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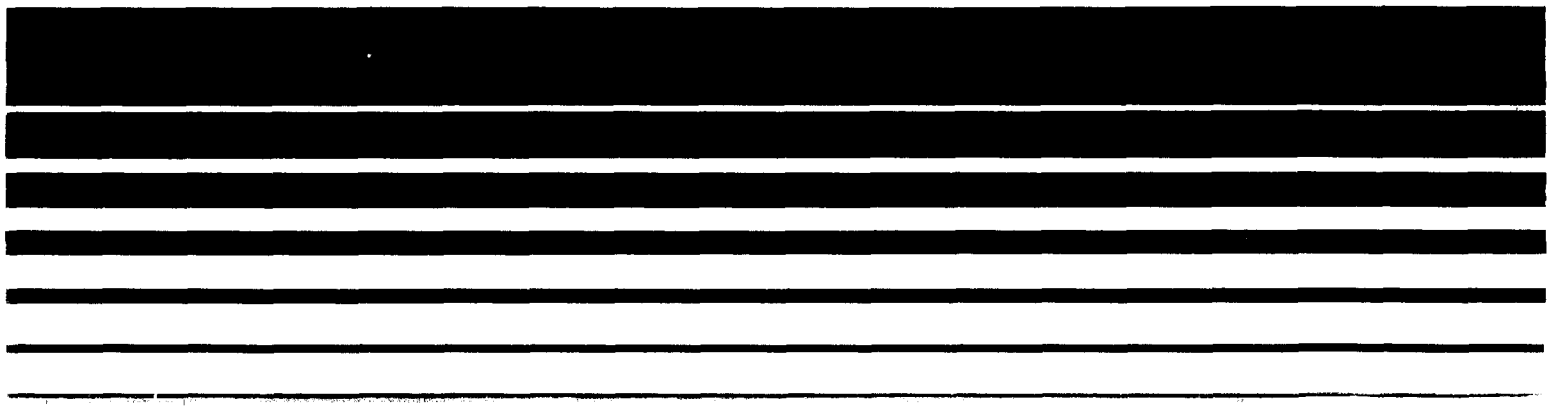
Evaluation Of Ambient Air Quality

In The State Of Missouri

Based on Monitoring Data Through 1982



EVALUATION OF AMBIENT AIR QUALITY

IN THE STATE OF MISSOURI

Prepared by
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Environmental Monitoring and
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August 1983

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EXECUTIVE SUMMARY

This report presents an evaluation of recent ambient air quality in Missouri, based on 1981 and 1982 monitoring data for the criteria pollutants [Total Suspended Particulates (TSP), Sulfur Dioxide (SO_2), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Ozone (O_3) and Lead (Pb)]. Trend evaluations are based on five years of data, 1978-1982. All monitoring data used were retrieved from the Storage and Retrieval of Aerometric Data (SAROAD) system.

The report presents the following information in graphical form:

- Recent air quality and trends
- Boundaries of designated non-attainment areas
- Spatial scale of representativeness and data completeness by monitor
- Population within designated non-attainment areas.

Tabular summaries in the Appendices show the numerical data on which the graphics are based.

The findings and recommendations of the evaluation can be summarized in three categories: Attainment/Non-Attainment Designations; Areas of Air Quality Concern; and Monitor Operation.

A. Attainment/Non-Attainment Designations

The evaluation of ambient air quality based on recent monitoring data finds attainment status designations to be generally consistent with recent data in most parts of the State. Recommendations are made in the report to consider attainment status changes in some locations for TSP and CO. Those recommendations, which are summarized in Table 5 of Section XIV, recognize improvements in air quality in some locations and possible air quality impairments in other locations. The State has recently requested redesignations from primary non-attainment to secondary non-attainment for TSP in Kansas City, St. Joseph and St. Louis; and from primary non-attainment to attainment for O_3 in Kansas City. Those requests are under review by the Air Branch of EPA, Region VII.

B. Areas of Air Quality Concern

Relatively few serious air quality problems are found in Missouri, based on the monitoring data available in SAROAD. The areas which have recently posed human health concerns (because the primary NAAQS's were exceeded) are summarized in the following paragraphs.

Exceedances of the alert level and violation of the eight-hour primary standard were observed in 1981 and 1982 at one site.

- CO in Independence

Violation of the primary standards was observed at the following sites in 1982 (or in the last year of operation, if 1982 data were not available).

- TSP in St. Joseph (Pump Station South) and in St. Louis (four sites which did not meet siting criteria for monitors intended to represent neighborhood-sized geographical areas).

- SO_2 in West Alton (attributed to point source impact from the Wood River Power plant in Illinois).

- O_3 in the St. Louis Area (305 Weidman Road, Clayton, Water Department, and 8227 South Broadway).

Violation of the primary standards was observed at the following sites before 1982, but the 1982 data showed no violations.

- SO_2 - Sugar Creek

- CO - St. Ann

- O_3 - Kansas City Area (most sites) and St. Louis Area (Ferguson, Jefferson County, St. Ann and West Alton)

Two of the above areas are the focus of Section XII, which gives brief background information for each site, presents pollution roses for the monitors which recorded violations of the standard, and evaluates possible causes of the high concentrations observed. The pollution roses provide an additional perspective which may be useful to the efforts of the State and local agencies in ensuring that the National Ambient Air Quality Standards are met.

C. Monitor Operation and Siting

Reviews of the monitoring data and the precision and accuracy data generally reflect conscientious efforts by the State and local agency personnel. Recommendations are made for the following items:

- Establishing a downtown CO monitor in Kansas City.

- Re-establishing TSP monitoring in three areas of St. Louis.

- Increasing the number of precision checks and monitor audits performed by the State and local agencies.

- Increasing the number of samples collected at the existing collocated monitors.

- Including the lead monitoring data collected near the lead smelters in the SAROAD data bank.

ACKNOWLEDGEMENTS

This report draws on the work and talents of several people in addition to the author.

State and local agency personnel collected, processed and reported the monitoring data which forms the basis of this evaluation. Based on their first-hand experience at the monitoring locations, they have also provided valuable insights into local conditions, both in cooperative discussions and in formal reports which they have prepared. We appreciate their help.

Jeff Wandtke, of EPA Region VII, who has a special ability to coax useful data and graphic output from reluctant computers, provided data retrievals and map production runs in a consistently timely manner. Carl Hess, of the Computer Sciences Corporation, wrote the software to translate air quality data and emissions data into symbols for the maps in the text. That software is now available from Region VII. Mick Daye, the Regional Meteorologist for EPA Region VII, provided the meteorological data for pollution roses and useful, objective insights into the utility and the limitations of pollution roses.

Barbara Nichols of EPA Region VII typed the manuscript. Rob Ireson of Systems Applications, Inc., developed software which we requested for computing population estimates for designated non-attainment areas. Tim Matzke of the Environmental Results Branch, OMSE, EPA Headquarters, provided coordination for the funding of that software.

The unique contributions of each of those individuals to this project are gratefully acknowledged.

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I. INTRODUCTION

The Environmental Services Division of EPA Region VII prepares an annual evaluation of ambient air quality for each State within the Region. The evaluation report serves as a basic reference document which summarizes the following information for the State:

- recent monitoring data
- current attainment and non-attainment area designations
- air quality trends
- ambient monitor locations
- population
- data completeness
- monitor scales of representativeness
- precision and accuracy estimates

Data summaries are presented both in graphical form (on maps) and in tabular form.

While the format and evaluation methods are similar to the FY-82 report, two new features have been added this year. First, pollution roses have been constructed, subject to data availability, to aid in identifying possible sources of high pollutant concentrations. (The description of data analysis procedures in Section III.H of this report highlights the nature and limitations of those roses.) Second, population estimates within specific non-attainment areas have been calculated. (The population density maps on which those calculations were based are included as Appendix C).

The evaluation is based on information available as of March 31, 1983. That information includes non-attainment area designation changes which were made during 1982. Ambient monitoring data for 1981 and 1982 are included for all pollutants. In addition, since the ozone standard is based on a three-year average, 1980 data are included for ozone.

II. GRAPHICAL EVALUATION PROCEDURES

A primary goal of the Clean Air Act is the protection of public health and welfare through the attainment and maintenance of National Ambient Air Quality Standards (NAAQS's). Those standards have been set for six "criteria pollutants" [total suspended particulates (TSP), sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2) and lead (Pb).] Before the standards were set, studies of the effects of each pollutant were carefully reviewed and evaluated. Primary standards are designed to protect human health, and are required by law to provide a margin of safety in order to protect sensitive segments of the population. Secondary standards protect public welfare (crops, building materials, animals, etc.). Numerical values of those standards are given in Table 1.

The regulations which implement the Clean Air Act require that public announcement be made and that measures be taken to reduce pollutant emissions when the ambient concentration exceeds the alert level for that pollutant. Numerical values for these alert levels are also given in Table 1.

The evaluation of air quality presented in this report is based on the National Ambient Air Quality Standards. So that the results of the evaluation may be readily seen, the body of the text is designed around graphic presentations which summarize a wide variety of air quality information. Those presentations include pollution roses and maps. Detailed numerical data summaries, from which the graphical summaries were prepared, are included as appendices to the report.

The maps show:

- the boundaries of designated non-attainment and unclassified areas,
- the locations and scales of representativeness of ambient monitors,
- the comparison of ambient data with the standards,
- the specific standard(s) exceeded (if any) at each site,
- the statistical trend observed at each site (subject to data availability), and
- data completeness (relative to the National Aerometric Data Branch data summary criteria.)

TABLE 1

SUMMARY OF NATIONAL AMBIENT AIR QUALITY STANDARDS AND ALERT LEVELS

POLLUTANT	AVERAGING TIME	PRIMARY STANDARDS	SECONDARY STANDARDS	ALERT LEVEL
Particulate Matter	Annual (Geometric Mean)	75 ug/m^3		
	24-hour*	260 ug/m^3	150 ug/m^3	375 ug/m^3
Sulfur Dioxide	Annual (Arithmetic Mean)	80 ug/m^3 (0.03 ppm)	-	
	24-hour*	365 ug/m^3 (0.14 ppm)	-	800 ug/m^3 (0.3 ppm)
	3-hour*	-	1300 ug/m^3 (0.5 ppm)	
Carbon Monoxide	8-hour*	10 mg/m^3 (9 ppm)	(Same as primary)	17 mg/m^3 (15 ppm)
	1-hour*	40 mg/m^3 (35 ppm)		
Nitrogen Dioxide	Annual (Arithmetic Mean)	100 ug/m^3 (0.05 ppm)	(Same as primary)	
	1-hour	-		1130 ug/m^3 (0.6 ppm)
	24-hour	-		282 ug/m^3 (0.15 ppm)
Ozone	1-hour**	0.12 ppm (235 ug/m^3)	(Same as primary)	0.2 ppm (400 ug/m^3)
Lead	Calendar Quarter	1.5 ug/m^3	(Same as primary)	

* Not to be exceeded more than once per year, for primary and secondary standards.

** Not more than 1.0 expected exceedance per year, three-year average.

The above items are illustrated in the legend to the maps (Table 2). The following paragraphs explain in detail the interpretation of the maps. For convenience, an extra copy of the legend, a map with county names, and a map of population density by county are inserted unbound at the back of this report.

A. Monitoring Data Maps

For each monitor, the symbol location on the map shows the monitor location. The symbol size displays the scale of representativeness of the monitor - microscale, middle scale, neighborhood scale, urban scale or regional scale. Symbol shading indicates data completeness. If the data did not meet the completeness criteria described in Section III.F in any one year evaluated, an open symbol "O" is shown. If the data met the criteria in each year included in the evaluation, a filled circle is shown. The symbol color presents the comparison of recent monitoring data with the NAAQS's. Green indicates no violation of the standards. Blue depicts violation of the secondary standard, but no violation of the primary standard. Red highlights violation of the primary standard. If the alert level was exceeded during the years evaluated, a red flag is placed on top of the symbol. If any violation of standards was observed, annotations next to the symbol specify which standard(s) was (were) violated. Red annotations specify primary standards, while blue annotations specify secondary standards. Where the primary and secondary standards are identical, only the primary standard is shown. Possible annotations include A, Q, 24, 8, 3 and 1, signifying annual, quarterly 24-hour, 8-hour, 3-hour and 1-hour standards, respectively.

The boundaries of the designated non-attainment areas and unclassified areas are shown as lines on the map. Red solid lines outline primary non-attainment areas, blue solid lines outline secondary non-attainment areas, and dashed lines show unclassified areas. Consequently, if the attainment status designations are consistent with recent data, red monitor symbols should appear only in red-outlined areas, and blue monitor symbols only in blue-outlined areas.

For monitors which have recorded sufficient data during the five years from 1978 through 1982, trends are presented as an additional annotation. The trend labels and their respective symbols are: increasing trend ($\uparrow$), probable increasing trend ($\hat{}$), no trend (-), probable decreasing trend ($\triangledown$), and decreasing trend ($\downarrow$). For pollutants which have only short-term standards (CO and O_3), the trend presented is for the 90th percentile hourly concentrations observed each month over those five years. For NO_2, which has only an annual standard, the trend presented is for the monthly average concentrations. For pollutants which have both short-term and long-term standards (TSP and SO_2), two trend symbols are presented. The first symbol is for long-term averages, the second for 90th percentile concentrations. For lead, lack of sufficient data precludes trend analysis at this time. Further details of the trend analysis procedure are given later in this report (Section III. C).

TABLE 2

LEGEND FOR AMBIENT MONITORING DATA MAPS

Boundaries

- Primary Nonattainment Area
- Secondary Nonattainment Area
- Unclassified Area

Monitor Symbol Colors and Flag

- No Violation of Standard
- Violation of Secondary Standard
- Violation of Primary Standard
- Exceedance of Alert Level

Annotation for Standards Violated

- A — Annual Primary Standard
- Q — Quarterly Primary Standard
- 24 — 24-hour Primary Standard
- 24 — 24-hour Secondary Standard
- 8 — 8-hour Primary Standard
- 3 — 3-hour Secondary Standard
- 1 — 1-hour Primary Standard

Annotation for Trends

- ↑ Increasing Trend
- ∧ Probable Increasing Trend
- – No Trend
- ∨ Probable Decreasing Trend
- ↓ Decreasing Trend

(Where two trend symbols are shown, the first is for long-term averages, the second for 24-hour observations.)

Monitor Symbol Sizes

- Microscale
- Middle Scale
- Neighborhood Scale
- Urban Scale
- Regional Scale

Data Completeness

- Data met completeness criteria each year.
- Data did not meet completeness criteria one or more years.

B. Pollution Roses

In areas where the NAAQS's have been exceeded, pollution roses can be useful in evaluating possible sources of high pollutant concentrations. Those roses show the wind speeds and the directions from which the wind blew when high pollutant concentrations were monitored in the ambient air. The longest arms of the rose point toward the locations of possible causes of the high concentrations. Section III.H discusses the meaning, construction, and limitations of the roses. Because of their inherent limitations, the roses do not provide positive identifications of the definitive causes of elevated concentrations. They do, however, provide useful indications of possible causes.

III. DATA DESCRIPTION - Information Sources, Limitations and Analysis Procedures

The evaluation procedure described above requires detailed examination of various kinds of data from various sources. The following paragraphs describe the information sources, the limitations and the analysis procedures for the necessary data.

A. Ambient Air Monitoring Data

A network of ambient air monitoring stations has been established by the State of Missouri, as required by 40 CFR §58.20 and §58.30. The network includes not only the required National Air Monitoring Stations (NAMS) and State and Local Air Monitoring Stations (SLAMS), but also a number of Special Purpose Monitoring Stations (SPMS) designed to address short-term monitoring needs or special situations of interest to the State or local agencies. The monitor locations shown in the graphical presentations of this report were obtained from the site file of the Storage and Retrieval of Aerometric Data (SAROAD) system.

The ambient data used in this report were obtained from the SAROAD data base. A copy of the SAROAD Quick Look Summary is included as Table A1 of the Appendix. The recorded values were compared with the alert levels, the primary standards and the secondary standards for graphical display on the maps. Data for 1981 and 1982 were used in the analysis of recent air quality for all six criteria pollutants. Since the ozone standard is based on a three-year average, 1980 data were also included for ozone. For the analysis of trends, five years of data (1978 through 1982) were used.

B. Precision and Accuracy

Each organization which reports air monitoring data is required to calculate and report 95 percent probability limits for precision and accuracy for all NAMS data collected after January 1, 1981, and for all SLAMS data collected after January 1, 1983. Those probability limits, which are calculated using specific equations from 40 CFR 58 Appendix A, summarize the results of quality control checks which those same regulations require. The meaning of the probability limits and the procedures for performing the quality control checks are discussed below in Section X.

The precision and accuracy reports available in SAROAD as of April, 1983 are provided as Table A2 of the Appendix.

C. Trends

The trend analyses were performed on data from 1978 through 1982, using the same statistical procedure as in prior years. That procedure calculates the Sen non-parametric statistic, using the NADB*TRENDRUN programs on the UNIVAC computer associated with the National Aerometric Data Branch (NADB). The Sen statistic is described in more detail in Appendix B.

The analysis procedure can be visualized as follows. From all the data for a given month, one single value is computed. The monthly values are adjusted to account for seasonal variation. Each month's adjusted value is compared with the value for every preceding month in the measurement period. Next, for each month, tallies are made of how many preceding months' values were higher and how many were lower than the month in question. Those tallies are then summed to give grand totals of months with higher readings and months with lower readings. Those two grand totals are compared using the Sen statistic to determine whether or not a statistically significant trend existed. Appendix B gives the detailed step-by-step procedure, including the mathematical equation for the Sen statistic. That appendix also provides a sample calculation. The values used for each month were selected as follows. Two trend calculations were performed for TSP. For the first calculation, the value used for a month was the geometric mean of all values measured during the month. For the second calculation, the value used was the 90th percentile 24-hour concentration for all concentrations measured during the month. (Because of the small number of samples each month, the 90th percentile concentration is also the maximum concentration.) Two calculations were likewise performed for SO_2. The first used the monthly arithmetic mean, the second the 90th percentile 24-hour concentration. For NO_2, the monthly arithmetic mean was used. For CO and O_3, which have only short-term standards, the value used was the 90th percentile 1-hour concentration. Since final lead monitor siting criteria were not promulgated until late 1981, with deadlines for monitor siting in 1982 and 1983, historical lead data from sites meeting those criteria are scarce. Therefore, trend analyses were not performed for lead.

