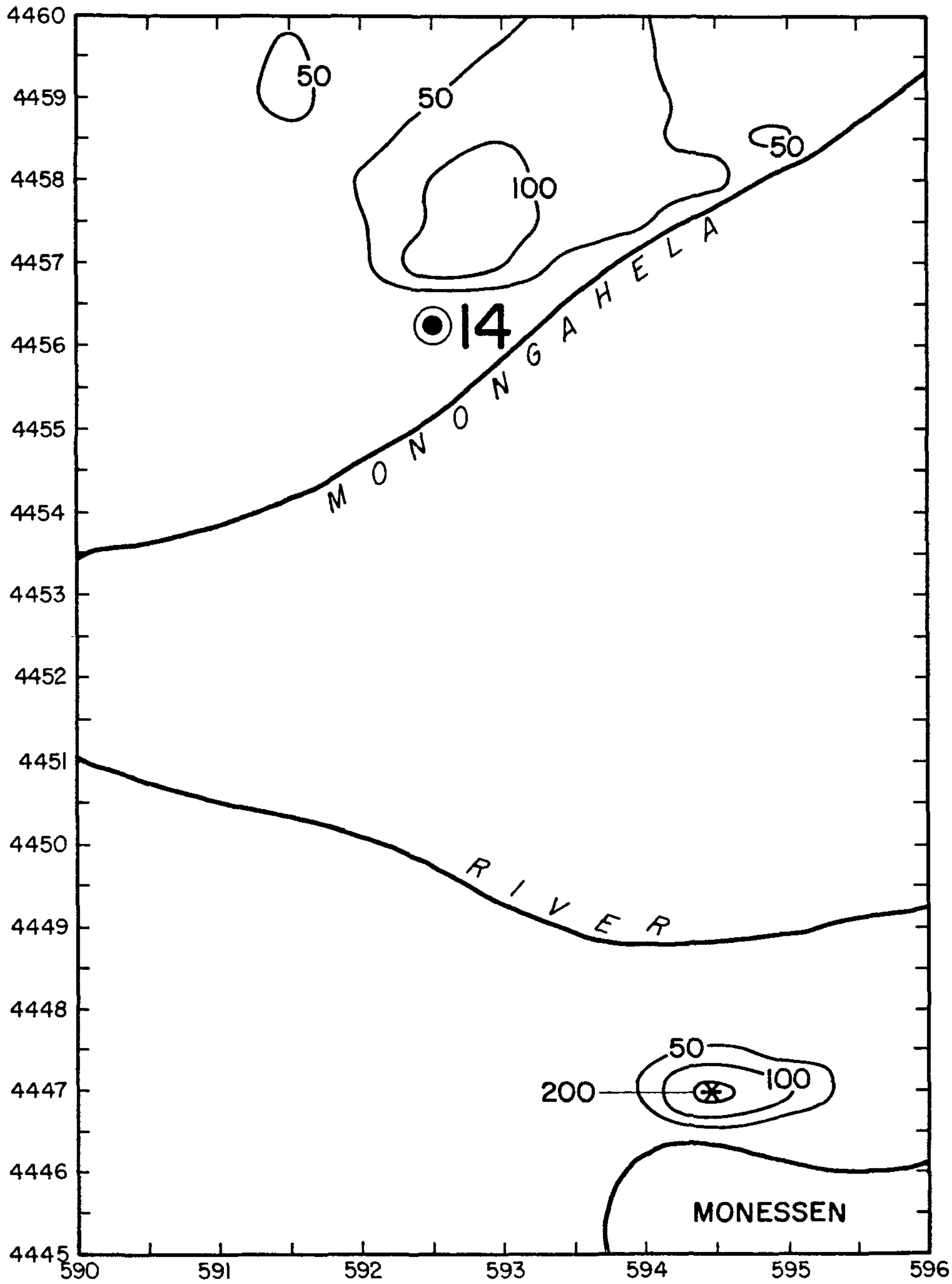

FIGURE 6-2. Isopleths of 24-hour average SO_2 ground-level concentrations in μh/m^3 calculated for the Monessen detail grid using the short-term 1980 compliance emissions inventory. The number 14 refers to the Duquesne Light, Elrama Plant. The asterisk symbol indicates the point of maximum concentration.

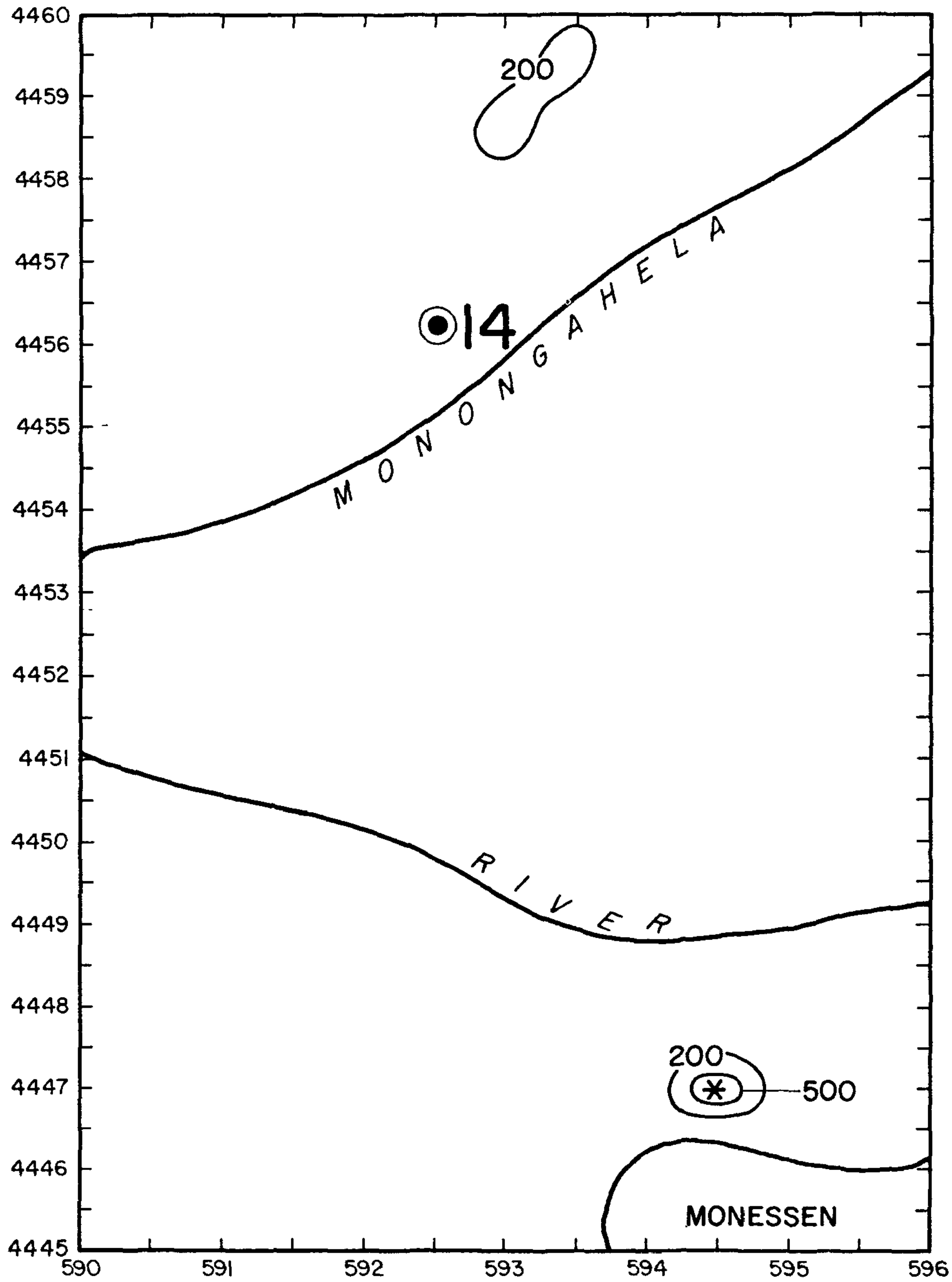

FIGURE 6-3. Isopleths of 3-hour average SO_2 ground-level concentrations in $\mu g/m^3$ calculated for the Monessen detail grid using the short-term 1980 compliance emissions inventory. The number 14 refers to the Duquesne Light, Elrama Plant. The asterisk symbol indicates the point of maximum concentration.

SECTION 7

MODEL VALIDATION

Previous model validation studies in which the ground-level SO_2 concentrations calculated by the LONGZ and SHORTZ computer programs have been directly compared with measured values of average annual and short-term SO_2 concentrations are described in reports by Cramer, et al. (1975; 1976; 1977) and by Bjorklund and Bowers (1979). The results of these previous validation studies show that, on the average, the annual SO_2 concentrations calculated using the LONGZ program are within about 10 percent of the corresponding measured values. Similarly, the 3-hour and 24-hour concentrations calculated by the SHORTZ program are within about 20 percent of the corresponding measured values when reasonable allowance is made for the fact that the mean hourly wind direction measurements used in the model to fix the exact position of hourly mean plume centerlines with respect to SO_2 monitor locations are reported only to the nearest 10 degrees. It is important to recognize that the maximum source-receptor distances in these previous model validation studies are of the order of 10 kilometers and we have not been able to test the accuracy of LONGZ and SHORTZ model calculations for source-receptor distances greater than about 30 kilometers. We also point out that the results of all model validation studies are critically dependent on the accuracy and representativeness of both the emissions inventory and air quality measurements as well as the accuracy and representativeness of the meteorological observations used in the studies. As explained below, we originally planned to use 1975 emissions inventory data, meteorological data and SO_2 monitor data in the validation study of the LONGZ and SHORTZ model calculations for the Southwest Pennsylvania AQCR. However, principally because of deficiencies in the SO_2 monitor data, it was necessary to use various combinations of emissions inventory, meteorological and SO_2 monitor data for the years 1976 through 1979 in the model validation study.

7.1 SO_2 MONITOR DATA USED FOR MODEL VALIDATION

During 1975, the Pennsylvania Department of Environmental Resources (DER) operated continuous SO_2 monitors within the Southwest Pennsylvania AQCR at four COPAMS stations: New Castle, Beaver Falls, Baden and Charleroi. Copies of the hourly SO_2 concentration measurements for 1975 from these four stations were obtained from DER and from the EPA air quality measurement retrieval system SAROAD. Both data sets showed valid data retrieval rates ranging from 11 to about 45 percent which are too low for use in validating long-term dispersion-model calculations. The Allegheny County Burea of Air Pollution Control (BAPC) operated a network of seven continuous SO_2 monitors in 1975. However, during this period, there were serious problems with calibration procedures and instrument operations at all of these monitoring sites. Because of the resulting uncertainties in the measurements, the 1975 Allegheny County BAPC SO_2 monitoring data are also unsuitable for model validation purposes.

The lack of adequate SO_2 monitor data for 1975 thus forced the use of SO_2 measurements for other years in validating the dispersion models. The Allegheny County BAPC provided us with annual average SO_2 monitor data for 1976. The Pennsylvania DER replaced the SO_2 monitors at the COPAMS stations in 1978. Since this replacement, the valid data recovery rates have improved but are still below desirable levels. We used the annual average SO_2 monitor data for 1978 and 1979 from the following DER stations in the model validation study:

- New Castle
- Beaver Falls
- Baden
- Midland

The valid data retrieval rates at these stations during 1978 and 1979 ranged from 31 percent at New Castle to 58 percent at Midland. The Pennsylvania Power Company has operated an SO_2 monitoring network in the vicinity of the Bruce Mansfield Power Station since 1974. Measurements from three continuous monitors in this network made during 1977 were used for both the long-term and short-term model validation. The names of these Pennsylvania Power Company monitor stations are: Fairview, Western Beaver and Route 68. Table 7-1 lists the SO_2 monitor sites and periods of observation used in validating the LONGZ dispersion-model calculations. Locations of the monitor sites are shown in Figure 5-1 and in Table 5-1. In validating the SHORTZ dispersion-model calculations, we used only the Pennsylvania DER and Pennsylvania Power Company monitor data.

7.2 SO_2 EMISSIONS INVENTORY DATA USED FOR MODEL VALIDATION

The emissions inventory data used for model validation were obtained from four agencies:

- Pennsylvania Department of Environmental Resources (DER)
- Allegheny County Burea of Air Pollution Control (BAPC)
- EPA Region III
- West Virginia Air Pollution Control Commission

The Pennsylvania DER supplied the emissions inventory for sources located within Pennsylvania that were outside of Allegheny County. This DER inventory is based on product or fuel through-put for the years 1976 and 1977 and was reviewed and updated by DER personnel for the model validation study. The emissions inventory for sources located in Allegheny County, which was developed by the Allegheny County BAPC, is based on the actual operating levels for 1976 and includes quarterly operating data for the U. S. Steel sources. The 1976 SO_2 emissions inventory for Allegheny County sources used for model validation reflects updates and changes made jointly by the Allegheny County BAPC and EPA Region III. The SO_2 emissions inventory for sources located in West Virginia was developed by the West Virginia

TABLE 7-1

COMPARISON OF CALCULATED AND OBSERVED ANNUAL GROUND LEVEL SO_2 CONCENTRATIONS

Monitor Site (Operator)	Observation Period	Observed Concentration ($\mu g/m^3$)	1976		1977	
			Calculated Concentration ($\mu g/m^3$))	Observed / Calculated	Calculated Concentration ($\mu g/m3$)	Observed / Calculated
Baden (DER)	9/78 - 8/79	81.2	153.5	0.53	243.3	0.33
Beaver (DER)	9/78 - 8/79	47.2	43.1	1.10	47.4	1.00
New Castle (DER)	9/78 - 8/79	39.3	29.1	1.35	33.9	1.16
Midland (DER)	1979	78.6	112.5	0.70	120.5	0.65
Fairview (Penn Power)	1977	109.4	77.4	1.41	69.7	1.57
Western Beaver (Penn Power)	1977	85.2	97.5	0.87	85.2	1.00
Route 68 (Penn Power)	1977	101.0	89.0	1.14	81.1	1.24
Liberty Boro (BAPC)	1976	104.0	133.3	0.78	141.1	0.74
Downtown (BAPC)	1976	73.0	75.5	0.97	69.9	1.04
Hazelwood (BAPC)	1976	141.5	354.2	0.40	406.8	0.35

TABLE 7-1 (Continued)

Monitor Site (Operator)	Observation Period	Observed Concentration ($\mu g/m^3$)	1976		1977	
			Calculated Concentration ($\mu g/m^3$)	Observed / Calculated	Calculated Concentration ($\mu g/m^3$)	Observed / Calculated
Glassport (BAPC)	1976	96.0	91.6	1.05	97.7	0.98
North Braddock (BAPC)	1976	91.0	98.4	0.92	112.4	0.81
Logans Ferry (BAPC)	1976	73.0	57.5	1.27	66.8	1.09

Air Pollution Control Commission and is based on typical source operations. The emissions inventory for sources located in Ohio was developed from industrial source information supplied by the Ohio Environmental Protection Agency to EPA Region III and from information on Ohio power plants contained in reports published by the Federal Power Commission. The annual emission rates for the Ohio power plants were set at 65 percent of the maximum generating capacity. The 1976/1977 SO_2 emissions inventory used for the model validation calculations is listed in Appendix C.3.

7.3 LONG-TERM VALIDATION CALCULATIONS

Because the SO_2 emissions inventory supplied by the Pennsylvania DER covers both 1976 and 1977, and the emissions inventory provided by the Allegheny County BAPC is for 1976, we made average annual concentration calculations with the long-term dispersion model LONGZ for both 1976 and 1977. The meteorological inputs used in these calculations were developed from the 1976 and 1977 hourly observations made at the Greater Pittsburgh Airport, following the procedures described in Section 3. The detailed tabulations of seasonal and annual meteorological inputs for 1976 and 1977 are contained in Appendices B.2 and B.3.

The long-term dispersion model LONGZ was executed with the 1976/1977 emissions inventory listed in Appendix C.3 and the 1976, 1977 Greater Pittsburgh Airport meteorological inputs to calculate annual average ground-level concentrations at the SO_2 monitor sites listed in Table 7-1. The locations of these monitor sites are also shown in Figure 5-1 and the UTM coordinates and site elevations are given in Table 5-1. It is apparent from the discussion of monitor data for model validation in Section 7.1 and from Table 7-1 that the observation periods for the four Pennsylvania DER monitors (Baden, Beaver, New Castle and Midland) are for 1978 and 1979, while the emissions inventory and meteorological data used in the model calculations are for 1976 and 1977.

Consequently, there are serious reservations, for model validation purposes, about the significance of any comparisons made between the model calculations for these monitor sites and the observed concentrations.

The observed and calculated annual average SO_2 concentrations at all monitor sites are shown in Table 7-1 together with the ratios of the observed concentration and the calculated 1976 and 1977 concentrations at each monitor site. There are three ratios in the table that are less than 0.5 which indicates that the model concentrations overpredict the observed concentration by more than a factor of two. One of these low ratios occurs at the Baden monitor when the annual average concentration for 1977 calculated by the LONGZ computer program is used to form the ratio. The other two low ratio values occur at the Hazelwood monitor where the calculated annual average concentrations for both 1976 and 1977 are much larger than the observed 1976 concentration. We have not investigated the possible reasons for the model overprediction at the Baden monitor site because the observed concentration is for the period from September 1978 through August 1979 while the calculated concentrations were made on the basis of the 1976/1977 emissions inventory and the 1976 and 1977 meteorological data from the Greater Pittsburgh Airport. However, the large model overpredictions at the Hazelwood monitor are of serious concern and, as described below, we have made a detailed analysis of the 1976 annual average concentrations calculated by the LONGZ computer program in the immediate vicinity of the Hazelwood monitor.

If the observed and calculated values at all the monitor sites in Table 7-1 are accepted at face value, the overall average ratio of observed and calculated concentrations is 0.79 when the calculated 1976 concentrations are used; the value of the overall average ratio is 0.71 when the calculated 1977 concentrations are used. If the Hazelwood monitor is excluded from consideration, the overall average ratio values are 0.92 and 0.84 for 1976 and 1977, respectively. If both the Baden and

Hazelwood monitors are excluded, the values of the overall average ratio are 0.99 for 1976 and 0.97 for 1977. We conclude that, except for the Hazelwood and Baden monitors, the annual average SO_2 concentrations calculated by the LONGZ computer program are in good agreement with the annual average concentrations measured at the SO_2 monitor sites.

Figure 7-1 shows the isopleths of the 1976 annual average SO_2 ground-level concentration within a distance of about 1 kilometer from the Hazelwood monitor calculated by the LONGZ computer program. The location of the monitor is indicated by the filled triangle near the center of the figure. The asterisks show the locations of individual sources within the J & L Pittsburgh source complex which is designated by the number 7. The important feature in Figure 7-1 is the very large spatial concentration gradient within an area of about 1 square kilometer centered on the monitor site. Calculated values equal to the annual average concentration of 141.5 micrograms per cubic meter observed at the Hazelwood monitor in 1976 occur at a distance of about 0.5 kilometers south and northwest of the monitor. Although we are not able to explain the differences between the model calculations and the observed concentration at the monitor, the calculated isopleth concentration pattern in Figure 7-1 illustrates the need for an increase in the density of the monitoring network in the vicinity of major SO_2 sources to define accurately the ambient air quality.

7.4 SHORT-TERM VALIDATION CALCULATIONS

The SO_2 monitor data available for validating the short-term dispersion-model calculations for the five grid areas of the Southwest Pennsylvania AQCR are very limited. The Pennsylvania DER provided 3-hour and 24-hour maximums measured at the New Castle and Beaver monitor sites for the 12-month period from September 1978 through August 1979. We also obtained summaries of the SO_2 concentration measurements, made during 1977 by the Pennsylvania Power Company in the vicinity of the Bruce

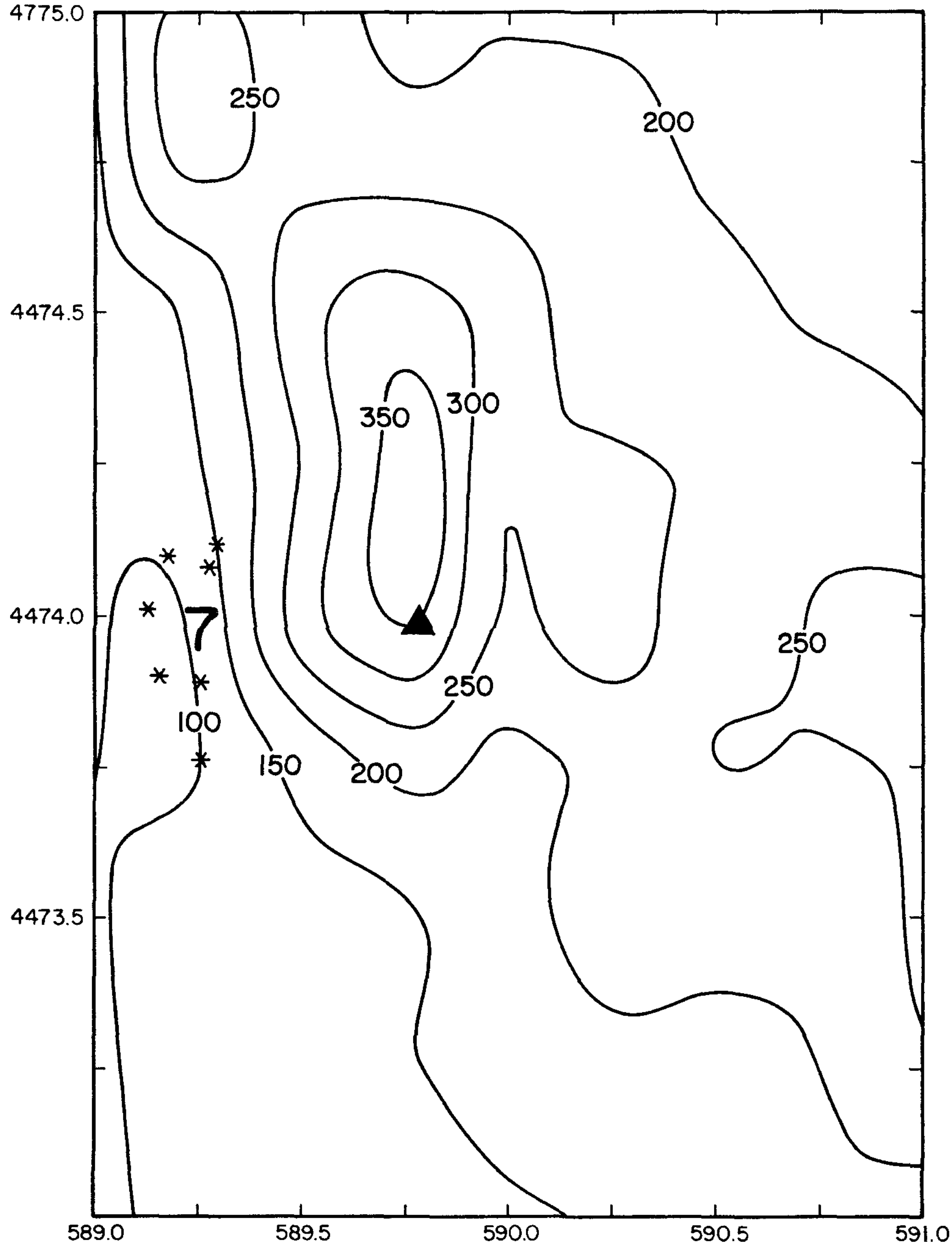

FIGURE 7-1. Isopleths of calculated 1976 annual average SO_2 ground-level concentration in micrograms per cubic meter for the vicinity of the Hazelwood monitor. The monitor location is indicated by the filled triangle. The asterisks show the location of individual sources within the J & L Pittsburgh source complex which is designated by the number 7.

Mansfield Plant, which were above the 3-hour and 24-hour NAAQS for SO_2. No SO_2 monitor data are available for the Monessen grid. Because of these severe limitations in the short-term SO_2 monitor data, as well as the uncertainties involved in applying the 1976/1977 annual emissions inventory and hourly meteorological observations from the Greater Pittsburgh Airport to the specific 3-hour and 24-hour time periods for which SO_2 monitor data are available, direct comparisons of short-term model calculations with SO_2 monitor data are of questionable value. For these reasons, we decided to limit the short-term model validation study to comparisons of SHORTZ model calculations, made using the 1976/1977 emissions inventory in Appendix C.3 and the hourly meteorological inputs for 28 August 1976 in Table 6-1, with the highest short-term SO_2 concentrations measured at the monitor sites mentioned above.

The maximum 3-hour and 24-hour average SO_2 ground-level concentrations calculated by the SHORTZ computer program for the New Castle grid, using the 1976/1977 emissions inventory in Appendix C.3 with the hourly meteorological data for 28 August 1976 in Table 6-1, are 469 and 108 micrograms per cubic meter, respectively. During the 12-month period from September 1978 through August 1979, the maximum 3-hour average SO_2 concentration measured at the DER New Castle monitor site was 550 micrograms per cubic meter as compared with the calculated concentration of 469 micrograms. The maximum 24-hour average SO_2 concentration measured during this 12-month period at the New Castle monitor was 128 micrograms per cubic meter as compared with the calculated maximum of 108 micrograms per cubic meter.

The maximum 3-hour and 24-hour SO_2 concentrations calculated by the SHORTZ computer program for 28 August 1976 at grid points near the West Penn Fairview monitor, which is located at the eastern edge of the Northwest Border calculation grid (see Figure 5-1), are 1190 and 333 micrograms per cubic meter, respectively. The maximum 3-hour average SO_2

concentration measured at the Fairview monitor during 1977 was 1387.7 micrograms per cubic meter and the maximum 24-hour average SO_2 concentration measured during 1977 at the Fairview monitor was 528.2 micrograms per cubic meter. Of the 11 cases during 1977 when the 24-hour average SO_2 concentrations measured at the Fairview monitor exceeded the 24-hour NAAQS, the prevailing wind directions reported by the Pennsylvania Power Company were between south and west-southwest for 8 cases which include the case of the maximum observed 24-hour average. The reported average wind directions for the other 3 cases were between east-northeast and east-southeast. For the two cases during 1977 in which the 3-hour average SO_2 concentrations were above the 3-hour NAAQS, the reported average wind directions were from the southeast and south-southeast. Concurrent hourly observations from the Greater Pittsburgh Airport show low wind speeds and variable wind directions during the periods for these three cases.

We conclude that the 24-hour average concentrations calculated by the SHORTZ computer program using the 28 August 1976 meteorological data are supported by the limited SO_2 monitor data which are available for the New Castle, Beaver and Western Border grids. The maximum 3-hour average concentrations calculated by the SHORTZ program for these grids, using the 28 August 1976 meteorological data, are lower than the maximum 3-hour SO_2 concentrations measured at the monitor sites. The prevailing wind directions reported by the Pennsylvania Power Company for the Bruce Mansfield Plant, for the period in which the maximum 3-hour SO_2 concentrations were measured at the Fairview monitor during 1977, indicate that the worst-case 3-hour meteorology may be different from that represented by the 28 August 1976 observation from the Greater Pittsburgh Airport used in the SHORTZ model validation calculations. However, a detailed short-term model validation study which would provide the requisite objective comparison of SO_2 monitor data with model predictions is beyond the scope of this study and is probably not possible because of the limitations in the existing emissions, meteorological and SO_2 monitor data.

SECTION 8

PRELIMINARY CALCULATIONS OF SO_2 CONCENTRATIONS ALONG THE PERIMETER OF THE SOUTHWEST PENNSYLVANIA AQCR

8.1 LONG-TERM CALCULATIONS

The results of the long-term model calculations of SO_2 ground-level concentrations made for the gross calculation grid (See Figure 5-1), using the annual 1980 compliance emissions inventory showed calculated annual average concentrations above the annual SO_2 NAAQS of 80 micrograms per cubic meter along the western border of Pennsylvania with Ohio and West Virginia. For this reason, the two Western Border grids 3 and 4 in Figure 5-1, which are outside of the Beaver and Monongahela Valley Air Basins, were included in the detailed model calculations. In the calculations made using the annual 1980 compliance emissions inventory, concentrations above the annual standard of 80 micrograms per cubic meter occur in a narrow strip approximately 17 kilometers long and 3 kilometers wide located principally in the Southwest Border grid. Figure 8-1 shows the calculated SO_2 isopleths for the Western Border area. The calculated maximum annual average SO_2 concentration of 101.4 micrograms per cubic meter occurs in the Southwest Border grid (4) at a grid point with the UTM X and Y coordinates of 541.0 and 4472.5 kilometers, respectively. At this point, Ohio sources contributed 35.8 micrograms per cubic meter (35 percent), West Virginia sources contributed 54.0 micrograms per cubic meter (53 percent) and all of the Pennsylvania sources contribute 11.5 micrograms per cubic meter (11 percent) to the total. The contributions of individual major SO_2 sources and source complexes in Ohio and West Virginia to the calculated maximum ranges from about 5 micrograms per cubic meter to 20 micrograms per cubic meter. It thus appears that no single source or source complex is responsible for producing the high calculated ground-level concentrations.

There are points within the area of the calculated exceedance of the annual standard where Ohio sources contribute more than 50 percent of

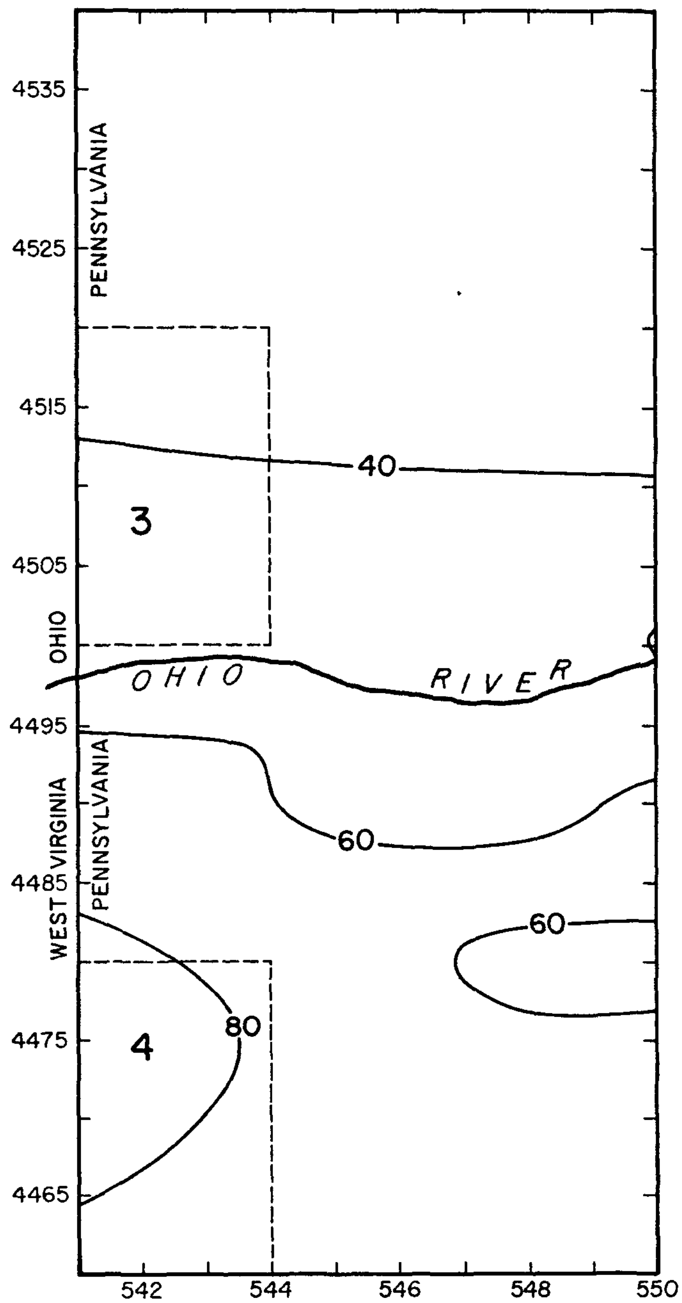

FIGURE 8-1. Isopleths of annual average SO_2 concentration in $\mu g/m^3$ calculated for the Western Border area of the Southwest Pennsylvania AQCR using the LONGZ computer program with the annual 1980 compliance emissions inventory. The numbers 3 and 4 refer to the Northwest Border and Southwest Border calculation grids, respectively.

the calculated concentration. At the point with UTM coordinates X=541.0 kilometers and Y=4482.5 kilometers, the concentration is 83.9 micrograms per cubic meter. Ohio sources contribute 46.4 micrograms per cubic meter, West Virginia sources contribute 26.3 micrograms per cubic meter, and the remainder of 11.2 micrograms per cubic meter is contributed by sources in Pennsylvania. Thus, the sources in Ohio and West Virginia are jointly responsible, according to these calculations, for the high concentrations in the border areas.