As noted above, the trend evaluations for short-term high concentrations use 90th percentile concentrations, rather than maximum concentrations. The reason for that choice is that the 90th percentile values give more stable trend estimates, and minimize the bias which would result from extreme values caused by data handling errors, unusual weather conditions, etc.

Since the trend evaluation uses a statistical technique, unrepresentative results could be obtained if a limited amount of data were used. Minimum criteria chosen were at least 50% complete data for the five years 1978-1982, and at least 75% complete data for at least three of those years. These criteria disallowed trend evaluation at many monitoring sites.

The results of recent pollution abatement actions may not be reflected in the five-year trend analysis, since concentration increases early in the time period could mask recent short-term improvements. As mentioned before, the trends are based on 1978 through 1982 data. The data used in reviewing attainment or non-attainment of the NAAQS's, however, cover only the periods 1980-1982 for ozone and 1981-1982 for the other pollutants.

D. Scale of Representativeness

Spatial Scales of Representativeness are described in 40 CFR Part 58, Appendix D. The scale of representativeness identifies the size of an air parcel around a monitor which is homogeneous in terms of pollutant concentrations, population density and geographical features. The scales pertinent to the present analysis are, in order of increasing size: microscale (part of a city block); middle scale (a few square blocks); neighborhood scale (a few square kilometers); urban scale (the size of an entire city); and regional scale (several hundred to several thousand square kilometers, generally in rural areas). The air quality analysis includes the scale of representativeness for each monitor in order to depict the expected geographical extent of the concentrations monitored. The scales of representativeness for the monitors were obtained from the Missouri Air Quality Monitoring Network Description, which was prepared by the Missouri Department of Natural Resources.

E. Attainment Status Designations

The designations of attainment, non-attainment and unclassified areas are found in 40 CFR §81.326. The designations used in the analysis are included as Table A3 of Appendix A. Because of the logistics of graphics preparation, a cut-off date of March 31, 1983 was used. The map presentations show boundaries for non-attainment areas and unclassified areas, obtained from those designations. In cases where the wording of 40 CFR §81.326 does not provide specific boundaries, the boundaries were obtained from maps which the state submitted to EPA with the designation requests. Where non-attainment or unclassified area boundaries follow county lines, those lines on the map do not precisely coincide, in order that both lines can be clearly seen. In some cases, larger discrepancies in the boundaries are evident, because the county boundaries in the ZMAP computer mapping system are not exact.

F. Data Completeness

If monitoring data for a site are incomplete, they may give a distorted picture of air quality. Annual or quarterly averages calculated from incomplete data may be biased either high or low, making comparisons with long-term NAAQS's uncertain. Where the NAAQS's are based on short-term averages (1, 3, 8 or 24 hours), incomplete data may reduce the number of detected exceedances of the standard. For all such pollutants except ozone, any bias resulting from incomplete data would make short-term air quality appear better than it actually was. For ozone, the standard is based on "expected exceedances," which consider both the number of measured exceedances and the time period over which they were measured, in order to project the number of exceedances expected for a full year of monitoring. Therefore, incomplete ozone data could make the air quality appear either better or worse. For the analysis presented in

this report, the data are considered "complete" if they include enough observations (reported as valid) to meet the minimum NADB data requirements for calculating average concentrations. (Sites which do not meet these criteria are indicated by a question mark in Table A1 of Appendix A. The criteria are summarized in Appendix D.) Those criteria are applied by the NADB to pollutants which have NAAQS's based on annual or quarterly averages (TSP, SO_2, NO_2 and Pb). For CO and O_3, however, annual averages are not computed by the NADB. For those two pollutants, a minimum criterion of 75% complete data for the entire year is chosen for the analysis in this report.

G. Meteorological Data

Construction of wind roses or pollution roses requires wind speed and direction data. The ideal is to have meteorological instrumentation at the pollutant monitoring site. Data collected by such instrumentation would be stored in SAROAD.

However, the air monitoring regulations do not require meteorological date collection, and most SLAMS sites in Missouri do not include wind measurements. In those cases, data from a nearby National Weather Service station are used. The pollutant monitoring station and the meteorological station are identified for each pollution rose presented.

H. Pollution Roses

The pollution roses presented in this report are diagrams which summarize wind speeds and wind directions during periods when elevated pollutant concentrations were observed. The term "elevated pollutant concentrations" implies a threshold concentration, which must be selected as appropriate for the specific pollutant and averaging time of interest. For example, TSP has three different standards, as shown in Table 1:

a) a primary standard of 75 ug/m^3, annual geometric mean concentration;

b) a secondary standard of 150 ug/m^3, 24-hour concentration, not to be exceeded more than once per year; and

c) a different primary standard of 260 ug/m^3, 24-hour concentration, not to be exceeded more than once per year.

For sites exceeding the annual primary standard, only days with concentrations over 75 ug/m^3 will contribute to the exceedance, so only those days are included in the pollution rose. The resulting rose indicates possible sources of chronic, moderately elevated TSP concentrations. Where sites also show exceedances of the 24-hour secondary standard, a pollution rose constructed from only those days when TSP concentrations exceeded 150 ug/m^3 could indicate different or fewer sources of those higher concentrations.

The following threshold values were used in constructing the pollution roses in this report:

For TSP - Days with TSP concentrations above 75 ug/m^3, for sites exceeding the annual primary standard.

For CO - Hours with CO concentrations above 10 mg/m^3 for sites exceeding the eight-hour standard. (Only those hours could contribute to eight-hour averages above the standard.)

The following steps were followed in constructing pollution roses:

1. The times (days or days and hours) when pollutant concentrations exceeded the threshold concentration were identified. That information was obtained from the raw data (daily or hourly concentrations) in SAROAD.

2. The wind speed and wind direction were retrieved for each of the times identified in Step 1. On-site meteorological data are preferred, if available. Otherwise, National Weather Service data from a nearby station may be used, with the understanding that the separation between the weather station and the pollutant monitoring station introduces uncertainty into the interpretation of the pollution rose.

3. The weather data were summarized by ranges of wind speeds (e.g. 1-3 mph) and ranges of wind directions (e.g. 15-45°). The frequency of occurrence was then computed for each combination of speed range and direction range.

4. The rose was plotted, using different bar widths and shading patterns for each wind speed range.

Interpretation of a pollution rose considers not only the wind directions displayed, but also the wind speeds and significant pollutant sources in the vicinity of the monitor. If the rose is strongly directional (one or two arms much longer than the others), influence of a single point source or a small cluster of sources is indicated. A more diverse directional pattern would indicate inflence by line or area sources or by several point sources located in various directions from the monitor.

As stated earlier, if off-site meteorological data are used, uncertainty in the meaning of the pollution rose is introduced. The following three factors tend to increase that uncertainty:

a) short observation times,

b) large distances between the pollutant monitoring site and the weather station,

c) large variations in terrain between the pollutant monitor and the weather station.

Therefore, due caution should be exercised and the advice of the Regional Meteorologist should be sought in interpreting roses constructed from off-site weather data.

Uncertainty of a different type is introduced where a resultant wind speed and direction are used to represent winds for a 24-hour period for a TSP pollution rose. Wind shifts of more than 90° are common over the course of a day. The high pollutant concentrations may occur during only a part of the day, when the wind direction may be different from the resultant direction. In that case, the time resolution of pollutant monitoring data is not sufficient to detect that effect. Therefore, these pollution roses can provide only preliminary indications of probable sources of high concentrations.

The following description of the attached pollution rose (Figure 1) illustrates the evaluation process. The rose was constructed from on-site weather data for hours during which the CO concentration exceeded 10 mg/m^3. With very few exceptions, wind speeds were low (below 3 mph) when those concentrations were observed. From the spread of the directional pattern, a single point source is probably not the cause of the elevated concentrations. Rather, an area source or a line source would be expected. At the bottom of the diagram, the monitor location is shown, along with the adjacent freeway. Considering the location, wind speeds and wind directions, vehicle traffic on the freeway is indicated as the probable cause of the elevated concentrations.

I. Population Data

Population data are used in two contexts in the report. First, a map of population density by county is provided at the back of the report. That map is based on 1980 population data which was obtained directly from the U.S. Bureau of the Census. Second, population exposure estimates are presented in Section XIII for non-attainment areas, based on 1970 census data which are available at a higher level of spatial resolution. Those estimates were produced by Systems Applications, Inc., using block group and enumeration district population data, and were scaled to approximate 1978 values using county-level growth factors. Appendix C describes the procedures used for those calculations.

Figure 1(a). Sample Pollution Rose

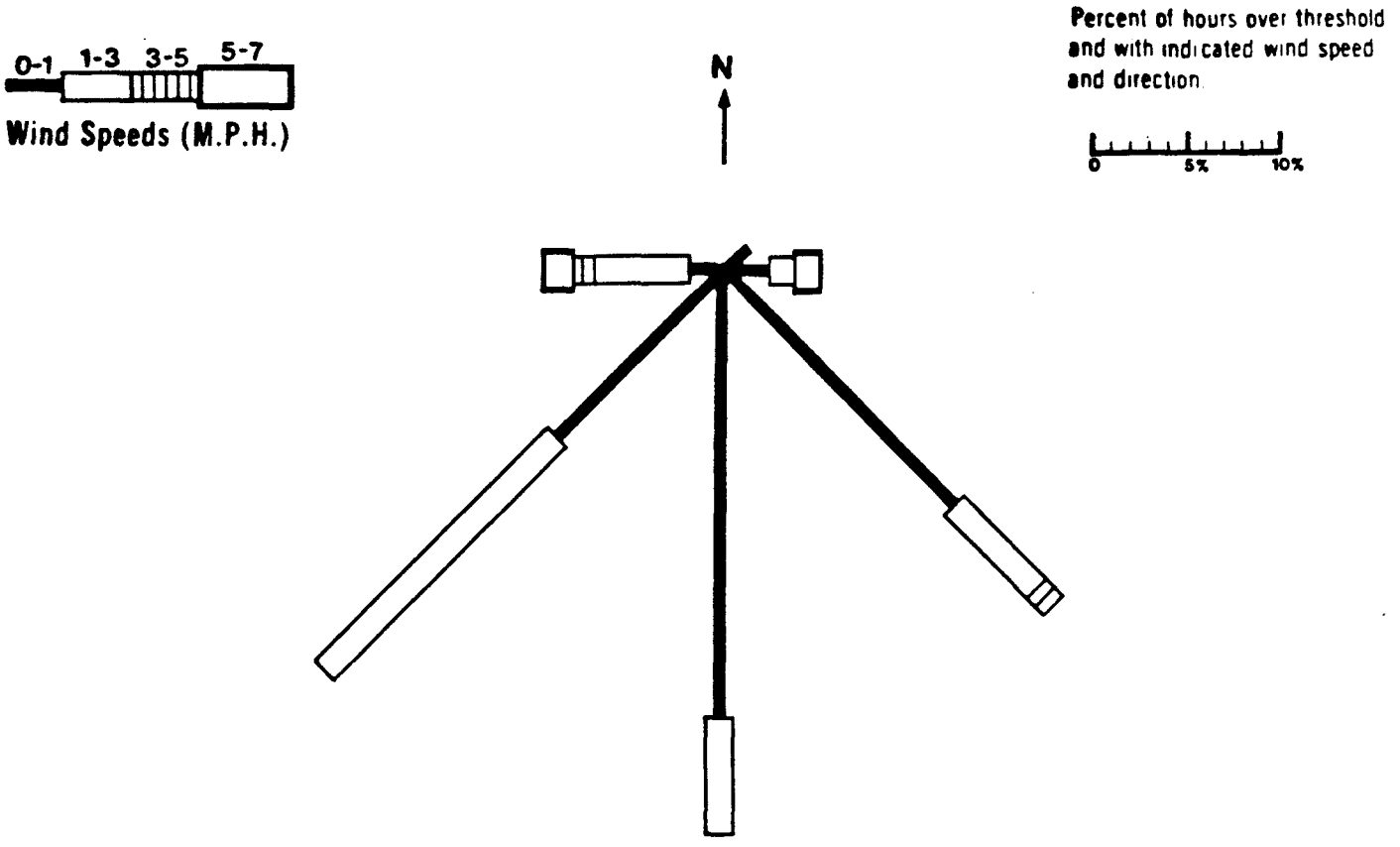
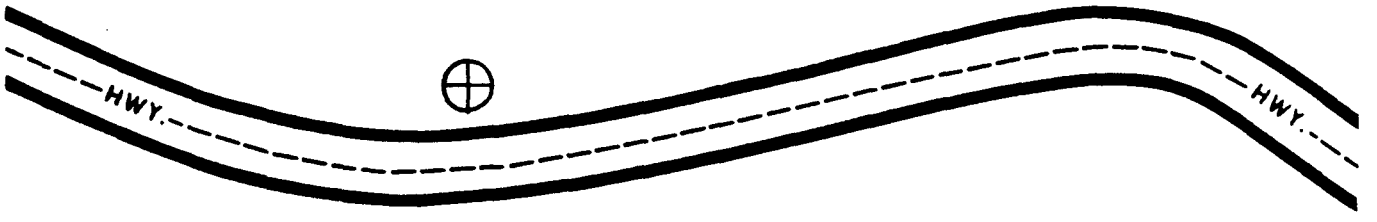


Figure 1(b). Monitor Location for the Rose of Figure 1(a).



IV. TOTAL SUSPENDED PARTICULATES (TSP)

The TSP monitoring network in Missouri includes numerous monitors in Kansas City, St. Louis, Springfield, and St. Joseph, plus monitors in several of the smaller cities throughout the State. This review will focus first on the smaller cities in the out-state areas, where the monitor symbols on the State map are uncrowded. The focus will then shift to the inset maps, where information for the larger cities is presented. The review is based on the data shown in Table A1 of Appendix A. The State has noted that on April 4, 1981, high TSP concentrations were monitored over a wide area of eastern Missouri, and has correlated those observations with a wide-spread dust storm. Those concentrations are included in Table A1, since EPA does not have a policy of deleting such data points. We acknowledge, however, that for several stations in the table, one of the 1981 exceedances is attributed by the State to that dust storm.

With two exceptions, data from neighborhood scale or regional scale monitors in the out-state areas show no violation of the particulate standards during 1981 or 1982. Herculaneum showed two exceedances of the secondary standard in 1981. One of those exceedances is attributed by the State to the dust storm. New Madrid showed three exceedances of the secondary standard in 1981. Neither site showed any exceedances in 1982.

Data from two middle scale monitors show violation of the secondary standard. The monitor in Hannibal shows three exceedences of that standard in each year, 1981 and 1982. One monitor in Mexico shows two exceedances of the secondary standard in 1982 only.

Trend evaluation data from the out-state areas shows no monitors with increasing concentrations. Most monitors show decreasing trends, an encouraging observation.

The following comments highlight the detailed analyses presented on the inset maps. The abbreviations PNA and SNA are used for "primary non-attainment area" and "secondary non-attainment area," respectively, based on current designations.

Kansas City - The current designations of non-attainment areas in Kansas City show a PNA in the central part of the city, and a larger SNA encompassing most of the city. Monitoring data throughout the city show no violation of the primary standards at any of the monitors in the city during 1981 and 1982. Two monitors show violation of the secondary standard in 1981. The monitor at the downtown airport shows three exceedances of the secondary standard, and the one on North Brighton Road shows two exceedances. The trend evaluation shows decreasing concentrations at nearly all monitors in the area. Recommendations have been made by the Environmental Services Division for removing the PNA designation and for reducing the size of the SNA.

St. Joseph - Current designations of non-attainment areas in St. Joseph show a PNA surrounded by a larger SNA. Monitoring data for 1981 and 1982 are in basic agreement with those designations. Data from one monitoring

site in the PNA show confirmed violations of the 24-hour secondary standard in 1982 and an apparent violation of the annual primary standard in that same year. That site was established in mid-year, however, so the geometric mean is based on the partial year of data which could be collected (22 observations). The site in the eastern part of the SNA shows violation of the secondary standard in 1981. Data from the two northernmost sites show no recorded violations of the standards in either year. Of those two sites, only the one at 8th and Edmond met the data completeness criteria in both years. Based on that site, some reduction in the size of the non-attainment areas could be considered. While only one monitor shows sufficient historical data for trend analysis, that site does show decreasing concentrations. Data from the other monitors in the area were less than 50 percent complete during 1982. High priority should be given to ensuring data completeness.

Springfield - Data throughout the Springfield area show no violations of the standards in 1981 or 1982. Trend evaluation data generally show no trend or decreasing trend. Therefore, the current designation of the entire area as attainment is consistent with the recent data.

St. Louis - Because of the large number of closely-spaced symbols on parts of the St. Louis area map, three insets are provided, each showing a progressively smaller area. Current designations show a PNA consisting of a strip approximately two miles wide along the Mississippi River, and an SNA including the remainder of St. Louis city. Significantly larger non-attainment areas have been designated across the state line by the State of Illinois.

Data from most monitors within the city limits show violation of the annual primary standard in 1981, but no exceedances of either standard in 1982. Trend evaluations show statistically significant improvements in air quality over the period 1978-1982 at most of the current monitoring sites in the city. Four monitors were discontinued in 1981 (Shreve at I-70, River des Peres, Water Department and 322 Catalan). These monitors had shown high concentrations in 1981, but did not meet all of the monitor siting criteria specified in the regulations for neighborhood scale sites. Monitoring is conducted at other sites in the vicinity of 322 Catlan. The absence of monitoring data from the other three areas leaves uncertainty in the assessment of current air quality in those areas.

Since two years of data free of violations of the standards are generally required to redesignate an area from non-attainment to attainment, redesignation of most of the PNA is not recommended at this time. Since data from the designated SNA showed violation of the primary standard in 1981 and prior years, consideration should be given to redesignating parts of that area to a PNA if those concentrations recur. Data from St. Louis County (outside the designated SNA) showed marginal violations (two exceedances) of the secondary standard at each of several sites in one of the two years covered by this evaluation. Those violations occurred in 1981 at the Bellefontaine Neighbors, Ferguson and Berkeley sites, and in 1982 at the 305 Weidman site. Therefore, expansion of the designated SNA may also need to be considered. The size of both the PNA and the SNA should be re-evaluated when the 1983 data are available.

In order to provide a broader perspective of air quality in the St. Louis area, a brief summary of the Illinois data is provided for the three border counties in the metropolitan area. Those data show violations of the annual primary standard in both 1981 and 1982 in East St. Louis and at most sites in Granite City. Data elsewhere in the area showed no violations of primary or secondary standards in 1982, though the Alton and Wood River sites recorded violations in 1981. Trend information became available after the maps were prepared. Only one site (2301 East 23rd in Granite City) showed an increasing trend. All others showed decreasing trends or probable decreasing trends.

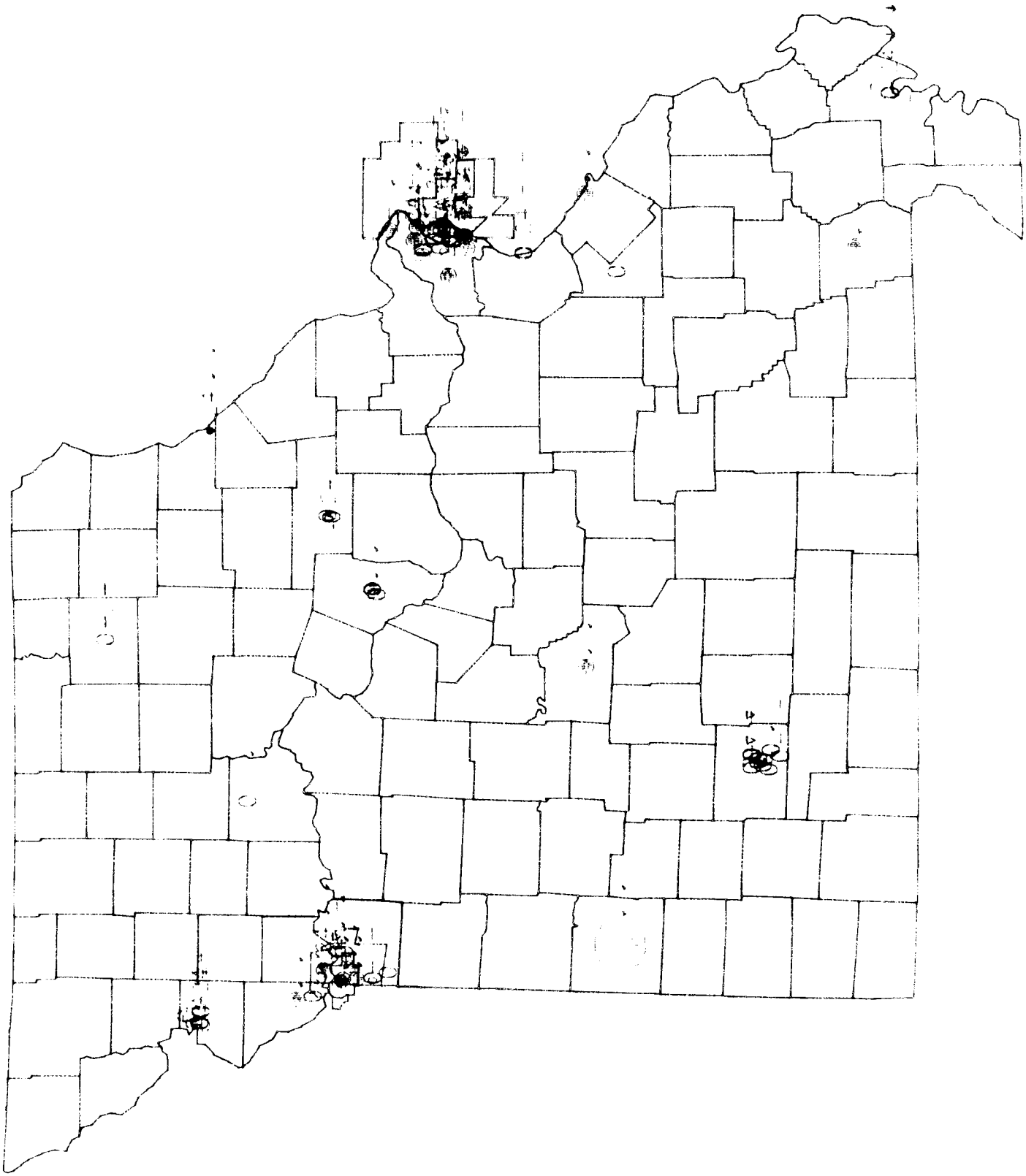
TSP Synopsis and Recommendations

The recent TSP monitoring data show improvements in air quality in some parts of the state. Redesignation of areas from non-attainment to attainment is recommended in those cases. Data from St. Louis provide an incomplete picture of air quality. While no violations of the standards were observed in 1982, monitoring was not performed in some areas where violations were possible. Recommended changes in attainment status designations are summarized in Table 3. In each case, we recommend that the decision be based on the ambient monitoring data, plus all supplemental information available. The state has recently requested redesignations in Kansas City, St. Joseph and St. Louis. Those requests are under review by the Air Branch of EPA Region VII.

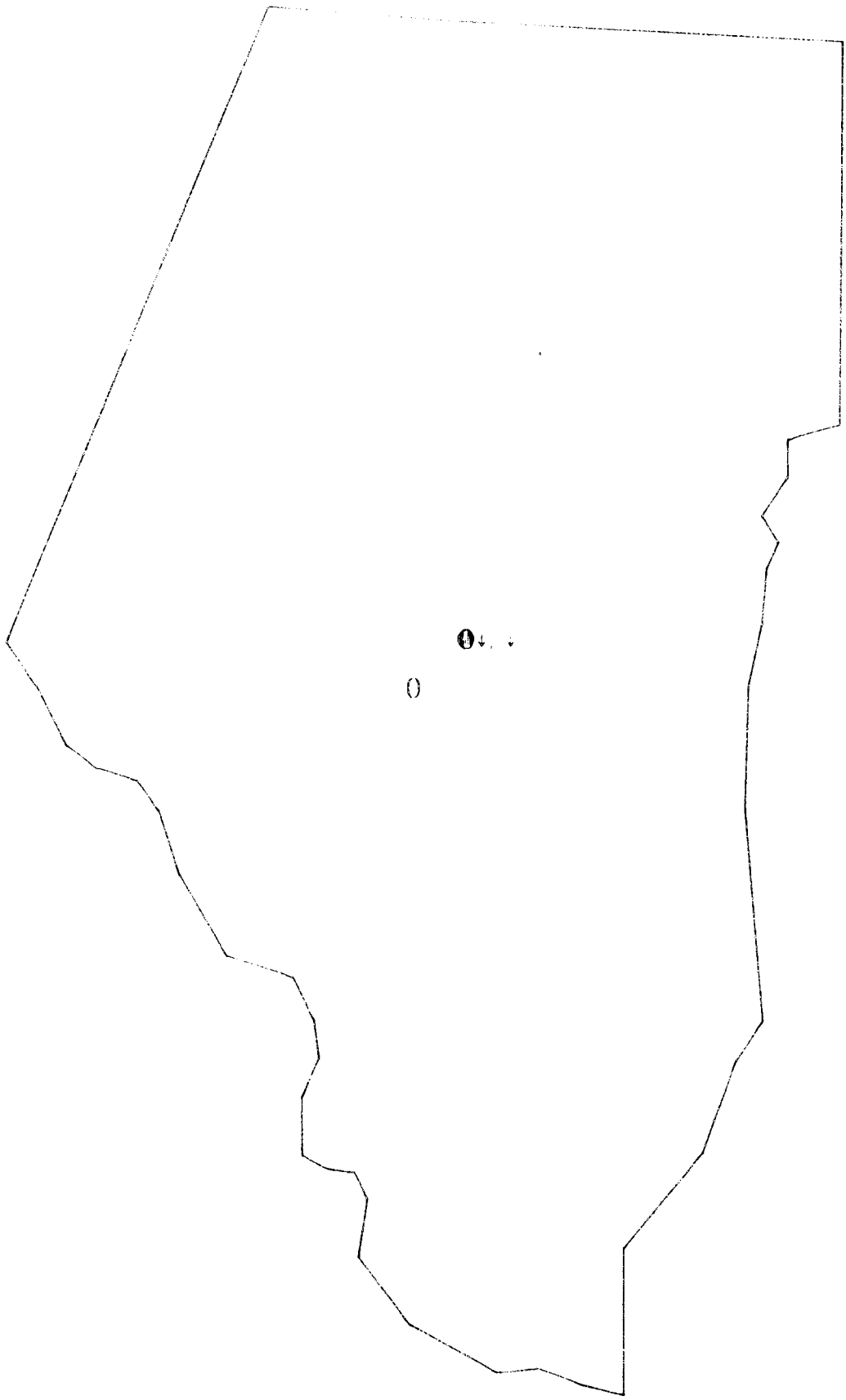
TABLE 3

Summary of TSP Recommendations

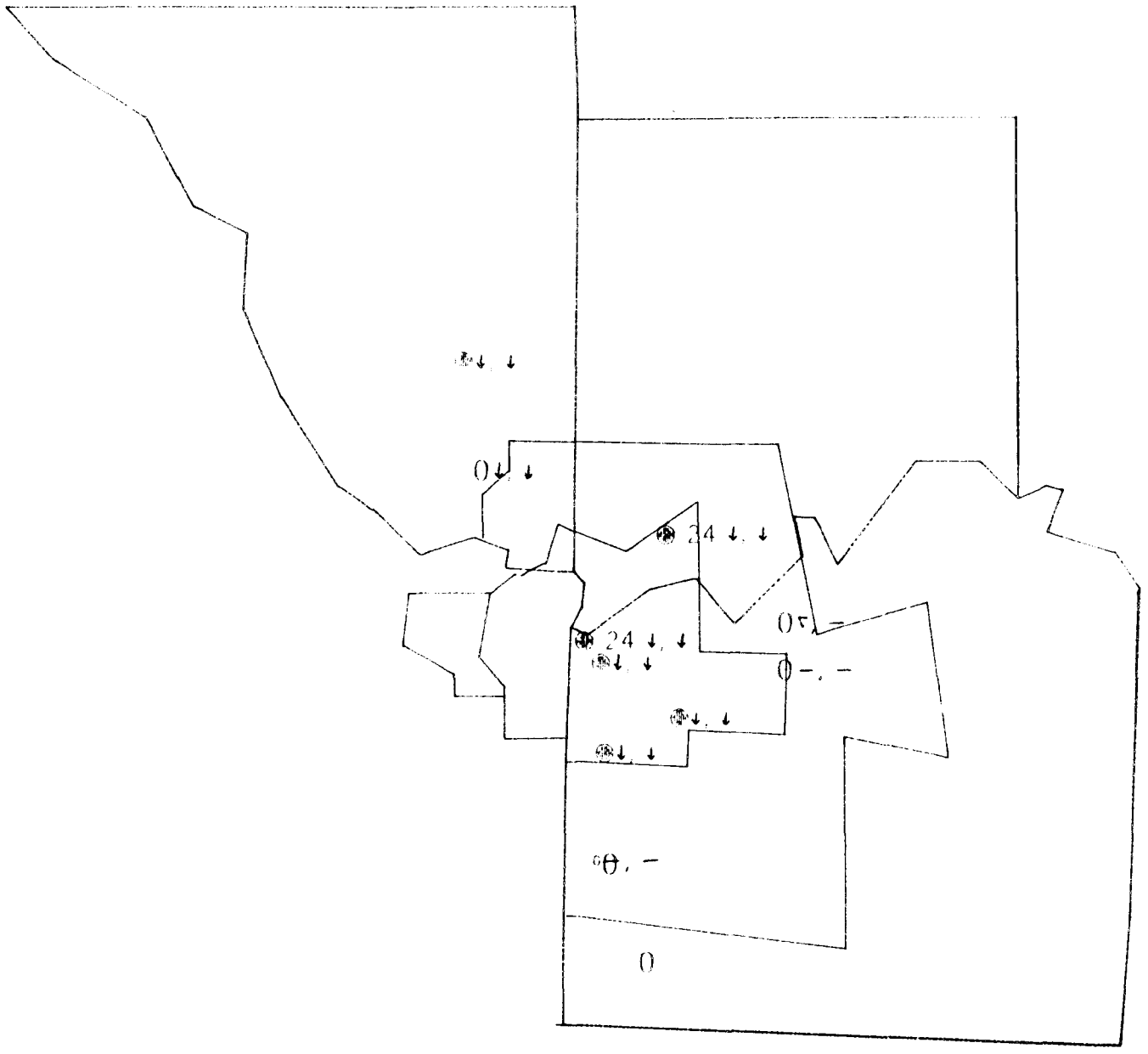
Kansas City	Remove the primary non-attainment designation. Reduce the size of the secondary non-attainment area.
St. Joseph	Continue efforts to ensure the completeness of data collection. Consider reducing the size of the non-attainment areas.
St. Louis Area	Add monitors which meet siting criteria in three areas which have previously shown violations. Re-evaluate the size of the designated primary and secondary non-attainment areas when the 1983 data are available.