8.2 SHORT-TERM CALCULATIONS

The two Western Border grids were also included in the model calculations made using the short-term 1980 compliance emissions inventory. Ground-level concentrations above the 24-hour NAAQS were calculated within a very small area of approximately 3 square kilometers in the Southwest Border grid. The calculated maximum concentration of 425.2 micrograms per cubic meter occurs at the grid point with UTM coordinates X=544.0 kilometers and Y=4,466.0 kilometers. At this point, Ohio sources contributed 60.6 micrograms per cubic meter, West Virginia sources contributed 352.1 micrograms per cubic meter and Pennsylvania sources contributed 12.4 micrograms per cubic meter to the total concentration.

A maximum 3-hour SO_2 concentration of 2,375 micrograms per cubic meter was calculated at the same grid point at which the calculated 24-hour maximum occurred. Practically all of this maximum (2,368 micrograms per cubic meter) is contributed by sources located in West Virginia. We found several other cases in which the calculated 3-hour maximum concentrations were above 2,000 micrograms per cubic meter. These concentrations are also almost entirely due to sources in West Virginia. However, calculations necessary to define the maximum 3-hour and 24-hour concentrations due to sources located in Ohio and/or West Virginia were not made.

Additionally, there is some indication from the short-term calculations that there may be an area of high ground-level concentration near the Hatfield Power station. We calculated a 24-hour SO_2 concentration of approximately 200 micrograms per cubic meter produced by Hatfield emissions at the extreme southern edge of the Monnessen grid on 28 August 1976 in the presence of southerly winds. The calculated maximum 3-hour concentration produced by emissions from the Hatfield Power Station at the southern boundary of the Monnessen grid was approximately 650 micrograms per cubic meter.

We point out that the model calculations for the border areas described above were made using worst-case meteorological conditions selected for other areas and may not be representative of the worst-case situations for the border areas. In addition, there are some questions about the validity of the emissions inventory data for the West Virginia and Ohio sources. While the results of our model calculations serve to point out potential air quality problems in these border areas, an additional effort beyond the scope of the present study is required to establish the magnitude and areal extent of high SO_2 concentrations along the western and southern perimeter of the Southwest Pennsylvania AQCR.

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APPENDIX A

MATHEMATICAL MODELS USED TO CALCULATE GROUND-LEVEL CONCENTRATIONS

A.1 INTRODUCTION

The computerized diffusion models described in this appendix fall into two general categories: (1) Short-term models for calculating time-averaged ground-level concentrations for averaging times of 1, 3, 8, and 24 hours; (2) Long-term models for calculating seasonal and annual ground-level concentrations. Both the short-term and long-term concentration models are modified versions of the Gaussian plume model for continuous sources described by Pasquill (1962). In the short-term model, the plume is assumed to have Gaussian vertical and lateral concentration distributions. The long-term model is a sector model similar in form to the Environmental Protection Agency's Climatological Dispersion Model (Calder, 1971) in which the vertical concentration distribution is assumed to be Gaussian and the lateral concentration distribution within a sector is rectangular (a smoothing function is used to eliminate sharp discontinuities at the sector boundaries). Vertical plume growth (σ_z) in the short-term and long-term models and lateral plume growth (σ_y) in the short-term model are calculated by using turbulent intensities in simple power-law expressions that include the effects of initial source dimensions. In both the short-term and long-term models, buoyant plume rise is calculated by means of the Briggs (1971; 1972) plume-rise formulas, modified to include the effects of downwash in the lee of the stack during periods when the wind speed at stack height equals or exceeds the stack exit velocity. An exponent law is used to adjust the surface wind speed to the source height for plume-rise calculations and to the plume stabilization height for the concentration calculations. Both the short-term and the long-term models contain provisions to account for the effects of complex terrain.

Table A-1 lists the hourly meteorological inputs required by the short-term concentration model. Lateral and vertical turbulent intensities σ_A' and σ_E' may be directly specified or may be assigned on the basis of the Pasquill stability category (see Section 3 of Cramer, et al., 1975). The Pasquill stability cateogry is determined from surface weather observations using the Turner (1964) wind-speed and solar-index values. Mixing depths may be obtained from rawinsonde or pibal measurements, or they may be assigned on the basis of tabulations of the frequency of occurrence of wind speed and mixing depth (available from the National Climatic Center for synoptic rawinsonde stations). Potential temperature gradients may be obtained from measurements or assigned on the basis of climatology.

Table A-2 lists the meteorological inputs required by the long-term concentration model. Joint-frequency distributions of wind-speed and wind-direction categories, classified according to the Pasquill stability categories, are available from the National Climatic Center. Alternately, surface wind observations may be analyzed to generate wind-frequency distributions by time-of-day categories (night, morning, afternoon and evening). Vertical turbulent intensities may be determined from a climatology of actual measurements or may be assigned on the basis of the Pasquill stability categories. Median mixing depths may be determined from the seasonal tabulations of the frequency of occurrence of wind-speed and mixing depth prepared by the National Climatic Center. Vertical potential temperature gradients may be assigned to the combinations of wind-speed and stability or time-of-day categories on the basis of climatology.

Table A-3 lists the source input parameters required by the short-term and long-term diffusion models. As shown by the table, the computerized short-term and long-term models calculate ground-level concentrations produced by emissions from stacks, building vents and roof monitors, and from area sources. Both the short-term and long-term models also use a Cartesian coordinate system (usually the Universal Transverse Mercator system) with the positive X axis directed toward the east and the positive Y axis directed toward the north.

TABLE A-1

HOURLY METEOROLOGICAL INPUTS REQUIRED BY THE SHORT-TERM CONCENTRATION MODEL

Parameter	Definition
$\bar{u}_R$	Mean wind speed at height z_R (m/sec)
θ	Mean wind direction at height z_R (deg)
p	Wind-profile exponent
σ'_A	Wind azimuth-angle standard deviation in radians
σ'_E	Wind elevation-angle standard deviation in radians
T_a	Ambient air temperature (^{o}K)
H_m	Depth of surface mixing layer (m)
$\frac{\partial \theta}{\partial z}$	Vertical potential temperature gradient (^{o}K/m)

TABLE A-2

METEOROLOGICAL INPUTS REQUIRED BY THE LONG-TERM CONCENTRATION MODEL

Parameter	Definition
$f_{i,j,k,\ell}$ (Table)	Frequency distribution of wind-speed and wind-direction categories by stability or time-of-day categories for the ℓ^{th} season
$p_{k,i}$ (Table)	Wind-profile exponent for each stability or time-of-day category and i^{th} wind-speed category
$\sigma'_{E;i,k}$ (Table)	Standard deviation of the wind-elevation angle in radians for the i^{th} wind-speed category and k^{th} stability or time-of-day category
$T_{a;k,\ell}$ (Table)	Ambient air temperature for the k^{th} stability or time-of-day category and ℓ^{th} season (°K)
$\left(\frac{\partial\theta}{\partial z}\right)_{i,k}$ (Table)	Vertical potential temperature gradient for the i^{th} wind-speed category and k^{th} stability or time-of-day category (°K/m)
$H_{m;i,k,\ell}$ (Table)	Median surface mixing depth for the i^{th} wind-speed category, k^{th} stability or time-of-day category and ℓ^{th} season (m)
$\bar{u}\{z_R\}_i$ (Table)	Mean wind speed at height z_R for the i^{th} wind-speed category (m/sec)

TABLE A-3

SOURCE INPUTS REQUIRED BY THE SHORT-TERM AND LONG-TERM CONCENTRATION MODELS

Parameter	Definition
<u>Stacks</u>	
Q	Pollutant emission rate (mass per unit time)
X, Y	X and Y coordinates of the stack (m)
z_s	Elevation above mean sea level of the base of the stack (m)
h	Stack height (m)
v	Actual volumetric emission rate (m^3/sec)
T_s	Stack exit temperature (^oK)
r	Stack inner radius (m)
<u>Building Sources</u>	
Q	Pollutant emission rate (mass per unit time)
X, Y	X and Y coordinates of the center of the building (m)
z_s	Elevation above mean sea level of the base of the building (m)
h	Building height (m)
L	Building length (m)
W	Building width (m)
δ	Angle measured clockwise between north and the long side of the building (deg)
<u>Area Sources</u>	
Q	Pollutant emission rate (mass per unit time)
X, Y	X and Y coordinates of the center of the area source (m)
z_s	Elevation above mean sea level of the area source (m)

TABLE A-3 (Continued)

Parameter	Definition
Area Sources (Continued)	
h	Characteristic vertical dimension of the area source (m)
L	Length of the area source (m)
W	Width of the area source (m)
δ	Angle measured clockwise between north and the long side of the area source (deg)

A.2 PLUME-RISE FORMULAS

The effective stack height H of a buoyant plume is given by the sum of the physical stack height h and the buoyant rise Δh. For an adiabatic or unstable atmosphere, the buoyant rise Δh_N is given by

$$\Delta h_N = \left[\frac{1}{\bar{u}\{h\}} \left(\frac{3F}{2\gamma_1^2} \right)^{1/3} (10h)^{2/3} \right] f \qquad \text{(A-1)}$$

where the expression in the brackets is from Briggs (1971; 1972) and

$\bar{u}\{h\}$ = the mean wind speed at the stack height h (m/sec)

γ_1 = the adiabatic entrainment coefficient ~ 0.6 (Briggs, 1972)

F = The initial buoyancy flux (m^4/sec^3)

$$= \frac{gV}{\pi} \left(1 - \frac{T_a}{T_s} \right) \qquad \text{(A-2)}$$

V = The volumetric emission rate of the stack (m^3/sec)

$= \pi r^2 w$

r = inner radius of stack (m)

w = stack exit velocity (m/sec)

g = the acceleration due to gravity (m/sec^2)

T_a = the ambient air temperature (^oK)

T_s = the stack exit temperature (^oK)

The factor f, which limits the plume rise as the mean wind speed at stack height approaches or exceeds the stack exit velocity, is defined by

$$f = \begin{cases} 1 & ; \quad \bar{u}\{h\} \leq w/1.5 \\ \left(\dfrac{3w - 3\bar{u}\{h\}}{w}\right) & ; \quad w/1.5 < \bar{u}\{h\} < w \\ 0 & ; \quad \bar{u}\{h\} \geq w \end{cases} \tag{A-3}$$

The empirical correction factor f is generally not applied to stacks with Froude numbers less than about unity. The corresponding Briggs (1971) rise formula for a stable atmosphere (potential temperature gradient greater than zero) is

$$\Delta h_s = \begin{cases} \left[\dfrac{6F}{\bar{u}\{h\}\gamma_2^{\,2}\, S}\right]^{1/3} & ; \pi\, \bar{u}\{h\}\, S^{-1/2} < 10h \\ \left[\dfrac{3F}{\bar{u}\{h\}\gamma_2^{\,2}\, S}\left(1 - \cos\left(\dfrac{10S^{1/2}h}{\bar{u}\{h\}}\right)\right)\right]^{1/3} & ; \pi\, \bar{u}\{h\}\, S^{-1/2} \geq 10h \end{cases} \quad f \tag{A-4}$$

where

γ_2 = the stable entrainment coefficient ~ 0.66 (Briggs, 1972)

$S = \dfrac{g}{T_a} \dfrac{\partial\theta}{\partial z}$

$\dfrac{\partial\theta}{\partial z}$ = vertical potential temperature gradient (^{o}K/m)

The entrainment coefficients γ_1 and γ_2 are based on the suggestions of Briggs (1972). It should be noted that Equation (A-4) does not permit the calculated stable rise Δh_S to exceed the adiabatic rise Δh_N as the atmosphere approaches a neutral stratification ($\partial\theta/\partial z$ approaches 0). A procedure of this type is recommended by Briggs (1972).

A.3 SHORT-TERM CONCENTRATION MODEL

A.3.1 Elevated Sources

The atmospheric dispersion model used to calculate hourly average ground-level concentrations downwind from an elevated continuous source is given by

$$\{\chi\}x,y = \frac{K\ Q}{\pi\ \bar{u}\{H\}\sigma_y\ \sigma_z} \{\text{Vertical Term}\} \{\text{Lateral Term}\} \{\text{Decay Term}\} \quad \text{(A-5)}$$

where

- K = scaling coefficient to convert input parameters to dimensionally consistent units
- Q = source emission rate (mass per unit time)
- $\bar{u}\{H\}$ = mean wind speed at the plume stabilization height H (m/sec)
- σ_y, σ_z = standard deviations of the lateral and vertical concentration distributions at downwind distance x (m)

The Vertical Term refers to the plume expansion in the vertical or z direction and includes a multiple reflection term that limits cloud growth to the surface mixing layer.

$$\{\text{Vertical Term}\} = \left\{\exp\left[-\frac{1}{2}\left(\frac{H}{\sigma_z}\right)^2\right] + \sum_{n=1}^{\infty}\left[\exp\left[-\frac{1}{2}\left(\frac{2n\ H_m + H}{\sigma_z}\right)^2\right]\right.\right.$$

$$\left.\left. + \exp\left[-\frac{1}{2}\left(\frac{2n\ H_m - H}{\sigma_z}\right)^2\right]\right]\right\} \quad \text{(A-6)}$$

where H_m is the depth of the surface mixing layer. The exponential terms in the infinite series in Equation (A-6) rapidly approach zero near the source. At the downwind distance where the exponential terms exceed exp(-10) for n equal 3, the plume has become approximately uniformly mixed within the surface mixing layer. In order to shorten computer computation time, Equation (A-6) is changed to the form

$$\{\text{Vertical Term}\} = \frac{\sqrt{2\pi}\,\sigma_z}{2H_m} \tag{A-7}$$

beyond this point. Equation (A-7) changes the form of the vertical concentration distribution from Gaussian to rectangular. If H exceeds H_m, the Vertical Term is set equal to zero which results in a zero value for the ground-level concentration.

The Lateral Term refers to the crosswind expansion of the plume and is given by the expression

$$\{\text{Lateral Term}\} = \exp\left[-\frac{1}{2}\left(\frac{y}{\sigma_y}\right)^2\right] \tag{A-8}$$

where y is the crosswind distance from the plume centerline to the point at which concentration is calculated.

The Decay Term, which accounts for the possibility of pollutant removal by physical or chemical processes, is of the form

$$\{\text{Decay Term}\} = \exp\left[-\psi\, x/\bar{u}\{H\}\right] \tag{A-9}$$

where

ψ = the washout coefficient Λ (sec^{-1}) for precipitation scavenging

$= \frac{0.692}{T_{1/2}}$, where $T_{1/2}$ is the pollutant half life in seconds for physical or chemical removal

= 0 for no depletion (ψ is automatically set to zero by the computer program unless otherwise specified)

In the model calculations, the observed mean wind speed $\bar{u}_R$ is adjusted from the measurement height z_R to the source height h for plume-rise calculations and to the stabilization height H for the concentration calculations by a wind-profile exponent law

$$\bar{u}\{z\} = \bar{u}\{z_R\} \left(\frac{z}{z_R}\right)^p \tag{A-10}$$

The exponent p, which is assigned on the basis of atmospheric stability, ranges from about 0.1 for very unstable conditions to about 0.4 for very stable conditions.

According to the derivation in the report by Cramer, et al. (1972), the standard deviation of the lateral concentration distribution σ_y is given by the expression

$$\sigma_y\{x\} = \sigma'_A \, x_{ry} \left[\frac{x + x_y - x_{ry}(1-\alpha)}{\alpha x_{ry}}\right]^\alpha \tag{A-11}$$

$$x_y = \begin{cases} \dfrac{\sigma_{yR}}{\sigma'_A} - x_R & ; \dfrac{\sigma_{yR}}{\sigma'_A} \le x_{ry} \\[2ex] \alpha x_{ry} \left(\dfrac{\sigma_{yR}}{x_{ry}\,\sigma'_A}\right)^{1/\alpha} - x_R + x_{ry}(1-\alpha) & ; \dfrac{\sigma_{yR}}{\sigma'_A} > x_{ry} \end{cases} \tag{A-12}$$

where

σ'_A = the standard deviation of the wind-azimuth angle in radians

x_{ry} = distance over which rectilinear plume expansion occurs downwind from an ideal point source (~50 meters)

σ_{yR} = the standard deviation of the lateral concentration distribution at downwind distance x_R (m)

α = the lateral diffusion coefficient (~0.9)

The virtual distance x_y is not permitted to be less than zero. The lateral turbulent intensity σ'_A may be specified directly or may be assigned on the basis of the Pasquill stability category.

Following the derivation of Cramer, et al. (1972) and setting the vertical diffusion coefficient β equal to unity, the standard deviation of the vertical concentration distribution σ_z is given by the expression

$$\sigma_z\{x\} = \sigma'_E \left(x + x_z\right) \qquad \text{(A-13)}$$

$$x_z = \begin{cases} \dfrac{\sigma_{zR}}{\sigma'_E} - x_R & ; \dfrac{\sigma_{zR}}{\sigma'_E} \geq x_R \\[2ex] 0 & ; \dfrac{\sigma_{zR}}{\sigma'_E} < x_R \end{cases} \qquad \text{(A-14)}$$

where

σ'_E = standard deviation of the wind-elevation angle in radians

σ_{zR} = the standard deviation of the vertical concentration distribution at downwind distance x_R (m)

The vertical turbulent intensity σ'_E may also be obtained from direct measurements or may be assigned according to the Pasquill stability categories. When σ'_E values corresponding to the Pasquill stability categories are entered in Equation (A-13), the resulting curves will differ from the corresponding Pasquill-Gifford curves in that Equation (A-13) assumes rectilinear expansion at all downwind distances. Thus, σ_z values obtained from Equation (A-13) will be smaller than the values obtained from the Pasquill-Gifford A and B curves and larger than the values obtained from the D, E and F curves at long downwind distances. However, the multiple reflection term in Equation (A-6), which confines the plume to the surface mixing layer, accounts for the behavior of the D, E and F curves (decrease in the expansion rate with distance) in a manner that may be related to the meteorology of the area.

Following the recommendations of Briggs (1972), the lateral and vertical standard deviations of a stabilized buoyant plume are defined by

$$\sigma_{yR} = \sigma_{zR} = \frac{0.5\ \Delta h}{2.15} \qquad \text{(A-15)}$$

The downwind distance to stabilization x_R is given by

$$x_R = \left\{ \begin{array}{lll} 10h & ; & \frac{\partial\theta}{\partial z} \leq 0 \\ \pi\ \bar{u}\{h\}\ S^{-1/2} & ; & \frac{\partial\theta}{\partial z} > 0 \text{ and } \pi\ \bar{u}\{h\}\ S^{-1/2} < 10h \\ 10h & ; & \frac{\partial\theta}{\partial z} > 0 \text{ and } \pi\ \bar{u}\{h\}\ S^{-1/2} \geq 10h \end{array} \right\} \qquad \text{(A-16)}$$

A.3.2 Application of the Short-Term Model to Low-level Emissions

The short-term diffusion model in Section A.3.1 may be used to calculate ground-level concentrations resulting from low-level emissions such as losses through building vents. These emissions are rapidly distributed by the cavity circulation of the building wake and quickly assume the dimensions of the building. Ground-level concentrations are calculated by setting the buoyancy parameter F equal to zero. The standard deviation of the lateral concentration distribution at the source σ_{yo} is defined by the building crosswind dimension y_o divided by 4.3. The standard deviation of the vertical concentration distribution at the source is obtained by dividing the building height by 2.15. The initial dimensions σ_{yo} and σ_{zo} are assumed to be applicable at the downwind edge of the building. These procedures are in good agreement with the results of recent wind-tunnel experiments reported by Huber and Snyder (1976). It should be noted that separate turbulent intensities σ'_A and σ'_E may be defined for the low-level sources to account for the effects of surface roughness elements and heat sources.

A.3.3 Short-Term Concentration Model for Area Sources

The atmospheric dispersion model used to calculate ground-level concentrations at downwind distance x from the downwind edge of an area source is given by the expression

$$\chi\{x, y\} = \frac{K\,Q}{\sqrt{2\pi}\,\bar{u}\{h\}\,\sigma_z\{x\}\,y_o}\ \{\text{Vertical Term}\}\ \{\text{Lateral Term}\}\ \{\text{Decay Term}\} \qquad \text{(A-17)}$$

where

Q = area source strength in units of mass per unit time

y_o = crosswind source dimension (m)

$$
\sigma_z\{x\} = \begin{cases} \dfrac{\sigma'_E \, x_o}{\ln\left[\dfrac{\sigma'_E(x+x_o)+h}{\sigma'_E(x)+h}\right]} & ; \quad x < 3\,x_o \\[2em] \sigma'_E(x+x_o/2)+h & ; \quad x \geq 3\,x_o \end{cases} \qquad \text{(A-18)}
$$

x_o = alongwind dimension of the area source (m)

h = the characteristic height of the area source (m)

The Vertical Term for an area source is given by

$$
\{\text{Vertical Term}\} = \begin{cases} 1+2\displaystyle\sum_{n=1}^{3} \exp\left[-\frac{1}{2}\left(\frac{2n\,H_m}{\sigma_x\{x\}}\right)^2\right] & ; \quad \dfrac{1}{2}\left(\dfrac{6H_m}{\sigma_z\{x\}}\right)^2 \geq 10 \\[2em] \dfrac{\sqrt{2\pi}\,\sigma_z\{x\}}{2H_m} & ; \quad \dfrac{1}{2}\left(\dfrac{6H_m}{\sigma_z\{x\}}\right)^2 < 10 \end{cases} \qquad \text{(A-19)}
$$

The Lateral Term is given by the expression

$$
\{\text{Lateral Term}\} = \left\{ \text{erf}\left[\frac{y_o/2 + y}{\sqrt{2}\,\sigma_y\{x\}}\right] + \text{erf}\left[\frac{y_o/2 - y}{\sqrt{2}\,\sigma_y\{x\}}\right] \right\} \qquad \text{(A-20)}
$$

where

y_o = crosswind dimension of the area source (m)

y = crosswind distance from the centerline of the area source (m) and

$$\sigma_y\{x\} = \sigma'_A \, (x + x_o/2) \qquad \text{(A-21)}$$

The Decay Term is given by Equation (A-9) above.

The concentration at points interior to the area source is given by

$$\chi\{x'\} = \frac{2\ K\ Q}{\sqrt{2\pi}\ \bar{u}\{h\}\ x_o\ y_o\ \sigma'_E} \left\{ \ln \left[\frac{\sigma'_E\ (x'+1)+h}{\sigma'_E + h} \right] \right\} \{\text{Vertical Term}\} \qquad \text{(A-22)}$$

where

x' = distance downwind from the upwind edge of the area source (m)

A.4 LONG-TERM CONCENTRATION MODEL

A.4.1 Elevated Sources

The atmospheric dispersion model for elevated point and volume sources is similar in form to the Air Quality Display Model (Environmental Protection Agency, 1969) and the Climatological Dispersion Model (Calder, 1971). In the model, the area surrounding a continuous source of pollutants is divided into sectors of equal angular width corresponding to the class intervals of the seasonal and annual frequency distributions of wind direction. The emission rate during a season or year is partitioned according to the relative wind-direction frequencies. Ground-level concentration fields for each source are translated to a common reference coordinate grid system and summed to obtain the total due to all emissions. For a single source, the mean seasonal concentration at a point (r, θ) is given by

$$\chi_{\ell}\{r, \theta\} = \frac{2 K Q}{\sqrt{2\pi}\, r\ \Delta\theta'} \sum_{i,j,k} \left[\frac{f_{i,j,k,\ell}}{\bar{u}_i \left\{H_{i,k,\ell}\right\} \sigma_{z;i,k,\ell}} S\{\theta\} V_{i,k,\ell} \right. \tag{A-23}$$

$$\left. \exp\left[- \psi\, r/\bar{u}_i \ H_{i,k,\ell}\left\{ \right\} \right] \right]$$

$$V_{i,k,\ell} = \exp\left[-\frac{1}{2}\left(\frac{H_{i,k,\ell}}{\sigma_{z;i,k,\ell}}\right)^2\right] + \sum_{n=1}^{\infty} \left\{ \exp\left[-\frac{1}{2}\left(\frac{2n\ H_{m;i,k,\ell} - H_{i,k,\ell}}{\sigma_{z;i,k,\ell}}\right)^2\right] \right. \tag{A-24}$$

$$\left. + \exp\left[-\frac{1}{2}\left(\frac{2n\ H_{m;i,k,\ell} + H_{i,k,\ell}}{\sigma_{z;i,k,\ell}}\right)^2\right] \right\}$$

where

$f_{i,j,k,\ell}$ = frequency of occurrence of the i^{th} wind-speed category, j^{th} wind-direction category and k^{th} stability or time-of-day category for the ℓ^{th} season

$\Delta\theta'$ = the sector width in radians

$S\{\theta\}$ = a smoothing function

$$S\{\theta\} = \begin{cases} \dfrac{\Delta\theta' - |\theta_j' - \theta'|}{\Delta\theta'} & ; \quad |\theta_j' - \theta'| \le \Delta\theta' \\ 0 & ; \quad |\theta_j' - \theta'| > \Delta\theta' \end{cases} \tag{A-25}$$

θ_j' = the angle measured in radians from north to the center-line of the j^{th} wind-direction sector

θ' = the angle measured in radians from north to the point (r,θ)

As with the short-term model, the Vertical Term given by Equation (A-24) is changed to the form

$$V_{i,k,\ell} = \frac{\sqrt{2\pi}\,\sigma_{z;i,k,\ell}}{2H_{m;i,k,\ell}} \tag{A-26}$$

when the exponential terms in Equation (A-24) exceed exp(-10) for n equal 3. The remaining terms in Equations (A-23) are identical to those previously defined in Section A.3.1 for the short-term model, except that the turbulent intensities and potential temperature gradients may be separately assigned to each wind-speed and/or stability (or time-of-day) category; the ambient air temperatures may be separately assigned to each stability (or time-of-day) category for each season; and the surface mixing depths may be separately assigned to each wind-speed and/or stability (or time-of-day) category for each season.

As shown by Equation (A-25), the rectangular concentration distribution within a given angular sector is modified by the function $S\{\theta\}$ which smoothes discontinuities in the concentration at the boundaries of adjacent sectors. The centerline concentration in each sector is unaffected by contributions from adjacent sectors. At points off the sector centerline, the concentration is weighted function of the concentration at the centerline of the sector in which the calculation is being made and the concentration at the centerline of the nearest adjoining sector.

The mean annual concentration at the point (r,θ) is calculated from the seasonal concentrations using the expression

$$\chi_a\{r,\theta\} = \frac{1}{4}\sum_{\ell=1}^{4} \chi_\ell\{r,\theta\} \tag{A-27}$$

A.4.2 Application of the Long-Term Model to Low-Level Emissions

Long-term ground-level concentrations produced by low-level emissions are calculated from Equation (A-23) by setting the buoyancy parameter F equal to zero. The standard deviation of the vertical concentration distribution at the downwind edge of the building σ_{zo} is defined as the building height divided by 2.15. Separate vertical turbulent intensities σ'_E may be defined for the low-level sources to account for the effects of surface heat sources and roughness elements. A virtual point source is used to account for the initial lateral dimension of the source in a manner identical to that described below for area sources.

A.4.3 Long-Term Concentration Model for Area Sources

The mean seasonal concentration at downwind distance r with respect to the center of an area source is given by the expression

$$\chi_\ell\{r > r_o\} = \frac{2\,K\,Q}{\sqrt{2\pi}\,R\,\Delta\theta'} \left\{ \sum_{i,j,k} \left[\frac{f_{i,j,k,\ell}}{\bar{u}_i\{h\}\,\sigma_{z;i,k}} \quad S\{\theta\} \quad V_{i,k,\ell} \right] \right. \tag{A-28}$$

$$\left. \exp\left[-\psi\left(r' - r_o\right)/\bar{u}_i\{h\} \right] \right\}$$

where

R = radial distance from the virtual point source to the receptor

$= \left(\left(r' + x_y\right)^2 + y^2\right)^{1/2}$

r' = distance from source center to receptor, measured along the sector centerline (m)

r_o = effective source radius (m)

y = lateral distance from the sector centerline to the receptor (m)

x_y = lateral virtual distance (m)

$$= r_o \cot \frac{\Delta\theta'}{2} \qquad \text{(A-29)}$$

$$\sigma_{z;i,k} = \begin{cases} \dfrac{2\sigma'_{E;i,k}\; r_o}{\ln\left[\dfrac{\sigma'_{E;i,k}(r'+r_o) + h}{\sigma'_{E;i,k}(r'-r_o) + h}\right]} & ;\; r_o < r' < 6r_o \\ \\ \sigma'_{E;i,k} r' + h & ;\; r' \geq 6r_o \end{cases} \qquad \text{(A-30)}$$

$$V_{i,k,\ell} = \begin{cases} 1+2\displaystyle\sum_{n=1}^{3} \exp\left[-\frac{1}{2}\left(\frac{2n\; H_{m;i,k,\ell}}{\sigma_{z;i,k}}\right)^2\right] & ;\; \dfrac{1}{2}\left(\dfrac{6H_{m;i,k,\ell}}{\sigma_{z;i,k}}\right)^2 \geq 10 \\ \\ \dfrac{\sqrt{2\pi}\; \sigma_{z;i,k}}{H_{m;i,k,\ell}} & ;\; \dfrac{1}{2}\left(\dfrac{6H_{m;i,k,\ell}}{\sigma_{z;i,k}}\right)^2 < 10 \end{cases} \qquad \text{(A-31)}$$

and the remaining parameters are identical to those previously defined.

For points interior to the area source, the seasonal average concentration is given by the expression:

$$\chi_\ell\{r \leq r_o\} = \frac{2\,K\,Q}{\sqrt{2\pi}\; x_o\; y_o} \sum_{i,j,k} \left[\frac{f_{i,j,k,\ell}}{\bar{u}_i\{h\}\; \sigma'_{E;i,k}} \ln\left[\frac{\sigma'_{E;i,k}(r''+1) + h}{\sigma'_{E;i,k} + h}\right] V_{i,k,\ell}\right] \qquad \text{(A-32)}$$

where

r'' = the downwind distance, measured along the sector centerline from the upwind edge of the area source (m)

A.5 APPLICATION OF THE SHORT-TERM AND LONG-TERM CONCENTRATION MODELS IN COMPLEX TERRAIN

The short-term and long-term concentration models described in Sections A.3 and A.4 are strictly applicable only for flat terrain where the base of the stack (or the building source) and the ground surface downwind from the source are at the same elevation. However, both models may also be applied to complex terrain by defining effective stabilization heights and mixing depths. The following assumptions are made in the model calculations for complex terrain:

- The top of the surface mixing layer extends over the calculation grid at a constant height above mean sea level
- Ground-level concentrations at all grid points above the top of the surface mixing layer are zero
- Plumes that stabilize above the top of the surface mixing layer do not contribute to ground-level concentrations at any grid point (this assumption also applies to flat terrain)

In order to determine whether the stabilized plume is contained within the surface mixing layer, it is necessary to calculate the mixing depth $H_m^*\{z_s\}$ at the source from the relationship

$$H_m^*\{z_s\} = \left(H_m + z_a - z_s\right) \qquad \text{(A-33)}$$

where

H_m = the depth of the surface mixing layer measured at a point with elevation z_a above mean sea level

z_s = the height above mean sea level of the source

Equation (A-33) is represented schematically in Figure A-1. As shown by the figure, the actual top of the surface mixing layer is assumed to remain at a constant elevation above mean sea level. If the height H of the stabilized plume above the base of the stack is less than or equal to $H_m^*\{z_s\}$, the plume is defined to be contained within the surface mixing layer.