AMBIENT TSP DATA

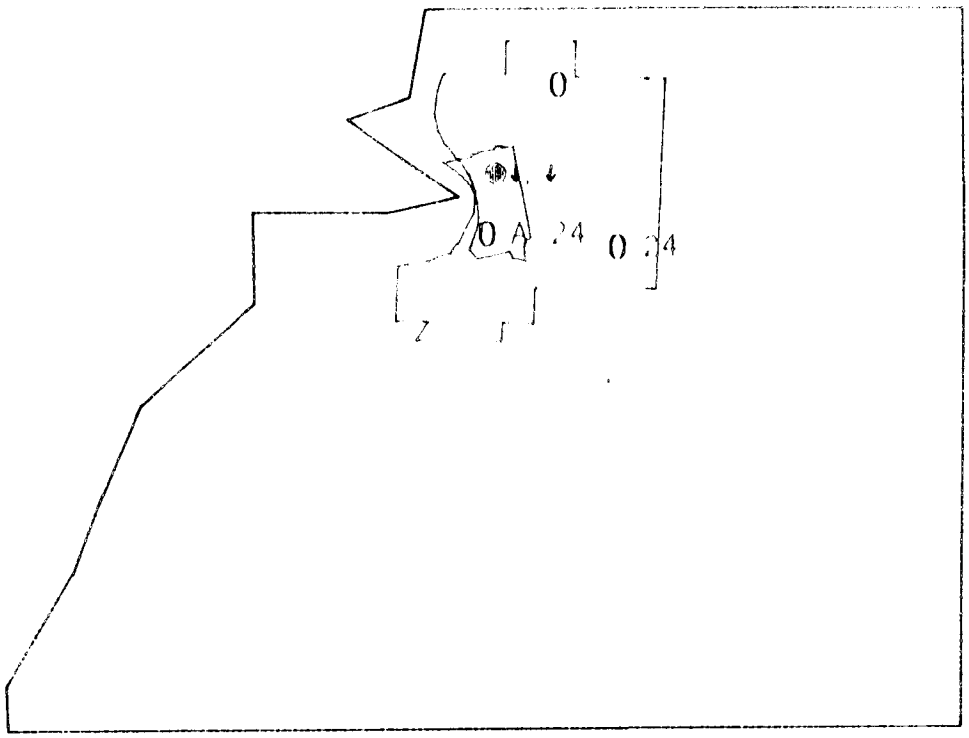


AMBIENT TSP DATA – COLUMBIA AREA

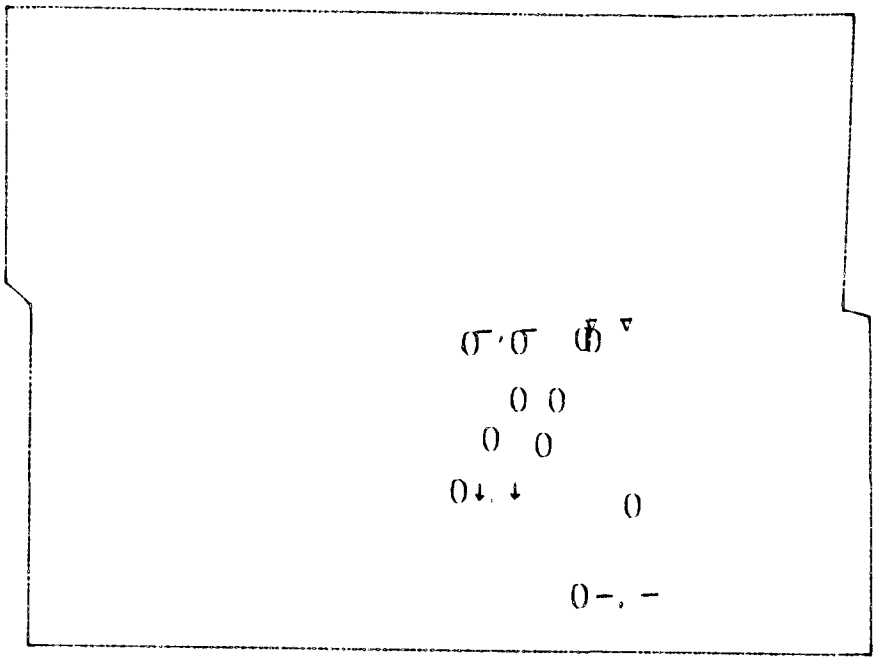


AMBIENT TSP DATA – KANSAS CITY AREA

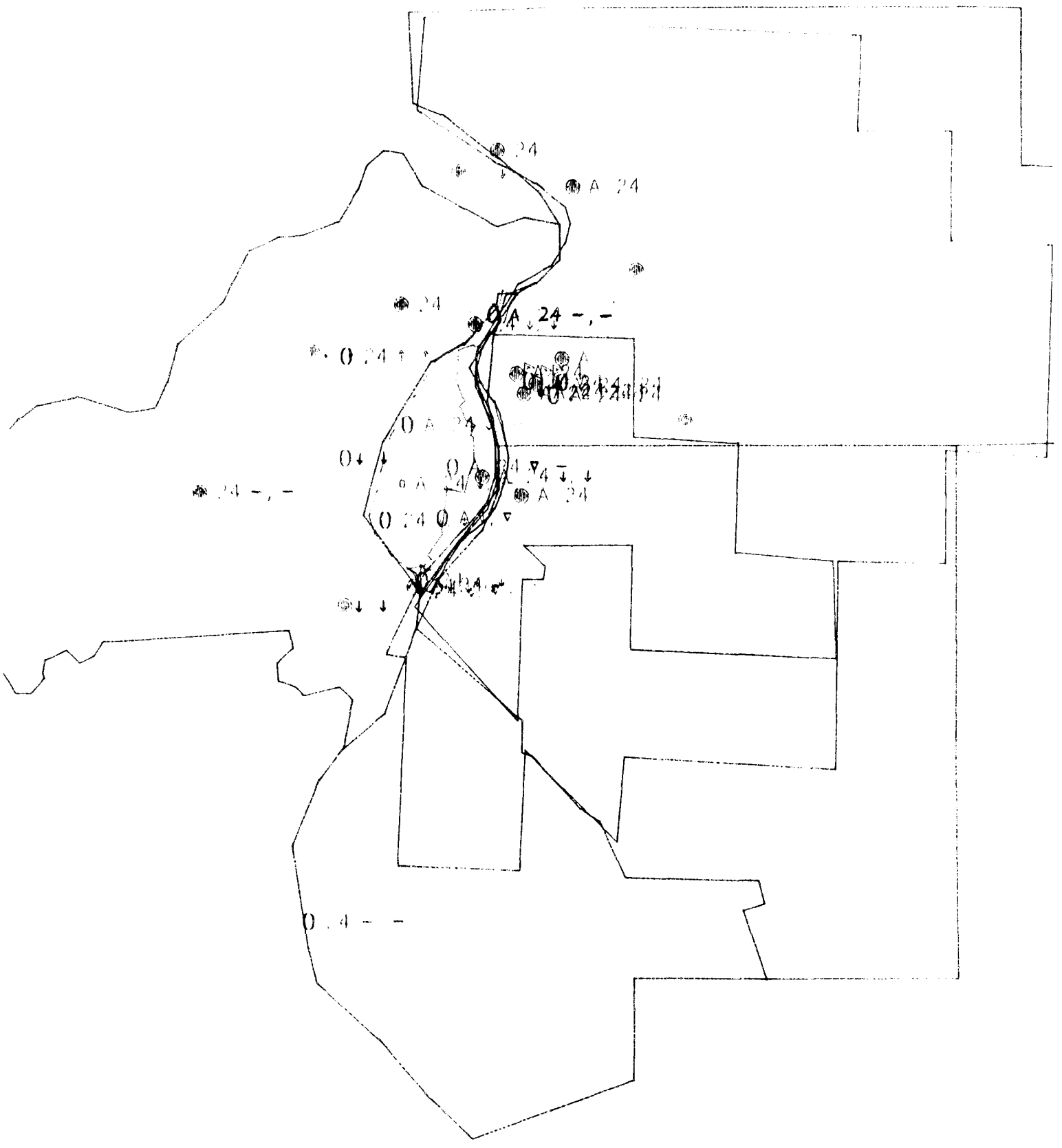
AMBIENT TSP DATA – MEXICO AREA



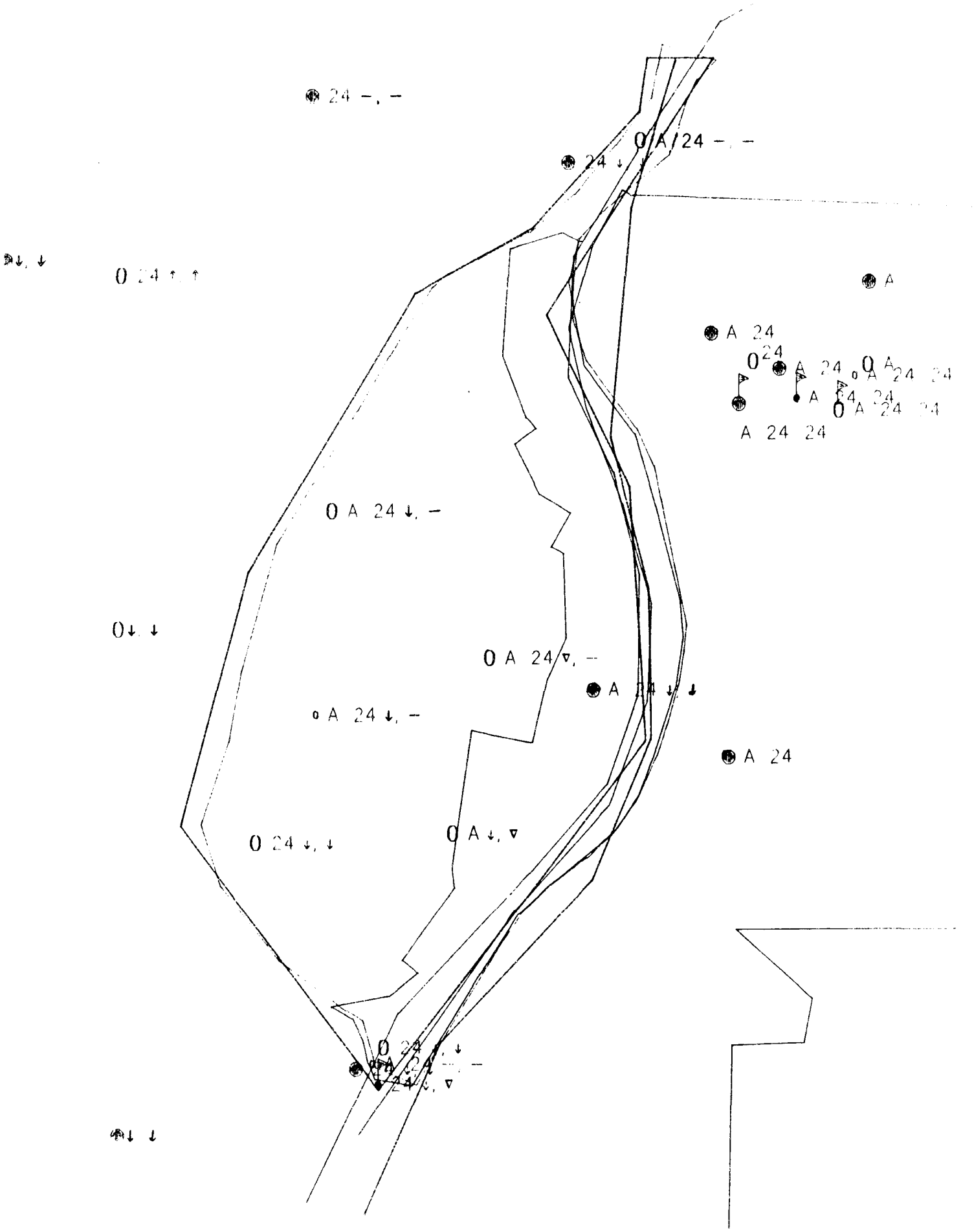
AMBIENT TSP DATA - ST.JOSEPH AREA



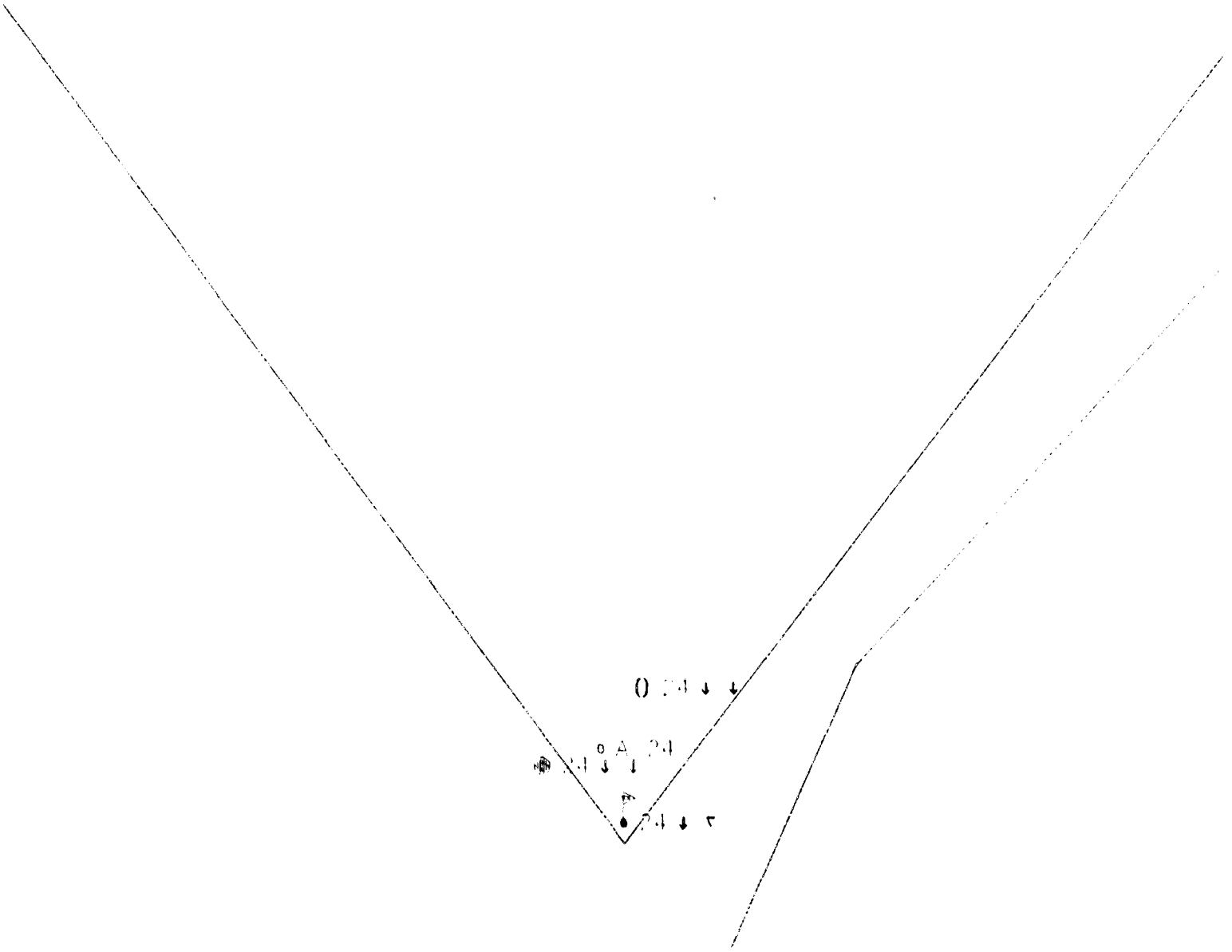
AMBIENT TSP DATA - SPRINGFIELD AREA



AMBIENT TSP DATA – ST.LOUIS AREA



AMBIENT TSP_{24} DATA – ST.LOUIS AREA



ARCHIVED TSP DATA
ST LOUIS AREA

V. SULFUR DIOXIDE (SO_2)

Monitoring for sulfur dioxide is conducted in Kansas City, St. Louis, Springfield, Bixby, and New Madrid. No areas of the State have been designated as non-attainment for SO_2. Monitoring data from the Kansas City area show violation of the 24-hour primary standard at one site (Sugar Creek) in 1981, but no violations in 1982. Furthermore, the violations were attributed to one large industrial source, which has since ceased operation. Data from Springfield showed no violations of the standard. The annual average concentrations observed in that area run less than one-half the standard. Data from Bixby show one exceedance each of the 24-hour primary standard and the three-hour secondary standard in 1982. While that does not constitute a violation of the standard, it does indicate a situation which bears observation in future years. Data from New Madrid show no violation of the standards, based on the very limited data available in SAROAD. The annual average based on those limited data was approximately three-fourths of the standard. The State has recently supplied a more extensive summary of data from that site, showing a mean concentration of .010 ppm (one-third of the standard). That average was based on 91% complete data since the time of monitor installation.

No data were submitted to SAROAD for any continuous monitors (SO_2, CO, NO_2 or O_3) in St. Louis City during 1981 and most of 1982. During that time period, a number of problems were experienced with operation, calibration and quality control procedures for all of the continuous monitors. Through special efforts of State and local agency personnel, including extensive planning and guidance from Jim Beers of the MDNR, operation of continuous monitors has been restored and appropriate quality control procedures have been implemented. Although the lack of data during those two years leaves large gaps in the picture of recent air quality in the area, the outlook for collection of reliable data in the future has brightened considerably.

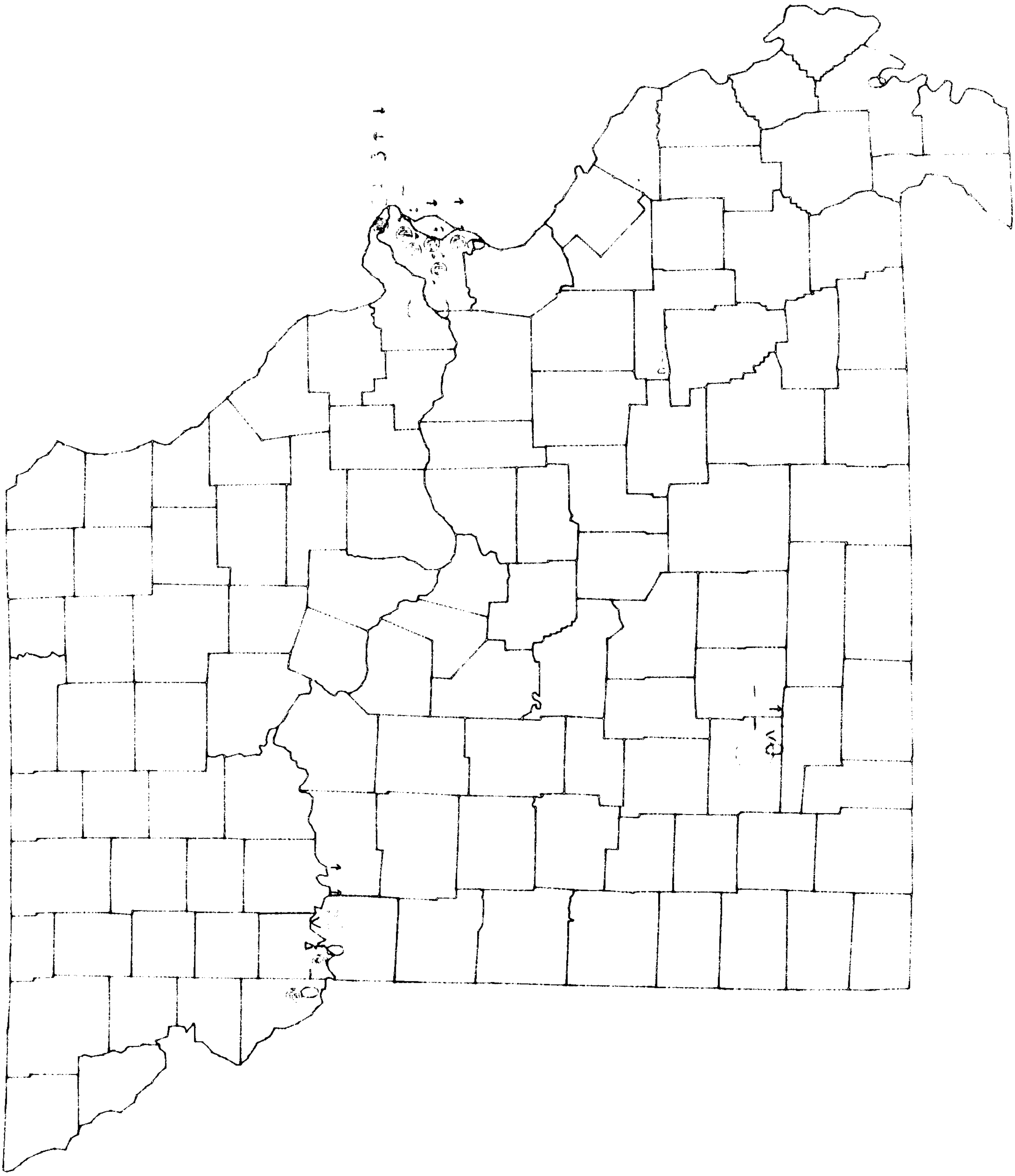
Data from other parts of the St. Louis area show no violation of the standards in St. Louis County. However, the monitor at West Alton in St. Charles County recorded six exceedances of the 24-hour primary standard and 13 exceedances of the three-hour secondary standard in 1982. Data from previous years had shown no violation of the standard at that site. A study of SO_2 concentrations and concurrent wind directions was conducted by Richard Tripp of the Environmental Services Division, EPA, Region VII. That study showed that the high concentrations occurred only with winds from the east, and concluded that the probable cause was industrial emissions near Wood River. The State of Missouri analyzed the high concentrations, including wind data, patterns of vegetation damage, and stack heights and magnitudes of point source emissions in their analysis. They identified emissions from the Alton Box Board plant as the most probable cause of the high concentrations.

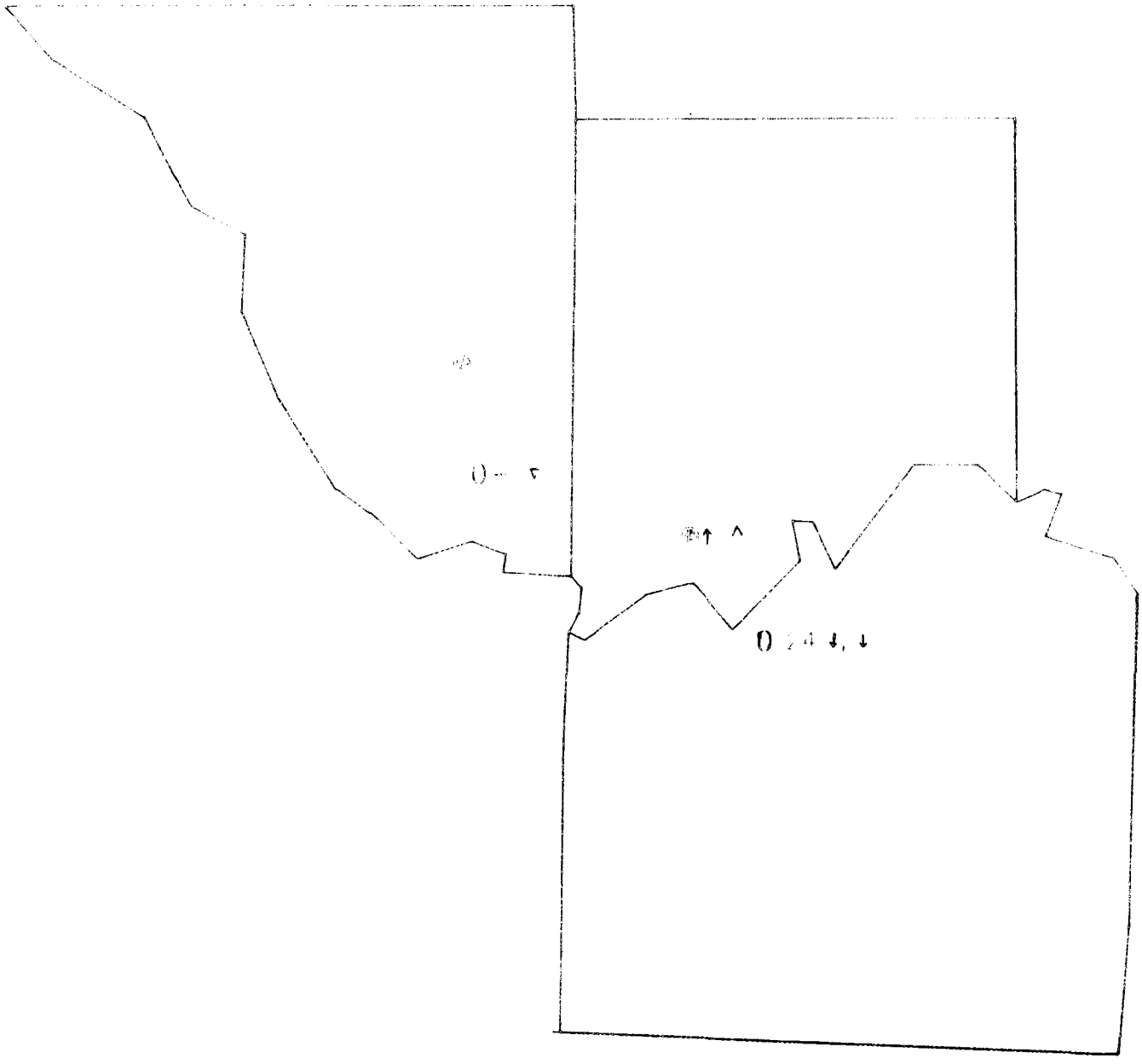
Trend analysis data are fascinating at the West Alton site because they seem contradictory at first glance. As mentioned in section III.C, two trend calculations were performed for SO_2. The first was based on monthly

average concentrations, and shows an increasing trend during the period 1978 through 1982. The second calculation was based on 90th percentile concentrations measured during each month. That calculation shows a decreasing trend in high concentration values normally observed during that time. The composite picture presented by the two trend evaluations is one of increasing average concentrations, with less variation in concentrations (less extreme fluctuations).

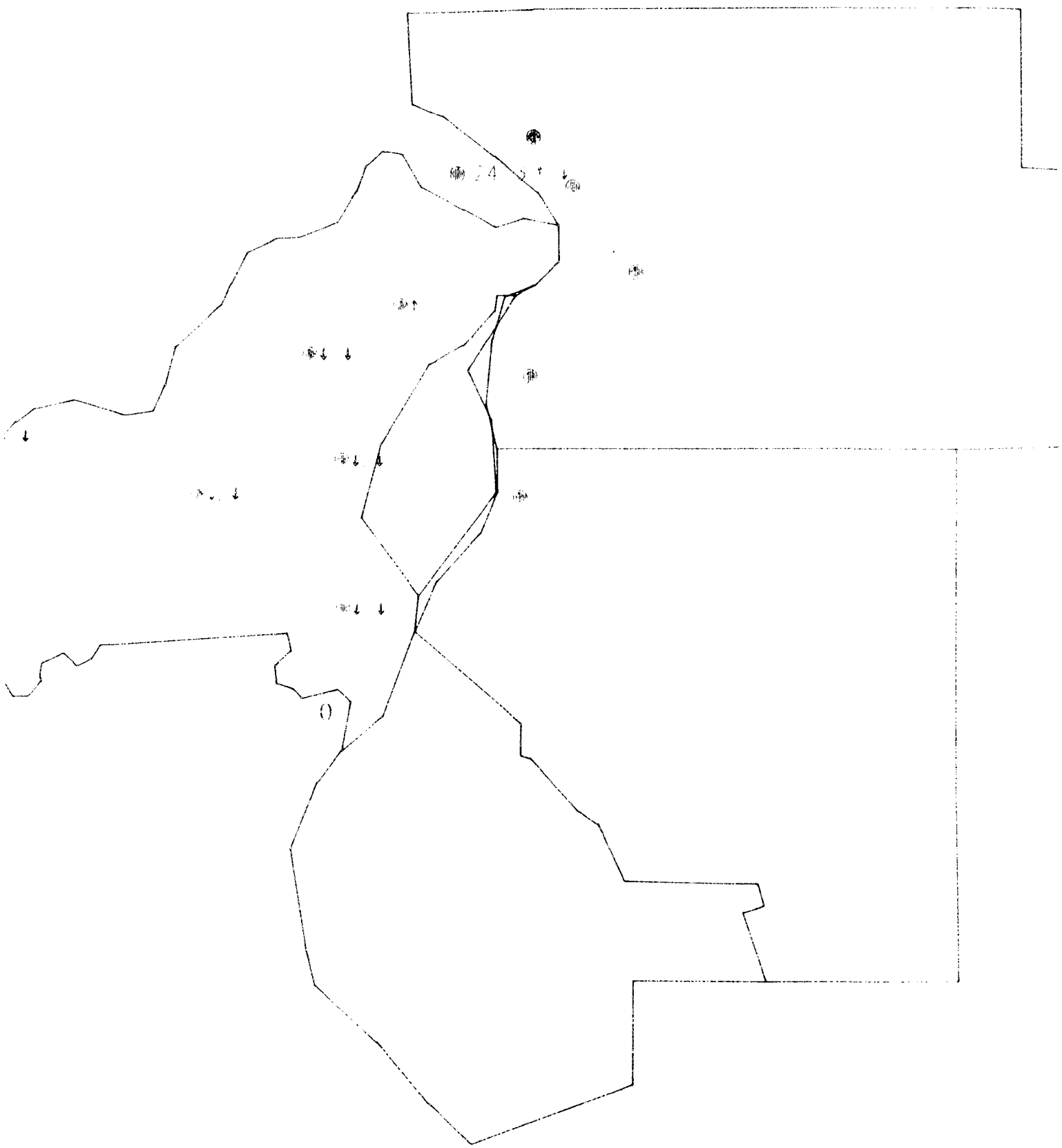
Trend data from the other monitoring sites in the St. Louis area show an increasing trend in the average concentrations at the Ferguson site (located south-southwest of the West Alton site), and decreasing trends in both average and 90th percentile concentrations at the other monitoring sites.

Data from nearby Illinois sites show no violations of the standards in 1981 or 1982. Those sites show decreasing trends, with one exception. The Cahokia site shows no statistically significant trend. Since the East St. Louis site recorded concentrations near the standard in 1981, that area bears continued observation in future years.





AMBIENT SO2 DATA – KANSAS CITY AREA



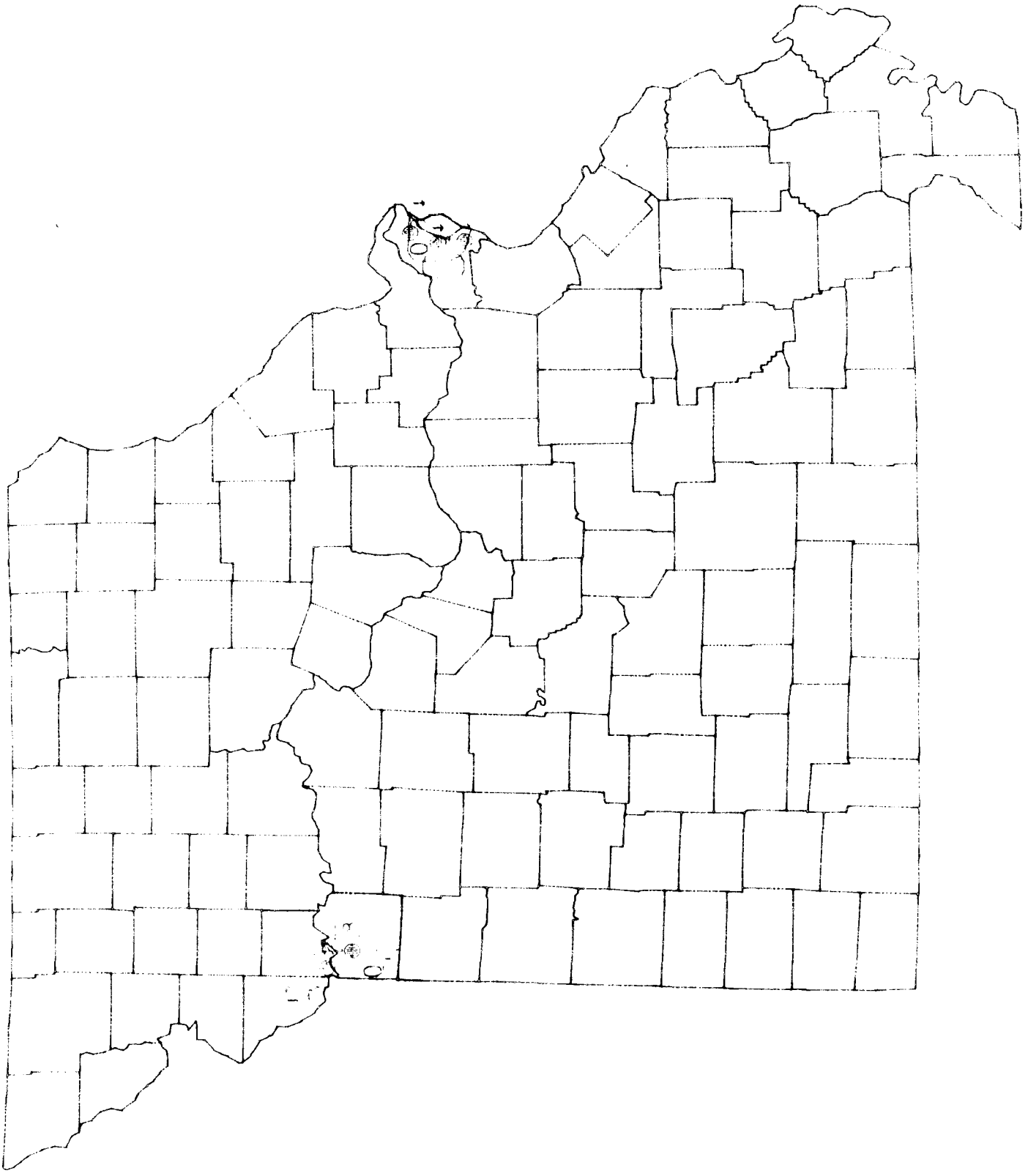
AMBIENT SO2 DATA – ST.LOUIS AREA

VI. CARBON MONOXIDE (CO)

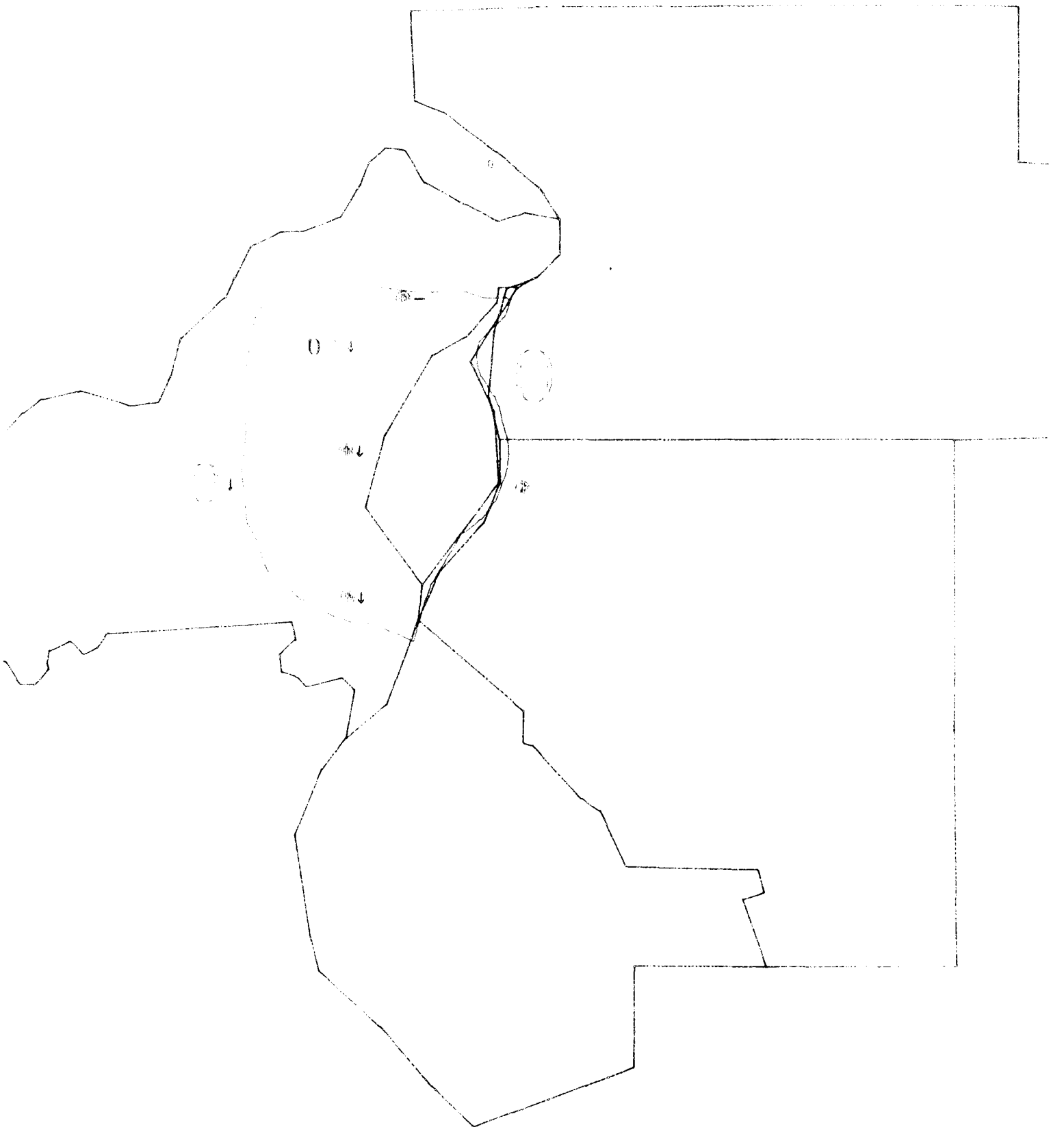
Carbon monoxide monitoring is conducted in the Kansas City and St. Louis areas only. Monitoring data from Kansas City show no violation of the standard at two monitors, (the Parvin Road and Bannister Road monitors) but several exceedances of the eight-hour primary standard each year at another monitor (Independence). That monitor showed one exceedance of the alert level in each year 1981 and 1982. The CO monitoring network in Kansas City does not, however, include any monitors in downtown Kansas City. Since the lack of that monitor leaves a major gap in the CO monitoring network for the area, its establishment should be given high priority. Audits performed during 1982 on the monitor in Independence showed the monitor to be operating satisfactorily at that time. In view of the high concentrations observed at that site, we recommend that the State give consideration to redesignating a portion of the Kansas City area to non-attainment for CO.

In the St. Louis area, a primary non-attainment area has been designated, bounded by Interstate 270 and the Mississippi River. Monitoring data in that area show no violation of the standards in St. Louis County, except at one monitor. That monitor (St. Ann) observed four exceedances of the eight-hour standard in 1981, but no exceedances in 1982. While the 1982 data from that monitor submitted to SAROAD were incomplete, the 1982 SLAMS report shows no violation of the standard, based on 93% complete data. All sites which had enough data for trend evaluation showed decreasing concentrations. Based on the monitoring data available, a reduction in the size of the non-attainment area within St. Louis County is recommended. As was noted in Section V, no data from CO monitoring in St. Louis City are present in SAROAD for 1981 and most of 1982. The current network description lists five sites where CO monitoring has been re-established.

Data from the three CO monitors on the Illinois side show no violations of the standards in 1981 or 1982. No statistically significant trends were observed at any of those three sites.