The height H_o of the stabilized plume above mean sea level is given by the sum of the height H of the stabilized plume above the base of the stack and the elevation z_s of the base of the stack. At any elevation z above mean sea level, the effective height $H'\{z\}$ of the plume centerline above the terrain is then given by

$$H'\{z\} = \begin{Bmatrix} H_o - z \; ; & H_o - z \geq 0 \\ \\ 0 \; ; & H_o - z < 0 \end{Bmatrix} \qquad \text{(A-34)}$$

The effective mixing depth $H_m'\{z\}$ above a point at elevation z above mean sea level is defined by

$$H_m'\{z\} = \begin{Bmatrix} H_m \; ; & z \geq z_a \\ \\ H_m + z_a - z \; ; & z < z_a \end{Bmatrix} \qquad \text{(A-35)}$$

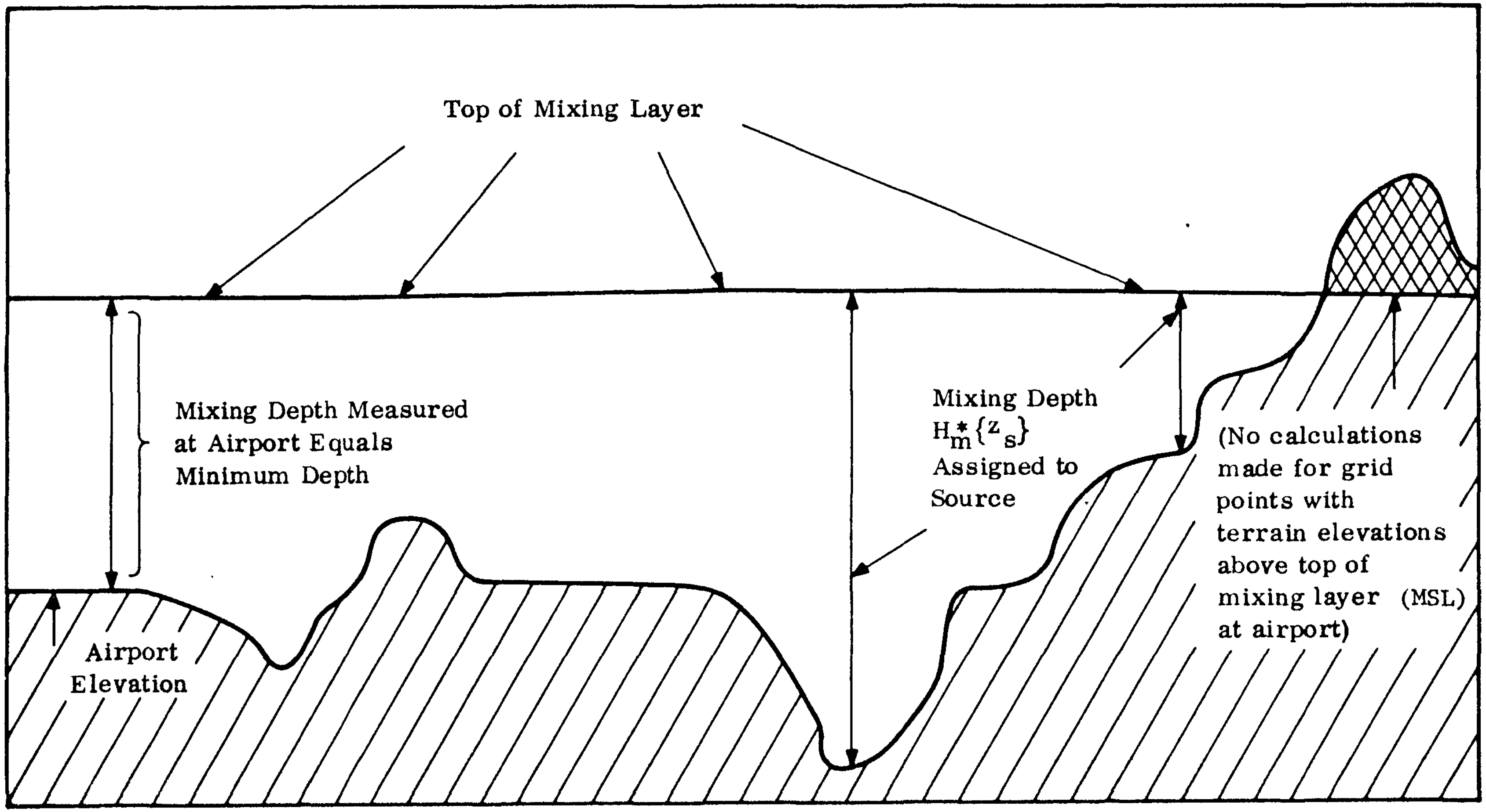

FIGURE A-1. Mixing depth $H_m^*\{z_s\}$ used to determine whether the stabilized plume is contained within the surface mising layer.

Figure A-2 illustrates the assumptions implicit in Equation (A-35). For grid points at elevations below the airport elevation, the effective mixing depth $H_m'\{z\}$ is allowed to increase in a manner consistent with Figure A-1. However, in order to prevent a physically unrealistic compression of plumes as they pass over elevated terrain, the effective mixing depth is not permitted to be less than the mixing depth measured at the airport. It should be noted that the concentration is set equal to zero for grid points above the actual top of the mixing layer (see Figure A-1).

The terrain adjustment procedures also assume that the mean wind speed at any given height above sea level is constant. Thus, the wind speed $\bar{u}_R$ above the surface at a point with elevation z_a above mean sea level is adjusted to the stack height for the plume-rise calculations by the relationship

$$\bar{u}\{h\} = \left\{ \begin{array}{ll} \bar{u}_R \left(\dfrac{h_o - z_a}{z_R} \right)^p & ; \quad h_o \geq z_a + z_R \\ \\ \bar{u}_R & ; \quad h_o < z_a + z_R \end{array} \right\} \qquad \text{(A-36)}$$

where h_o is the height above mean sea level of the top of the stack. Similarly, the wind speed $\bar{u}\{H\}$ used in the concentration calculations is given by

$$\bar{u}\{H\} = \left\{ \begin{array}{ll} \bar{u}_R \left(\dfrac{H_o - z_a}{z_R} \right)^p & ; \quad H_o \geq z_a + z_R \\ \\ \bar{u}_R & ; \quad H_o < z_a + z_R \end{array} \right\} \qquad \text{(A-37)}$$

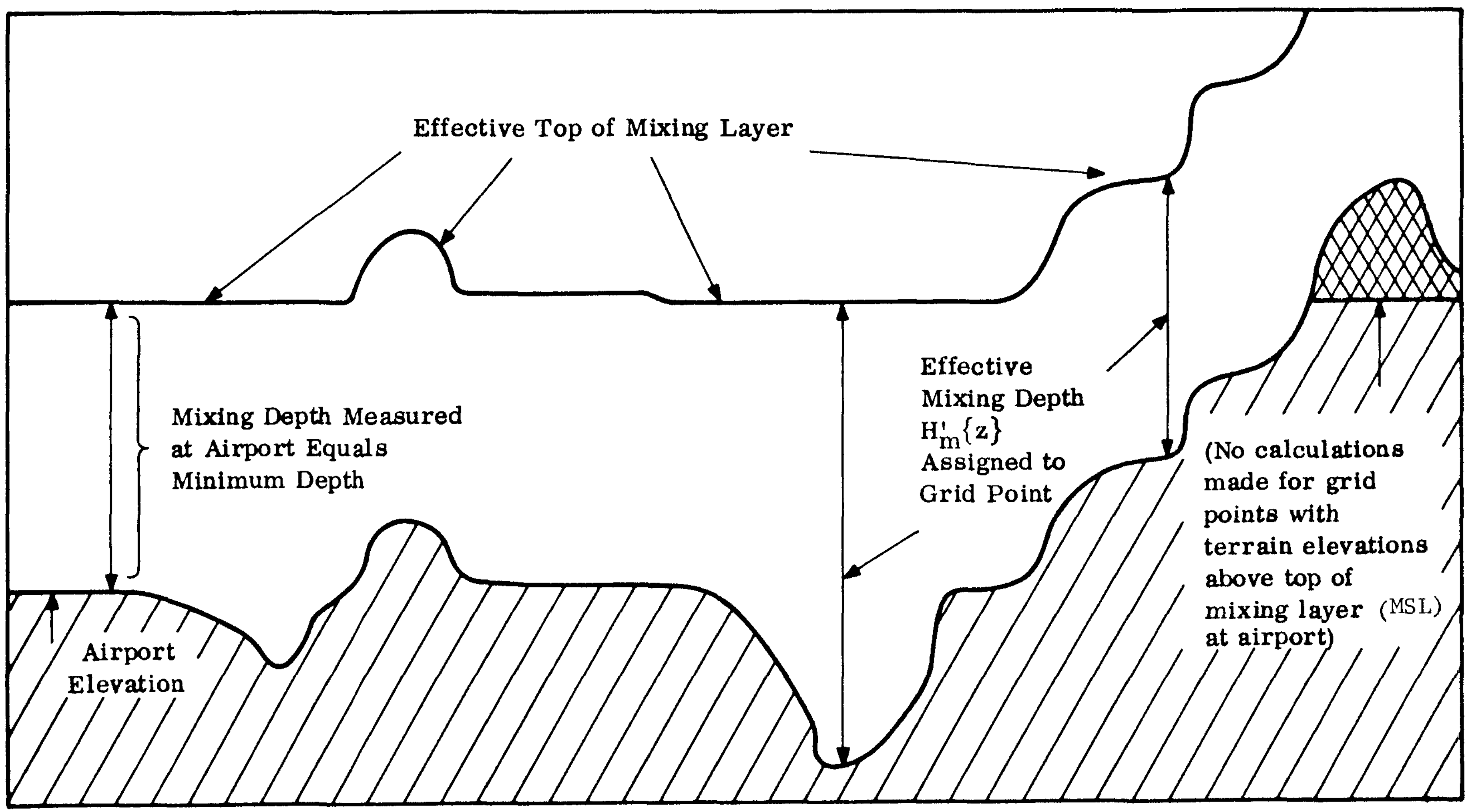

FIGURE A-2. Effective mixing depth $H'_m\{z\}$assigned to grid points for the concentration calculations.

It should be noted that the terrain-adjustment procedures outlined above provide a very simple representation of complex plume-terrain interactions that are not yet well understood. Because the model assumptions are generally conservative, it is possible that concentrations calculated for elevated terrain, especially elevated terrain near a source, exceed the concentrations that actually occur. It should also be noted that the procedures described above differ from previous "terrain-intersection" models in that terrain intersection is only permitted for a plume contained within a mixing layer. That is, terrain intersection is permitted for all stability categories, but only for a plume contained within the surface mixing layer.

APPENDIX B

METEOROLOGICAL INPUTS USED IN THE LONG-TERM AND MODEL CALCULATIONS
(BASED ON METEOROLOGICAL OBSERVATIONS MADE AT THE
GREATER PITTSBURGH AIRPORT)

APPENDIX B.1

1965 SEASONAL INPUTS USED FOR THE 1980 COMPLIANCE CALCULATIONS

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 1

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.9000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00038100	.00113840	.00034150	0.00000000	0.00000000	0.00000000
22.500	.00049480	.00125230	.00102460	0.00000000	0.00000000	0.00000000
45.000	.00072260	.00068310	.00011380	0.00000000	0.00000000	0.00000000
67.500	.00056080	.00091080	.00068310	0.00000000	0.00000000	0.00000000
90.000	.00096190	.00182150	.00125230	0.00000000	0.00000000	0.00000000
112.500	.00055060	.00170760	.00045540	0.00000000	0.00000000	0.00000000
135.000	.00046700	.00091080	.00011380	0.00000000	0.00000000	0.00000000
157.500	.00106170	.00193540	.00102460	0.00000000	0.00000000	0.00000000
180.000	.00090610	.00136610	.00148000	0.00000000	0.00000000	0.00000000
202.500	.00022540	.00102460	.00102460	0.00000000	0.00000000	0.00000000
225.000	.00062270	.00102450	.00079690	0.00000000	0.00000000	0.00000000
247.500	.00092000	.00170770	.00068310	0.00000000	0.00000000	0.00000000
270.000	.00063660	.00113840	.00125230	0.00000000	0.00000000	0.00000000
292.500	.00033920	.00079690	.00022770	0.00000000	0.00000000	0.00000000
315.000	.00035310	.00091070	.00091070	0.00000000	0.00000000	0.00000000
337.500	.00045310	.00079690	.00091070	0.00000000	0.00000000	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 2

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00014590	.00159380	.00387070	.00011380	0.00000000	0.00000000
22.500	.00024930	.00136610	.00239070	.00011380	0.00000000	0.00000000
45.000	.00012510	.00136610	.00182150	0.00000000	0.00000000	0.00000000
67.500	.00010420	.00113840	.00341530	0.00000000	0.00000000	0.00000000
90.000	.00040570	.00307380	.00352910	0.00000000	0.00000000	0.00000000
112.500	.00066380	.00182150	.00352910	.00022770	0.00000000	0.00000000
135.000	.00062290	.00273220	.00216300	0.00000000	0.00000000	0.00000000
157.500	.00030140	.00193530	.00387070	.00011380	0.00000000	0.00000000
180.000	.00100700	.00421220	.00626140	.00022770	0.00000000	0.00000000
202.500	.00050830	.00148000	.00387070	.00045540	0.00000000	0.00000000
225.000	.00043610	.00204920	.00478140	.00056920	0.00000000	0.00000000
247.500	.00041530	.00182150	.00660290	.00034150	.00022770	.00011380
270.000	.00022930	.00250460	.00660290	.00113840	.00022770	.00011380
292.500	.00009380	.00102460	.00364300	.00022770	.00034150	0.00000000
315.000	.00008340	.00091070	.00307380	.00068310	0.00000000	0.00000000
337.500	.00007300	.00079690	.00318760	.00045540	0.00000000	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 3

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00102040	.00603370	.02311021	.01115661	.00056920	0.00000000
22.500	.00103130	.00387070	.01013211	.00261840	0.00000000	0.00000000
45.000	.00020010	.00398450	.00650290	.00113840	.00011380	0.00000000
67.500	.00031970	.00398450	.00774131	.00341530	.00079690	.00011380
90.000	.00067310	.00626140	.01035971	.00250460	.00011360	0.00000000
112.500	.00045640	.00432600	.01236431	.00273220	.00022770	0.00000000
135.000	.00077550	.00591990	.01423041	.00523680	.00011360	.00022770
157.500	.00074120	.00523680	.01149821	.00261840	.00022770	0.00000000
180.000	.00064510	.00808291	.02083331	.00660290	.00034150	0.00000000
202.500	.00014290	.00284610	.01423041	.00796901	.00056920	.00011380
225.000	.00030250	.00364300	.02060562	.02367942	.00569220	.00091070
247.500	.00099130	.00307380	.01707651	.02550092	.00762751	.00330150
270.000	.00076980	.00580600	.02459022	.03107922	.01070131	.00364300
292.500	.00024530	.00250460	.01377501	.01707651	.00466760	.00125230
315.000	.00067840	.00398450	.01741801	.01423041	.00409840	.00034150
337.500	.00022820	.00216300	.01650731	.01275051	.00136610	.00022770

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 4

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00265950	.00762751	.00530600	0.00000000	0.00000000	0.00000000
22.500	.00251300	.00774141	.00261840	0.00000000	0.00000000	0.00000000
45.000	.00451490	.00831060	.00227690	0.00000000	0.00000000	0.00000000
67.500	.00445440	.00762751	.00113840	0.00000000	0.00000000	0.00000000
90.000	.00322560	.01445311	.00136610	0.00000000	0.00000000	0.00000000
112.500	.00710580	.01468581	.00443990	0.00000000	0.00000000	0.00000000
135.000	.00756101	.01639351	.00216300	0.00000000	0.00000000	0.00000000
157.500	.00551370	.00876600	.00227690	0.00000000	0.00000000	0.00000000
180.000	.01132441	.01605191	.00193530	0.00000000	0.00000000	0.00000000
202.500	.00410390	.00762751	.00397070	0.00000000	0.00000000	0.00000000
225.000	.00555440	.00956291	.00762751	0.00000000	0.00000000	0.00000000
247.500	.00477730	.00933521	.00614750	0.00000000	0.00000000	0.00000000
270.000	.00319010	.01331971	.00694440	0.00000000	0.00000000	0.00000000
292.500	.00511880	.00808291	.00193530	0.00000000	0.00000000	0.00000000
315.000	.00671990	.01070131	.00364300	0.00000000	0.00000000	0.00000000
337.500	.00230100	.00478140	.00409840	0.00000000	0.00000000	0.00000000

STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR ELEVATED POINT OR VOLUME SOURCES
(SIGEPU RADIANS)

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.174500E+00	.174500E+00	.174500E+00	.174500E+00	.174500E+00	.174500E+00
STABILITY CATEGORY 2	.108000E+00	.108000E+00	.108000E+00	.109000E+00	.108000E+00	.108000E+00
STABILITY CATEGORY 3	.735000E-01	.735000E-01	.735000E-01	.735000E-01	.735000E-01	.735000E-01
STABILITY CATEGORY 4	.465000E-01	.465000E-01	.465000E-01	.465000E-01	.465000E-01	.465000E-01

STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR AREA OR BUILDING EMISSIONS SOURCES
(SIGEPL RADIANS)

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.174500E+00	.174500E+00	.174500E+00	.174500E+00	.174500E+00	.174500E+00
STABILITY CATEGORY 2	.108000E+00	.108000E+00	.108000E+00	.109000E+00	.108000E+00	.108000E+00
STABILITY CATEGORY 3	.735000E-01	.735000E-01	.735000E-01	.735000E-01	.735000E-01	.735000E-01
STABILITY CATEGORY 4	.465000E-01	.465000E-01	.465000E-01	.465000E-01	.465000E-01	.465000E-01

VERTICAL POTENTIAL TEMPERATURE GRADIENT
(DPDZ DEGREES KELVIN)

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.000000E+00	.000000E+00	.000000E+00	.000000E+00	.000000E+00	.000000E+00
STABILITY CATEGORY 2	.000000E+00	.000000E+00	.000000E+00	.000000E+00	.000000E+00	.000000E+00
STABILITY CATEGORY 3	.150000E-01	.100000E-01	.500000E-02	.300000E-02	.300000E-02	.300000E-02
STABILITY CATEGORY 4	.300000E-01	.200000E-01	150000E-01	.300000E-02	.300000E-02	.300000E-02

WIND PROFILE POWER LAW EXPONENT
(P)

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.100000E+00	.100000E+00	.100000E+00	.100000E+00	.100000E+00	.100000E+00
STABILITY CATEGORY 2	.200000E+00	.150000E+00	.100000E+00	.100000E+00	.100000E+00	.100000E+00
STABILITY CATEGORY 3	.250000E+00	.200000E+00	.150000E+00	.100000E+00	.100000E+00	.100000E+00
STABILITY CATEGORY 4	.300000E+00	.250000E+00	.200000E+00	.200000E+00	.200000E+00	.200000E+00

AMBIENT AIR TEMPERATURE
(TA DEGREES KELVIN)

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	286.9900	286.9900	283.9000	280.7800		

MIXING LAYER DEPTH
(HM METERS)

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.124750E+04	.128500E+04	.130000E+04	.130000E+04	.130000E+04	.130000E+04
STABILITY CATEGORY 2	.124750E+04	.128500E+04	.130000E+04	.130000E+04	.130000E+04	.130000E+04
STABILITY CATEGORY 3	.697500E+03	.788750E+03	.976250E+03	.115250E+04	.119125E+04	.119125E+04
STABILITY CATEGORY 4	.147500E+03	.292500E+03	.652500E+03	.652500E+03	.652500E+03	.652500E+03

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY *-*

APPENDIX B.2

1976 SEASONAL METEOROLOGICAL INPUTS USED FOR MODEL VALIDATION CALCULATIONS

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 1

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00038100	.00113840	.00034150	0.00000000	0.00000000	0.00000000
22.500	.00049480	.00125230	.00102460	0.00000000	0.00000000	0.00000000
45.000	.00072260	.00068310	.00011380	0.00000000	0.00000000	0.00000000
67.500	.00058080	.00091080	.00068310	0.00000000	0.00000000	0.00000000
90.000	.00096190	.00182150	.00125230	0.00000000	0.00000000	0.00000000
112.500	.00055060	.00170760	.00045540	0.00000000	0.00000000	0.00000000
135.000	.00046700	.00091080	.00011380	0.00000000	0.00000000	0.00000000
157.500	.00106170	.00193540	.00102460	0.00000000	0.00000000	0.00000000
180.000	.00090610	.00136610	.00148000	0.00000000	0.00000000	0.00000000
202.500	.00022540	.00102460	.00102460	0.00000000	0.00000000	0.00000000
225.000	.00062270	.00102450	.00079690	0.00000000	0.00000000	0.00000000
247.500	.00092000	.00170770	.00068310	0.00000000	0.00000000	0.00000000
270.000	.00063660	.00113840	.00125230	0.00000000	0.00000000	0.00000000
292.500	.00033920	.00079690	.00022770	0.00000000	0.00000000	0.00000000
315.000	.00035310	.00091070	.00091070	0.00000000	0.00000000	0.00000000
337.500	.00045310	.00079690	.00091070	0.00000000	0.00000000	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 2

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00014590	.00159380	.00387070	.00011380	0.00000000	0.00000000
22.500	.00024930	.00136610	.00239070	.00011380	0.00000000	0.00000000
45.000	.00012510	.00136610	.00182150	0.00000000	0.00000000	0.00000000
67.500	.00010420	.00113840	.00341530	0.00000000	0.00000000	0.00000000
90.000	.00040570	.00307380	.00352910	0.00000000	0.00000000	0.00000000
112.500	.00066380	.00182150	.00352910	.00022770	0.00000000	0.00000000
135.000	.00062290	.00273220	.00216300	0.00000000	0.00000000	0.00000000
157.500	.00030140	.00193530	.00387070	.00011380	0.00000000	0.00000000
180.000	.00100700	.00421220	.00626140	.00022770	0.00000000	0.00000000
202.500	.00050830	.00148000	.00387070	.00045540	0.00000000	0.00000000
225.000	.00043610	.00204920	.00478140	.00056920	0.00000000	0.00000000
247.500	.00041530	.00182150	.00660290	.00034150	.00022770	.00011380
270.000	.00022930	.00250460	.00660290	.00113840	.00022770	.00011380
292.500	.00009380	.00102460	.00364300	.00022770	.00034150	0.00000000
315.000	.00008340	.00091070	.00307380	.00068310	0.00000000	0.00000000
337.500	.00007300	.00079690	.00318760	.00045540	0.00000000	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 3

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00102040	.00603370	.02311021	.01115661	.00056920	0.00000000
22.500	.00103130	.00387070	.01013211	.00261840	0.00000000	0.00000000
45.000	.00020010	.00398450	.00660290	.00113840	.00011380	0.00000000
67.500	.00031970	.00398450	.00774131	.00341530	.00079690	.00011380
90.000	.00067310	.00626140	.01035971	.00250460	.00011380	0.00000000
112.500	.00045640	.00432600	.01286431	.00273220	.00022770	0.00000000
135.000	.00077550	.00591990	.01423041	.00523680	.00011380	.00022770
157.500	.00074120	.00523680	.01149821	.00261840	.00022770	0.00000000
180.000	.00064510	.00808291	.02083331	.00660290	.00034150	0.00000000
202.500	.00014290	.00284610	.01423041	.00796901	.00056920	.00011380
225.000	.00030250	.00364300	.02060562	.02367942	.00569220	.00091070
247.500	.00099130	.00307380	.01707651	.02550092	.00762751	.00330150
270.000	.00076980	.00580600	.02459022	.03107922	.01070131	.00364300
292.500	.00024530	.00250460	.01377501	.01707651	.00466760	.00125230
315.000	.00067840	.00398450	.01741801	.01423041	.00409840	.00034150
337.500	.00022820	.00216300	.01650731	.01275051	.00136610	.00022770

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 4

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00265950	.00762751	.00580600	0.00000000	0.00000000	0.00000000
22.500	.00291300	.00774141	.00261840	0.00000000	0.00000000	0.00000000
45.000	.00451490	.00831060	.00227690	0.00000000	0.00000000	0.00000000
67.500	.00445440	.00762751	.00113840	0.00000000	0.00000000	0.00000000
90.000	.00822560	.01445811	.00136610	0.00000000	0.00000000	0.00000000
112.500	.00710580	.01468581	.00443990	0.00000000	0.00000000	0.00000000
135.000	.00798101	.01639351	.00216300	0.00000000	0.00000000	0.00000000
157.500	.00551370	.00876600	.00227690	0.00000000	0.00000000	0.00000000
180.000	.01132441	.01605191	.00193530	0.00000000	0.00000000	0.00000000
202.500	.00410390	.00762751	.00387070	0.00000000	0.00000000	0.00000000
225.000	.00585440	.00956291	.00762751	0.00000000	0.00000000	0.00000000
247.500	.00477730	.00933521	.00614750	0.00000000	0.00000000	0.00000000
270.000	.00819010	.01331971	.00694440	0.00000000	0.00000000	0.00000000
292.500	.00511880	.00808291	.00193530	0.00000000	0.00000000	0.00000000
315.000	.00671990	.01070131	.00364300	0.00000000	0.00000000	0.00000000
337.500	.00230100	.00478140	.00409840	0.00000000	0.00000000	0.00000000

STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR ELEVATED POINT OR VOLUME SOURCES
(SIGEPU RADIANS)

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.174500E+00	.174500E+00	.174500E+00	.174500E+00	.174500E+00	.174500E+00
STABILITY CATEGORY 2	.108000E+00	.108000E+00	.108000E+00	.108000E+00	.108000E+00	.108000E+00
STABILITY CATEGORY 3	.735000E-01	.735000E-01	.735000E-01	.735000E-01	.735000E-01	.735000E-01
STABILITY CATEGORY 4	.465000E-01	.465000E-01	.465000E-01	.465000E-01	.465000E-01	.465000E-01

STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR AREA OR BUILDING EMISSIONS SOURCES
(SIGEPL RADIANS)

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.174500E+00	.174500E+00	.174500E+00	.174500E+00	.174500E+00	.174500E+00
STABILITY CATEGORY 2	.108000E+00	.108000E+00	.108000E+00	.108000E+00	.108000E+00	.108000E+00
STABILITY CATEGORY 3	.735000E-01	.735000E-01	.735000E-01	.735000E-01	.735000E-01	.735000E-01
STABILITY CATEGORY 4	.465000E-01	.465000E-01	.465000E-01	.465000E-01	.465000E-01	.465000E-01

VERTICAL POTENTIAL TEMPERATURE GRADIENT
(DPDZ DEGREES KELVIN)

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.000000E+00	.000000E+00	.000000E+00	.000000E+00	.000000E+00	.000000E+00
STABILITY CATEGORY 2	.000000E+00	.000000E+00	.000000E+00	.000000E+00	.000000E+00	.000000E+00
STABILITY CATEGORY 3	.150000E-01	.100000E-01	.500000E-02	.300000E-02	.300000E-02	.300000E-02
STABILITY CATEGORY 4	.300000E-01	.200000E-01	.150000E-01	.300000E-02	.300000E-02	.300000E-02

WIND PROFILE POWER LAW EXPONENT
(P)

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.100000E+00	.100000E+00	.100000E+00	.100000E+00	.100000E+00	.100000E+00
STABILITY CATEGORY 2	.200000E+00	.150000E+00	.100000E+00	.100000E+00	.100000E+00	.100000E+00
STABILITY CATEGORY 3	.250000E+00	.200000E+00	.150000E+00	.100000E+00	.100000E+00	.100000E+00
STABILITY CATEGORY 4	.300000E+00	.250000E+00	.200000E+00	.200000E+00	.200000E+00	.200000E+00

AMBIENT AIR TEMPERATURE
(TA DEGREES KELVIN)

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	286.9900	286.9900	283.9000	280.7800		

MIXING LAYER DEPTH
(HM METERS)

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.124750E+04	.128500E+04	.130000E+04	.130000E+04	.130000E+04	.130000E+04
STABILITY CATEGORY 2	.124750E+04	.128500E+04	.130000E+04	.130000E+04	.130000E+04	.130000E+04
STABILITY CATEGORY 3	.697500E+03	.788750E+03	.976250E+03	.115250E+04	.119125E+04	.119125E+04
STABILITY CATEGORY 4	.147500E+03	.292500E+03	.652500E+03	.652500E+03	.652500E+03	.652500E+03

APPENDIX B.3

1977 SEASONAL METEOROLOGICAL INPUTS USED FOR MODEL VALIDATION CALCULATIONS

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 1

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00067210	.00228310	.00159820	0.00000000	0.00000000	0.00000000
22.500	.00051470	.00102740	.00079910	0.00000000	0.00000000	0.00000000
45.000	.00061480	.00182650	.00079910	0.00000000	0.00000000	0.00000000
67.500	.00157220	.00125570	.00034250	0.00000000	0.00000000	0.00000000
90.000	.00186110	.00148400	.00011420	0.00000000	0.00000000	0.00000000
112.500	.00127170	.00091330	.00034250	0.00000000	0.00000000	0.00000000
135.000	.00109240	.00148410	.00034250	0.00000000	0.00000000	0.00000000
157.500	.00177950	.00182650	.00057080	0.00000000	0.00000000	0.00000000
180.000	.00251310	.00353880	.00285390	0.00000000	0.00000000	0.00000000
202.500	.00146340	.00239730	.00114160	0.00000000	0.00000000	0.00000000
225.000	.00063260	.00194070	.00079910	0.00000000	0.00000000	0.00000000
247.500	.00068620	.00136980	.00102740	0.00000000	0.00000000	0.00000000
270.000	.00021960	.00171240	.00068490	0.00000000	0.00000000	0.00000000
292.500	.00051150	.00102740	.00068490	0.00000000	0.00000000	0.00000000
315.000	.00011790	.00091320	.00102740	0.00000000	0.00000000	0.00000000
337.500	.00034470	.00068500	.00079910	0.00000000	0.00000000	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 2

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00062790	.00159820	.00525110	.00034250	0.00000000	0.00000000
22.500	.00029490	.00057080	.00068490	0.00000000	0.00000000	0.00000000
45.000	.00037100	.00148400	.00091320	0.00000000	0.00000000	0.00000000
67.500	.00020930	.00102740	.00114160	0.00000000	0.00000000	0.00000000
90.000	.00094180	.00239730	.00148400	0.00000000	0.00000000	0.00000000
112.500	.00033300	.00102740	.00034250	0.00000000	0.00000000	0.00000000
135.000	.00126520	.00182650	.00045660	0.00000000	0.00000000	0.00000000
157.500	.00096080	.00262560	.00228310	0.00000000	0.00000000	0.00000000
180.000	.00135080	.00433790	.00536530	0.00000000	0.00000000	0.00000000
202.500	.00080860	.00228310	.00399540	.00011420	0.00000000	0.00000000
225.000	.00046610	.00262560	.00479450	.00022830	0.00000000	0.00000000
247.500	.00030440	.00216890	.00730590	.00057080	.00022830	0.00000000
270.000	.00025680	.00159820	.00696350	.00136990	.00011420	0.00000000
292.500	.00085620	.00136990	.00296800	.00079910	0.00000000	0.00000000
315.000	.00010460	.00125570	.00353880	.00022830	0.00000000	0.00000000
337.500	.00043760	.00079910	.00296800	.00022830	.00011420	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 3