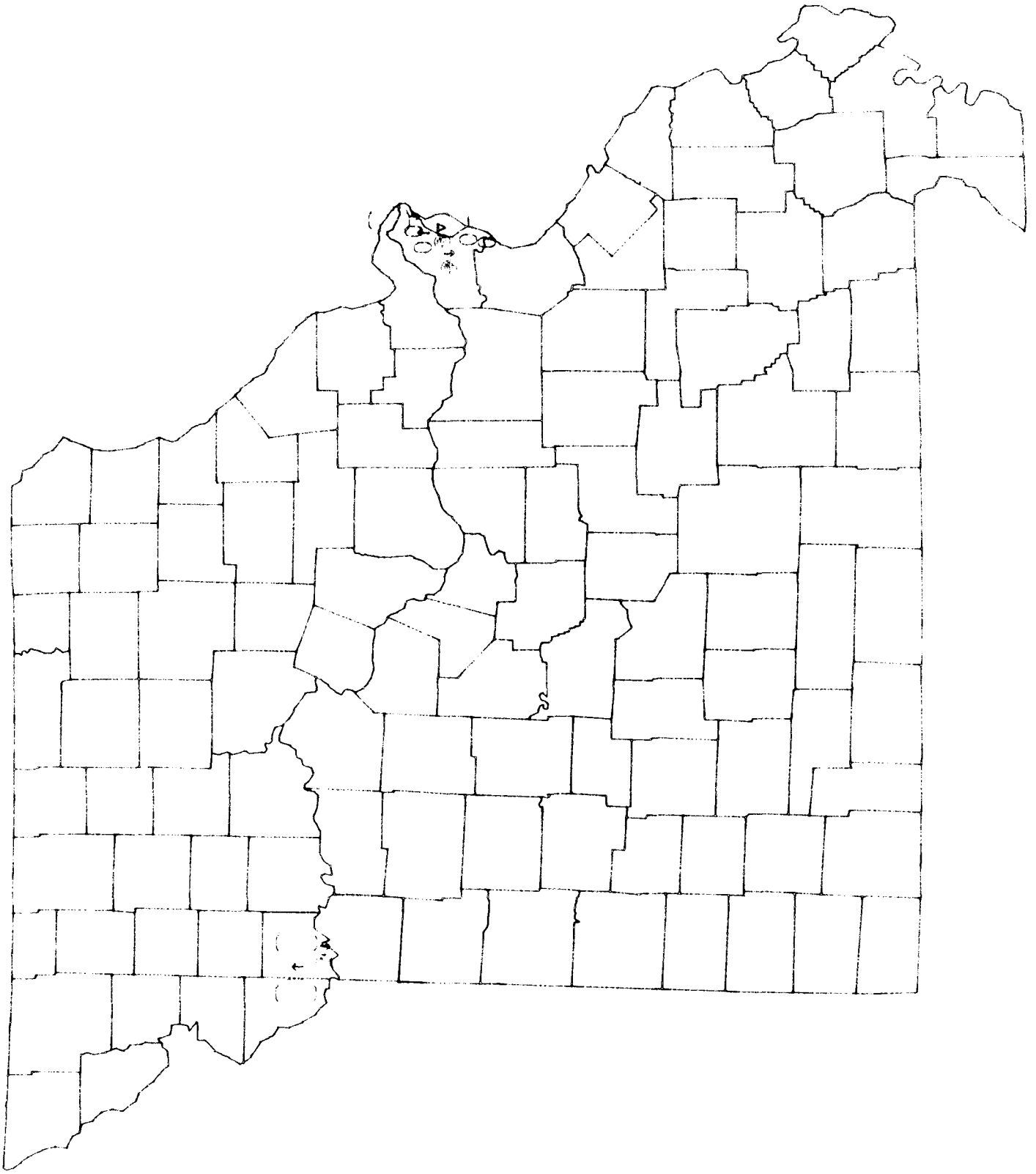
AMBIENT CO DATA - KANSAS CITY AREA



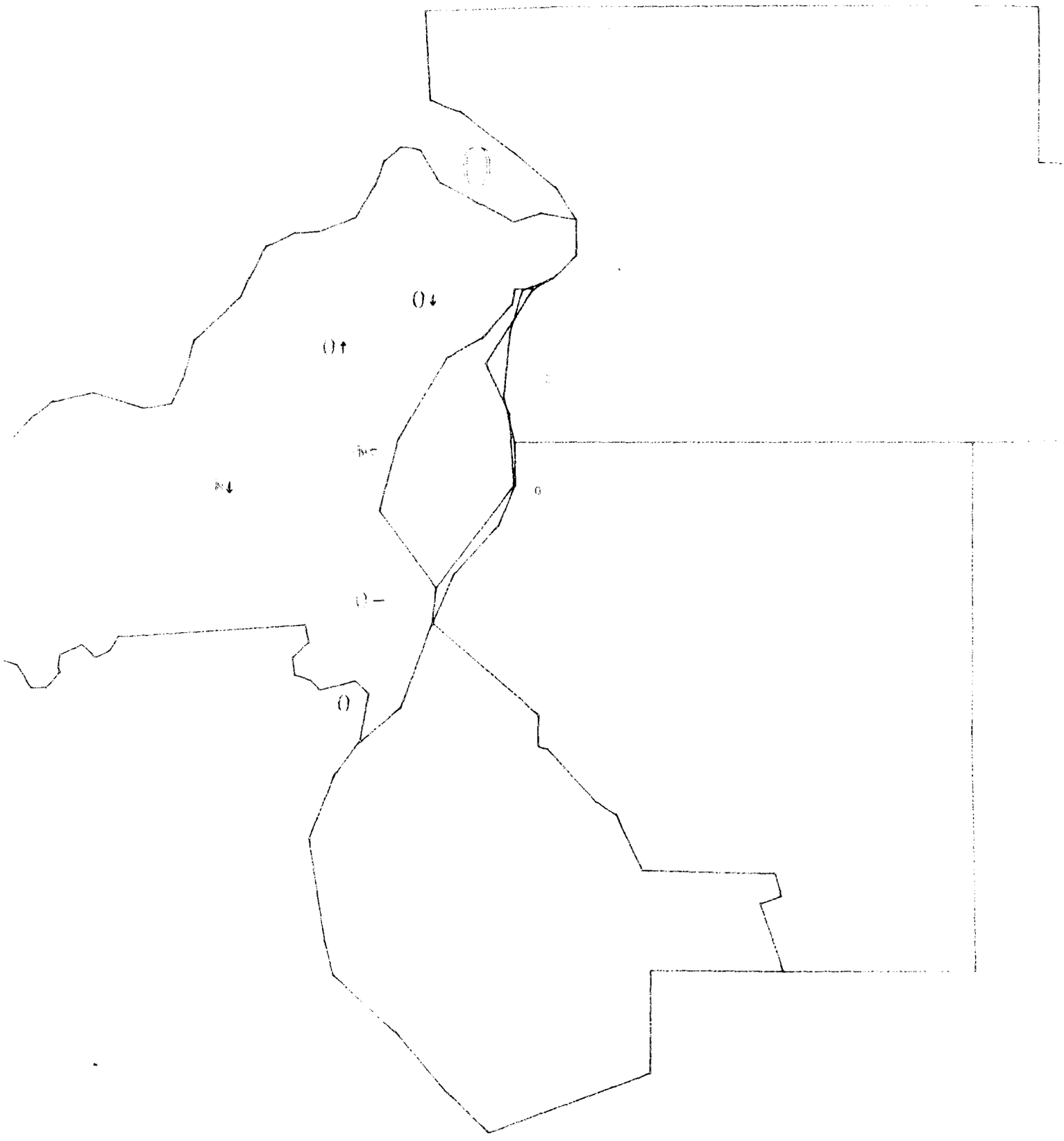
AMBIENT CO DATA – ST.LOUIS AREA

VII. NITROGEN DIOXIDE (NO_2)

Monitoring for nitrogen dioxide is conducted in the Kansas City and St. Louis areas only. The data show no violation of the standard at any of the sites. Trend evaluation data are mixed. Some sites show increasing trends, others decreasing trends. Average concentrations observed in the Kansas City area generally range below one-third of the standard. Concentations in the St. Louis area (Missouri and Illinois) generally range below one-half the standard. As noted in Section V, no NO_2 data from St. Louis City were reported for 1981 and most of 1982. The current network description indicates that NO_2 monitoring has been resumed at two sites in the City.



AMBIENT NO2 DATA -- KANSAS CITY AREA



AMBIENT NO2 DATA – ST.LOUIS AREA

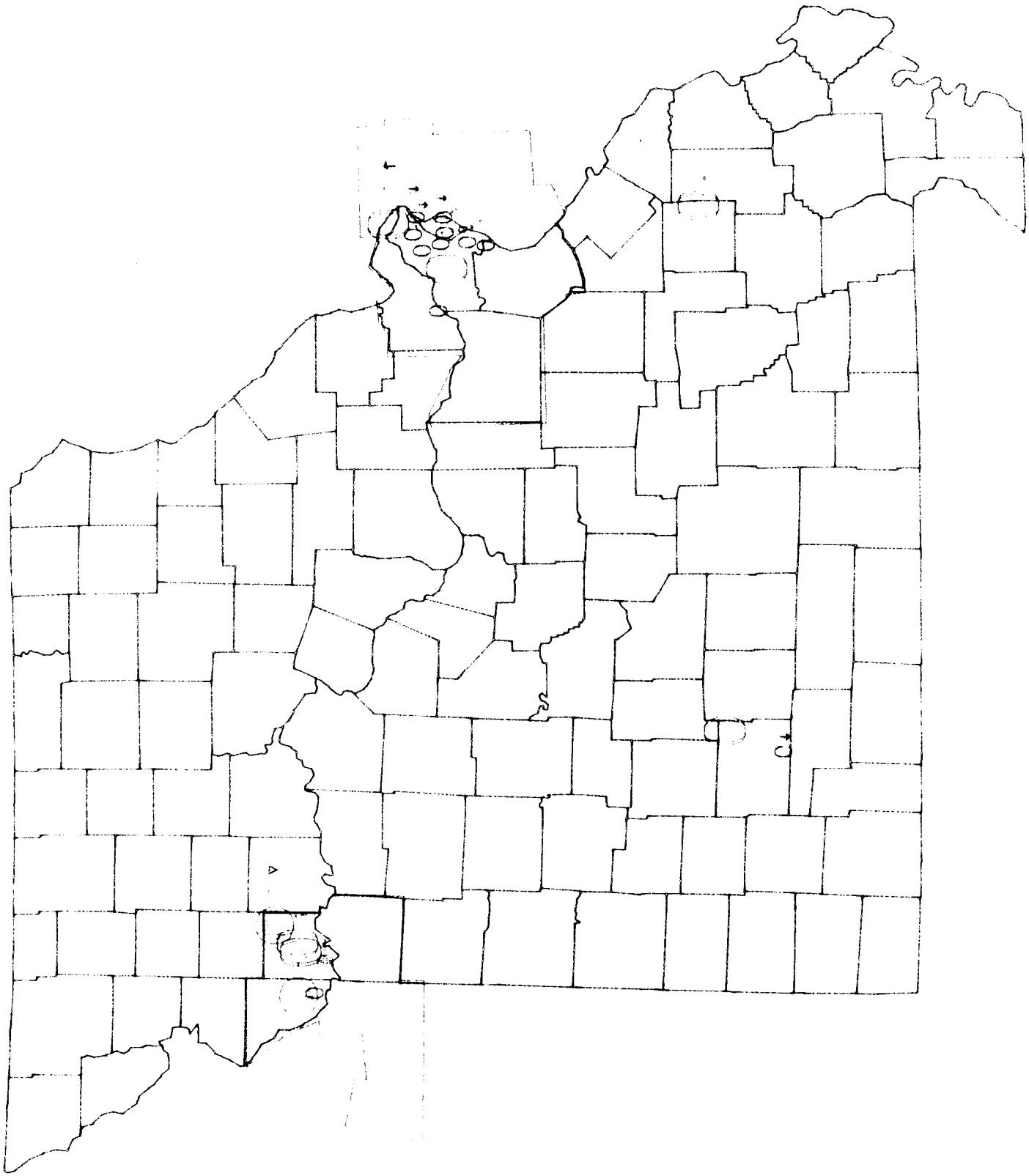
VIII. OZONE (O_3)

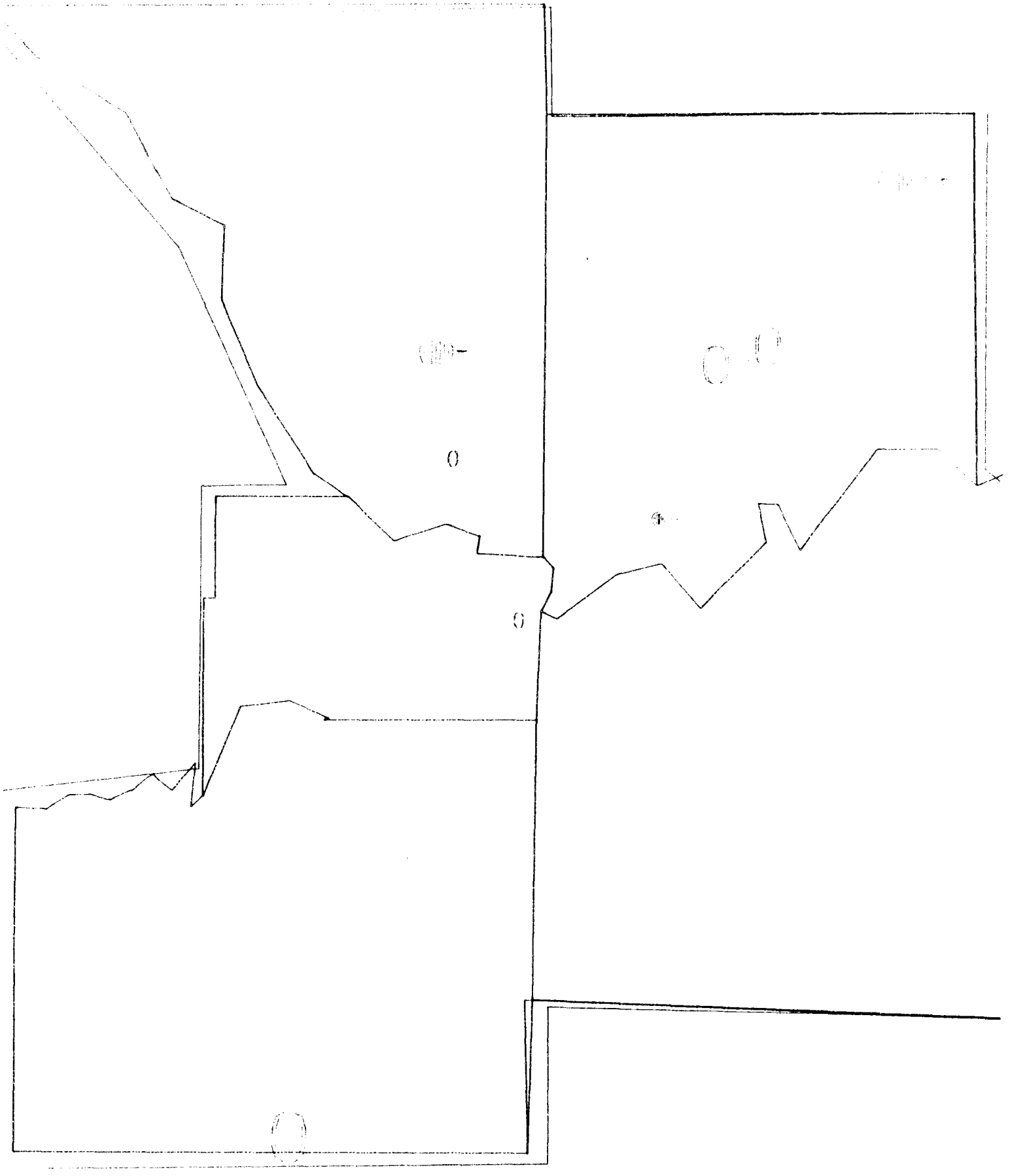
Ozone monitoring is conducted in the metropolitan areas of Kansas City, Springfield, and St. Louis. A background concentration site is operated in the Mark Twain national forest in southeast Missouri.

Ozone is formed by a complex photochemical reaction among non-methane hydrocarbons, oxides of nitrogen, and oxygen in the atmosphere. The reaction time is measured in hours. During that time, the wind usually carries the pollutants tens of miles from the locations where the precursors were emitted. Therefore, ozone concentrations measured at a point some 25 to 50 miles downwind of the city may indicate a need for emission reductions throughout the city. Consequently, the following ozone evaluations focus on entire metropolitan areas, rather than on limited areas around specific monitors. Furthermore, the inset maps for Kansas City and St. Louis include data from both sides of the state line, in order show that broader perspective.

Kansas City - Monitoring data from Kansas City show violation of the ozone standard at two monitors located downwind of the city, based on the prevailing summer wind direction. A closer look at the data in Table A1 of Appendix A show that those violations occurred in 1980. Data for 1981 and 1982 showed no more than one measured exceedance at each site each year. Based on the 1981-82 data, coupled with documented hydrocarbon emission reductions, redesignation of the Kansas City area to attainment has been requested by the State agencies of Kansas and Missouri. That request is under review by the Air Branch of EPA, Region VII.

St. Louis - Monitoring data from the St. Louis area show violation of the ozone standard in multiple years at several sites on both sides of the state line. Trend evaluation data at most sites show a decreasing trend. However, two sites (West Alton and East St. Louis) show increasing trends. The number of exceedances observed in recent years (less than ten per year at any one site) shows an improvement over prior years. However, the designation of the area as non-attainment for ozone is still currently appropriate. As was noted in Section V, no ozone data from St. Louis City were reported for 1981 and most of 1982. The current network description shows resumption of ozone monitoring at four sites in the City.



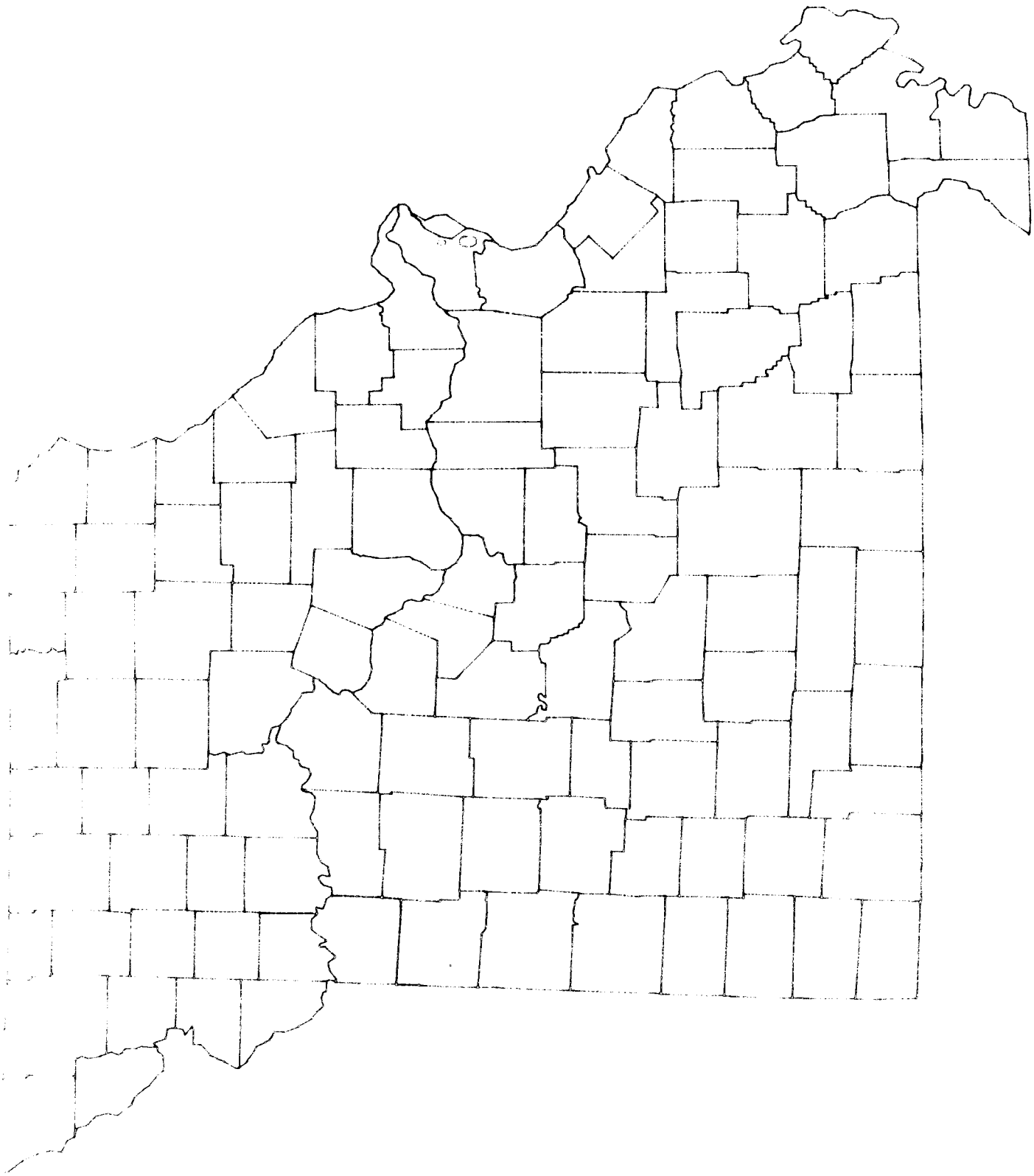


AMBIENT O3 DATA – KANSAS CITY AREA

42

IX. LEAD (PB)

The State map for lead shows monitoring data from two locations in St. Louis County. Those monitors were established in 1982, and recorded observations for approximately one-fourth of that year. The State ambient air monitoring network description lists the following additional monitors: two in the Kansas City area; two in the St. Louis area; and one each in Herculaneum, New Madrid, St. Joseph, and Columbia. No data were reported for 1982 from those monitors. Special purpose monitoring studies conducted in earlier years around the lead smelters in the State showed concentrations above the NAAQS in Herculaneum (St. Joe Lead) and in Iron County (AMAX). The operation of two long-term SLAMS lead monitors near each of the three smelters has been implemented by the State. In addition, monitoring is currently conducted by the smelters at several sites. We encourage the State to enter the data from all of those sites into SAROAD.



X. PRECISION AND ACCURACY

For continuous monitors (CO, SO_2, NO_2, and O_3), the regulations of 40 CFR Part 58, Appendix A require precision checks in order to assess precision for each pollutant, and audits in order to assess accuracy.

Precision checks are performed by introducing a gas of known concentration into the analyzer, and comparing the concentration reading from the monitor with the known concentration of the gas. These checks are required every two weeks, and involve one gas concentration. Audits likewise involve comparison of known gas concentrations with the analyzer readings. Audits are more extensive than precision checks, requiring at least three different concentrations of gases. Audit of each analyzer is required annually, and audit of at least 25% of the SLAMS analyzers for each pollutant is required each quarter.

For manual methods (TSP, Pb, SO_2 bubblers and NO_2 bubblers), the regulations require duplicate (collocated) sampling to assess precision and audits to assess accuracy.

Each collocated sampler is operated at the same time and in the same manner as the SLAMS monitor at the same site. The percent difference between the two sample concentrations forms the basis for precision estimates. For lead, analysis of duplicate portions of a single Hi-vol filter may be substituted for collocated sampling. Audits for manual methods differ by method. For TSP, the audits are performed by comparing the flow rate indicated by the Hi-vol sampler to the true flow rate determined from a flow standard. The audit frequency required for Hi-vol samplers is the same as that required for continuous monitors.

Audit procedures for SO_2 bubblers, NO_2 bubblers and Pb require that the analytical measurement process be audited. Details of those procedures are found in 40 CFR Part 58, Appendix A.

Use of specific equations is required for the calculation of precision and accuracy. Each organization which reports data is required to calculate and report precision and accuracy estimates for all NAMS data collected after January 1, 1981, and for all SLAMS data collected after January 1, 1983.

Table A2 of Appendix A summarizes the precision and accuracy estimates reported by the State during 1981 and 1982. The numbers under the heading "YR-Q" near the left of each printout specify the year and calendar quarter to which the precision and accuracy data apply. (For example, 82-2 refers to the second quarter of 1982.) Composite data for the entire year are identified as quarter number 5. (For example, 81-5 gives the estimates for the full calendar year 1981).

The accuracy estimates are arranged by concentration levels L1 (low concentration) through L4 (high concentration). Specific ranges for the concentration levels are required by 40 CFR 58, Appendix A, as follows:

	NO_2, O_3, SO_2 (ppm)	CO (ppm)	TSP (cfm)	Pb (ug/strip)
L1	.03 to .08	3 to 8	---	100-300
L2	.15 to .20	15 to 20	40-60	600-1000
L3	.40 to .45	40 to 45	---	---
L4	.80 to .90	80 to 90	---	---

The precision and accuracy estimates are expressed as 95% probability limits, as required by the same regulations. The meaning of those limits is illustrated by the following three examples taken from Table A2.

a. The precision data for CO in Kansas City show composite limits of -10 and +09 for calendar year 1981 (line 81-5), based on a total of 34 precision checks. Therefore, 95% of the precision checks would be expected to fall between 10% below and 9% above the known concentration of the test gas used for the precision checks.

b. The accuracy data for SO_2 as determined by the State agency show limits of -07 and +04 for the audits performed at concentration level 3 (column L3) during the third quarter of 1981 (line 81-3). Therefore, 95% of the audits performed at that time at that concentration level would be expected to fall between 7% below and 4% above the known concentration of the audit gas.

c. The precision data for TSP in St. Louis County show probability limits of -08 and +14 for the third quarter of 1981 (line 81-3), based on 25 valid collocated data pairs. Therefore, 95% of the concentrations measured by the collocated sampler would be expected to fall between 8% lower and 14% higher than the corresponding concentrations measured at the same time by the SLAMS monitor at the same site.

The following observations are drawn from Table A2.

Multiple Agencies - In the precision data reports for all of the reporting organizations, the number of valid collocated data pairs is listed as zero for 1982. That is likely an error in interpreting the information requested, rather than an error in the procedure for performing control checks. The number of valid collocated dated pairs reported in 1981 generally ran about half of the number expected for complete operation of both collocated and SLAMS samplers. No precision and accuracy data were reported for lead during 1982 for any of the agencies in the State, except St. Louis County. Precision and accuracy assessment was required for the lead NAMS monitors, beginning July 1, 1982. The required reporting would cover the third and fourth quarters of 1982 only. While the St. Louis County data have been

supplied by the State, temporary delays have prevented their listing in the standard SAROAD Precision-Accuracy Report (Table A2 of Appendix A). Those delays are being resolved now.

State Agency - The number of TSP audits performed by the State agency in 1981 and 1982 met the requirements of 40 CFR 58, Appendix A for auditing NAMS monitors. Beginning January 1, 1983, those regulations require an annual audit of each SLAMS monitor. That increased requirement likewise increases the number of audits which the State agency should perform. The precision and accuracy data for ozone reflect conscientious performance of the required precision checks and audits. The precision and accuracy data for SO_2, CO and NO_2 show that some audits and precision checks have been performed, and that the number of precision checks has increased each quarter. The number of audits for those three pollutants, and the number of precision checks for SO_2 and NO_2, met the requirements of the regulations for quality control checks for NAMS monitors. An increase in the number of precision checks for CO was needed to meet those requirements. Effective January 1, 1983, a further increase in the number of audits and precision checks is needed in order to meet the expanded requirements for SLAMS.

Kansas City - The number of audits for both TSP samplers and continuous monitors meets the required frequency specified in the regulations. The agency operates one NAMS continuous monitor for each of the pollutants SO_2, CO, ozone, and NO_2. The number of precision checks in 1981 and 1982 meets the required frequency for the NAMS monitors. An increase in the number of precision checks will be needed to meet the required frequency for SLAMS monitors, effective January 1, 1983.

St. Louis City - The number of audits for TSP reported in 1982 meet the required frequency for SLAMS monitors. No precision and accuracy data were reported for continuous monitors during 1981. Data for 1982, which have very recently been reported, reflect the establishment of the required quality control checks during the latter part of 1982.

St. Louis County - The number of audits for TSP met the required frequency for NAMS monitors. Effective January 1, 1983, an increase is needed to meet the more extensive requirements for audits on the SLAMS monitors. The precision and accuracy data for continuous monitors generally show conscientious efforts for implementing the data assessment requirements of the regulations, well in advance of the required due dates. Only modest increases in the number of audits and precision checks would be required to fully meet the requirement of the regulations after January 1, 1983.

Springfield - The total number of audits for TSP was sufficient to meet the minimum requirements for NAMS. However, audits were not reported for the third quarter of 1982. Those audits should be conducted each calendar quarter on 25% of the analyzers in the network. The precision and accuracy data for continuous monitors show an effort toward implementing the precision checks and audits in advance of the required deadline of January 1, 1983.

In summary, the precision and accuracy data generally reflect efforts by the State and local agencies toward meeting the data assessment requirements of 40 CFR 58, Appendix A. For most agencies, increases in the number of precision checks, collocated samples, and audits was needed effective January 1, 1983, in order to meet the expanded quality assurance requirements for SLAMS monitors.

XI. TRENDS

The results of trend analyses were presented graphically in the preceding sections for each monitor whose data met the required completeness criteria (described in Section III.C). The following table gives a summary of the trend evaluations, with the last column designed to highlight areas of concern.

Pollutant	Total Monitors	Monitors with Sufficient Data for Trend Analysis	Monitors with Decreasing or Probable Decreasing Trend	Monitors with Increasing or Probable Increasing Trend	Monitors with Violations and Increasing or Probable Increasing Trend
TSP	61	42	33	1	1
SO_2	16	13	10	4	1
CO	8	6	5	0	0
O_3	21	11	8	1	1
NO_2	10	7	4	2	0
Pb	2	0	0	0	0

The TSP site which showed violation of a standard and an increasing trend in geometric mean concentrations is located in Berkeley, and showed two exceedances of the secondary standard in 1981, but not in 1982. The SO_2 site at West Alton showed violations of the 24-hour primary standard and the three-hour secondary standard in 1982. Those SO_2 violations are attributed to impact from the Wood River Power Plant. As was noted in Section V, the increasing trend noted was for average concentrations. The trend in 90th percentile concentrations, however, was a decreasing trend. Therefore, the trend data at that site indicate higher average SO_2 concentrations, but with less variability in those concentrations. The O_3 site which showed violations of the primary standard and an incresing trend in 90th percentile concentrations was West Alton.

In summary, the trend analyses show more sites with improving trends than with worsening trends. Areas of immediate concern (identified by the combination of violations of a primary standard and increasing trends in concentrations) were limited to SO_2 and O_3 at the West Alton site.

XII. FURTHER EVALUATION OF SELECTED AREAS

The following subsections examine in greater detail two areas where pollutant concentrations exceeded the primary (health-related) standards at some time during the period 1981-82. For those areas, pollution roses are presented and evaluated, and brief historical backgrounds are given, in an attempt to understand the causes of the high concentrations which were observed. At the time the pollution rose preparation was begun, available meteorological data included 1980 and 1981, but not 1982. Therefore, the roses are based on air quality data and meteorological data for 1980 and 1981. Consequently, any significant new pollutant sources or any recent pollution abatements are not reflected in the roses. Because of the limitations discussed in Section III.H, the roses provide indications of possible causes, rather than concrete identifications of definite causes.

While other areas could have been selected, the areas around two monitors in the St. Louis area (322 Catalan and 10267 St. Charles Rock Road in St. Ann) were chosen for further evaluation. The studies of those two areas illustrate some of the capabilities and limitations of pollution roses for addressing specific areas of interest.

A. TSP in St. Louis

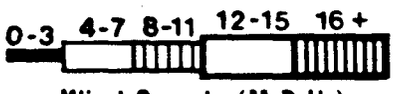
As did many other TSP sites in St. Louis City, the site at 322 Catalan demonstrated annual geometric mean concentrations in excess of the primary standard in 1981 and prior years. As was mentioned in Section IV above, the site was discontinued in 1981 because it did not meet the siting criteria prescribed in the regulations for a neighborhood scale site. Although the the data from the site are not used by the State for determining the current attainment or non-attainment status of the area, the data can be used in conjunction with wind speed and direction data to indicate possible sources of the localized high concentrations observed in the past at the site.

Figure 2 shows the pollution rose, based on wind speeds and directions observed at the airport on days when the TSP concentration at 322 Catalan exceeded 75 ug/m^3. (Only those days could contribute to an annual geometric mean above the standard.) That figure shows that concentrations above the selected threshhold were observed for all wind directions, but those concentrations occurred most frequently with winds from the south, south-southeast, north-northwest and west-northwest. The distance between the airport and the monitor introduces some uncertainty in the interpretation of the wind directions shown in the pollution rose, especially with low wind speeds.

A different kind of meteorological rose, a wind rose, is shown in Figure 3. Two essential differences distinguish the wind rose from the pollution rose shown in Figure 2.

- First, the wind rose includes all wind observations, regardless of the pollutant concentrations. The pollution rose includes only the wind observations recorded when the pollutant concentrations exceeded a specified threshold.

Figure 2. TSP in St. Louis



Wind Speeds (M.P.H.)

Percent of days with TSP over threshhold and with indicated wind speed and direction.

Met. Station: International Airport
Air Quality Site: 322 Catalan
TSP >75 $\mu g/m^3$
58 Observations
1980 and 1981 data

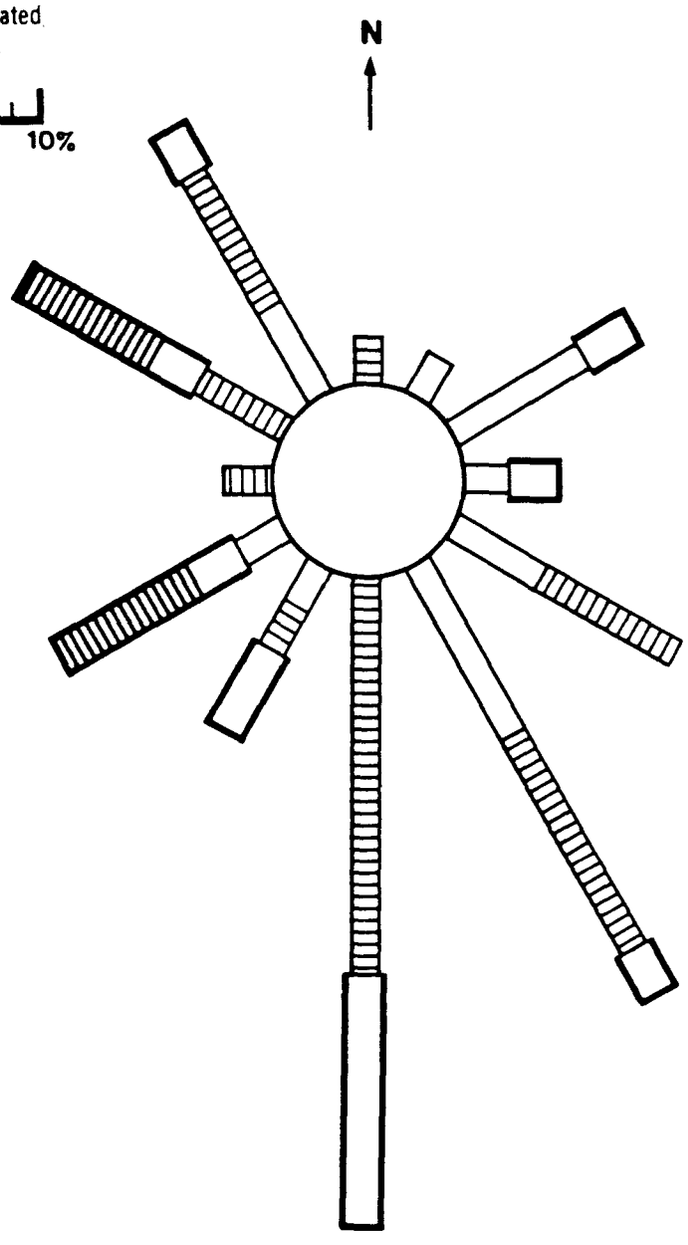
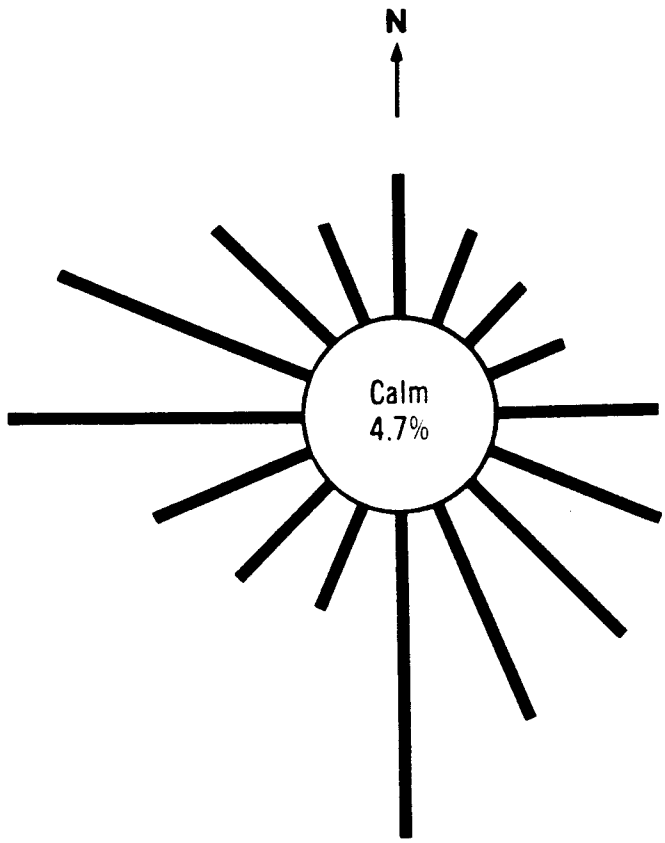


Figure 3. Historical Wind Rose-International Airport, St. Louis

Percent of observations with indicated wind direction.

1965-1974 Data
29215 Observations



- Second, since the data summaries used to construct the wind rose classify wind directions in 16 directional sectors, the rose includes 16 arms, each representing a 22.5° sector. By contrast, the wind data used for constructing the pollution rose were reported by the National Weather Service in 10° increments. That rose presents 12 arms, each representing a 30° sector (three of the 10° directional increments). Conversion formulas are not available for transforming a 12-arm rose to a 16-arm rose or vice versa. Therefore, comparisons between wind roses and pollution roses are qualitative, rather than quantitative.