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00131280	.00605020	.01244290	.00502280	.00068490	0.00000000
22.500	.00082250	.00171230	.00331050	.00045660	0.00000000	0.00000000
45.000	.00150830	.00525110	.00502280	.00022830	0.00000000	0.00000000
67.500	.00138390	.00308220	.00593610	.00057080	0.00000000	0.00000000
90.000	.00118550	.00593610	.01175800	.00182650	0.00000000	0.00000000
112.500	.00102830	.00319630	.00890410	.00285390	0.00000000	0.00000000
135.000	.00257880	.00707760	.01563930	.00547950	.00022830	.00022830
157.500	.00111070	.00673520	.01221460	.00285390	.00011420	0.00000000
180.000	.00340220	.01301370	.02180370	.00650680	.00034250	.00011420
202.500	.00125760	.00719180	.01541100	.00719180	.00068490	0.00000000
225.000	.00253670	.00844750	.02534250	.02020551	.00285390	.00011420
247.500	.00152520	.00764840	.02808220	.03196350	.00924660	.00182650
270.000	.00148960	.00913240	.03196350	.03915530	.01221460	.00468040
292.500	.00147560	.00468040	.01803650	.01575340	.00433790	.00057080
315.000	.00121730	.00228310	.01438360	.01609590	.00273970	.00114160
337.500	.00036590	.00216890	.01347030	.00970320	.00079910	0.00000000

FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY

SEASON 1

STABILITY CATEGORY 4

DIRECTION (PHI DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	.00722410	.00833340	.00684930	0.00000000	0.00000000	0.00000000
22.500	.00438180	.00673520	.00091320	0.00000000	0.00000000	0.00000000
45.000	.00403670	.00502280	.00068490	0.00000000	0.00000000	0.00000000
67.500	.00332110	.00639270	.00091320	0.00000000	0.00000000	0.00000000
90.000	.00707400	.00890410	.00125570	0.00000000	0.00000000	0.00000000
112.500	.00282850	.00331050	.00114160	0.00000000	0.00000000	0.00000000
135.000	.00905900	.00821920	.00216890	0.00000000	0.00000000	0.00000000
157.500	.00742750	.00958910	.00045660	0.00000000	0.00000000	0.00000000
180.000	.01310940	.01906390	.00125570	0.00000000	0.00000000	0.00000000
202.500	.00386120	.00867580	.00148400	0.00000000	0.00000000	0.00000000
225.000	.00387230	.00878990	.00308220	0.00000000	0.00000000	0.00000000
247.500	.00636950	.00936080	.00468040	0.00000000	0.00000000	0.00000000
270.000	.00992110	.01780820	.00707760	0.00000000	0.00000000	0.00000000
292.500	.00673410	.00764840	.00228310	0.00000000	0.00000000	0.00000000
315.000	.00540340	.00787670	.00525110	0.00000000	0.00000000	0.00000000
337.500	.00148090	.00479450	.00479450	0.00000000	0.00000000	0.00000000

STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR ELEVATED POINT OR VOLUME SOURCES
(SIGEPU RADIANS)

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.174500E+00	.174500E+00	.174500E+00	.174500E+00	.174500E+00	.174500E+00
STABILITY CATEGORY 2	.108000E+00	.108000E+00	.108000E+00	.108000E+00	.108000E+00	.108000E+00
STABILITY CATEGORY 3	.735000E-01	.735000E-01	.735000E-01	.735000E-01	.735000E-01	.735000E-01
STABILITY CATEGORY 4	.465000E-01	.465000E-01	.465000E-01	.465000E-01	.465000E-01	.465000E-01

STANDARD DEVIATION OF THE WIND ELEVATION ANGLE FOR AREA OR BUILDING EMISSIONS SOURCES
(SIGEPL RADIANS)

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.174500E+00	.174500E+00	.174500E+00	.174500E+00	.174500E+00	.174500E+00
STABILITY CATEGORY 2	.108000E+00	.108000E+00	.108000E+00	.108000E+00	.108000E+00	.108000E+00
STABILITY CATEGORY 3	.735000E-01	.735000E-01	.735000E-01	.735000E-01	.735000E-01	.735000E-01
STABILITY CATEGORY 4	.465000E-01	.465000E-01	.465000E-01	.465000E-01	.465000E-01	.465000E-01

VERTICAL POTENTIAL TEMPERATURE GRADIENT
(DPDZ DEGREES KELVIN)

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.000000E+00	.000000E+00	.000000E+00	.000000E+00	.000000E+00	.000000E+00
STABILITY CATEGORY 2	.000000E+00	.000000E+00	.000000E+00	.000000E+00	.000000E+00	.000000E+00
STABILITY CATEGORY 3	.150000E-01	.100000E-01	.500000E-02	.300000E-02	.300000E-02	.300000E-02
STABILITY CATEGORY 4	.300000E-01	.200000E-01	.150000E-01	.300000E-02	.300000E-02	.300000E-02

WIND PROFILE POWER LAW EXPONENT
(P)

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.100000E+00	.100000E+00	.100000E+00	.100000E+00	.100000E+00	.100000E+00
STABILITY CATEGORY 2	.200000E+00	.150000E+00	.100000E+00	.100000E+00	.100000E+00	.100000E+00
STABILITY CATEGORY 3	.250000E+00	.200000E+00	.150000E+00	.100000E+00	.100000E+00	.100000E+00
STABILITY CATEGORY 4	.300000E+00	.250000E+00	.200000E+00	.200000E+00	.200000E+00	.200000E+00

AMBIENT AIR TEMPERATURE
(TA DEGREES KELVIN)

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	286.9900	286.9900	283.9000	280.7800		

MIXING LAYER DEPTH
(HM METERS)

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.124750E+04	.128500E+04	.130000E+04	.130000E+04	.130000E+04	.130000E+04
STABILITY CATEGORY 2	.124750E+04	.128500E+04	.130000E+04	.130000E+04	.130000E+04	.130000E+04
STABILITY CATEGORY 3	.697500E+03	.788750E+03	.976250E+03	.115250E+04	.119125E+04	.119125E+04
STABILITY CATEGORY 4	.147500E+03	.292500E+03	.652500E+03	.652500E+03	.652500E+03	.652500E+03

APPENDIX C

SO_2 EMISSIONS INVENTORIES

APPENDIX C.1

SWPA AQCR ANNUAL COMPLIANCE EMISSIONS INVENTORY

SOURCE NO.	SOURCE STRENGTH G/S ANNUAL	SEA 2	SEA 3	SEA 4	UTM X	UTM Y	HT (M)	ELE (M)	TEMP. K	VOL. M/S3	R (M)
ALLEGHENY COUNTY SOURCES AS SUPPLIED BY ACBAPC/TRC RECEIVED FROM REGION III: 07 SEPTEMBER 1979											
PITTSBURGH BREWING											
1	11.10				587550	4479280	58.0	226	488	16.9	1.60
KOPPERS											
2	2.44				574400	4468100	28.6	250	533	34.1	.62
3	2.44				574400	4468100	28.6	250	637	18.4	.76
12TH STREET STEAM PLANT											
4	19.20				585200	4477600	82.0	221	604	265.5	2.20
WEST PENN. POWER SPRINGDALE											
5	10.80				604380	4488740	64.3	227	472	185.5	2.44
6	10.80				604380	4488740	64.3	227	444	192.7	1.85
DUQUESNE LIGHT CHESWICK											
7	1306.30				602330	4487800	229.0	229	558	1024.6	3.20
SATELLITE ALLOY											
81	5.78				604200	4488500	10.0	229	100	100	
EDGE STEEL											
9	.80				597600	4485200	38.1	220	348	21.8	.76
DUQUESNE LIGHT BRUNOT ISLAND TURBINES											
10	19.30				580680	4479680	10.0	222	735	248.6	2.06
11	53.30				580680	4479680	19.2	222	467	333.7	1.91
MARQUET CEMENT											
12	47.80				578300	4482600	46.0	222	491	94.0	1.90
SHENANGO BATTERIES #2,#3											
13	2.40				578050	4483110	76.0	222	588	106.0	1.05

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SHENANGO BATTERIES #4
 14     1.90                    5779404483200  69.0   222   478  62.0 1.05
SHENANGO BOILER #7,#8
 15    11.40                    5783304482800  26.0   222   452  38.0  .90
SHENANGO BOILER #9
 16     3.20                    5783604482790  38.7   222   627 155.0 1.50
VULCAN MATERIALS
 17     3.00                    5748004484600  20.3   223   553  10.2  .50
 18     2.00                    5748004484600  17.2   223   553   2.4  .50
PITTSBURGH ACTIVATED CARBON
 19     2.15                    5781004482500  12.2   223   533    .7  .20
 20     2.80                    5781004482500  18.9   223  1255   5.3  .38
 21     1.30                    5781004482500  17.8   223  1144  25.0  .52
ALCOSAN
 22     8.40                    5814004480800  91.4   230   344  23.5 1.22
DUQUESNE LIGHT PHILLIPS POWER STATION
 23   266.10                    5652604491020 104.0   226   322 340.4 3.96
DRAVCO
 70     7.20                    5786004482600  25.6   226   416  20.7  .75
USS CHEMICAL NEVEL ISLAND
 71     2.20                    5780004483000  30.5   223   322   5.6  .30
 72     4.50                    5779004483700  12.2   223   541  18.8  .60
NEVEL CHEMICALS
 73     3.00                    5764004483700  12.0   223   573   8.0  .61
 74     3.50                    5764004483700  14.0   223   543   6.8  .61
BLAWNOX
 75     2.50                    5878004480400  22.3   223   352  14.6  .55
 76     2.20                    5878004480400  22.3   223   352  10.7  .55
 77     1.90                    5878004480400  22.3   223   352   9.9  .55
HAHN
 78     2.90                    5862004484900  47.2   329   394  10.8  .60
BLTZHVR
 79      .10                    5848004474400  18.3   305   408   1.0  .50
PERRY
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80	.90	5831004482300	18.3	354	408	10.3	.50
OVERBROOK							
81	.10	5851004471200	18.3	280	408	.9	.50
SOUTH HILLS							
82	.60	5844004475000	18.3	335	408	7.5	.50
21ST STREET STEAM							
83	19.20	5864004478100	18.3	268	408	.8	.50
MORSE							
84	.10	5874004475500	18.3	229	408	1.0	.50
LATIMER							
85	.60	5846004478700	18.3	244	408	3.7	.50
MCKEYSPORT HOSPITAL							
86	.50	5990004466600	27.4	274	408	5.4	.70
87	.10	5965004466900	18.3	238	408	1.2	.50
ST. JOSEPH'S HOSPITAL							
88	.70	5816004480900	40.0	238	408	3.9	.55
PPG							
89	.60	6044004494200	73.2	274	514	18.7	1.85
90	.50	6044004494200	39.2	274	514	10.1	.90
GLASSMERE							
91	.10	6036004492500	15.2	229	644	6.2	.60
DUQUESNE LIGHT MANSFIELD							
92	.30	5821004478900	12.2	232	1033	3.9	.45
SHENANGO BLAST AREA							
941	.50	5782204482970	10.0	222	100	100	
SHENANGO BOILER #10							
95	2.29	5783904482780	33.5	222	477142.79		1.50
SHENANGO BATTERY #2 AREA							
961	5.56	5780504483120	10.0	222	100	100	
SHENANGO BATTERY #3 AREA							
971	5.56	5779804483160	10.0	222	100	100	
SHENANGO BATTERY #4 AREA							
981	8.75	5779504483210	10.0	222	100	100	
SHENANGO MISCELLANEOUS AREA							

991	.02	5779604483160	10.0	222	100	100	
SHENANGO D/S PLANT							
100	8.75	5780604482940	34.3	222	976	1.0	.22
USS CLAIRTON							
BATTERY #1							
110	2.31	5958954461555	69.0	229	588	37.4	1.22
BATTERY #2							
111	2.31	5958804461565	69.0	229	588	37.4	1.22
BATTERY #3							
112	2.31	5957454461715	69.0	229	588	37.4	1.22
BATTERY #7							
113	2.31	5959304461590	65.0	229	575	35.6	1.27
BATTERY #8							
114	2.31	5959304461590	65.0	229	575	35.6	1.27
BATTERY #9							
115	2.31	5959304461590	65.0	229	575	35.6	1.27
BATTERY #13							
120	2.22	5953604461925	61.0	229	575	45.9	1.50
BATTERY #14							
121	2.22	5953504461935	61.0	229	575	45.9	1.50
BATTERY #15							
122	2.22	5952154462105	61.0	229	575	45.9	1.50
BATTERY #19							
125	3.90	5952254461875	76.0	229	577	50.4	2.14
BATTERY #20							
126	3.90	5952104461895	76.0	229	577	50.4	2.14
BATTERY #21							
127	3.90	5951104462140	76.0	229	575	51.5	2.14
BATTERY #22							
128	3.90	5949954462160	76.0	229	575	51.5	2.14
TAIL GAS							
129	2.33	5957154461695	46.0	223	561	18.0	.61

REHEAT MILLS							
130	1.35	5958714461000	18.0	224	811	70.0	.70
131	1.35	5958674460980	18.0	224	811	70.0	.70
132	.52	5960094460924	30.5	224	811	70.0	.60
133	.52	5959964460929	30.5	224	811	70.0	.60
134	.52	5959824460933	30.5	224	811	70.0	.60
135	.52	5959694460930	30.5	224	811	70.0	.60
136	.37	5958334461020	25.9	226	811	11.8	.65
137	.37	5958274461004	25.9	226	811	11.8	.65
138	.37	5958224460991	25.9	226	811	11.8	.65
BOILER #1							
141	50.60	5949584462545	50.0	226	478	91.7	1.33
BOILER #2							
142	34.50	5949334462564	50.0	226	478	80.4	1.06
BOILER #13							
143	16.40	5947604462427	27.0	226	613	62.3	1.14
BOILER #14							
144	16.40	5947894462402	27.0	226	613	62.3	1.14
BOILER R1,R2							
145	18.36	5948004462400	50.0	227	444	48.8	1.52
USS DUQUESNE							
SOAKING PITS							
146	28.07	5981874470077	54.9	229	600	23.9	1.20
147	28.07	5982104470053	54.9	229	600	23.9	1.20
148	28.07	5982324470025	54.9	229	600	23.9	1.20
149	28.07	5982554469998	54.9	229	600	23.9	1.20
HEAT TREATING							
1501	7.42	5978834470353	10.0	229	100	100	
REHEAT FURNACE							
151	1.55	5978974470169	8.0	229	811	12.5	.62
152	1.55	5979044470162	8.0	229	811	12.5	.62
153	2.68	5978574470162	37.0	229	589	8.8	.90

154	2.68	5978734470143	37.0	229	589	8.8	.90
155	2.68	5978844470129	37.0	229	589	8.8	.90
BOILER #15							
157	1.20	5985624469030	49.0	229	478	33.4	1.15
BOILER #17							
158	1.20	5985434469062	49.0	229	478	33.4	1.15
USS NATIONAL							
SINTER PLANT							
159	0.00	5977204467400	27.4	229	330	3.4	.94
SOAKING PITS							
160	1.21	5976804467485	27.0	229	616	4.9	.62
161	1.21	5976904467490	27.0	229	616	4.9	.62
162	1.21	5977104467492	27.0	229	616	4.9	.62
163	1.21	5977154467493	27.0	229	616	4.9	.62
164	1.21	5977304467494	27.0	229	616	4.9	.62
165	1.21	5977454467495	27.0	229	616	4.9	.62
166	1.26	5977604467497	27.0	229	616	5.9	.62
167	1.26	5977704467498	27.0	229	616	5.9	.62
168	1.26	5977854467499	27.0	229	616	5.9	.62
169	1.26	5977974467500	27.0	229	616	5.9	.62
ROTARY							
170	20.90	5967444467549	38.0	229	1089	98.5	.88
HEAT FURNACE							
171	7.53	5966664467575	38.0	229	533	30.6	.76
172	7.53	5966684467563	38.0	229	533	30.6	.76
REHEAT FURNACE							
173	1.71	5967814467574	38.0	229	533	7.4	.68
174	1.71	5967994467578	38.0	229	533	7.4	.68
175	1.71	5969324467442	38.0	229	533	7.4	.68
NORMALIZER							
176	2.25	5969254467478	14.0	229	533	1.0	.25
177	.64	5970754467532	14.0	229	477	16.9	.65

WALKING FURNACE							
178	1.71	5967044467557	38.5	229	532	5.6	.68
WARM FURNACE							
1791	3.26	5972404467600	10.0	229	100	100	
BOILER #1							
180	16.90	5972154467595	44.7	221	635	101.5	1.34
BOILER #2							
181	16.90	5972154467580	44.7	221	635	101.5	1.34
BOILER #3							
182	16.90	5972254467580	44.7	221	635	101.5	1.34
BOILER #4							
183	16.90	5972254467595	44.7	221	635	101.5	1.34
BOILER #5							
184	16.90	5974004467330	44.7	221	635	101.5	1.34
USS IRVIN							
SLAB HEATING							
185	16.80	5931454465680	21.3	283	450	46.7	1.30
186	16.80	5931504465628	21.3	283	450	46.7	1.30
187	16.80	5931554465693	21.3	283	450	46.7	1.30
188	16.80	5931574465710	21.3	283	450	46.7	1.30
189	21.80	5931564465725	21.3	283	450	46.7	1.50
BOILERS #3,#4							
190	14.40	5932134465750	32.0	283	643	109.0	1.52
BOILERS #5,#6							
191	17.90	5932194465765	32.0	283	643	115.6	1.52
BOILER #7							
192	9.80	5932104465712	26.5	283	455	42.5	.91
USS CLAIRTON							
BATTERY B							
193	6.38	5956804461900	83.8	229	575	80.01	2.74

BATTERY C							
194	6.38	5955004462100	83.8	229	575	80.01	2.74
BOILERS T1 & T2							
195	23.28	5947704462400	26.5	226	444	20.93	.73
USS NATIONAL							
TEMPERING							
1961	0.00	5967044467557	10.0	229	100	100	
DUQUESNE LIGHT STANWICK							
201	17.10	5843804477300	97.5	220	574	217.2	2.40
H J HEINZ							
202	11.90	5860004478900	76.0	222	464	70.3	1.50
203	19.80	5860004478900	76.0	222	464	103.1	1.50
WESTINGHOUSE ELECTRIC							
204	4.00	5990204472550	37.1	308	466	23.4	.99
BELLEFIELD BOILERS							
205	21.10	5891904477100	59.4	256	589	49.6	1.40
206	22.40	5891904477100	77.7	256	517	91.9	1.70
WABCO							
207	4.70	5944004475550	27.0	274	569	19.3	.70
MESTA MACHINE							
208	.10	5909204471980	61.0	229	393	18.8	.90
B&O RAILROAD							
209	3.30	5898004472500	38.0	230	533	99.6	1.06
UNIVERSAL ATLAS							
210	63.80	6003004479400	16.7	371	513	202.5	1.10
USS HOMESTEAD							
OPEN HEARTH							
211	21.50	5924504473650	37.0	229	533	94.0	1.98
212	21.50	5924754473685	37.0	229	533	94.0	1.98
213	21.50	5925104473750	37.0	229	533	94.0	1.98

214	21.50	5925204473760	37.0	229	533	94.0	1.98
215	21.50	5925504473820	37.0	229	533	94.0	1.98
SOAKING PITS							
216	1.43	5918954473025	37.0	229	533	6.5	.84
217	1.43	5919004473035	37.0	229	533	6.5	.84
218	1.43	5919034473045	37.0	229	533	6.5	.84
219	1.43	5919054473050	37.0	229	533	6.5	.84
220	2.20	5919104473060	31.0	229	533	10.0	.76
221	2.20	5919134473070	31.0	229	533	10.0	.76
222	2.20	5919154473080	31.0	229	533	10.0	.76
223	2.20	5919204473090	31.0	229	533	10.0	.76
224	2.20	5919254473100	31.0	229	533	10.0	.76
225	2.20	5919304473110	31.0	229	533	10.0	.76
226	2.20	5919354473120	31.0	229	533	10.0	.76
227	2.20	5919404473130	31.0	229	533	10.0	.76
228	2.20	5919504473140	31.0	229	533	10.0	.76
229	2.20	5919604473150	31.0	229	533	10.0	.76
230	2.20	5919654473160	31.0	229	533	10.0	.76
231	2.20	5919704473170	31.0	229	533	10.0	.76
232	2.26	5919754473180	44.0	229	533	7.5	1.05
233	13.73	5931084473742	50.0	230	533	117.2	.84
234	11.70	5930924473742	50.0	230	533	117.2	.84
36" MILL							
235	2.18	5932254473733	23.0	230	477	28.5	.40
236	1.84	5932254473755	35.0	230	477	8.8	.76
BLACKSMITH							
237	1.16	5934254474000	23.0	227	477	12.0	.38
100" MILL							
238	26.82	5918874473270	38.0	227	477	17.2	.80
NORMALIZER							
2391	.35	5918874473270	10.0	229	100	100	
PREHEAT HOODS							
2401	8.24	5923804473606	10.0	229	100	100	

160" REHEAT FURNACE							
241	7.71	5919754473450	70.0	227	477	25.9	1.52
160" IN-OUT FURNACE							
242	3.44	5919584473250	31.0	227	477	7.0	.68
243	1.66	5919504473450	31.0	227	477	3.4	.68
#2 FORGE							
244	3.71	5927334473833	30.0	229	477	6.8	.91
245	1.05	5927334473833	30.0	229	477	3.4	.38
246	.84	5927334473833	24.0	229	477	2.8	.38
247	.84	5927334473833	24.0	229	477	5.5	.91
248	4.78	5927334473833	24.0	229	477	9.5	.99
249	1.25	5927334473833	18.0	229	477	1.5	.38
250	3.96	5927334473833	29.0	229	477	10.1	.99
HARVEY FORGE							
251	2.89	5932254473893	24.0	229	477	1.0	.68
252	.69	5932254473893	25.0	229	477	1.7	.68
253	2.07	5932254473893	24.0	229	477	1.7	.68
254	.66	5932254473893	24.0	229	477	1.4	.68
48" MILL							
255	1.18	5938654473555	32.0	229	477	3.4	.68
BOILER #3							
256	54.90	5942924474640	44.7	222	588	270.4	1.75
BOILER #4							
257	44.30	5942834474750	44.7	222	588	167.9	1.25
USS EDGAR THOMSON							
SOAKING PITS							
258	17.99	5974404471870	30.0	233	533	42.1	.88
RILEY BOILER #1							
259	27.37	5970834471740	50.0	221	616	69.6	1.91
RILEY BOILER #2							
260	27.37	5972604471685	50.0	221	616	69.6	1.91
RILEY BOILER #3							

261	27.37	5972764471673	50.0	221	616	69.6	1.91
J&L PITTSBURGH							
KEELER BOILER							
262	1.75	5892604473890	24.4	235	405	9.3	.66
RILEY BOILER							
263	5.95	5892604473890	21.7	235	566	13.2	.98
SOUTHSIDE BOILERS							
264	58.90	5880004475340	36.0	225	461	38.7	1.22
10" MILL							
266	1.47	5892804474080	38.1	238	1089	25.5	1.06
14" MILL							
267	5.96	5893004474120	38.1	238	1089	8.9	.84
COKE BATTERIES							
268	5.20	5891304474010	61.0	235	634	54.7	1.30
269	5.20	5891604473900	61.0	235	634	54.7	1.30
270	3.68	5892604473760	69.0	235	533	50.9	1.45
SOAKING PITS "D"							
281	4.02	5877804475520	46.0	226	811	18.7	.95
282	.75	5877804475520	46.0	226	700	7.0	.95
USS HOMESTEAD							
PACKAGE BOILERS #1-3							
283	8.67	5925754473900	15.0	226	561	25.74	1.60
USS EDGAR THOMSON							
B&W BOILERS							
284	0.00	5972724471676	33.0	221	551	26.19	1.20
J&L PITTSBURGH							

SLAB HEAT FURNACE							
285	0.68	5883004475790	22.7	235	839	22.34	1.30
TAIL GAS							
286	21.20	5891804474100	30.5	235	350	5.31	.17
ELECTRIC FURNACE							
2871	0.80	5881004475140	10.0	235	100	100.	
MISCELLANEOUS AREA							
2881	0.17	5891004473900	10.0	235	100	100.	
USS DUQUESNE							
BOILER #6							
290	0.74	5985504469010	49.0	229	560	72.03	1.15
BOILER #7							
291	0.74	5985704469010	49.0	229	560	72.03	1.15
BOILER #8							
292	0.74	5985504469020	49.0	229	560	72.03	1.15
BOILER #9							
293	0.74	5985604469020	49.0	229	560	72.03	1.15
BOILER #10							
294	0.74	5985404469030	49.0	229	560	72.03	1.15
BOILER #11							
295	0.74	5985604469039	49.0	229	560	72.03	1.15
BOILER #12							
296	0.67	5985504469040	49.0	229	476	67.1	1.15
BOILER #13							
297	0.67	5985604469040	49.0	229	476	67.1	1.15
BOILER #14							
298	0.67	5985404469050	49.0	229	476	67.1	1.15
BOILER #16							
299	0.67	5985404469060	49.0	229	476	67.1	1.15

MONONGAHELA VALLEY SOURCES

ARMCO STEEL							
417	7.45	5652834495355	24.0	233	589	62.40	.91
DUQUESNE LIGHT ELRAMA							
420	326.80	5920004456200	119.0	229	333	867.90	3.96
WEST PENN. POWER MITCHELL							
426	30.00	5873404452810	59.0	232	464	113.30	2.13
429	30.60	5873404452810	59.0	232	464	113.30	2.13
430	25.20	5873404452810	59.0	232	464	113.30	2.13
431	201.50	5873404452810	107.0	232	422	519.20	3.05
WHEELING-PITTSBURGH STEEL MONESSEN							
432	1.60	5939144446100	31.0	230	505	3.84	.61
435	4.80	5939144446100	38.0	230	666	7.00	.91
440	1.60	5946224446236	80.0	230	588	37.19	1.22
441	3.90	5948124446177	56.0	230	337	106.10	1.25
443	5.41	5941704446350	34.1	230	450	48.97	1.98
444	5.41	5941904446350	34.1	230	450	48.97	1.98
445	4.54	5942204446350	34.1	230	450	33.46	1.98
446	4.54	5942404446350	34.1	230	450	33.46	1.98
447	4.54	5942654446350	34.1	230	450	33.46	1.98
448	4.54	5942904446350	34.1	230	450	33.46	1.98
WHEELING-PITTSBURGH STEEL ALLENPORT							
450	5.50	5987524437902	15.0	235	421	9.30	0.22
451	14.60	5987524437902	61.0	235	575	64.90	1.52
CALIFORNIA STATE COLLEGE							
454	1.80	5952314435359	46.0	238	450	7.70	1.22
ALLIED CHEMICAL							
460	3.20	5946444436862	8.0	234	355	18.90	.50
CORNING GLASS							
463	1.00	5936544444158	15.0	233	477	1.76	.46

BEAVER VALLEY SOURCES

J&L ALIQUIPPA

BOILER #5,#58							
5001	3.16	5643304497350	46.6	219	533	75.28	1.30
BOILER #6							
5002	51.95	5643104497560	76.2	232	485202.28		2.09
NEW BOILER #6							
5003	23.44	5643104497560	61.0	232	473117.99		1.68
A-1N. ST.							
5004	1.81	5645904497990	68.6	232	577	42.71	1.45
A-1S. ST.							
5005	1.81	5646004497940	68.6	232	577	42.71	1.45
A-5 ST.							
5006	4.16	5645904497790	76.2	232	577	19.66	1.68
A-5N. REHEAT							
5007	.55	5645904497790	64.3	232	358	12.72	.56
A-5S. REHEAT							
5008	.55	5645904497790	64.3	232	358	12.72	.56
SOAKING PIT #2							
5009	1.29	5644204497590	53.3	232	922	13.92	.76
SOAKING PIT #3							
5010	1.29	5644204497580	53.3	232	922	13.92	.76
SOAKING PIT #4							
5011	1.29	5644204497570	53.3	232	922	13.92	.76
SOAKING PIT #5							
5012	1.29	5644204497560	53.3	232	922	13.92	.76
SOAKING PIT #6							
5013	1.29	5644204497550	53.3	232	922	13.92	.76
SOAKING PIT #7							
5014	1.29	5644204497540	53.3	232	922	13.92	.76
SOAKING PIT #8							

5015	1.29	SOAKING PIT #9	5644204497530	53.3	232	922 13.92	.87
5016	1.29	SOAKING PIT #10	5644204497520	53.3	232	922 13.92	.87
5017	1.29	SOAKING PIT C	5643204497510	53.3	232	922 13.92	.87
5018	1.62	SOAKING PIT P	5643204497490	53.3	232	922 17.40	.87
5019	1.62	SOAKING PIT E	5643204497490	53.3	232	922 17.40	.87
5020	1.62	SLAB FURNACE #1	5643204497480	53.3	232	922 17.40	.87
5021	1.52	SLAB FURNACE #2	5644504497410	61.0	232	700 75.70	1.30
5022	1.52	A-2 SLTM FURNACE	5644504497420	61.0	232	700 75.70	1.30
5023	.58	14" MILL REHEAT	5643204495640	38.1	232	977 14.68	.91
5024	.79	30" ROD MILL FURNACE #1	5644704498000	38.1	232	700 13.70	1.25
5025	1.03	30" ROD MILL FURNACE #2	5642604494510	38.1	232	977 31.54	.87
5026	1.03	30" ROD MILL FURNACE #3	5642604494490	38.1	232	977 31.54	.87
5027	1.03	14" PIPE MILL FURNACE #1	5642604494460	38.1	232	977 31.54	1.07
5028	.39	14" PIPE MILL FURNACE #2	5643204495710	38.1	232	977 12.82	.87
5029	.39	14" PIPE MILL FURNACE #3	5643204495720	38.1	232	977 12.82	.87
5030	.39	SL. ANNEX FURNACE #1	5643204495750	38.1	232	977 12.82	1.07
5031	.34	SL. ANNEX FURNACE #2	5642704495720	27.4	232	700 11.28	.76

5032	.19	5642704494750	27.4	232	422	3.75	.76
ROD MILL FURNACE							
5033	.84	5642404497950	38.1	232	811	28.01	.91
TAIL GAS							
5034	12.16	5645804497950	45.7	232	977	3.62	.53
MEDUSA CEMENT							
5380	51.60	5568744525270	91	244	589	113.30	1.83
5381	4.41	5568744525270	40	244	560	53.00	1.68
ARCO							
BOILER #1							
5384	10.02	5546304500620	61	229	330	59.70	0.91
BOILER #2							
5385	10.02	5546304500620	61	229	330	59.70	0.91
BOILER #3							
5386	10.02	5546304500620	61	229	330	59.70	0.91
OIL BOILER							
5388	2.52	5546304500620	55	229	399	22.66	1.98
B&W WALLACE RUN KTB 48,49							
5391	3.44	5552644515255	21	275	575	11.67	0.76
B&W AMBRIDGE BOILERS #1,#2, KTB #63,#64							
5395	1.20	5652834495355	26	233	450	23.40	1.14
B&W TUBULAR PRODUCTS							
5398	5.66	5564984513322	23	268	536	32.42	0.76
5399	1.50	5564984513322	21	268	577	16.06	0.91
SHENANGO CHINA (INTERPACE)							
5402	1.80	5537014539975	41	245	471	7.36	0.76
ASHLAND OIL							
CRUDE HEATER							
5404	.70	5623154504580	34	229	477	6.45	.53
CHARGE HEATER							

BOILERS #1-3						
5405 .50	5623154504580	18	229	477	4.15	.26
VACUUM HEATER						
5406 3.05	5623154504580	58	229	422	30.50	1.22
NRV, RERUN & BRIGHT ST. HEATERS						
5407 .30	5623154504580	34	229	477	2.28	.53
WESTINGHOUSE ELECTRIC BEAVER						
5408 1.10	5623154504580	18	229	477	2.90	.26
HERCULES INC.						
5413 2.63	5575284486194	15	243	515	24.69	0.71
5469 0.00	5973514449231	15	232	533	11.16	0.46
WEST PENN POWER WEST PITTSBURGH						
UNIT #1						
5472 236.60	5531054531767	145	238	413663.37		4.00
UNIT #2						
5473 0.00	5531054531767	145	238	444108.50		2.05
UNIT #3						
5474 0.00	5531054531767	145	238	406169.90		2.05
UNIT #4						
5475 0.00	5531054531767	145	238	423176.90		2.05
UNIT #5						
5476 0.00	5531054531767	145	238	417296.90		2.05
PENN POWER MANSFIELD						
5479 461.03	5490494498067	290	219	341740.36		2.90
5480 230.46	5490494498067	183	219	341740.36		2.90
ST. JOE MINERALS						
275' STACK						
5512 88.45	5552234501841	84	236	422	80.20	1.68
200' STACK						
5513 0 6.8	5561604502218	61	236	347122.3		1.52

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 400' STACK
5514 0  209.3                       5560654502301   122   236   336 213.7 2.74

 BESSEMER CEMENT

 UNIT #2
5518 0   25.5                       5428604535850    67   320   477 51.4  1.68
 UNIT #2
5519 0   33.0                       5428604535850    67   320   505 91.6  1.98

                 OTHER PENNSYLVANIA SOURCES

 ARMSTRONG POWER
6021    520.0                       6289794531996  70.0   258   405 160.0 2.30
6022    600.0                       6289794531996  70.0   258   439 285.0 2.30
 CARPENTERTOWN COAL
6031      0.00                      6329974530988   5.0   274   9921177.4  .10
 KEYSTONE POWER
6041   5198.9                       6401414502155 244.0   311   4081193.8 4.60
 HOMER CITY POWER
6051   4752.4                       6527564486147 244.0   366   405 967.6 4.70
 CONEMAUGH POWER
6061   4712.3                       6645824471929 305.0   330   4081194.0 4.10
 SEWARD POWER
6071    854.0                       6668824474602  69.0   332   414 207.0 1.50
6072      0.0                       6668824474602  69.0   332   450 126.7 1.20
 HATFIELD POWER
6081   5792.5                       5915704412040 213.4   220   411 935.0 3.45
 AVERTON FUEL
6091      3.2                       6192894443933   5.0   334   922 221.3  .10
6092      6.9                       6205444443891   5.0   334   922  88.5  .10
 SLIPPERYROCK COLLEGE
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6101	31.2		5798254545763	53.0	412	505	25.6	.90
SUNNEBORN								
6111	58.3		6077764540569	61.0	366	505	15.8	1.25
SHENLEY DISTILLERS								
6121	27.1		6134204505200	24.0	251	477	7.4	.80

EASTERN OHIO SOURCES

NOTE: 1975 EMISSIONS DATA WERE USED FOR THE NON-POWER GENERATING
SOURCES DUE TO A LACK OF COMPLIANCE DATA.
COMPLIANCE DATA FOR THE OHIO POWER STATIONS WAS OBTAINED
FROM EPA REGION III.
REVISED BY REGION III: 05 NOVEMBER 1979
(CONVERSATIONS WITH OHIO & REGION V)

FEDERAL PAPERBOARD								
8003	60.3		5332004468900	66	256	544	19.45	1.52
KAOL CLAY								
8011	2.55		5330004481300	46	283	421	1.43	1.51
OHIO POWER TORONTO		75% LOAD	(REVISED 11/5/79)					
8023	1850.6		5335004481800	198	201	441	368.40	2.29
OHIO EDISON SAMMIS		75% LOAD	(REVISED 11/5/79)					
8031	610.5		5317004485500	154	210	405	598.03	3.20
8032	610.5		5317004485500	154	210	405	619.21	3.05
8035	4224.0		5317004485500	259	210	405	507.11	4.76
8036	2816.3		5317004485500	305	210	405	1050.9	4.09
OHIO EDISON BURGER								
8041	3987.0		5205004417500	259	198	466	1088.0	3.30
OHIO EDISON TIDD			(SHUT DOWN)					
8051	0.0		5299004455700	75	207	455	99.10	1.50
8052	0.0		5299004455700	75	207	455	99.10	1.50

8053	0.0	5299004455700	75	207	455234.91		2.15
CARDINAL POWER 75% LOAD		(REVISED 11/5/79)					
8061	3451.5	5300004455800	252	198	447897.84		3.36
8062	3451.5	5300004455800	252	198	447897.84		3.36
8063	1126.5	5300004455800	274	204	4301025.5		3.66
TORONTO PAPERBORD							
8071	31.9	5337004480200	19	215	533	16.76	1.05
NATIONAL STEEL WEIRTON DIVISION							
8081	1.54	5327004467000	47	204	516	6.13	.85
8082	1.54	5327004467000	47	204	516	6.13	.85
8083	1.54	5327004467000	47	204	516	6.13	.85
8084	1.54	5327004467000	47	204	516	6.13	.85
WHEELING-PITTSBURGH NORTH PLANT							
8091	30.4	5325004466700	77	204	589	47.66	1.70
8092	30.1	5325004466700	36	204	505	32.39	1.20
8093	29.4	5325004466700	36	204	505	31.67	1.20
8094	30.2	5325004466700	36	204	505	32.48	1.20
8095	3.8	5325004466700	46	204	533	2.67	.75
8096	7.7	5325004466700	46	204	644	6.41	1.05
8097	7.7	5325004466700	44	204	644	6.41	1.05
8098	7.7	5325004466700	46	204	644	6.41	1.05
8099	3.8	5325004466700	46	204	644	3.50	.75
WHEELING-PITTSBURGH SOUTH PLANT							
8121	39.3	5346004463300	91	204	589	66.27	2.35
8122	6.8	5346004463300	49	204	519	12.25	1.00
8123	6.8	5346004463300	49	204	519	12.25	1.00
8124	6.8	5346004463300	49	204	519	12.25	1.00
8125	6.8	5346004463300	49	204	519	12.25	1.00
8126	6.8	5346004463300	49	204	519	12.25	1.00
8127	6.8	5346004463300	49	204	519	12.25	1.00
8128	6.8	5346004463300	49	204	547	12.88	1.00
8129	6.8	5346004463300	49	204	547	12.88	1.00
8130	4.8	5346004463300	33	204	644	1.48	.90
8131	4.8	5346004463300	33	204	644	1.48	.90

8132	4.8	5346004463300	50	204	644	1.48	.90
8133	4.8	5346004463300	50	204	644	1.48	.90
8134	4.8	5346004463300	50	204	644	1.48	.90
WHEELING-PITTSBURGH YORKVILLE							
8141	43.6	5254004445400	58	205	450	26.98	1.67
8142	54.5	5254004445400	60	205	450	41.62	1.67
WHEELING-PITTSBURGH MARTINS FERRY							
8151	9.6	5247004439200	24	202	511	12.39	.61
8152	26.2	5247004439200	38	202	516	40.00	1.55
OHIO EDISON EAST PALESTINE		(SHUT DOWN)					
8161	0.0	5359004520300	30	314	561	38.17	1.50
8162	0.0	5359004520300	29	314	561	26.15	.75
8163	0.0	5359004520300	58	314	561	26.15	.75

WEST VIRGINIA SOURCES

NOTE: WEST VIRGINIA EMISSIONS DATA WERE OBTAINED FROM DATA PROVIDED BY WEST VIRGINIA AND REGION X: 1978A

NOTE: REVISED BY REGION III: 05 NOVEMBER 1979 COMMUNICATION WITH WEST VIRGINIA

ALLIED CHEMICAL							
#1,#2 COAL-FIRED BOILER		(REVISED 11/5/79)					
9001	42.0	5167004417000	31	203	299	6.20	1.00
#3,#4 COAL-FIRED BOILER		(REVISED 11/5/79)					
9002	42.0	5167004417000	31	203	293	6.50	1.30
NORTH PLANT COAL-FIRED BOILERS							
9003	12.9	5167004417000	20	203	800	15.00	1.00
BANNER FIBREBOARD							
TWO OIL-FIRED BOILERS							
9011	14.0	5333004458800	7	204	575	11.70	.50
BLAW-KNOX PENINSULA PLANT							

#3 OPEN HEARTH							
9021	2.1	5239004436400	40	201	755	9.49	.58
CITY SERVICE							
#1 REACTOR							
9042	1.2	5115004398700	23	204	507	19.20	.46
#2 REACTOR							
9043	1.2	5115004398700	23	204	507	12.60	.57
#3 REACTOR							
9044	1.5	5115004398700	24	204	507	14.90	.61
#4 REACTOR							
9045	1.5	5115004398700	24	204	507	14.90	.61
DIECKMANN & SONS							
THREE COAL-FIRED BOILERS							
9050	8.5	5308004434000	25	209	633	11.20	.60
GLOBE REFRACTORY							
#5A TUNNEL KILN							
9061	40.0	5319004495700	12	207	533	21.40	.73
#5B TUNNEL KILN							
9062	40.0	5319004495700	12	207	533	21.40	.73
#4 TUNNEL KILN							
9063	10.0	5319004495700	11	207	583	7.15	.73
#2 TUNNEL KILN							
9064	6.4	5319004495700	6	207	516	3.46	.43
H B REED							
9071	.1	5159004407400	12	204	327	6.68	.42
KAMMER POWER							
9081	2770.0	5153204410320	183	197	442	613.10	2.38
9082	1385.0	5153304410330	183	197	442	305.90	1.68
KOPPERS							
#2 COAL/OIL-FIRED BOILER		(REVISED 11/5/79)					
9091	8.0	5334004465500	61	204	589	30.90	1.55
#3 COAL/OIL-FIRED BOILER		(REVISED 11/5/79)					
9092	13.0	5334004465500	44	204	589	18.40	1.07
#4 COAL-FIRED BOILER		(REVISED 11/5/79)					

9093	28.0	5334004465500	58	204	477	25.20	.68
F2 FLARE		(REVISED 11/5/79)					
9095	39.0	5334004465000	15	204	789	2.58	.38
H2S FLARE		(REVISED 11/5/79)					
9096	.5	5334004465000	21	204	1144	1.60	.08
#5 COAL-FIRED BOILER							
9097	50.0	5334004465000	61	204	477	35.7	1.55
MITCHELL POWER							
9101	9289.0	5158004408670	366	210	441	2410.0	5.03
MONBAY CHEMICALS							
#9,#10 OIL-FIRED BOILERS		(REVISED 11/5/79)					
9111	85.0	5147004397200	15	199	452	14.28	.88
OHIO VALLEY MEDICAL CENTER							
THREE COAL/OIL-FIRED BOILERS							
9131	4.6	5238004434300	38	219	633	4.75	1.10
PPG							
#4 COAL-FIRED BOILER		(REVISED 11/5/79)					
9141	175.0	5126004399600	69	200	450	79.70	2.45
#5 COAL-FIRED BOILER		(REVISED 11/5/79)					
9142	308.0	5126004399600	91	200	436	123.60	1.35
SULFUR RECOVERY							
9143	45.0	5127004399800	31	207	477	2.36	.38
QUAKER STATE REFINERY							
#1 OIL-FIRED BOILER		(REVISED 11/5/79)					
9151	57.0	5309004496200	46	207	561	37.70	.91
#2 OIL-FIRED BOILER		(REVISED 11/5/79)					
9152	57.0	5309004496200	46	207	561	37.70	.91
#3 OIL-FIRED BOILER		(REVISED 11/5/79)					
9153	57.0	5309004496200	46	207	561	37.70	.91
H-101 CRUDE HEATER							
9154	12.0	5309004496200	38	207	522	7.10	.46
PLATEFORMER							
9155	6.0	5309004496200	38	207	533	10.20	.84
150 HEATER							

9156	4.0	5309004496200	38	207	700	7.90	.91
WASTE GAS FLARE							
9157	12.0	5309004496200	67	207	866	.05	.70
ST. GEORGE							
TWO COAL-FIRED BOILERS							
9161	3.8	5329004458200	24	204	633	.50	.53
TAYLOR SMITH & TAYLOR							
TWO COAL-FIRED BOILERS							
9181	7.2	5373004496300	38	207	477	4.67	.57
TRIANGLE CONDUIT							
THREE COAL-FIRED BOILERS							
9191	21.5	5209004420300	24	207	586	8.80	.57
US STAMPING							
TWO COAL-FIRED BOILERS							
9201	5.6	5225004419400	24	209	421	1.32	.54
VALLEY CAMP COAL #1							
#2 THERMAL DRYER							
9211	5.5	5308004444800	23	255	394	54.10	2.55
#1 THERMAL DRYER							
9212	5.5	5308004444800	26	255	394	45.20	1.10
VALLEY CAMP COAL #3							
#1 THERMAL DRYER							
9221	2.8	5333004434600	24	248	394	15.10	.91
#2 THERMAL DRYER							
9222	1.7	5333004434600	26	248	394	9.10	.91
*							
* NATIONAL STEEL							
*							
BROWNS ISLAND COKE							
BATTERY UNDERFIRE							
9231	18.6	5333004474800	76	232	533	53.60	2.06
GAS FLARE							
9232	2.0	5333004474800	42	232	866	19.20	.38
BATTERY AREA							
92331	.3	5333004474800	25	232	100	100	

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 MAINLAND COKE
   BATTERY #5 UNDERFIRE
9252      9.1                   5338004474600    76    232    555 19.20 1.37
   BATTERY #6 UNDERFIRE
9253      9.1                   5338004474600    76    232    555 19.20 1.37
   BATTERY #7 UNDERFIRE
9254     10.6                   5338004474600    76    232    555 22.40 1.68
   BATTERY #8,#9 UNDERFIRE
9255     14.0                   5338004474600    76    232    555 14.94 1.30
   BATTERY AREA
92571     3.8                   5338004474600    18    232    100   100
 NATIONAL STEEL
   #2 WIND BOX
9262     89.0                   5343004474100    49    232    422257.00 2.29
 WHEELING HOSPITAL
   COAL-FIRED BOILERS
9271      1.5                   5234004436800    35    207    633  2.16  .91
 WHEELING-PITTSBURGH STEEL BENWOOD
     #1,#2 COAL BOILERS
9281      3.9                   5229004430200    21    198.   450 10.00  .66
     DESULFURIZATION
9285     15.0                   5335004465600    26    204    335  3.30  .30
     #8 BATTERY UNDERFIRE
9286     13.0                   5335004465600    76    204    422 43.10 1.98
     #4,#5 BOILERS            (REVISED 11/5/79)
9287      7.0                   5336004465600    38    204    630 25.10 1.15
     #6-8 BOILERS             (REVISED 11/5/79)
9288     79.0                   5336004465600    70    204    630 37.70 1.37

 WHEELING-PITTSBURGH FOLLENSBEE PLANT

     #1 BATTERY UNDERFIRE
9291      2.5                   5335004465900    61    204    616 19.90 1.26
     #2 BATTERY UNDERFIRE
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 9292      2.5                      5335004465800    61   204   616 19.90 1.26
      #3 BATTERY UNDERFIRE
 9293      2.8                      5335004465700    69   204   616 22.40 1.22
      #1-3,#8 AREA SOURCES
 92971     3.4                      5335004465600    18   204   100   100
      #1 STRAND WIND BOX
 9301     18.7                      5335004465200    30   204   325 81.80 1.22
*
* NATIONAL STEEL WEIRTON DIVISION
*
      #1-3 COAL-FIRED BOILERS
 9341    540.0                      5343004474400    43   204   505118.20 1.52
      #4 COAL-FIRED BOILER        (REVISED 11/5/79)
 9344    185.0                      5343004474400    43   204   505118.00 1.52
      #5 COG-FIRED BOILER         (REVISED 11/5/79)
 9345    211.0                      5343004474400    55   204   505 91.40 1.68
      P1,P2 GAS BOILERS           (REVISED 11/5/79)
 9346    158.0                      5343004474400    67   204   505 76.00 2.30
      #15 COG BOILER
 9351     16.0                      5343004474400    67   204   530 96.00 2.30
      #6,#7 HEAT EXCHANGERS
 9352     22.0                      5348004473800    61   204   333118.00 2.70
      60 T REHEAT
 9353      2.6                      5350004473000    46   204   540  4.20 1.06
      #1-4 REHEATS                (REVISED 11/5/79)
 9354    295.0                      5350004473000    61   204   520 41.60 1.45
      #1,#2 SPELTERS
 9355      2.3                      5350004472900    40   204   650  5.00  .86
      #3,#4 SPELTERS
 9356      1.5                      5350004472900    26   204   650  2.37  .44
      ANNEALING FURNACE
 9357       .2                      5350004473000    29   204   480   .56  .69
      #1-12 ANNEALING FURNACES
 9358       .6                      5350004473000    15   204   480   .22  .17
      TIN MILL
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9359	1.5	5350004473000	30	204	420	1.10	1.07
	BLOOMING FURNACE						
9360	19.6	5350004473000	53	204	505	4.78	.95
	HCL REGENERATOR						
9361	4.2	5351004472500	24	232	366	4.20	.30

APPENDIX C.2

SWPA AQCR SHORT TERM COMPLIANCE EMISSIONS INVENTORY

SOURCE NO.	SOURCE STRENGTH G/S ANNUAL	SEA 2	SEA 3	SEA 4	UTM X	UTM Y	HT (M)	ELE (M)	TEMP. K	VOL. M/S3	R (M)
ALLEGHENY COUNTY SOURCES AS SUPPLIED BY ACBAPC/ENVIROPLAN											
RECEIVED FROM ENVIROPLAN: 19 SEPTEMBER 1979											
REVISED BY REGION III (MARK): 05 OCTOBER 1979											
PITTSBURGH BREWING											
1	12.90				587550	4479280	58.0	226	488	16.9	1.60
KOPPERS											
2	2.87				574400	4468100	28.6	250	533	34.1	.62
3	3.00				574400	4468100	28.6	250	637	18.4	.76
12TH STREET STEAM PLANT											
4	87.20				585200	4477600	82.0	221	.604	265.5	2.20
WEST PENN. POWER SPRINGDALE											
5	16.50				604380	4488740	64.3	227	472	185.5	2.44
6	17.50				604380	4488740	64.3	227	444	192.7	1.85
DUQUESNE LIGHT CHESWICK											
7	1864.00				602330	4487800	229.0	229	558	1024.6	3.20
SATELLITE ALLOY											
81	5.78				604200	4488500	10.0	229	100	100	
EDGE STEEL											
9	.90				597600	4485200	38.1	220	348	21.8	.76
DUQUESNE LIGHT BRUNOT ISLAND TURBINES											
10	87.40				580680	4479680	10.0	222	735	248.6	2.06
11	242.40				580680	4479680	19.2	222	467	333.7	1.91
MARQUET CEMENT											
12	47.80				578300	4482600	46.0	222	491	94.0	1.90
SHENANGO BATTERIES #2,#3 (REVISED 10/5/79)											

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*     SWPA AQCR COMPLIANCE EMISSIONS INVENTORY:  06 OCTOBER 1979
*                           WORST CASE SHORT TERM
*
*
*SOURCE   SOURCE STRENGTH G/S            UTM          HT     ELE  TEMP. VOL.   R
*  NO.    ANNUAL SEA 2 SEA 3 SEA 4      X     Y      (M)    (M)   K    M/S3  (M)
*
*
*     ALLEGHENEY COUNTY SOURCES AS SUPPLIED BY ACBAPC/ENVIROPLAN
*                  RECEIVED FROM ENVIROPLAN:  19 SEPTEMBER 1979
*                  REVISED BY REGION III (MARK):  05 OCTOBER 1979
*
* PITTSBURGH BREWING
   1    12.90                       5875504479280  58.0   226   488  16.9 1.60
* KOPPERS
   2     2.87                       5744004468100  28.6   250   533  34.1  .62
   3     3.00                       5744004468100  28.6   250   637  18.4  .76
* 12TH STREET STEAM PLANT
   4    87.20                       5852004477600  82.0   221   604 265.5 2.20
* WEST PENN. POWER SPRINGDALE
   5    16.50                       6043804488740  64.3   227   472 185.5 2.44
   6    17.50                       6043804488740  64.3   227   444 192.7 1.85
* DUQUESNE LIGHT CHESWICK
   7  1864.00                       6023304487800 229.0   229   5581024.6 3.20
* SATELLITE ALLOY
  81     5.78                       6042004488500  10.0   229   100   100
* EDGE STEEL
   9      .90                       5976004485200  38.1   220   348  21.8  .76
* DUQUESNE LIGHT BRUNOT ISLAND TURBINES
  10    87.40                       5806804479680  10.0   222   735 248.6 2.06
  11   242.40                       5806804479680  19.2   222   467 333.7 1.91
* MARQUET CEMENT
  12    47.80                       5783004482600  46.0   222   491  94.0 1.90
* SHENANGO BATTERIES #2,#3        (REVISED 10/5/79)
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  13     4.84                      5780504483110  76.0   222   588 106.0 1.05
* SHENANGO BATTERY #4             (REVISED 10/5/79)
  14     3.83                      5779404483200  69.0   222   478  62.0 1.05
* SHENANGO BOILERS #7,#8          (REVISED 10/5/79)
  15     0.00                      5783304482800  26.0   222   452  38.0  .90
* SHENANGO BOILER #9              (REVISED 10/5/79)
  16     6.46                      5783604482790  38.7   222   627 155.0 1.50
* VULCAN MATERIALS
  17     3.70                      5748004484600  20.3   223   553  10.2  .50
  18     2.50                      5748004484600  17.2   223   553   2.4  .50
* PITTSBURGH ACTIVATED CARBON
  19     2.15                      5781004482500  12.2   223   533    .7  .20
  20     2.80                      5781004482500  18.9   223  1255   5.3  .38
  21     1.30                      5781004482500  17.8   223  1144  25.0  .52
* ALCOSAN
  22     8.40                      5814004480800  91.4   230   344  23.5 1.22
* DUQUESNE LIGHT PHILLIPS POWER STATION
  23   443.50                      5652604491020 104.0   226   322 340.4 3.96
* DRAVCO
  70     7.20                      5786004482600  25.6   226   416  20.7  .75
* USS CHEMICAL NEVEL ISLAND
  71     2.20                      5780004483000  30.5   223   322   5.6  .30
  72    15.40                      5779004483700  12.2   223   541  18.8  .60
* NEVEL CHEMICALS
  73     3.90                      5764004483700  12.0   223   573   8.0  .61
  74     4.60                      5764004483700  14.0   223   543   6.8  .61
* BLAWNOX
  75     2.50                      5878004480400  22.3   223   352  14.6  .55
  76     2.20                      5878004480400  22.3   223   352  10.7  .55
  77     1.90                      5878004480400  22.3   223   352   9.9  .55
* HAHN
  78     3.80                      5862004484900  47.2   329   394  10.8  .60
* BLTZHVR
  79      .50                      5848004474400  18.3   305   408   1.0  .50
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* PERRY							
80	5.30	5831004482300	18.3	354	408	10.3	.50
* OVERBROOK							
81	.50	5851004471200	18.3	280	408	.9	.50
* SOUTH HILLS							
82	3.80	5844004475000	18.3	335	408	7.5	.50
* 21ST STREET STEAM							
83	.20	5864004478100	18.3	268	408	.8	.50
* MORSE							
84	.50	5874004475500	18.3	229	408	1.0	.50
* LATIMER							
85	1.90	5846004478700	18.3	244	408	3.7	.50
* MCKEYSPORT HOSPITAL							
86	2.80	5990004466600	27.4	274	408	5.4	.70
87	.60	5965004466900	18.3	238	408	1.2	.50
* ST. JOSEPH'S HOSPITAL							
88	2.00	5816004480900	40.0	238	408	3.9	.55
* PPG							
89	.60	6044004494200	73.2	274	514	18.7	1.85
90	.50	6044004494200	39.2	274	514	10.1	.90
* GLASSMERE							
91	.10	6036004492500	15.2	229	644	6.2	.60
* DUQUESNE LIGHT MANSFIELD							
92	.30	5821004478900	12.2	232	1033	3.9	.45
* SHENANGO BLAST AREA		(REVISED 10/5/79)					
941	.55	5782204482970	10.0	222	100	100	
* SHENANGO BOILER #10		(REVISED 10/5/79)					
95	6.15	5783904482780	33.5	222	477142.79		1.50
* SHENANGO BATTERY #2 AREA		(REVISED 10/5/79)					
961	0.00	5780504483120	10.0	222	100	100	
* SHENANGO BATTERY #3 AREA		(REVISED 10/5/79)					
971	0.00	5779804483160	10.0	222	100	100	
* SHENANGO BATTERY #4 AREA		(REVISED 10/5/79)					
981	0.00	5779504483210	10.0	222	100	100	

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* SHENANGO MISCELLANEOUS AREA     (REVISED 10/5/79)
   991     0.00                     5779604483160  10.0   222   100   100
* SHENANGO D/S PLANT
  100    17.63                      5780604482940  34.3   222   976   1.0  .22
*
* USS CLAIRTON
*
* BATTERY #1
  110      2.45                     5958954461555  69.0   229   588  37.4 1.22
* BATTERY #2
  111      2.45                     5958804461565  69.0   229   588  37.4 1.22
* BATTERY #3
  112      2.45                     5957454461715  69.0   229   588  37.4 1.22
* BATTERY #7
  113      2.45                     5959304461590  65.0   229   575  35.6 1.27
* BATTERY #8
  114      2.45                     5959304461590  65.0   229   575  35.6 1.27
* BATTERY #9
  115      2.45                     5959304461590  65.0   229   575  35.6 1.27
* BATTERY #13
  120      2.35                     5953604461925  61.0   229   575  45.9 1.50
* BATTERY #14
  121      2.35                     5953504461935  61.0   229   575  45.9 1.50
* BATTERY #15
  122      2.35                     5952154462105  61.0   229   575  45.9 1.50
* BATTERY #19
  125      4.13                     5952254461875  76.0   229   577  50.4 2.14
* BATTERY #20
  126      4.13                     5952104461895  76.0   229   577  50.4 2.14
* BATTERY #21
  127      4.13                     5951104462140  76.0   229   575  51.5 2.14
* BATTERY #22
  128      4.13                     5949954462160  76.0   229   575  51.5 2.14
* TAIL GAS
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129	2.47	5957154461695	46.0	223	561	18.0	.61
* REHEAT MILLS							
130	1.59	5958714461000	18.0	224	811	70.0	.70
131	1.59	5958674460980	18.0	224	811	70.0	.70
132	.60	5960094460924	30.5	224	811	70.0	.60
133	.60	5959964460929	30.5	224	811	70.0	.60
134	.60	5959824460933	30.5	224	811	70.0	.60
135	.60	5959694460930	30.5	224	811	70.0	.60
136	.44	5958334461020	25.9	226	811	11.8	.65
137	.44	5958274461004	25.9	226	811	11.8	.65
138	.44	5958224460991	25.9	226	811	11.8	.65
* BOILER #1							
141	67.30	5949584462545	50.0	226	478	91.7	1.33
* BOILER #2							
142	45.90	5949334462564	50.0	226	478	80.4	1.06
* BOILER #13							
143	16.40	5947604462427	27.0	226	613	62.3	1.14
* BOILER #14							
144	16.40	5947894462402	27.0	226	613	62.3	1.14
* BOILER R1,R2							
145	24.40	5948004462400	50.0	227	444	48.8	1.52
*							
* USS DUQUESNE							
*							
* SOAKING PITS							
146	33.00	5981874470077	54.9	229	600	23.9	1.20
147	33.00	5982104470053	54.9	229	600	23.9	1.20
148	33.00	5982324470025	54.9	229	600	23.9	1.20
149	33.00	5982554469998	54.9	229	600	23.9	1.20
* HEAT TREATING							
1501	8.70	5978834470353	10.0	229	100	100	
* REHEAT FURNACE							
151	1.80	5978974470169	8.0	229	811	12.5	.62
152	1.80	5979044470162	8.0	229	811	12.5	.62

153	3.15	5978574470162	37.0	229	589	8.8	.90
154	3.15	5978734470143	37.0	229	589	8.8	.90
155	3.15	5978844470129	37.0	229	589	8.8	.90
* BOILER #15							
157	1.36	5985624469030	49.0	229	478	33.4	1.15
* BOILER #17							
158	1.36	5985434469062	49.0	229	478	33.4	1.15
*							
* USS NATIONAL							
*							
* SINTER PLANT							
159	0.00	5977204467400	27.4	229	330	3.4	.94
* SOAKING PITS							
160	1.43	5976804467485	27.0	229	616	4.9	.62
161	1.43	5976904467490	27.0	229	616	4.9	.62
162	1.43	5977104467492	27.0	229	616	4.9	.62
163	1.43	5977154467493	27.0	229	616	4.9	.62
164	1.43	5977304467494	27.0	229	616	4.9	.62
165	1.43	5977454467495	27.0	229	616	4.9	.62
166	1.48	5977604467497	27.0	229	616	5.9	.62
167	1.48	5977704467498	27.0	229	616	5.9	.62
168	1.48	5977854467499	27.0	229	616	5.9	.62
169	1.48	5977974467500	27.0	229	616	5.9	.62
* ROTARY							
170	24.60	5967444467549	38.0	229	1089	98.5	.88
* HEAT FURNACE							
171	8.86	5966664467575	38.0	229	533	30.6	.76
172	8.86	5966684467563	38.0	229	533	30.6	.76
* REHEAT FURNACE		(REVISED 10/5/79: ADD SOURCE #300)					
173	2.00	5967814467574	38.0	229	533	7.4	.68
174	2.00	5967994467578	38.0	229	533	7.4	.68
175	2.00	5969324467442	38.0	229	533	7.4	.68
* NORMALIZER							
176	2.65	5969254467478	14.0	229	533	1.0	.25

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  177       .75                  5970754467532  14.0   229   477  16.9  .65
* WALKING FURNACE
  178      1.71                  5967044467557  38.5   229   532   5.6  .68
* WARM FURNACE
  1791     3.84                  5972404467600  10.0   229   100   100
* BOILER #1
  180     16.90                  5972154467595  44.7   221   635 101.5 1.34
* BOILER #2
  181     16.90                  5972154467580  44.7   221   635 101.5 1.34
* BOILER #3
  182     16.90                  5972254467580  44.7   221   635 101.5 1.34
* BOILER #4
  183     16.90                  5972254467595  44.7   221   635 101.5 1.34
* BOILER #5
  184     16.90                  5974004467330  44.7   221   635 101.5 1.34
*
* USS IRVIN
*
* SLAB HEATING
  185     19.76                  5931454465680  21.3   283   450  46.7 1.30
  186     19.76                  5931504465628  21.3   283   450  46.7 1.30
  187     19.76                  5931554465693  21.3   283   450  46.7 1.30
  188     19.76                  5931574465710  21.3   283   450  46.7 1.30
  189     25.65                  5931564465725  21.3   283   450  46.7 1.50
* BOILERS #3,#4
  190     16.90                  5932134465750  32.0   283   643 109.0 1.52
* BOILERS #5,#6
  191     20.70                  5932194465765  32.0   283   643 115.6 1.52
* BOILER #7
  192     11.50                  5932104465712  26.5   283   455  42.5  .91
*
* USS CLAIRTON
*
* BATTERY B
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  193     6.76                 5956804461900  83.8   229   575  80.01 2.74
* BATTERY C
  194     6.76                 5955004462100  83.8   229   575  80.01 2.74
* BOILERS T1,T2
  195    21.70                 5947704462400  26.5   226   444  20.93  .73
*
* USS NATIONAL
*
* TEMPERING
  1961    0.00                 5967044467557  10.0   229   100    100
* DUQUESNE LIGHT STANWICK
  201    77.60                 5843804477300  97.5   220   574 217.2 2.40
* H J HEINZ
  202    13.70                 5860004478900  76.0   222   464  70.3 1.50
  203    22.60                 5860004478900  76.0   222   464 103.1 1.50
* WESTINGHOUSE ELECTRIC
  204     5.20                 5990204472550  37.1   308   466  23.4  .99
* BELLEFIELD BOILERS
  205    28.20                 5891904477100  59.4   256   589  49.6 1.40
  206    29.90                 5891904477100  77.7   256   517  91.9 1.70
* WABCO
  207     5.40                 5944004475550  27.0   274   569  19.3  .70
* MESTA MACHINE
  208      .10                 5909204471980  61.0   229   393  18.8  .90
* B&O RAILROAD
  209     3.30                 5898004472500  38.0   230   533  99.6 1.06
* UNIVERSAL ATLAS
  210    63.80                 6003004479400  16.7   371   513 202.5 1.10
*
* USS HOMESTEAD
*
* OPEN HEARTH
  211    29.54                 5924504473650  37.0   229   533  94.0 1.98
  212    29.54                 5924754473685  37.0   229   533  94.0 1.98
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213	29.54	5925104473750	37.0	229	533	94.0	1.98
214	29.54	5925204473760	37.0	229	533	94.0	1.98
215	29.54	5925504473820	37.0	229	533	94.0	1.98
* SOAKING PITS							
216	1.68	5918954473025	37.0	229	533	6.5	.84
217	1.68	5919004473035	37.0	229	533	6.5	.84
218	1.68	5919034473045	37.0	229	533	6.5	.84
219	1.68	5919054473050	37.0	229	533	6.5	.84
220	2.59	5919104473060	31.0	229	533	10.0	.76
221	2.59	5919134473070	31.0	229	533	10.0	.76
222	2.59	5919154473080	31.0	229	533	10.0	.76
223	2.59	5919204473090	31.0	229	533	10.0	.76
224	2.59	5919254473100	31.0	229	533	10.0	.76
225	2.59	5919304473110	31.0	229	533	10.0	.76
226	2.59	5919354473120	31.0	229	533	10.0	.76
227	2.59	5919404473130	31.0	229	533	10.0	.76
228	2.59	5919504473140	31.0	229	533	10.0	.76
229	2.59	5919604473150	31.0	229	533	10.0	.76
230	2.59	5919654473160	31.0	229	533	10.0	.76
231	2.59	5919704473170	31.0	229	533	10.0	.76
232	2.66	5919754473180	44.0	229	533	7.5	1.05
233	16.15	5931084473742	50.0	230	533	117.2	.84
234	13.76	5930924473742	50.0	230	533	117.2	.84
* 36" MILL							
235	2.60	5932254473733	23.0	230	477	28.5	.40
236	2.17	5932254473755	35.0	230	477	8.8	.76
* BLACKSMITH							
237	1.36	5934254474000	23.0	227	477	12.0	.38
* 100" MILL							
238	31.54	5918874473270	38.0	227	477	17.2	.80
* NORMALIZER							
2391	.41	5918874473270	10.0	229	100	100	
* PREHEAT HOODS							
2401	9.70	5923804473606	10.0	229	100	100	

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* 160" REHEAT FURNACE
  241     9.07                   5919754473450  70.0   227   477   25.9 1.52
* 160" IN-OUT FURNACE
  242     4.05                   5919584473250  31.0   227   477    7.0  .68
  243     1.95                   5919504473450  31.0   227   477    3.4  .68
* #2 FORGE
  244     4.63                   5927334473833  30.0   229   477    6.8  .91
  245     1.23                   5927334473833  30.0   229   477    3.4  .38
  246      .99                   5927334473833  24.0   229   477    2.8  .38
  247      .99                   5927334473833  24.0   229   477    5.5  .91
  248     5.60                   5927334473833  24.0   229   477    9.5  .99
  249     1.47                   5927334473833  18.0   229   477    1.5  .38
  250     4.66                   5927334473833  29.0   229   477   10.1  .99
* HARVEY FORGE
  251     3.40                   5932254473893  24.0   229   477    1.0  .68
  252      .80                   5932254473893  25.0   229   477    1.7  .68
  253     2.40                   5932254473893  24.0   229   477    1.7  .68
  254      .80                   5932254473893  24.0   229   477    1.4  .68
* 48" MILL
  255     1.40                   5938654473555  32.0   229   477    3.4  .68
* BOILER #3
  256    57.80                   5942924474640  44.7   222   588  270.4 1.75
* BOILER #4
  257    46.65                   5942834474750  44.7   222   588  167.9 1.25
*
* USS EDGAR THOMSON
*
* SOAKING PITS
  258    21.16                   5974404471870  30.0   233   533   42.1  .88
* RILEY BOILER #1
  259    32.84                   5970834471740  50.0   221   616   69.6 1.91
* RILEY BOILER #2
  260    32.84                   5972604471685  50.0   221   616   69.6 1.91
* RILEY BOILER #3
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  261    32.84                      5972764471673  50.0   221   616  69.6 1.91
*
* J&L PITTSBURGH
*
* KEELER BOILER
  262     1.75                      5892604473890  24.4   235   405   9.3  .66
* RILEY BOILER
  263     5.95                      5892604473890  21.7   235   566  13.2  .98
* SOUTHSIDE BOILERS
  264    62.10                      5880004475340  36.0   225   461  38.7 1.22
* 10" MILL
  266     1.47                      5892804474080  38.1   238  1089  25.5 1.06
* 14" MILL
  267     5.96                      5893004474120  38.1   238  1089   8.9  .84
* COKE BATTERIES
  268     5.56                      5891304474010  61.0   235   634  54.7 1.30
  269     5.56                      5891604473900  61.0   235   634  54.7 1.30
  270     3.93                      5892604473760  69.0   235   533  50.9 1.45
* SOAKING PITS "D"
  281     4.02                      5877804475520  46.0   226   811  18.7  .95
  282      .75                      5877804475520  46.0   226   700   7.0  .95
*
* USS HOMESTEAD
*
* PACKAGE BOILERS #1-3
  283    11.52                      5925754473900  15.0   226   561 25.74 1.60
*
* USS EDGAR THOMSON
*
* B&W BOILERS
  284    00.00                      5972724471676  33.0   221   551 26.19 1.20
*
* J&L PITTSBURGH
*
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* SLAB HEAT FURNACE
 285     0.68                  5883004475790  22.7   235   839 22.34 1.30
* TAIL GAS
 286    21.20                  5891804474100  30.5   235   350  5.31  .17
* ELECTRIC FURNACE
 2871    0.80                  5881004475140  10.0   235   100  100.
* MISCELLANEOUS AREA
 2881    0.17                  5891004473900  10.0   235   100  100.
*
* USS DUQUESNE
*
* BOILER #6
 290     0.84                  5985504469010  49.0   229   560 72.03 1.15
* BOILER #7
 291     0.84                  5985704469010  49.0   229   560 72.03 1.15
* BOILER #8
 292     0.84                  5985504469020  49.0   229   560 72.03 1.15
* BOILER #9
 293     0.84                  5985604469020  49.0   229   560 72.03 1.15
* BOILER #10
 294     0.84                  5985404469030  49.0   229   560 72.03 1.15
* BOILER #11
 295     0.84                  5985604469039  49.0   229   560 72.03 1.15
* BOILER #12
 296     0.76                  5985504469040  49.0   229   476 67.1  1.15
* BOILER #13
 297     0.76                  5985604469040  49.0   229   476 67.1  1.15
* BOILER #14
 298     0.76                  5985404469050  49.0   229   476 67.1  1.15
* BOILER #16
 299     0.76                  5985404469060  49.0   229   476 67.1  1.15
*
* USS NATIONAL REHEAT FURNACE   (ADD AS OF 10/05/79)
*
```

```
 300      2.00                   5972204467590  38.0   229   533  7.40  .68
*
*
*                  MONONGAHELA VALLEY SOURCES
*
*
* ARMCO STEEL
  417     7.45                   5652834495355  24.0   233   589 62.40  .91
* DUQUESNE LIGHT ELRAMA
  420   326.80                   5920004456200 119.0   229   430195.60 3.96
* WEST PENN. POWER MITCHELL
  426    30.00                   5873404452810  59.0   229   464113.30 2.13
  429    30.60                   5873404452810  59.0   229   422519.20 3.05
  430    25.20                   5873404452810  59.0   229   422519.20 3.05
  431   201.50                   5873404452810 107.0   229   422519.20 3.05
* WHEELING-PITTSBURGH STEEL MONESSEN
  432     1.60                   5939144446100  31.0   230   505  2.00  .61
  435     4.80                   5939144446100  38.0   230   666  7.00  .91
  440     1.60                   5946224446236  80.0   230   588 37.19 1.22
  441     3.90                   5948124446177  56.0   230   337106.10 1.25
  443     5.41                   5941704446350  34.1   230   450 48.97 1.98
  444     5.41                   5941904446350  34.1   230   450 48.97 1.98
  445     5.41                   5942204446350  34.1   230   450 33.46 1.98
  446     5.41                   5942404446350  34.1   230   450 33.46 1.98
  448     5.41                   5942904446350  34.1   230   450 33.46 1.98
* WHEELING-PITTSBURGH STEEL ALLENPORT
  450     5.50                   5987524437902  15.0   235   421  9.30  .22
  451    14.60                   5987524437902  61.0   235   575 64.90 1.52
* CALIFORNIA STATE COLLEGE
  454     1.80                   5952314435359  46.0   238   450  7.70 1.22
* ALLIED CHEMICAL
  460     3.20                   5946444436862   8.0   234   355 18.90  .50
* CORNING GLASS
  463     1.00                   5936544444158  15.0   233   477  1.76  .46
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*
*
*                 BEAVER VALLEY SOURCES
*
*
* J&L ALIQUIPPA
*
* BOILER #5,#58
 5001    37.17                 5643304497350  46.6   219   533 75.28 1.30
* BOILER #6
 5002    51.95                 5643104497560  76.2   232   485202.28 2.09
* NEW BOILER #6
 5003    34.07                 5643104497560  61.0   232   473117.99 1.68
* A-1N. ST.
 5004     1.81                 5645904497990  68.6   232   577 42.71 1.45
* A-1S. ST.
 5005     1.81                 5646004497940  68.6   232   577 42.71 1.45
* A-5 ST.
 5006     4.16                 5645904497790  76.2   232   577 19.66 1.68
* A-5N. REHEAT
 5007      .55                 5645904497790  64.3   232   358 12.72  .56
* A-5S. REHEAT
 5008      .55                 5645904497790  64.3   232   358 12.72  .56
* SOAKING PIT #2
 5009     1.30                 5644204497590  53.3   232   922 13.92  .76
* SOAKING PIT #3
 5010     1.30                 5644204497580  53.3   232   922 13.92  .76
* SOAKING PIT #4
 5011     1.30                 5644204497570  53.3   232   922 13.92  .76
* SOAKING PIT #5
 5012     1.30                 5644204497560  53.3   232   922 13.92  .76
* SOAKING PIT #6
 5013     1.30                 5644204497550  53.3   232   922 13.92  .76
* SOAKING PIT #7
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 5014      1.30                    5644204497540  53.3   232   922  13.92   .76
* SOAKING PIT #8
 5015      1.30                    5644204497530  53.3   232   922  13.92   .87
* SOAKING PIT #9
 5016      1.30                    5644204497520  53.3   232   922  13.92   .87
* SOAKING PIT #10
 5017      1.30                    5643204497510  53.3   232   922  13.92   .87
* SOAKING PIT C
 5018      1.62                    5643204497490  53.3   232   922  17.40   .87
* SOAKING PIT P
 5019      1.62                    5643204497490  53.3   232   922  17.40   .87
* SOAKING PIT E
 5020      1.62                    5643204497480  53.3   232   922  17.40   .87
* SLAB FURNACE #1
 5021      2.29                    5644504497410  61.0   232   700  75.70  1.30
* SLAB FURNACE #2
 5022      2.29                    5644504497420  61.0   232   700  75.70  1.30
* A-2 SLTM FURNACE
 5023       .58                    5643204495640  38.1   232   977  14.68   .91
* 14" MILL REHEAT
 5024       .79                    5644704498000  38.1   232   700  13.70  1.25
* 30" ROD MILL FURNACE #1
 5025      1.03                    5642604494510  38.1   232   977  31.54   .87
* 30" ROD MILL FURNACE #2
 5026      1.03                    5642604494490  38.1   232   977  31.54   .87
* 30" ROD MILL FURNACE #3
 5027      1.03                    5642604494460  38.1   232   977  31.54  1.07
* 14" PIPE MILL FURNACE #1
 5028       .39                    5643204495710  38.1   232   977  12.82   .87
* 14" PIPE MILL FURNACE #2
 5029       .39                    5643204495720  38.1   232   977  12.82   .87
* 14" PIPE MILL FURNACE #3
 5030       .39                    5643204495750  38.1   232   977  12.82  1.07
* SL. ANNEX FURNACE #1
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 5031      .34                        5642704495720  27.4   232   700 11.28  .76
* SL. ANNEX FURNACE #2
 5032      .19                        5642704494750  27.4   232   422  3.75  .76
* ROD MILL FURNACE
 5033      .84                        5642404497950  38.1   232   911 28.01  .91
* TAIL GAS
 5034    12.16                        5645804497950  45.7   232   977  3.62  .53
* SOAKING PIT "A"
 5035     1.57                        5643204497490  53.3   232   922 17.40 1.14
* SOAKING PITS "B","F","G"
 5036     4.86                        5643204497490  53.3   232   922 17.40 1.14
* MEDUSA CEMENT
 5380    76.40                        5568744525270    91   244   589113.30 1.83
 5381     6.07                        5568744525270    40   244   560 53.00 1.68
*
* ARCO
*
* BOILER #1
 5384    33.82                        5546304500620    61   229   330 59.70 0.91
* BOILER #2
 5385    33.82                        5546304500620    61   229   330 59.70 0.91
* BOILER #3
 5386    33.82                        5546304500620    61   229   330 59.70 0.91
* OIL BOILER
 5388     4.64                        5546304500620    55   229   399 22.66 1.98
* B&W WALLACE RUN KTB #48,#49
 5391    14.40                        5552644515255    21   275   575 11.67 0.76
* B&W AMBRIDGE BOILERS #1,#2, KTB #63,#64
 5395     2.39                        5652834495355    26   233   450 23.40 1.14
* B&W TUBULAR PRODUCTS
 5398     5.66                        5564984513322    23   268   536 32.42 0.76
 5399     1.50                        5564984513322    21   268   577 16.06 0.91
* SHENANGO CHINA (INTERPACE)
 5402     3.20                        5537014539975    41   245   471  7.36 0.76
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*
* ASHLAND OIL
*
* CRUDE HEATER
 5404      .73                  5623154504580    34    229    477  6.45   .53
* CHARGE HEATER
 5405      .50                  5623154504580    18    229    477  4.15   .26
* BOILERS #1-3
 5406     3.17                  5623154504580    58    229    422 30.50 1.22
* VACUUM HEATER
 5407      .30                  5623154504580    34    229    477  2.28   .53
* NRV, RERUN & BRIGHT ST. HEATERS
 5408     1.10                  5623154504580    18    229    477  2.90   .26
* WESTINGHOUSE ELECTRIC BEAVER
 5413     8.34                  5575284486194    15    243    515 24.69 0.71
* HERCULES INC.
 5469     0.00                  5973514449231    15    232    533 11.16 0.46
*
* WEST PENN POWER WEST PITTSBURGH
*
* OPERATING @100%
 5472   353.90                  5531054531767   145    238    413961.50 4.00
* OPERATING @90%
 5473   318.51                  5531054531767   145    238    413865.35 4.00
* OPERATING @80%
 5474   283.12                  5531054531767   145    238    413769.20 4.00
* OPERATING @75%
 5475   265.43                  5531054531767   145    238    413721.13 4.00
* OPERATING @70%
 5476   247.73                  5531054531767   145    238    413673.05 4.00
* OPERATING @65%
 5477   236.60                  5531054531767   145    238    413663.37 4.00
* PENN POWER BRUCE MANSFIELD
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 5479   720.95                    5490494498067   290   219   341740.36 2.90
 5480   360.48                    5490494498067   183   219   341740.36 2.90

* ST. JOE MINERALS

* 275' STACK
 5512    88.45                    5552234501841    84   236   422 80.20 1.68
* 200' STACK
 5513 0    6.8                    5561604502218    61   236   347122.3  1.52
* 400' STACK
 5514 0  364.48                   5560654502301   122   236   336 213.7 2.74

* BESSEMER CEMENT

* UNIT #2
 5518 0   32.5                    5428604535850    67   320   477 51.4  1.68
* UNIT #2
 5519 0   49.3                    5428604535850    67   320   505 91.6  1.98
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OTHER PENNSYLVANIA SOURCES

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* ARMSTRONG POWER
 6021    520.0                    6289794531996  70.0   258   405 160.0 2.30
 6022    600.0                    6289794531996  70.0   258   439 285.0 2.30
* CARPENTERTOWN COAL
 6031      0.00                   6329974530988   5.0   274   9921177.4  .10
* KEYSTONE POWER
 6041   5198.9                    6401414502155 244.0   311   4081193.8 4.60
* HOMER CITY POWER
 6051   4752.4                    6527564486147 244.0   366   405 967.6 4.70
* CONEMAUGH POWER
 6061   4712.3                    6645824471929 305.0   330   4081194.0 4.10
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* SEWARD POWER
 6071    854.0                     6668824474602  69.0   332   414 207.0 1.50
 6072      0.0                     6668824474602  69.0   332   450 126.7 1.20
* HATFIELD POWER
 6081   5792.5                     5915704412040 213.4   220   411 935.0 3.45
* AVERTON FUEL
 6091      3.2                     6192894443933   5.0   334   922 221.3  .10
 6092      6.9                     6205444443891   5.0   334   922  88.5  .10
* SLIPPERYROCK COLLEGE
 6101     31.2                     5798254545763  53.0   412   505  25.6  .90
* SUNNEBORN
 6111     58.3                     6077764540569  61.0   366   505  15.8 1.25
* SHENLEY DISTILLERS
 6121     27.1                     6134204505200  24.0   251   477   7.4  .80
*
*
*                  EASTERN OHIO SOURCES
*
*     NOTE: 1975 EMISSIONS DATA WERE USED FOR THE NON-POWER GENERATING
*           SOURCES DUE TO A LACK OF COMPLIANCE DATA.
*           COMPLIANCE DATA FOR THE OHIO POWER STATIONS WAS OBTAINED
*           FROM EPA REGION III.
*           REVISED BY REGION III:  05 NOVEMBER 79
*           (CONVERSATIONS WITH OHIO & REGION V)
*
*
*
* FEDERAL PAPERBOARD
 8003    153.0                     5332004468900    71   256   644 45.95 1.50
* KAOL CLAY
 8011      5.90                    5330004481300    46   283   421  1.41 1.51
* OHIO POWER TORONTO             (REVISED 11/5/79)
 8023   1894.0                     5335004481800   198   201   441368.40 2.29
* OHIO EDISON SAMMIS             (REVISED 11/5/79)
```

8031	970.0	5317004485500	154	210	405598.03	3.20
8032	970.0	5317004485500	154	210	405619.21	3.05
8035	2424.0	5317004485500	259	210	405507.11	4.76
8036	1616.0	5317004485500	305	210	4051050.9	4.09
* OHIO EDISON BURGER						
8041	3987.0	5205004417500	259	198	4661088.0	3.30
* OHIO EDISON TIDD		(SHUT DOWN)				
8051	0.0	5299004455700	75	207	455 99.10	1.50
8052	0.0	5299004455700	75	207	455 99.10	1.50
8053	0.0	5299004455700	75	207	455234.91	2.15
* CARDINAL POWER		(REVISED 11/5/79)				
8061	1223.0	5300004455800	252	198	447897.84	3.36
8062	1223.0	5300004455800	252	198	447897.84	3.36
8063	708.0	5300004455800	274	204	4301025.5	3.66
* TORONTO PAPERBORD						
8071	8.5	5337004480200	20	215	394 15.23	1.05
* NATIONAL STEEL WEIRTON DIVISION						
8081	14.80	5327004467000	51	204	516 11.12	.85
8082	14.80	5327004467000	51	204	516 11.12	.85
8083	14.80	5327004467000	51	204	516 11.12	.85
8084	14.80	5327004467000	51	204	516 11.12	.85
* WHEELING-PITTSBURGH NORTH PLANT						
8091	138.5	5325004466700	84	204	589 44.49	1.70
8092	80.7	5325004466700	39	204	505 26.24	1.20
8093	80.7	5325004466700	39	204	505 26.24	1.20
8094	80.7	5325004466700	39	204	505 26.24	1.20
8095	35.3	5325004466700	50	204	533 27.04	.75
8096	35.3	5325004466700	50	204	644 3.12	1.05
8097	35.3	5325004466700	50	204	644 6.23	1.05
8098	35.3	5325004466700	50	204	644 6.23	1.05
8099	35.3	5325004466700	50	204	644 3.71	.75
* WHEELING-PITTSBURGH SOUTH PLANT						
8121	94.4	5346004463300	91	204	589 58.99	2.35
8122	37.0	5346004463300	49	204	519 12.57	1.00

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 8123      36.6                   5346004463300    49   204   519 12.57 1.00
 8124      34.3                   5346004463300    49   204   519 12.57 1.00
 8125      34.3                   5346004463300    49   204   519 12.57 1.00
 8126      34.3                   5346004463300    49   204   519 12.57 1.00
 8127      34.3                   5346004463300    49   204   519 12.57 1.00
 8128      49.8                   5346004463300    49   204   547 13.51 1.00
 8129      49.8                   5346004463300    49   204   547 13.51 1.00
 8130      18.8                   5346004463300    49   204   644  3.82  .90
 8131      18.8                   5346004463300    33   204   644  3.82  .90
 8132      18.8                   5346004463300    50   204   700  3.82  .90
 8133      18.8                   5346004463300    50   204   700  3.82  .90
 8134      18.8                   5346004463300    50   204   700  3.82  .90
* WHEELING-PITTSBURGH YORKVILLE
 8141     102.8                   5254004445400    63   205   422  6.01 1.80
 8142     128.5                   5254004445400    63   205   422  6.01 1.80
* WHEELING-PITTSBURGH MARTINS FERRY
 8151      47.4                   5247004439200    24   202   510  1.13  .60
 8152     142.5                   5247004439200    38   202   516  7.07 1.50
* CRUCIBLE STEEL MIDLAND
 8171       3.9                   5150004396500    18   195   589  5.08 0.60
 8172      47.6                   5150004396500    18   195   297  7.85 0.70
 8173       1.5                   5150004396500    21   195   589 15.81 0.44
 8174       0.8                   5150004396500     6   195   589  8.30 0.75
* OHIO EDISON EAST PALESTINE       (SHUT DOWN)
 8161       0.0                   5359004520300    30   314   561 38.17 1.50
 8162       0.0                   5359004520300    29   314   561 26.15  .75
 8163       0.0                   5359004520300    58   314   561 26.15  .75
*
*
*                    WEST VIRGINIA SOURCES
*
*      NOTE: WEST VIRGINIA EMISSIONS DATA WERE OBTAINED FROM DATA
*            PROVIDED BY WEST VIRGINIA AND REGION X:  1978A
*      NOTE: REVISED BY REGION III:  05 NOVEMBER 1979
*            COMMUNICATION WITH WEST VIRGINIA
*
*
* ALLIED CHEMICAL
*   #1,#2 COAL-FIRED BOILERS      (REVISED 11/5/79)
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 9001     18.0                        5167004417000    31    203    299   6.20 1.00
*   #3,#4 COAL-FIRED BOILERS      (REVISED 11/5/79)
 9002     30.0                        5167004417000    31    203    293   6.50 1.30
*   NORTH PLANT COAL-FIRED BOILERS
 9003     12.9                        5167004417000    20    203    800  15.00 1.00
* BANNER FIBREBOARD
*   TWO OIL-FIRED BOILERS
 9011     14.0                        5333004458800     7    204    575  11.70  .50
* BLAW-KNOX PENINSULA PLANT
*   #3 OPEN HEARTH
 9021      2.1                        5239004436400    40    201    755   9.49  .58
* CITY SERVICE
*   #1 REACTOR
 9042      1.2                        5115004398700    23    204    507  19.20  .46
*   #2 REACTOR
 9043      1.2                        5115004398700    23    204    507  12.60  .57
*   #3 REACTOR
 9044      1.5                        5115004398700    24    204    507  14.90  .61
*   #4 REACTOR
 9045      1.5                        5115004398700    24    204    507  14.90  .61
* DIECKMANN & SONS
*   THREE COAL-FIRED BOILERS
 9050      8.5                        5308004434000    25    209    633  11.20  .60
* GLOBE REFRACTORY
*   #5A TUNNEL KILN
 9061     40.0                        5319004495700    12    207    533  21.40  .73
*   #5B TUNNEL KILN
 9062     40.0                        5319004495700    12    207    533  21.40  .73
*   #4 TUNNEL KILN
 9063     10.0                        5319004495700    11    207    583   7.15  .73
*   #2 TUNNEL KILN
 9064      6.4                        5319004495700     6    207    516   3.46  .43
* H B REED
 9071       .1                        5159004407400    12    204    327   6.68  .42
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* KAMMER POWER
 9081   2770.0                           5153204410320   183   197   442613.10 2.38
 9082   1385.0                           5153304410330   183   197   442305.90 1.68
* KOPPERS
*   #2 COAL/OIL-FIRED BOILER            (REVISED 11/5/79)
 9091      10.0                          533400446550O    61   204   589 30.90 1.55
*   #3 COAL/OIL-FIRED BOILER            (REVISED 11/5/79)
 9092      10.0                          5334004465500    44   204   589 18.40 1.07
*   #4 COAL-FIRED BOILER                (REVISED 11/5/79)
 9093      36.0                          5334004465500    58   204   477 25.20  .68
*   F2 FLARE                            (REVISED 11/5/79)
 9095      33.0                          5334004465000    15   204   789  2.58  .38
*   H2S FLARE                           (REVISED 11/5/79)
 9096        .5                          5334004465000    21   204  1144  1.60  .08
*   #5 COAL-FIRED BOILER
 9097      50.0                          5334004465000    61   204   477 35.7  1.55
* MITCHELL POWER
 9101   9289.0                           5158004408670   366   210   4412410.0 5.03
* MOMBAY CHEMICALS
*   #9,#10 OIL-FIRED BOILERS            (REVISED 11/5/79)
 9111     135.2                          5147004397200    15   199   452 14.28  .88
* OHIO VALLEY MEDICAL CENTER
*   THREE COAL/OIL-FIRED BOILERS
 9131       4.6                          5238004434300    38   219   633  4.75 1.10
* PPG
*   #4 COAL-FIRED BOILER                (REVISED 11/5/79)
 9141     190.0                          5126004399600    69   200   450 79.70 2.45
*   #5 COAL-FIRED BOILER                (REVISED 11/5/79)
 9142     340.0                          5126004399600    91   200   436123.60 1.35
*   SULFUR RECOVERY
 9143      45.0                          5127004399800    31   207   477  2.36  .38
* QUAKER STATE REFINERY
*   #1 OIL-FIRED BOILER                 (REVISED 11/5/79)
 9151      26.0                          5309004496200    46   207   561 37.70  .91
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*   #2 OIL-FIRED BOILER           (REVISED 11/5/79)
 9152     26.0                      5309004496200    46   207   561 37.70  .91
*   #3 OIL-FIRED BOILER           (REVISED 11/5/79)
 9153     26.0                      5309004496200    46   207   561 37.70  .91
*   H-101 CRUDE HEATER
 9154     12.0                      5309004496200    38   207   522  7.10  .46
*   PLATEFORMER
 9155      6.0                      5309004496200    38   207   533 10.20  .84
*   150 HEATER
 9156      4.0                      5309004496200    38   207   700  7.90  .91
*   WASTE GAS FLARE
 9157     12.0                      5309004496200    67   207   866   .05  .70
* ST. GEORGE
*   TWO COAL-FIRED BOILERS
 9161      3.8                      5329004458200    24   204   633   .50  .53
* TAYLOR SMITH & TAYLOR
*   TWO COAL-FIRED BOILERS
 9181      7.2                      5373004496300    38   207   477  4.67  .57
* TRIANGLE CONDUIT
*   THREE COAL-FIRED BOILERS
 9191     21.5                      5209004420300    24   207   586  8.80  .57
* US STAMPING
*   TWO COAL-FIRED BOILERS
 9201      5.6                      5225004419400    24   209   421  1.32  .54
* VALLEY CAMP COAL #1
*   #2 THERMAL DRYER
 9211      5.5                      5308004444800    23   255   394 54.10 2.55
*   #1 THERMAL DRYER
 9212      5.5                      5308004444800    26   255   394 45.20 1.10
* VALLEY CAMP COAL #3
*   #1 THERMAL DRYER
 9221      2.8                      5333004434600    24   248   394 15.10  .91
*   #2 THERMAL DRYER
 9222      1.7                      5333004434600    26   248   394  9.10  .91
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*
* NATIONAL STEEL
*
* BROWNS ISLAND COKE
*   BATTERY UNDERFIRE
9231     18.6               5333004474800    76   232   533 53.60 2.06
*   GAS FLARE
9232      2.0               5333004474800    42   232   866 19.20  .38
*   BATTERY AREA
92331      .3               5333004474800    25   232   100   100
* MAINLAND COKE
*   BATTERY #5 UNDERFIRE
9252      9.1               5338004474600    76   232   555 19.20 1.37
*   BATTERY #6 UNDERFIRE
9253      9.1               5338004474600    76   232   555 19.20 1.37
*   BATTERY #7 UNDERFIRE
9254     10.6               5338004474600    76   232   555 22.40 1.68
*   BATTERY #8,#9 UNDERFIRE
9255     14.0               5338004474600    76   232   555 14.94 1.30
*   BATTERY AREA
92571     3.8               5338004474600    18   232   100   100
*
* NATIONAL STEEL WEIRTON DIVISION
*
*   #2 WIND BOX
9262     89.0               5343004474100    49   232   422257.00 2.29
* WHEELING HOSPITAL
*   COAL-FIRED BOILERS
9271      1.5               5234004436800    35   207   633  2.16  .91
* WHEELING-PITTSBURGH STEEL BENWOOD
*   #1,#2 COAL BOILERS
9281      3.9               5229004430200    21   198   450 10.00  .66
*   DESULFURIZATION
9285     15.0               5335004465600    26   204   335  3.30  .30
*   #8 BATTERY UNDERFIRE
9286     13.0               5335004465600    76   204   422 43.10 1.98
*   #4,#5 BOILERS          (REVISED 11/5/79)
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 9287    135.0                      5335004465900    17   204   426 14.20  .60
* WHEELING-PITTSBURGH FOLLENSBEE PLANT
*
*   #1 BATTERY UNDERFIRE
 9291      2.5                      5335004465900    61   204   616 19.90 1.26
*   #2 BATTERY UNDERFIRE
 9292      2.5                      5335004465800    61   204   616 19.90 1.26
*   #3 BATTERY UNDERFIRE
 9293      2.8                      5335004465700    69   204   616 22.40 1.22
*   #1-3,#8 AREA SOURCES
 92971     3.4                      5335004465600    18   204   100   100
*   #1 STRAND WIND BOX
 9301     18.7                      5335004465200    30   204   325 81.80 1.22
*
* NATIONAL STEEL WEIRTON DIVISION
*
*   #1-3 COAL-FIRED BOILERS
 9341    540.0                      5343004474400    43   204   505118.20 1.52
*   #4 COAL-FIRED BOILER          (REVISED 11/5/79)
 9344    103.0                      5343004474400    43   204   505118.00 1.52
*   #5 COG-FIRED BOILER           (REVISED 11/5/79)
 9345    170.0                      5343004474400    55   204   505 91.40 1.68
*    P1,P2 GAS BOILERS            (REVISED 11/5/79)
 9346     86.0                      5343004474400    67   204   505 76.00 2.30
*   #15 COG BOILER
 9351     16.0                      5343004474400    67   204   530 96.00 2.30
*   #6,#7 HEAT EXCHANGER
 9352     22.0                      5348004473800    61   204   333118.00 2.70
*   60 T REHEAT
 9353      2.6                      5350004473000    46   204   540  4.20 1.06
*   #1-4 REHEATS                 (REVISED 11/5/79)
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 9354    107.9               5350004473000    61    204    520  41.60  1.45
*   #1,#2 SPELTERS
 9355      2.3               5350004472900    40    204    650   5.00   .86
*   #3,#4 SPELTERS
 9356      1.5               5350004472900    26    204    650   2.37   .44
*   ANNEALING FURNACE
 9357       .2               5350004473000    29    204    480    .56   .69
*   #1-12 ANNEALING FURNACES
 9358       .6               5350004473000    15    204    480    .22   .17
*   TIN MILL
 9359      1.5               5350004473000    30    204    420   1.10  1.07
*   BLOOMING FURNACE
 9360     19.6               5350004473000    53    204    505   4.78   .95
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APPENDIX C.3

ALLEGHENY COUNTY 1976/1977 EMISSIONS INVENTORY FOR VALIDATION STUDY

SOURCE NO.	SOURCE STRENGTH G/S ANNUAL	SEA 2	SEA 3	SEA 4	UTM X	UTM Y	HT (M)	ELE (M)	TEMP. K	VOL. M3/S	R (M)
ALLEGHENY COUNTY SOURCES AS SUPPLIED BY ACBAPC/TRC											
PITTSBURGH BREWING											
1	7.50	7.50	7.50	7.50	587550	4479280	58.0	226	488	16.9	1.60
KOPPERS											
2	2.44	2.44	2.44	2.44	574400	4468100	28.6	250	533	34.1	.62
3	2.44	2.44	2.44	2.44	574400	4468100	28.6	250	637	18.4	.76
12TH STREET STEAM PLANT											
4	14.10	14.10	14.10	14.10	585200	4477600	82.0	221	604	265.5	2.20
WEST PENN POWER SPRINGDALE											
5	6.70	6.70	6.70	6.70	604380	4488740	64.3	227	472	185.5	2.44
6	16.60	16.60	16.60	16.60	604380	4488740	64.3	227	444	192.7	1.85
DUQUESNE LIGHT CHESWICK											
7	1568.10	1568.10	1568.10	1568.10	602330	4487800	229.0	229	558	1024.6	3.20
SATELLITE ALLOY				(BILL MUER 6/8/79)							
81	21.17	21.17	21.17	21.17	604200	4488500	10.0	229	51	51	
EDGE STEEL											
9	1.20	1.20	1.20	1.20	597600	4485200	38.1	220	348	21.8	.76
DUQUESNE LIGHT BRUNOT ISLAND											
10	9.87	9.87	9.87	9.87	580680	4479680	10.0	222	735	248.6	2.06
11	9.87	9.87	9.87	9.87	580680	4479680	19.2	222	467	333.7	1.91
MARQUET CEMENT											
12	47.80	47.80	47.80	47.80	578300	4482600	46.0	222	491	94.0	1.90
SHENANGO BATTERIES #2,#3											
13	37.80	37.80	37.80	37.80	578050	4483110	76.0	222	588	106.0	1.05

SHENANGO BATTERY #4										
14	24.00	24.00	24.00	24.00	5780504483110	69.0	222	478	62.0	1.05
SHENANGO BOILERS #7,#8										
15	18.20	18.20	18.20	18.20	5783304482800	26.0	222	452	38.0	.90
SHENANGO BOILER #9										
16	34.92	34.92	34.92	34.92	5783604482790	38.7	222	627	155.0	1.50
VULCAN MATERIALS										
17	2.47	2.47	2.47	2.47	5748004484600	20.3	223	553	10.2	.50
18	2.47	2.47	2.47	2.47	5748004484600	17.2	223	553	2.4	.50
PITTSBURGH ACTIVATED CARBON										
19	2.15	2.15	2.15	2.15	5781004482500	12.2	223	533	.7	.20
20	2.80	2.80	2.80	2.80	5781004482500	18.9	223	1255	5.3	.38
21	1.30	1.30	1.30	1.30	5781004482500	17.8	223	1144	25.0	.52
ALCOSAN										
22	6.70	6.70	6.70	6.70	5814004480800	91.4	230	344	23.5	1.22
DUQUESNE LIGHT PHILLIPS POWER STATION										
23	570.20	570.20	570.20	570.20	5652604491020	104.0	226	322	340.4	3.96
ARMCO										
68	18.90	18.90	18.90	18.90	5652804495350	24.0	233	588	27.39	.91
GAVLICK										
69	6.90	6.90	6.90	6.90	5647004491860	12.0	229	365	56.28	.30
DRAVCO										
70	1.10	1.10	1.10	1.10	5786004482600	25.6	226	416	20.7	.75
USS CHEMICAL NEVEL ISLAND										
71	2.00	2.00	2.00	2.00	5780004483000	30.5	223	322	5.6	.30
72	0.10	0.10	0.10	0.10	5779004483700	12.2	223	541	18.8	.60
NEVEL CHEMICALS										
73	4.20	4.20	4.20	4.20	5764004483700	12.0	223	573	8.0	.61
74	0.60	0.60	0.60	0.60	5764004483700	14.0	223	543	6.8	.61
BLAWNOX										
75	0.80	0.80	0.80	0.80	5878004480400	22.3	223	352	14.6	.55
76	0.50	0.50	0.50	0.50	5878004480400	22.3	223	352	10.7	.55
77	1.10	1.10	1.10	1.10	5878004480400	22.3	223	352	9.9	.55
HAHN										

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 78     1.20   1.20   1.20   1.20 5862004484900  47.2   329   394  10.8  .60
BLTZHVR
 79     0.30   0.30   0.30   0.30 5848004474400  18.3   305   408   1.0  .50
PERRY
 80     2.60   2.60   2.60   2.60 5831004482300  18.3   354   408  10.3  .50
OVERBROOK
 81     0.20   0.20   0.20   0.20 5851004471200  18.3   280   408    .9  .50
S. HILLS
 82     1.90   1.90   1.90   1.90 5844004475000  18.3   335   408   7.5  .50
21ST STREET STEAM PLANT
 83     0.10   0.10   0.10   0.10 5864004478100  18.3   268   408    .8  .50
MORSE
 84     0.30   0.30   0.30   0.30 5874004475500  18.3   229   408   1.0  .50
LATIMER
 85     1.90   1.90   1.90   1.90 5846004478700  18.3   244   408   3.7  .50
MCKEYSPORT HOSPITAL
 86     1.30   1.30   1.30   1.30 5990004466600  27.4   274   408   5.4  .70
 87     0.30   0.30   0.30   0.30 5965004466900  18.3   238   408   1.2  .50
ST. JOSEPH'S HOSPITAL
 88     0.30   0.30   0.30   0.30 5816004480900  40.0   238   408   3.9  .55
PPG
 89     0.60   0.60   0.60   0.60 6044004494200  73.2   274   514  18.7 1.85
 90     0.50   0.50   0.50   0.50 6044004494200  39.2   274   514  10.1  .90
GLASSMERE
 91     0.10   0.10   0.10   0.10 6036004492500  15.2   229   644   6.2  .60
DUQUESNE MANSFIELD
 92     0.30   0.30   0.30   0.30 5821004478900  12.2   232  1033   3.9  .45
SHENANGO COKE OVEN
 941    3.39   3.39   3.39   3.39 5782204482540  10.0   222   100   100
SHENANGO BOILER #10
 95    00.00  00.00  00.00  00.00 5783904483030  33.5   222   477142.79 1.50

USS CLAIRTON                      (B BLOOM UPDATE 6/8/79)
BATTERY #1
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110	6.40	6.40	6.40	6.40	5958954461555	69.0	229	588	37.4 1.22
BATTERY #2									
111	6.40	6.40	6.40	6.40	5958804461565	69.0	229	588	37.4 1.22
BATTERY #3									
112	6.40	6.40	6.40	6.40	5957454461715	69.0	229	588	37.4 1.22
BATTERY #4									
113	5.90	5.90	5.90	5.90	5959254461585	65.0	229	575	35.6 1.27
BATTERY #5									
114	5.90	5.90	5.90	5.90	5958704461680	65.0	229	575	35.6 1.27
BATTERY #6									
115	5.90	5.90	5.90	5.90	5957854461750	65.0	229	575	35.6 1.27
BATTERY #7									
116	3.80	3.80	3.80	3.80	5956904461865	69.0	229	575	33.4 1.22
BATTERY #8									
117	3.80	3.80	3.80	3.80	5956854461875	69.0	229	575	33.4 1.22
BATTERY #9									
118	3.80	3.80	3.80	3.80	5955454462045	69.0	229	575	33.4 1.22
BATTERY #10									
119	4.10	4.10	4.10	4.10	5955104462090	69.0	229	575	34.7 1.52
BATTERY #13									
120	3.80	3.80	3.80	3.80	5953604461925	61.0	229	575	45.9 1.50
BATTERY #14									
121	3.80	3.80	3.80	3.80	5953504461935	61.0	229	575	45.9 1.50
BATTERY #15									
122	3.80	3.80	3.80	3.80	5952154462105	61.0	229	575	45.9 1.50
BATTERY #16									
123	3.80	3.80	3.80	3.80	5951894462140	76.0	229	575	45.65 1.70
BATTERY #17									
124	3.80	3.80	3.80	3.80	5950854462250	76.0	229	575	45.65 1.70
BATTERY #19									
125	3.70	3.70	3.70	3.70	5952254461875	76.0	229	577	50.4 2.14
BATTERY #20									
126	7.30	7.30	7.30	7.30	5952104461895	76.0	229	577	50.4 2.14
BATTERY #21									

127	7.30	7.30	7.30	7.30	5951104462140	76.0	229	575	51.5	2.14
BATTERY #22										
128	7.30	7.30	7.30	7.30	5949954462160	76.0	229	575	51.5	2.14
TAIL GAS										
129	27.90	27.90	27.90	27.90	5957154461695	46.0	223	561	18.0	.61
REHEAT MILLS										
130	4.10	1.25	1.25	1.25	5958714461000	18.0	224	811	70.0	.70
REHEAT MILLS										
131	4.10	1.25	1.25	1.25	5958674460980	18.0	224	811	70.0	.70
REHEAT MILLS										
132	5.90	2.00	2.00	2.00	5960094460924	30.5	224	811	70.0	.60
REHEAT MILLS										
133	5.90	2.00	2.00	2.00	5959964460929	30.5	224	811	70.0	.60
REHEAT MILLS										
134	5.90	2.00	2.00	2.00	5959824460933	30.5	224	811	70.0	.60
REHEAT MILLS										
135	5.90	2.00	2.00	2.00	5959694460930	30.5	224	811	70.0	.60
REHEAT MILLS										
136	4.60	1.43	1.43	1.43	5958334461020	25.9	226	811	11.8	.65
REHEAT MILLS										
137	4.60	1.43	1.43	1.43	5958274461004	25.9	226	811	11.8	.65
REHEAT MILLS										
138	4.60	1.43	1.43	1.43	5958224460991	25.9	226	811	11.8	.65
REHEAT										
139	2.20	0.72	0.72	0.72	5959874460973	25.9	226	811	5.5	0.65
REHEAT										
140	2.20	0.72	0.72	0.72	5959734460962	25.9	226	811	5.5	0.65
BOILERS										
141	147.55	70.24	70.24	70.24	5949584462545	50.0	226	478	91.7	1.33
BOILERS										
142	79.00	37.50	37.50	37.50	5949334462564	50.0	226	478	80.4	1.06
BOILERS										
143	21.80	10.40	10.40	10.40	5947604462427	27.0	226	613	62.3	1.14
BOILERS										

144	22.00	10.50	10.50	10.50	5947894462402	27.0	226	613	62.3	1.14
BOILERS										
145	54.20	25.74	25.74	25.74	5948004462400	50.0	227	444	48.8	1.52
USS DUQUESNE				(B BLOOM UPDATE 6/7/79)						
SOAKING PITS										
146	3.77	3.77	3.77	3.77	5981874470077	54.9	229	600	23.9	1.20
SOAKING PITS										
147	3.77	3.77	3.77	3.77	5982104470053	54.9	229	600	23.9	1.20
SOAKING PITS										
148	3.77	3.77	3.77	3.77	5982324470025	54.9	229	600	23.9	1.20
SOAKING PITS										
149	3.77	3.77	3.77	3.77	5982554469998	54.9	229	600	23.9	1.20
HEAT TREATING										
1501	15.30	5.34	5.34	5.34	5978834470353	10.0	229	100	100	
REHEAT FURNACE										
151	3.91	1.80	1.80	1.80	5978974470169	8.0	229	811	12.5	.62
REHEAT FURNACE										
152	3.91	1.80	1.80	1.80	5979044470162	8.0	229	811	12.5	.62
REHEAT FURNACE										
153	2.78	1.28	1.28	1.28	5978844470162	37.0	229	589	8.8	.90
REHEAT FURNACE										
154	2.78	1.28	1.28	1.28	5978734470143	37.0	229	589	8.8	.90
REHEAT FURNACE										
155	2.78	1.28	1.28	1.28	5978844470129	37.0	229	589	8.8	.90
156	9.96	4.68	4.68	4.68	5979004470160	28.4	229	699	31.5	.69
BOILER										
157	12.53	5.52	5.52	5.52	5985624469030	49.0	229	478	33.4	1.15
BOILER										
158	12.53	5.52	5.52	5.52	5985434469062	49.0	229	478	33.4	1.15
USS NATIONAL				(B BLOOM UPDATE 6/7/79)						
SINTER PLANT										
159	4.67	4.67	4.67	4.67	5977204467400	27.4	229	330	3.4	.94

SOAKING PITS										
160	1.50	0.57	0.57	0.57	5976804467485	27.0	229	616	4.9	.62
SOAKING PITS										
161	1.50	0.57	0.57	0.57	5976904467490	27.0	229	616	4.9	.62
SOAKING PITS										
162	1.50	0.57	0.57	0.57	5977104467492	27.0	229	616	4.9	.62
SOAKING PITS										
163	1.50	0.57	0.57	0.57	5977154467493	27.0	229	616	4.9	.62
SOAKING PITS										
164	1.50	0.57	0.57	0.57	5977304467494	27.0	229	616	4.9	.62
SOAKING PITS										
165	1.50	0.57	0.57	0.57	5977454467495	27.0	229	616	4.9	.62
SOAKING PITS										
166	1.77	0.66	0.66	0.66	5977604467497	27.0	229	616	5.9	.62
SOAKING PITS										
167	1.77	0.66	0.66	0.66	5977704467498	27.0	229	616	5.9	.62
SOAKING PITS										
168	1.77	0.66	0.66	0.66	5977854467499	27.0	229	616	5.9	.62
SOAKING PITS										
169	1.77	0.66	0.66	0.66	5977974467500	27.0	229	616	5.9	.62
ROTARY										
170	19.89	8.00	8.00	8.00	5967444467549	38.0	229	1089	98.5	.88
HEAT FURNACE										
171	6.11	2.50	2.50	2.50	5966664467575	38.0	229	533	30.6	.76
HEAT FURNACE										
172	6.11	2.50	2.50	2.50	5966684467563	38.0	229	533	30.6	.76
REHEAT FURNACE										
173	1.44	0.59	0.59	0.59	5967814467574	38.0	229	533	7.4	.68
REHEAT FURNACE										
174	1.44	0.59	0.59	0.59	5967994467578	38.0	229	533	7.4	.68
REHEAT FURNACE										
175	1.44	0.59	0.59	0.59	5969324467442	38.0	229	533	7.4	.68
NORMALIZER										
176	1.44	0.59	0.59	0.59	5969254467478	14.0	229	533	1.0	.25

NORMALIZER										
177	0.44	0.16	0.16	0.16	5970754467532	14.0	229	477	16.9	.65
WALKING FURNACE										
178	1.67	0.67	0.67	0.67	5967044467557	30.5	229	866	7.8	.68
WARM FURNACE										
1791	3.77	1.55	1.55	1.55	5972404467600	10.0	229	100	100	
BOILERS										
180	7.54	3.15	3.15	3.15	5972154467595	44.7	221	635	101.5	1.34
BOILERS										
181	7.54	3.15	3.15	3.15	5972154467580	44.7	221	635	101.5	1.34
BOILERS										
182	7.54	3.15	3.15	3.15	5972254467580	44.7	221	635	101.5	1.34
BOILERS										
183	7.54	3.15	3.15	3.15	5972254467595	44.7	221	635	101.5	1.34
BOILERS										
184	7.54	3.15	3.15	3.15	5974004467330	44.7	221	635	101.5	1.34
USS IRVIN										
SLAB HEATING										
185	13.40	13.40	13.40	13.40	5931454465680	21.3	283	450	46.7	1.30
SLAB HEATING										
186	13.40	13.40	13.40	13.40	5931504465628	21.3	283	450	46.7	1.30
SLAB HEATING										
187	13.40	13.40	13.40	13.40	5931554465693	21.3	283	450	46.7	1.30
SLAB HEATING										
188	13.40	13.40	13.40	13.40	5931574465710	21.3	283	450	46.7	1.30
SLAB HEATING										
189	13.40	13.40	13.40	13.40	5931564465725	21.3	283	450	46.7	1.50
BOILERS										
190	13.34	8.27	8.27	8.27	5932134465750	32.0	283	643	109.0	1.52
BOILERS										
191	30.97	19.31	19.31	19.31	5932194465765	32.0	283	643	115.6	1.52
BOILERS										
192	17.75	11.04	11.04	11.04	5932104465712	26.5	283	455	42.5	.91

USS CLAIRTON										
BATTERY B										
193	0.00	0.00	0.00	0.00	5956804461900	83.8	229	575	80.01	2.74
BATTERY C										
194	0.00	0.00	0.00	0.00	5955004462100	83.8	229	575	80.01	2.74
BOILERS T1,T2										
195	2.80	0.00	0.00	0.00	5947704462400	26.5	226	444	20.93	.73
USS NATIONAL										
TEMPERING										
1961	0.50	0.50	0.50	0.50	5967044467557	10.0	229	100	100	
DUQUESNE LIGHT STANWIX										
201	8.60	8.60	8.60	8.60	5843804477300	97.5	220	574	217.2	2.40
H J HEINZ										
202	3.60	3.60	3.60	3.60	5860004478900	76.0	222	464	70.3	1.50
203	8.80	8.80	8.80	8.80	5860004478900	76.0	222	464	103.1	1.50
WESTINGHOUSE ELECTRIC										
204	1.40	1.40	1.40	1.40	5990204472550	37.1	308	466	23.4	.99
BELLEFIELD BOILERS										
205	16.10	16.10	16.10	16.10	5891904477100	59.4	256	589	49.6	1.40
206	16.10	16.10	16.10	16.10	5891904477100	77.7	256	517	91.9	1.70
WABCO.										
207	3.80	3.80	3.80	3.80	5944004475550	27.0	274	569	19.3	.70
MESTA MACHINE										
208	0.10	0.10	0.10	0.10	5909204471980	61.0	229	393	18.8	.90
B&O RAILROAD										
209	3.30	3.30	3.30	3.30	5898004472500	38.0	230	533	99.6	1.06
UNIVERSAL ATLAS										
210	52.20	52.20	52.20	52.20	6003004479400	16.7	371	513	202.5	1.10
USS HOMESTEAD										
OPEN HEARTH										
211	12.90	12.90	12.90	12.90	5924504473650	37.0	229	533	94.0	1.98

212	12.90	12.90	12.90	12.90	5924754473685	37.0	229	533	94.0	1.98
213	12.90	12.90	12.90	12.90	5925104473750	37.0	229	533	94.0	1.98
214	12.90	12.90	12.90	12.90	5925204473760	37.0	229	533	94.0	1.98
215	12.90	12.90	12.90	12.90	5925504473820	37.0	229	533	94.0	1.98
SOAKING PITS										
216	1.93	1.00	1.00	1.00	5918954473025	37.0	229	533	6.5	.84
217	1.93	1.00	1.00	1.00	5919004473035	37.0	229	533	6.5	.84
218	1.93	1.00	1.00	1.00	5919034473045	37.0	229	533	6.5	.84
219	1.93	1.00	1.00	1.00	5919054473050	37.0	229	533	6.5	.84
220	3.63	1.89	1.89	1.89	5919104473060	31.0	229	533	10.0	.76
221	3.63	1.89	1.89	1.89	5919134473070	31.0	229	533	10.0	.76
222	3.63	1.89	1.89	1.89	5919154473080	31.0	229	533	10.0	.76
223	3.63	1.89	1.89	1.89	5919204473090	31.0	229	533	10.0	.76
224	3.63	1.89	1.89	1.89	5919254473100	31.0	229	533	10.0	.76
225	3.63	1.89	1.89	1.89	5919304473110	31.0	229	533	10.0	.76
226	3.63	1.89	1.89	1.89	5919354473120	31.0	229	533	10.0	.76
227	3.63	1.89	1.89	1.89	5919404473130	31.0	229	533	10.0	.76
228	3.63	1.89	1.89	1.89	5919504473140	31.0	229	533	10.0	.76
229	3.63	1.89	1.89	1.89	5919604473150	31.0	229	533	10.0	.76
230	3.63	1.89	1.89	1.89	5919654473160	31.0	229	533	10.0	.76
231	3.63	1.89	1.89	1.89	5919704473170	31.0	229	533	10.0	.76
232	2.25	1.80	1.80	1.80	5919754473180	44.0	229	533	7.5	1.05
233	9.77	5.10	5.10	5.10	5931084473742	50.0	230	533	117.2	.84
234	9.77	5.10	5.10	5.10	5930924473742	50.0	230	533	117.2	.84
36" MILL										
235	10.20	10.20	10.20	10.20	5932254473733	23.0	230	477	28.5	.40
236	3.00	3.00	3.00	3.00	5932254473755	35.0	230	477	8.8	.76
BLACK SMITH										
237	14.14	6.76	6.76	6.76	5934254474000	23.0	227	477	12.0	.38
100" REHEAT FURNACE										
238	32.14	15.27	15.27	15.27	5918874473270	38.0	227	477	17.2	.80
NORMALIZER										
2391	2.52	1.20	1.20	1.20	5918874473270	10.0	229	100	100	
PREHEAT HOODS										

2401	3.58	1.72	1.72	1.72	5923804473606	10.0	229	100	100	
160" REHEAT FURNACE										
241	26.80	12.80	12.80	12.80	5919754473450	70.0	227	477	25.9	1.52
160" IN-OUT FURNACE										
242	7.26	3.48	3.48	3.48	5919584473250	31.0	227	477	7.0	.68
243	3.58	1.73	1.73	1.73	5919504473450	31.0	227	477	3.4	.68
#2 FORGE										
244	4.07	1.92	1.92	1.92	5927334473833	30.0	229	477	6.8	.91
245	2.04	.98	.98	.98	5927334473833	30.0	229	477	3.4	.38
246	1.75	0.82	0.82	0.82	5927334473833	24.0	229	477	2.8	.38
247	3.29	1.56	1.56	1.56	5927334473833	24.0	229	477	5.5	.91
248	5.71	2.74	2.74	2.74	5927334473833	24.0	229	477	9.5	.99
249	1.94	1.91	1.91	1.91	5927334473833	18.0	229	477	1.5	.38
250	6.00	2.90	2.90	2.90	5927334473833	29.0	229	477	10.1	.99
HARVEY FORGE										
251	1.34	0.65	0.65	0.65	5932254473893	24.0	229	477	1.0	.68
252	2.13	1.04	1.04	1.04	5932254473893	25.0	229	477	1.7	.68
253	2.13	1.04	1.04	1.04	5932254473893	24.0	229	477	1.7	.68
254	1.84	0.88	0.88	0.88	5932254473893	24.0	229	477	1.4	.68
48" MILL										
255	2.50	1.16	1.16	1.16	5938654473555	32.0	229	477	3.4	.68
BOILER										
256	19.26	9.91	9.91	9.91	5942924474640	44.7	222	588	270.4	1.75
BOILER										
257	19.26	9.91	9.91	9.91	5942834474750	44.7	222	588	167.9	1.25
USS EDGAR THOMSON										
SOAKING PITS										
258	45.72	14.96	14.96	14.96	5974404471870	30.0	233	533	42.1	.88
BOILERS										
259	7.06	2.29	2.29	2.29	5970834471740	50.0	221	616	69.6	1.91
BOILERS										
260	7.06	2.29	2.29	2.29	5972604471685	50.0	221	616	69.6	1.91
BOILERS										
261	7.06	2.29	2.29	2.29	5972764471673	50.0	221	616	69.6	1.91

J&L PITTSBURGH										
KEELER BOILER										
262	32.20	32.20	32.20	32.20	5892604473890	24.4	235	405	9.3	.66
RILEY BOILER										
263	30.90	30.90	30.90	30.90	5892604473890	21.7	235	566	13.2	.98
SOUTHSIDE BOILERS										
264	55.50	55.50	55.50	55.50	5880004475340	36.0	225	461	38.7	1.22
265	24.80	24.80	24.80	24.80	5885004475490	41.5	219	505	15.60	1.34
10" MILL										
266	12.20	12.20	12.20	12.20	5892804474080	38.1	238	1089	25.5	1.06
14" MILL										
267	6.00	6.00	6.00	6.00	5893004474120	38.1	238	1089	8.9	.84
COKE BATTERIES										
268	65.30	65.30	65.30	65.30	5891304474010	61.0	235	634	54.7	1.30
269	56.90	56.90	56.90	56.90	5891604473900	61.0	235	634	54.7	1.30
270	22.90	22.90	22.90	22.90	5892604473760	69.0	235	533	50.9	1.45
SOAKING PITS										
279	2.40	2.40	2.40	2.40	5875504475520	50.0	236	810	104.4	0.76
280	0.50	0.50	0.50	0.50	5878304475520	35.0	236	810	104.2	0.77
281	22.90	22.90	22.90	22.90	5877804475520	46.0	226	811	18.7	.95
282	3.30	3.30	3.30	3.30	5877804475520	46.0	226	700	7.0	.95
USS HOMESTEAD										
PACKAGE BOILERS										
283	1.50	1.00	1.00	1.00	5925754473900	15.0	226	561	25.47	1.60
USS EDGAR THOMSON										
B&W BOILERS										
284	4.76	1.55	1.55	1.55	5972724471676	33.0	221	551	26.19	1.20
J&L PITTSBURGH										
SLAB HEAT FURNACE										
285	0.00	0.00	0.00	0.00	5883004475790	22.7	235	839	22.34	1.30

J&L PITTSBURGH
TAIL GAS

286	0.00	0.00	0.00	0.00	5891804474100	30.5	235	350	5.31	.17
287	.90	.60	.60	.60	5985504469010	49.0	229	560	72.30	1.15
288	.90	.60	.60	.60	5985704469010	49.0	229	560	72.30	1.15
289	.90	.60	.60	.60	5985504469020	49.0	229	560	72.30	1.15
290	.90	.60	.60	.60	5985604469020	49.0	229	560	72.30	1.15
291	.90	.60	.60	.60	5985404469030	49.0	229	560	72.30	1.15
292	.90	.60	.60	.60	5985604469030	49.0	229	560	72.30	1.15
293	1.40	.90	.90	.90	5985504469040	49.0	229	476	57.30	1.15
294	1.40	.90	.90	.90	5985604469040	49.0	229	476	57.30	1.15
295	1.40	.90	.90	.90	5985404469050	49.0	229	476	57.30	1.15
296	1.40	.90	.90	.90	5985404469060	49.0	229	476	57.30	1.15
301	4.40	4.40	4.40	4.40	5880604475150	43.6	222	532	32.90	.92
302	4.40	4.40	4.40	4.40	5880604475150	43.6	222	532	32.90	.92
303	4.40	4.40	4.40	4.40	5880904475120	43.6	222	532	32.90	.92
304	4.40	4.40	4.40	4.40	5880904475120	43.6	222	532	32.90	.92
305	4.40	4.40	4.40	4.40	5881604475160	43.6	222	532	32.90	.92
306	4.40	4.40	4.40	4.40	5881604475160	43.6	222	532	32.90	.92
307	4.40	4.40	4.40	4.40	5882004475020	43.6	222	532	32.90	.92
308	4.40	4.40	4.40	4.40	5882004475020	43.6	222	532	32.90	.92
309	1.50	1.00	1.00	1.00	5925604473940	14.8	222	476	58.08	1.41

MONONGAHELA VALLEY SOURCES

ARMCO STEEL

DUQUESNE LIGHT ELRAMA (DER HARRISBURG 6/8/79)

420	1428.86	1428.86	1428.86	1428.86	5920004456200	119.0	229	430	195.60	3.96

WEST PENN POWER MITCHELL (DER HARRISBURG 6/7/79)

426	30.00	30.00	30.00	30.00	5873404452810	59.0	232	464	113.30	2.13
429	30.60	30.60	30.60	30.60	5873404452810	59.0	232	464	113.30	2.13
430	25.20	25.20	25.20	25.20	5873404452810	59.0	232	422	113.30	2.19
431	1175.25	1175.25	1175.25	1175.25	5873404452810	107.0	232	333	519.20	3.05

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WHEELING-PITTSBURGH STEEL MONESSEN
432      5.70    5.70    5.70    5.70 5939144446100  31.0   230   505  2.00  .61
435     31.99   31.99   31.99   31.99 5939144446100  38.0   230   666  7.00  .91
440     16.83   16.83   16.83   16.83 5946224446236  57.0   230   334 83.10 1.22
441     67.40   67.40   67.40   67.40 5948124446177  56.0   230   405232.00 1.98
443     48.33   48.33   48.33   48.33 5944314446327  34.0   230   450 19.50 1.98
WHEELING-PITTSBURGH STEEL ALLENPORT
450      5.50    5.50    5.50    5.50 5987524437902  15.0   235   421  9.30 0.22
451     18.13   18.13   18.13   18.13 5987524437902  61.0   235   575 64.90 1.52
CALIFORNIA STATE TEACHERS COLLEGE
454      4.83    4.83    4.83    4.83 5952314435359  46.0   238   450  7.70 1.22
ALLIED CHEMICAL
460      5.49    5.49    5.49    5.49 5946444436862   8.0   234   355 18.90  .50
CORNING GLASS CHARLEROI
463      1.87    1.87    1.87    1.87 5936544444158  15.0   233   477  1.76  .46
470       .50                         5973514449231  15.0   232   533 11.16  .46


BEAVER VALLEY SOURCES


 J&L #5 BH - #58 BOILER
5001    10.10    8.20    8.20    8.20 5643304497350  46.6   219   533 75.28 1.30
 J&L #6 BOILER HOUSE
5002   129.39   89.64   89.64   89.64 5643104497560  76.2   232   485202.28 2.09
 J&L NEW #6 BOILER HOUSE
5003   357.93   23.44   23.44   23.44 5641604494236  83.3   232   498513.82 3.05
 J&L A-1N. ST.
5004    34.12    1.81    1.81    1.81 5645904497990  68.6   232   577 42.71 1.45
 J&L A-1S. ST.
5005    34.12    1.81    1.81    1.81 5646004497940  68.6   232   577 42.71 1.45
 J&L A-5 ST.
5006    74.22    4.16    4.16    4.16 5645904497790  76.2   232   577 19.66 1.68
 J&L A-5N. PREHEAT
5007     6.98    0.55    0.55    0.55 5645904497790  64.3   232   358 12.72  .56
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J&L A-5S. PREHEAT										
5008	6.98	0.55	0.55	0.55	5645904497790	64.3	232	358	12.72	.56
J&L OTHER SOURCES										
5109	37.25				5644874497661	76.0	228	602	25.40	1.68
5110	68.24				5644884497568	76.0	227	600	19.73	1.45
5111	15.51				5643744497197	38.0	226	700	34.30	1.22
5112	35.64				5643464497721	53.3	229	589	52.90	.76
5113	16.14				5642944495593	38.0	216	977	8.70	1.07
5114	1.01				5642944495531	30.0	216	977	6.10	.30
5115	1.64				5643414495532	27.0	216	977	10.40	.76
5116	15.94				5642254495407	38.0	218	977	13.80	.91
5117	31.87				5642264495346	38.0	218	977	13.80	.91
5118	32.31				5642084494605	38.0	218	977	21.30	.91
5119	14.81				5643464497752	53.3	229	977	12.50	.91
5120	56.87				5640644497749	31.0	232	311	17.80	.46
5121	16.14				5643724497382	61.0	226	533	38.50	1.37
5122	13.84				5643724497382	61.0	226	533	38.50	1.37
5123	8.95				5641514495777	27.0	219	811	4.00	.76
5124	8.34				5642464495716	27.0	218	422	2.10	.76
5125	10.24				5642464495716	27.0	218	700	6.90	.76
5126	27.70				5642464495654	38.1	218	977	14.00	.87
CRUCIBLE STEEL - MIDLAND										
5301	66.51				5459484498109	31.6	235	533	43.20	1.00
5302	1.83				5457984497800	7.3	233	533	10.42	.46
5303	23.09				5459524497523	27.2	232	533	25.24	.76
5304	15.51				5460234497431	30.6	232	533	3.38	.76
5305	3.88				5460474497308	18.3	226	533	8.11	.76
5306	7.76				5461004497300	11.9	226	533	9.03	.46
5307	32.56				5461504497250	76.0	226	477	90.30	1.83
MEDUSA CEMENT										
5380	103.77	152.70	152.70	152.70	5568744525270	91	244	589	113.30	1.83
5381	4.41	6.07	6.07	6.07	5568744525270	40	244	560	153.00	1.68
ARCO #1 BOILER										
5384	20.50	60.53	60.53	60.53	5546304500620	61	229	330	59.70	.91

ARCO #2 BOILER										
5385	128.86	165.58	165.58	165.58	5546304500620	61	229	330	59.70	.91
ARCO #3 BOILER										
5386	116.20	167.57	167.57	167.57	5546304500620	61	229	330	59.70	.91
ARCO OIL BOILER										
5387	120.29				5546304500620	61	229	330	59.70	.91
5388	2.50	0.89	0.89	0.89	5546304500620	55	229	399	22.66	1.98
B&W WALLACE RUN										
5391	7.07	10.47	10.47	10.47	5552644515255	21	275	575	11.67	0.76
B&W AMBRIDGE BOILERS #1,#2										
5395	9.66	9.66	9.66	9.66	5652834495355	26	233	450	23.40	1.14
B&W TUBULAR PRODUCTS										
5398	5.66	5.66	5.66	5.66	5564984513322	23	268	536	32.42	0.76
5399	1.50	1.50	1.50	1.50	5564984513322	21	268	577	16.06	0.91
SHENANGO CHINA (INTERPACE CORP.)										
5402	1.80	5.12	5.12	5.12	5537014539975	41	245	471	7.36	0.76
ASHLAND OIL CRUDE HEATER										
5404	0.70	0.70	0.70	0.70	5623154504580	34	229	477	6.45	.53
ASHLAND OIL CHARGE HEATER										
5405	1.24	1.24	1.24	1.24	5623154504580	18	229	477	4.15	.26
ASHLAND OIL BOILERS #1-3										
5406	1.86	1.86	1.86	1.86	5623154504580	58	229	422	30.50	1.22
ASHLAND OIL VACUUM HEATER										
5407	0.48	0.48	0.48	0.48	5623154504580	34	229	477	2.28	.53
ASHLAND OIL NRV, RERUN & BRIGHT ST. HEATERS										
5408	0.97	0.97	0.97	0.97	5623154504580	18	229	477	2.90	.26
WESTINGHOUSE ELECTRIC BEAVER										
5413	1.78	1.78	1.78	1.78	5575284486194	15	243	515	24.69	0.71
HERCULES INC.										
5469	0.50	0.50	0.50	0.50	5973514449231	15	232	533	11.16	0.46
WEST PENN POWER WEST PITTSBURGH UNIT #031,#032										
5472	1029.50	199.15	199.15	199.15	5531054531767	229	238	413663.37		4.00
PENN POWER MANSFIELD										
5479	235.89	235.89	235.89	235.89	5490494498067	290	219	341740.36		2.90

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 ST JOE MINERALS 275' STACK
5512   398.20 241.24 241.24 241.24 5552234501841    84    236    422 80.20 1.68
 ST JOE MINERALS 200' STACK
5513 0 130.64 118.89 118.89 118.89 5561604502218    61    236    347122.3  1.52
 ST JOE MINERALS 400' STACK
5514 0 164.40 157.50 157.50 157.50 5560654502301   122    236    336 213.7 2.44
 BESSEMER CEMENT UNIT #2
5518 0  25.50  52.93  52.93  52.93 5428604535850    67    320    477 51.4  1.68
 BESSEMER CEMENT UNIT #3
5519 0  33.00  59.89  59.89  59.89 5428604535850    67    320    505 91.6  1.98


 OTHER PENNSYLVANIA SOURCES


 ARMSTRONG POWER STATION
6021   538.12 538.12 538.12 538.12 6289794531996  70.0    258    405 160.0 2.30
6022   600.00 600.00 600.00 600.00 6289794531996  70.0    258    439 285.0 2.30
 CARPENTERTOWN COAL
6031    37.16  37.16  37.16  37.16 6329974530988   5.0    274  . 9921177.4  .10
 KEYSTONE POWER STATION
6041  3710.963710.963710.963710.96 6401414502155 244.0    311    4081193.8 4.60
 HOMER CITY POWER STATION
6051  3020.553020.553020.553020.55 6527564486147 244.0    366    405 874.8 4.70
 CONEMAUGH POWER STATION
6061  4343.844343.844343.844343.84 6645824471929 305.0    330    4081194.0 4.10
 SEWARD POWER STATION
6071   627.50 627.50 627.50 627.50 6668824474602  69.0    332    4142070.0 1.50
6072   763.50 763.50 763.50 763.50 6668824474602  69.0    332    450 126.7 1.20
 HATFIELD POWER STATION
6081  8503.508503.508503.508503.50 5915704412040 289      220    340 740.3 2.89
 ALVERTON FUEL
6091     3.20   3.20   3.20   3.20 6192894443933   5.0    334    922 221.3  .10
6092     6.90   6.90   6.90   6.90 6205444443891   5.0    334    922  88.5  .10
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 SLIPPERYROCK COLLLEGE
6101     31.20  31.20  31.20  31.20 5798254545763  53.0   412   505  25.6   .90
 SUNNEBORN
6111     58.30  58.30  58.30  58.30 6077764540569  61.0   366   505  15.8 1.25
 SHENLEY DISTILLERS
6121     27.10  27.10  27.10  27.10 6134204505200  24.0   251   477   7.4   .80


 EASTERN OHIO SOURCES
                NOTE: 1975 EMISSIONS DATA WERE USED FOR NON-POWER
                      STATION SOURCES DUE TO A LACK OF COMPLIANCE
                      DATA. 1975 EMISSIONS DATA WAS ALSO USED FOR
                      THE EAST PALESTINE POWER STATION.
                      THE COMPLIANCE DATA FOR THE OHIO POWER
                      STATIONS WAS OBTAINED FROM EPA REGION III.

                   **  UPDATED 06 JULY 1979 **
                       HENRY MODETY REGION V

 FEDERAL PAPERBOARD
8003   153.00 153.00 153.00 153.00 5332004468900    71   256   644 45.95 1.50
 KAOL CLAY
8011     5.90   5.90   5.90   5.90 5330004481300    46   283   421  1.41 1.51
 OHIO EDISON TORONTO
8023   827.40 827.40 827.40 827.40 5335004481800   198   201   441368.40 2.29
 OHIO EDISON SAMMIS
8031  1210.401210.401210.401210.40 5317004485500   154   210   405598.03 3.20
8032  1210.401210.401210.401210.40 5317004485500   154   210   405619.21 3.05
8035  3027.903027.903027.903027.90 5317004485500   259   210   405507.11 4.76
8036  2988.602988.602988.602988.60 5317004485500   305   210   4051050.9 4.09
 OHIO EDISON BURGER
8041  2358.402358.402358.402358.40 5205004417500   259   198   4661088.0 3.30
 OHIO EDISON TIDD
8051   156.60 156.60 156.60   0.00 5299004455700    75   207   455 99.10 1.50
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8052	156.60	156.60	156.60	0.00	5299004455700	75	207	455	99.10	1.50
8053	392.00	392.00	392.00	0.00	5299004455700	75	207	455	234.91	2.15
CARDINAL POWER STATION										
8061	1321.10	1321.10	1321.10	1321.10	5300004455800	252	198	447	897.84	3.36
8062	1321.10	1321.10	1321.10	1321.10	5300004455800	252	198	447	897.84	3.36
8063	764.80	764.80	764.80	764.80	5300004455800	274	204	430	1025.5	3.66
TORONTO PAPERBOARD										
8071	8.50	8.50	8.50	8.50	5337004480200	20	215	394	15.23	1.05
NATIONAL STEEL WEIRTON DIVISION										
8081	14.80	14.80	14.80	14.80	5327004467000	51	204	516	11.12	.85
8082	14.80	14.80	14.80	14.80	5327004467000	51	204	516	11.12	.85
8083	14.80	14.80	14.80	14.80	5327004467000	51	204	516	11.12	.85
8084	14.80	14.80	14.80	14.80	5327004467000	51	204	516	11.12	.85
WHEELING-PITTSBURGH STEEL NORTH PLANT										
8091	138.50	138.50	138.50	138.50	5325004466700	84	204	589	44.49	1.70
8092	80.70	80.70	80.70	80.70	5325004466700	39	204	505	26.24	1.20
8093	80.70	80.70	80.70	80.70	5325004466700	39	204	505	26.24	1.20
8094	80.70	80.70	80.70	80.70	5325004466700	39	204	505	26.24	1.20
8095	35.30	35.30	35.30	35.30	5325004466700	50	204	533	27.04	.75
8096	35.30	35.30	35.30	35.30	5325004466700	50	204	644	3.12	1.05
8097	35.30	35.30	35.30	35.30	5325004466700	50	204	644	6.23	1.05
8098	35.30	35.30	35.30	35.30	5325004466700	50	204	644	6.23	1.05
8099	35.30	35.30	35.30	35.30	5325004466700	50	204	644	3.71	.75
WHEELING-PITTSBURGH STEEL SOUTH PLANT										
8121	94.40	94.40	94.40	94.40	5346004463300	91	204	589	58.99	2.35
8122	37.00	37.00	37.00	37.00	5346004463300	49	204	519	12.57	1.00
8123	36.60	36.60	36.60	36.60	5346004463300	49	204	519	12.57	1.00
8124	34.30	34.30	34.30	34.30	5346004463300	49	204	519	12.57	1.00
8125	34.30	34.30	34.30	34.30	5346004463300	49	204	519	12.57	1.00
8126	34.30	34.30	34.30	34.30	5346004463300	49	204	519	12.57	1.00
8127	34.30	34.30	34.30	34.30	5346004463300	49	204	519	12.57	1.00
8128	49.80	49.80	49.80	49.80	5346004463300	49	204	547	13.51	1.00
8129	49.80	49.80	49.80	49.80	5346004463300	49	204	547	13.51	1.00
8130	18.80	18.80	18.80	18.80	5346004463300	33	204	644	3.82	.90

8131	18.80	18.80	18.80	18.80	5346004463300	33	204	644	3.82	.90
8132	18.80	18.80	18.80	18.80	5346004463300	50	204	700	3.82	.90
8133	18.80	18.80	18.80	18.80	5346004463300	50	204	700	3.82	.90
8134	18.80	18.80	18.80	18.80	5346004463300	50	204	700	3.82	.90
WHEELING-PITTSBURGH STEEL YORKVILLE										
8141	102.80	102.80	102.80	102.80	5254004445400	63	205	422	6.01	1.80
8142	128.50	128.50	128.50	128.50	5254004445400	63	205	422	6.01	1.80
WHEELING-PITTSBURGH STEEL MARTINS FERRY										
8151	47.40	47.40	47.40	47.40	5247004439200	24	202	510	1.13	.60
8152	142.50	142.50	142.50	142.50	5247004439200	38	202	516	7.07	1.50
OHIO EDISON EAST PALESTINE										
8161	18.70	18.70	18.70	18.70	5359004520300	30	314	561	38.17	1.50
8162	12.60	12.60	12.60	12.60	5359004520300	29	314	561	26.15	.75
8163	9.20	9.20	9.20	9.20	5359004520300	58	314	561	26.15	.75
CONALCO										
8171	3.90	3.90	3.90	3.90	5150004396500	18	195	589	5.08	.60
8172	47.60	47.60	47.60	47.60	5150004396500	18	195	297	7.85	.70
8173	1.50	1.50	1.50	1.50	5150004396500	21	195	589	15.81	.44
8174	0.80	0.80	0.80	0.80	5150004396500	6	195	589	8.30	.75

WEST VIRGINIA SOURCES

NOTE: WEST VIRGINIA EMISSIONS DATA WERE OBTAINED FROM THE DATA PROVIDED BY WEST VIRGINIA AND REGION X: 1978A

ALLIED CHEMICAL										
9001	94.00	94.00	94.00	94.00	5167004417000	31	203	299	6.20	1.00
9002	160.00	160.00	160.00	160.00	5167004417000	31	203	293	6.50	1.30
9003	0.00	0.00	0.00	0.00	5167004417000	20	203	800	15.00	1.00
BANNER FIBREBOARD										
9011	16.70	16.70	16.70	16.70	5333004458800	7	204	575	11.70	.50
BLAW-KNOX PENINSULA PLANT										
9021	1.90	1.90	1.90	1.90	5239004436400	40	201	755	9.49	.58

CITY SERVICE									
9042	1.20	1.20	1.20	1.20	5115004398700	23	204	507 19.20	.46
9043	1.20	1.20	1.20	1.20	5115004398700	23	204	507 12.60	.57
9044	1.50	1.50	1.50	1.50	5115004398700	24	204	507 14.90	.61
9045	1.50	1.50	1.50	1.50	5115004398700	24	204	507 14.90	.61
DIECKMANN & SONS									
9050	8.50	8.50	8.50	8.50	5308004434000	25	209	633 11.20	.60
GLOBE REFRACTORY									
9061	35.00	35.00	35.00	35.00	5319004495700	12	207	533 21.40	.73
9062	35.00	35.00	35.00	35.00	5319004495700	12	207	533 21.40	.73
9063	5.40	5.40	5.40	5.40	5319004495700	11	207	583 7.15	.73
9064	7.60	7.60	7.60	7.60	5319004495700	6	207	516 3.46	.43
H. B. REED									
9071	0.10	0.10	0.10	0.10	5159004407400	12	204	327 6.68	.42
KAMMER POWER STATION									
9081	2458.00	2458.00	2458.00	2458.00	5153204410320	183	197	442613.10	2.38
9082	1229.00	1229.00	1229.00	1229.00	5153304410330	183	197	442305.90	1.68
KOPPERS									
9091	25.00	25.00	25.00	25.00	5334004465500	61	204	589 30.90	1.55
9092	15.00	15.00	15.00	15.00	5334004465500	44	204	589 18.40	1.07
9093	23.00	23.00	23.00	23.00	5334004465500	58	204	477 25.20	.68
9095	35.20	35.20	35.20	35.20	5334004465000	15	204	789 2.58	.38
9096	0.20	0.20	0.20	0.20	5334004465000	21	204	1144 1.60	.08
9097	0.00	0.00	0.00	0.00	5334004465000	61	204	477 35.7	1.55
9098	12.30	12.30	12.30	12.30	5334004465000	38	204	755 12.3	1.55
MITCHELL POWER STATION									
9101	6295.24	6295.24	6295.24	6295.24	5158004408670	366	210	4412410.0	5.03
MOBAY CHEMICALS									
9111	135.20	135.20	135.20	135.20	5147004397200	15	199	452 14.28	.88
OHIO VALLEY MEDICAL CENTER									
9131	8.20	8.20	8.20	8.20	5238004434300	38	219	633 4.75	1.10
PPG INDUSTRIES									
9141	295.00	295.00	295.00	295.00	5126004399600	69	200	450 79.70	2.45
9142	275.00	275.00	275.00	275.00	5126004399600	91	200	436123.60	1.35
9143	45.00	45.00	45.00	45.00	5127004399800	31	207	477 2.36	.38

QUAKER STATE REFINERY										
9151	26.00	26.00	26.00	26.00	5309004496200	46	207	561	37.70	.91
9152	26.00	26.00	26.00	26.00	5309004496200	46	207	561	37.70	.91
9153	26.00	26.00	26.00	26.00	5309004496200	46	207	561	37.70	.91
9154	10.00	10.00	10.00	10.00	5309004496200	38	207	522	7.10	.46
9155	5.30	5.30	5.30	5.30	5309004496200	38	207	533	10.20	.84
9156	3.30	3.30	3.30	3.30	5309004496200	38	207	700	7.90	.91
9157	10.00	10.00	10.00	10.00	5309004496200	67	207	866	.05	.70
S. GEORGE										
9161	3.80	3.80	3.80	3.80	5329004458200	24	204	633	.50	.53
TAYLOR, SMITH & TAYLOR										
9181	6.50	6.50	6.50	6.50	5373004496300	38	207	477	4.67	.57
TRIANGLE CABLE & CONDUIT										
9191	21.50	21.50	21.50	21.50	5209004420300	24	207	586	8.80	.57
U. S. STAMPING										
9201	5.60	5.60	5.60	5.60	5225004419400	24	209	421	1.32	.54
VALLEY CAMP COAL #1										
9211	5.50	5.50	5.50	5.50	5308004444800	23	255	394	54.10	2.55
9212	5.50	5.50	5.50	5.50	5308004444800	26	255	394	45.20	1.10
VALLEY CAMP COAL #3										
9221	2.80	2.80	2.80	2.80	5333004434600	24	248	394	15.10	.91
9222	1.70	1.70	1.70	1.70	5333004434600	26	248	394	9.10	.91
NATIONAL STEEL BROWNS ISLAND COKE										
9231	134.00	134.00	134.00	134.00	5333004474800	76	232	533	53.60	2.06
9232	2.00	2.00	2.00	2.00	5333004474800	42	232	866	19.20	.38
92331	0.30	0.30	0.30	0.30	5333004474800	25	232	100	100	
NATIONAL STEEL MAINLAND COKE										
9252	7.25	7.25	7.25	7.25	5338004474600	76	232	555	19.20	1.37
9253	7.25	7.25	7.25	7.25	5338004474600	76	232	555	19.20	1.37
9254	8.45	8.45	8.45	8.45	5338004474600	76	232	555	22.40	1.68
9255	11.28	11.28	11.28	11.28	5338004474600	76	232	555	14.94	1.30
92571	3.80	3.80	3.80	3.80	5338004474600	18	232	100	100	
NATIONAL STEEL SINTER PLANT										
9262	89.00	89.00	89.00	89.00	5343004474100	49	232	422	257.00	2.29

WHEELING HOSPITAL										
9271	1.50	1.50	1.50	1.50	5234004436800	35	207	633	2.16	.91
WHEELING-PITTSBURGH STEEL BENWOOD PLANT										
9281	15.40	15.40	15.40	15.40	5229004430200	21	198	450	10.00	.66
9285	15.00	15.00	15.00	15.00	5335004465600	26	204	335	3.30	.30
9286	13.00	13.00	13.00	13.00	5335004465600	76	204	422	43.10	1.98
9287	0.00	0.00	0.00	0.00	5335004465900	17	204	426	14.20	.60
WHEELING-PITTSBURGH STEEL COKE PLANT										
9291	20.00	20.00	20.00	20.00	5335004465900	61	204	616	19.90	1.26
9292	20.00	20.00	20.00	20.00	5335004465800	61	204	616	19.90	1.26
9293	23.00	23.00	23.00	23.00	5335004465700	69	204	616	22.40	1.22
92971	6.40	6.40	6.40	6.40	5335004465600	18	204	100	100	
9298	34.00	34.00	34.00	34.00	5335004465600	76	204	616	32.20	1.35
9299	33.00	33.00	33.00	33.00	5335004465600	76	204	616	32.20	1.35
9300	39.00	39.00	39.00	39.00	5335004465600	76	204	616	37.80	1.35
WHEELING-PITTSBURGH STEEL SINTER PLANT										
9301	19.00	19.00	19.00	19.00	5335004465200	30	204	325	81.80	1.22
NATIONAL STEEL WEIRTON DIVISION										
9341	540.00	540.00	540.00	540.00	5343004474400	43	204	505	118.20	1.52
9344	250.00	250.00	250.00	250.00	5343004474400	43	204	505	118.00	1.52
9345	106.00	106.00	106.00	106.00	5343004474400	55	204	505	91.40	1.68
9346	70.00	70.00	70.00	70.00	5343004474400	67	204	505	76.00	2.30
9351	16.00	16.00	16.00	16.00	5343004474400	67	204	530	96.00	2.30
9352	22.00	22.00	22.00	22.00	5348004473800	61	204	333	118.00	2.70
9353	5.40	5.40	5.40	5.40	5350004473000	46	204	540	4.20	1.06
9354	224.20	224.20	224.20	224.20	5350004473000	61	204	520	41.60	1.45
9355	4.90	4.90	4.90	4.90	5350004472900	40	204	650	5.00	.86
9356	3.00	3.00	3.00	3.00	5350004472900	26	204	650	2.37	.44
9357	2.06	2.06	2.06	2.06	5350004473000	29	204	480	.56	.69
9358	4.20	4.20	4.20	4.20	5350004473000	15	204	480	.22	.17
9359	13.41	13.41	13.41	13.41	5350004473000	30	204	420	1.10	1.07
9360	35.00	35.00	35.00	35.00	5350004473000	53	204	505	4.78	.95
9361	0.00	0.00	0.00	0.00	5351004472500	24	232	366	4.20	.30

APPENDIX C.4

The following changes to the emissions inventory were received from the Commonwealth of Pennsylvania Department of Environmental Resources and the West Virginia Air Pollution Control Commission after review of the Draft Final Report. These changes are included here for reference and no attempt has been made to assess the effects of these changes on the study results. We point out that the changes received from the West Virginia Air Pollution Control Commission refer only to changes in SO_2 emission rates and do not include other changes that may have occurred in stack exit temperatures and flow rates. Without this information, it is not possible to estimate the effects of the changes in emission rates on the calculated concentrations.

CORRECTIONS AND CHANGES RECEIVED FROM THE WEST VIRGINIA AIR POLLUTION CONTROL COMMISSION

Source	Emissions (g/sec) Cramer Report	Emissions (g/sec) Recent WVAPCC Inventory*
Allied Chemical		
#1-4, Coal Fired Boilers (9001,9002)	84.0	48.0
North Plant Boilers (9003)	12.9	12.2
Banner Fiberboard		
Two Oil-Fired Boilers (9011)	14.0	14.0
Blaw-Knox Penindula Plant		
#3 Open Hearth (9021)	2.1	0
City Service (now is Columbian Carbon)		
#1 Reactor (9042)	1.2	1.2
#2 Reactor (9043)	1.2	1.2
#3 Reactor (9044)	1.5	1.5
#4 Reactor (9045)	1.5	1.5
Dieckmann & Sons		
Three Coal-Fired Boilers (9050)	8.5	8.5
Globe Refactory		
#5A, #4 Tunnel Kiln (9061, 9063)	50.0	22.0
#5B, #2 Tunnel Kiln (9062, 9064)	46.4	22.0
HB Reed		
(9071)	.1	.1
Kammer Power		
(9081)	2770.0	2770.0
(9082)	1385.0	1385.0
Koppers		
#2 Coal/Oil-Fired Boiler (9091)	8.0	8.0
#3 Coal/Oil-Fired Boiler (9092)	13.0	13.0
#4 Coal-Fired Boiler (9093)	28.0	28.0
F2 Flare (9095)	39.0	0.5
H2S Flare (9096)	0.5	0.5
#5 Coal-Fired Boiler (9097)	50.0	50.0
Mitchell Power		
(9101)	9289.0	9289.0
Mobay Chemicals		
#9, #10 Oil-Fired Boilers (9111)	85.0	35.0

Source	Emissions (g/sec) Cramer Report	Recent WVAPCC Inventory
Ohio Valley Medical Center		
Three Coal/Oil-Fired Boilers (9131)	4.6	4.6
PPG		
#4 Coal-Fired Boiler (9141)	175.0	175.0
#5 Coal-Fired Boiler (9142)	308.0	308.0
Sulfur Recovery (9143)	45.0	45.0
Quaker State Refinery		
#1 Oil-Fired Boiler (9151)	57.0	23.3
#2 Oil-Fired Boiler (9152)	57.0	23.3
#3 Oil-Fired Boiler (9153)	57.0	23.3
H-101 Crude Heater (9154)	12.0	12.0
Plateformer (9155)	6.0	6.0
150 Heater (9156)	4.0	4.0
Waste Gas Flare (9157)	12.0	12.0
St. George (Shutdown)		
Two Coal-Fired Boilers (9161)	3.8	0.0
Taylor Smith & Taylor (now is Anchor Hocking)		
Two Coal-Fired Boilers (9181)	7.2	7.2
Triangle Conduit (now is Triangle PWC)		
Three Coal-Fired Boilers (9191)	21.5	21.5
US Stamping (Shutdown)		
Two Coal-Fired Boilers (9201)	5.6	0.0
Valley Camp Coal #1		
#2 Thermal Dryer (9211)	5.5	5.5
#1 Thermal Dryer (9212)	5.5	5.5
Valley Camp Coal #3 (Shutdown)		
#1 Thermal Dryer (9221)	2.8	0.0
#2 Thermal Dryer (9222)	1.7	0.0
National Steel - Brown's Island Coke		
Battery Underfire (9231)	18.6	18.6
Gas Flare (9232)	2.0	2.0
Battery Area (92331)	0.3	0.3
Mainland Coke		
Battery #5 Underfire (9252) (Shutdown)	9.1	0
Battery #6 Underfire (9253) (Shutdown)	9.1	0
Battery #7 Underfire (9254)	10.6	0.4
Battery #8, #9 Underfire (9255) (Shutdown)	14.0	1.6
Battery Area (92571) (#7 & 8 only)	3.8	1.6

Source	Emissions (g/sec) Cramer Report	Recent WVAPCC Inventory
National Steel - Sinter Plant		
#2 Wind Box (9262)	89.0	89.0
Wheeling Hospital		
Coal-Fired Boilers (9271)	1.5	1.5
Wheeling - Pittsburgh Steel - Benwood		
#1, #2 Coal Boilers (9281) (now oil)	3.9	3.9
Wheeling-Pittsburgh Steel - Follansbee		
Desulfurization (9285)	15.0	15.0
#8 Battery Underfire (9286)	13.0	0.1
#4, #5 Boilers (9287)	7.0	7.0
#6-8 Boilers (9288) (only 6 & 7 coal)	79.0	46.2
#8 package (#2 oil)		1.8
#1 Battery Underfire (9291)	2.5	0.4
#2 Battery Underfire (9292)	2.5	0.4
#3 Battery Underfire (9293)	2.8	0.5
#1-3, #8 Area Sources (92971)	3.4	3.4
#1 Strand Wind Box (9301)	18.7	18.7
National Steel -Weirton Division		
#1-3 Coal-Fired Boilers (9341)	540.0	540.0
#4 Coal Fired Boiler (9344)	185.0	103.0
#5 COG-Fired Boiler (9345)	211.0	170.0
P1, P2 Gas Boilers (9346)	158.0	86.0
#15 COG Boiler (9351)	16.0	1.4
#6, #7 Heat Exchangers (9352)	22.0	22.0
60 T Reheat (9353)(Shutdown)	2.6	0.0
#1-4 Reheats (9354)	295.0	107.9
#1, #2 Spelters (9355)	2.3	2.3
#3, #4 Spelters (9356)	1.5	1.5
Annealing Furnace (9357)	0.2	0.2
#1-12 Annealing Furnaces (9358)	0.6	0.6
Tin Mill (9359)	1.5	1.5
Blooming Furnace (9360)	19.6	19.6
HCl Regenerator (9361)	4.2	4.2

*Revisions reflecting 1980 operating parameters and Regulation X allowable SO_2 emission limits as further explained in comments Section of the worksheets.

CORRECTIONS AND CHANGES RECEIVED FROM THE COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES

Source	Source Number	Change
Westinghouse Electric	5413	UTMX = 557.4, UTMY = 4504.7
Bruce Mansfield Power	5479	Emission Rate 461.03 g/sec Temperature 323 ^oK Volume 1480.72 m^3 Radius 5.79 meters
	5480	Emission Rate 230.46 Temperature 323 ^oK Volume 740.36 m^3 Radius 4.10 meters

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-903/9-81-001	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Calculations from Compliance Emissions of Long- and Short-Term SO_2 Concentrations in the Southwest Pennsylvania Air Quality Control Region		5. REPORT DATE May 1981 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO. TR-81-136-01
9. PERFORMING ORGANIZATION NAME AND ADDRESS H. E. Cramer Company, Inc. P. O. Box 8049 Salt Lake City, Utah 84108		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO. Contract No. 68-02-2547, Task Order No. 2
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15. SUPPLEMENTARY NOTES		

16. ABSTRACT

This report describes the results of dispersion-model calculations of maximum annual, 24-hour and 3-hour average ground-level SO_2 concentrations for selected areas in the Southwest Pennsylvania Air Quality Control Region (AQCR). The primary purpose of the model calculations was to assist EPA Region III and the Pennsylvania Department of Environmental Resources in determining the attainment or non-attainment of the National Ambient Air Quality Standards (NAAQS) for SO_2 in the Beaver Valley and Monongahela Valley Air Basins exclusive of Allegheny County. All of the dispersion-model calculations were made using the LONGZ and SHORTZ dispersion models with 1980 compliance emissions inventories containing 492 major SO_2 sources located within the Southwest Pennsylvania AQCR and in Ohio and West Virginia near the western border of the AQCR. The only calculated maximum that exceeds the NAAQS for SO_2 is the maximum annual average concentration at an isolated grid point located on high terrain about 1 kilometer north of the Monessen Plant of Wheeling-Pittsburgh Steel. The model calculations also indicate contributions of major SO_2 sources located along the Ohio River in Ohio and West Virginia to the air quality in the Southwest Pennsylvania AQCR.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Meteorology Sulfur Dioxide Turbulent Diffusion	Southwest Pennsylvania Air Quality Control Region Dispersion Modeling Beaver Valley Air Basin Monongahela Valley Air Basin	

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