If all pollutant sources were equally spaced around a monitor, the wind rose and the pollution rose should approximately coincide. Comparison of Figures 2 and 3 indicates that, for some wind directions, the high concentrations occurred more frequently than would be expected from the historical wind patterns and from a uniform distribution of pollutant sources. These directions include south, south-southeast, north-northwest and possibly east-northeast. Therefore, point or area source impact would be expected from sources south to south-southeast of the monitor, north-northwest of the monitor, and possibly east-northeast of the monitor. Figure 4 shows topographical features in the vicinity of the monitor. (The monitor is shown by the symbol ⊕ near the center of the figure.) Figure 5 shows the locations of nearby point sources which emitted over 100 tons/year during the time period covered by the meteorological and TSP monitoring data. Those same sources are listed in Table 4, with the location (UTM coordinates), the distance from the monitor, and the emissions estimate. Comparison of Figures 2, 3 and 5 indicates possible point source impact from the Monsanto Idaho Plant and the Carondelet Coke plant.

When the State evaluated the area around the monitor, they concluded that unvegetated land surrounding the monitor was the largest contributor to the high concentrations observed in 1981. Two features of the pollution rose indicate area source impact. First, the multiple arms on the rose indicate a wide angular spread in the location of sources. That pattern in pollution roses is often caused by area sources. Second, many of the high concentrations occurred under high wind speed conditions. Blowing dust from bare soil would be consistent with that feature of the pollution rose.

In summary, the results of this evaluation agree with the State's findings of significant area source impact, and also indicate possible point source impact. The pollution roses provide a visual perspective on the TSP and wind data. As such, they constitute one evaluation tool, which can be useful when applied in conjunction with other evaluation tools.

B. CO in the St. Louis Area

Monitoring data collected in the 1970's showed widespread exceedances of the CO standards in the St. Louis area. More recent data have shown no exceedances of those standards at several sites in St. Louis County. Monitoring at other sites was discontinued or interrupted in the early 1980's. The most recent recorded exceedances in the area occurred at the St. Ann site, which showed four exceedances of the eight-hour standard in 1981. The 1982 data

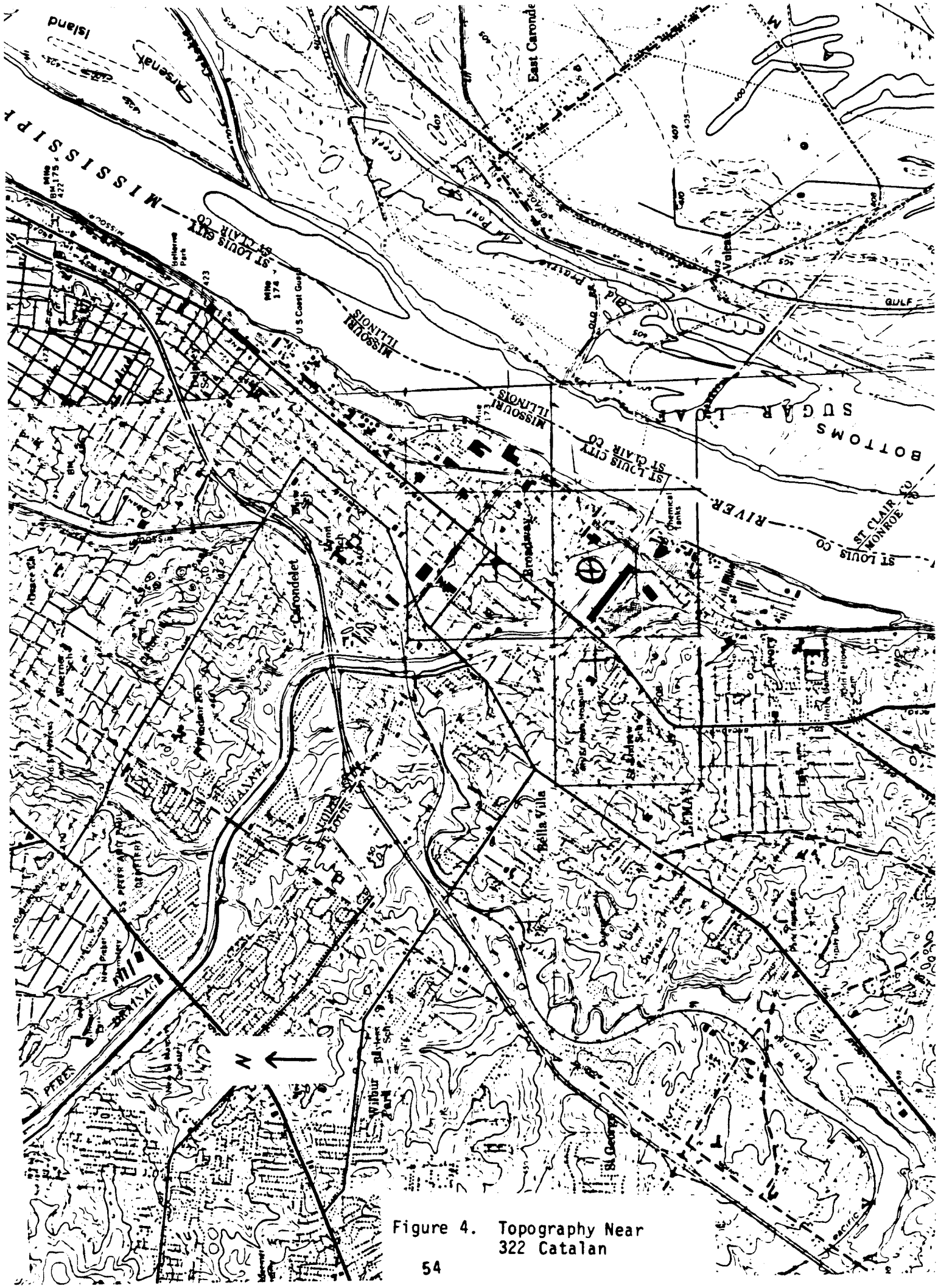


Figure 4. Topography Near 322 Catalan

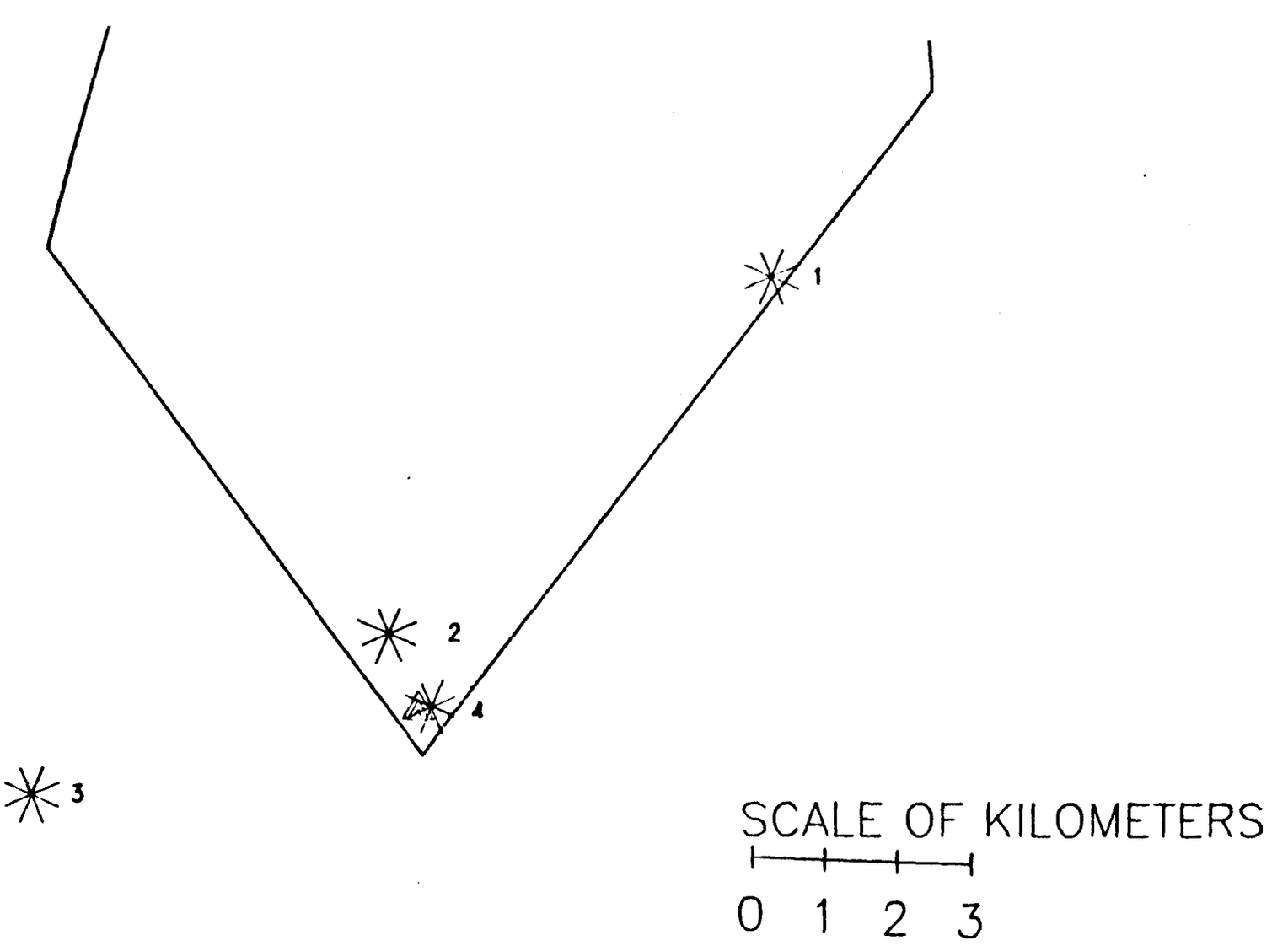


FIGURE 5. POINT SOURCES WITHIN 10 KM OF 322 CATALAN EMITTING OVER 100 TONS/YEAR

TABLE 4

Point Sources Within 10 km of 322 Catalan
Which Emitted over 100 tons/year

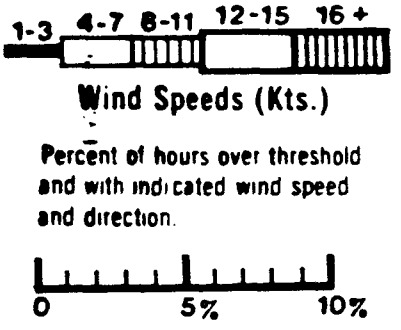
		Emissions* tons/year	UTME (km)	UTMN (km)	Distance from Monitor (km)
1.	Municipal South Incinerator	253	743.0	4275.0	7.8
2.	Monsanto Idaho Plant	3817	737.9	4269.9	1.0
3.	Alpha Portland Cement	868	733.0	4267.5	5.4
4.	Carondelet Coke	643	738.6	4268.7	.2
	Monitor Location		738.4	4268.7	

* Note: The Carondelet Coke estimate was calculated from the report of a plant inspection conducted on August 13, 1981 by Del Green Associates, Inc. The Monsanto estimate was obtained from the Missouri Department of Natural Resources. The emission estimates for the other two plants were retrieved from the National Emissions Data System.

showed no exceedances. The State has claimed that the site is not representative of a neighborhood scale area, citing influence from a parking lot as the basis for that claim.

Figure 6 shows a pollution rose for the monitor, based on wind data collected on-site during hours when the CO concentration exceeded 10 mg/m^3 (the eight-hour primary standard). Only those hours could contribute to exceedances of the eight-hour standard. That figure shows that the high CO concentrations occurred predominantly under calm conditions, or with light winds from a 90° sector south of the monitor. Therefore, point or area sources south of the monitor would be the most probable causes of the high concentrations observed. With the preponderance of calms and light winds, sources close to the monitor would be expected to have the greatest influence. Figure 7 shows the topographical features in the vicinity of the monitor. Figure 8 is a copy of an aerial photograph of the area. Figure 9 presents a traffic volume map for St. Louis County, and shows high traffic volume on several roads in the vicinity of the monitor. A review of the NEDS data shows no CO point sources emitting over 100 tons/year within three miles of the monitor. Based on the pattern of wind speeds and directions, traffic on St. Charles Rock Road is the probable cause of the high CO concentrations. However, some influence from localized sources south of the monitor may have contributed to those concentrations.

Figure 6. CO in St. Louis



Met. Station: St. Ann
Air Quality Site: St. Ann
CO>10mg/m^3
94 Observations
1980 and 1981 Data

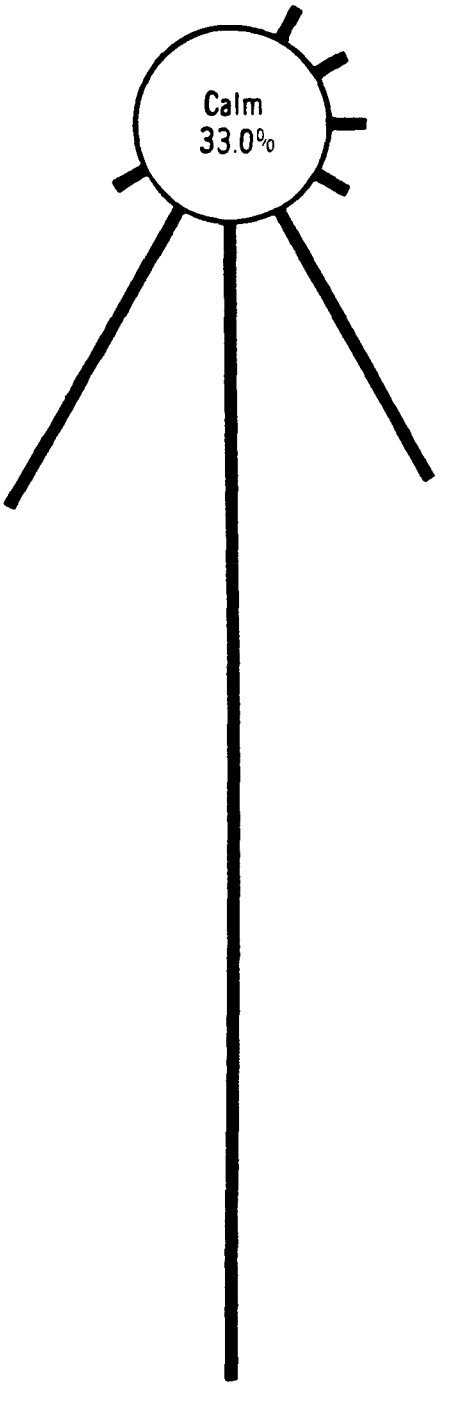


Figure 7. Topography Near the St. Ann Monitor

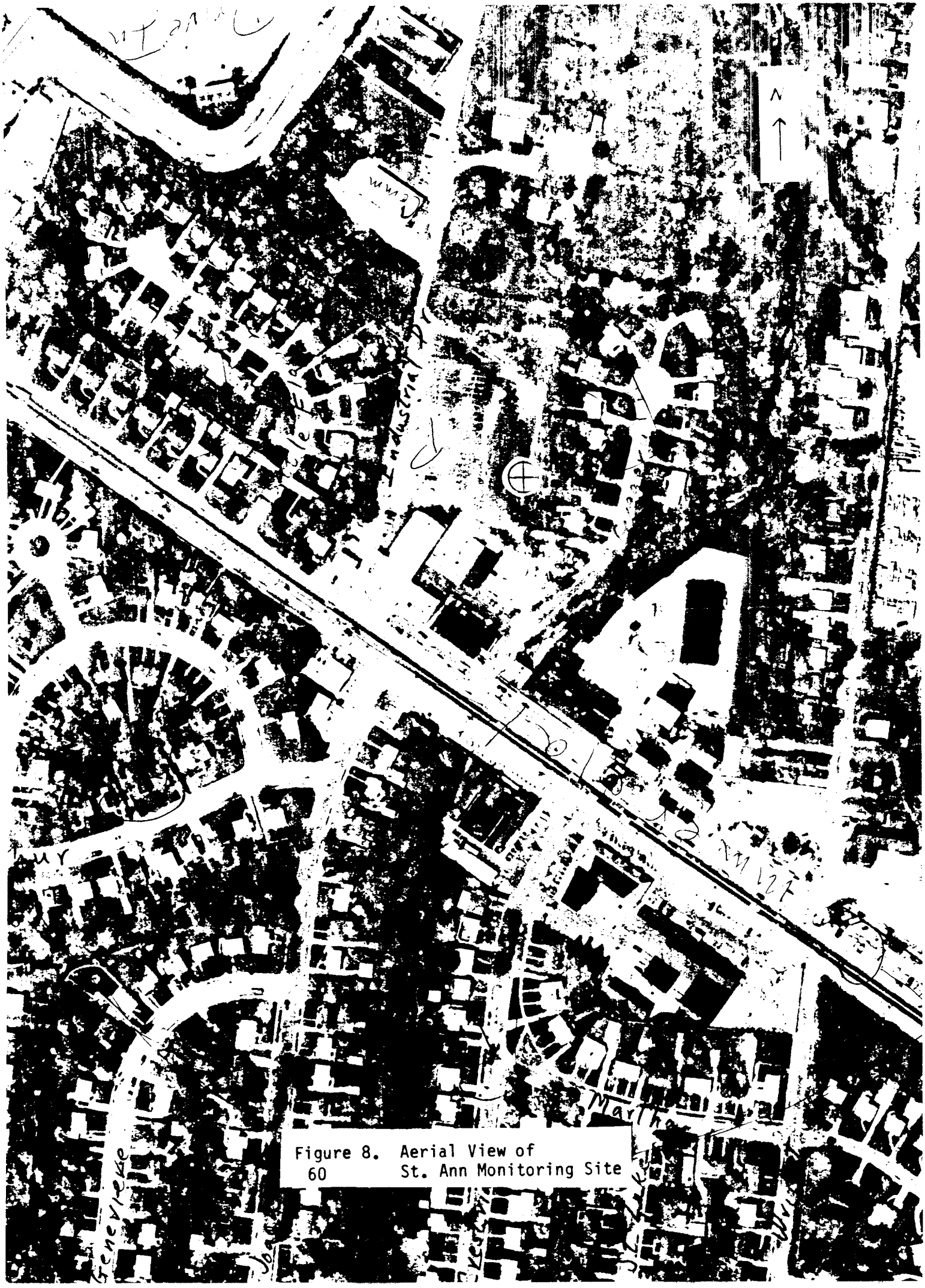


Figure 8. Aerial View of St. Ann Monitoring Site

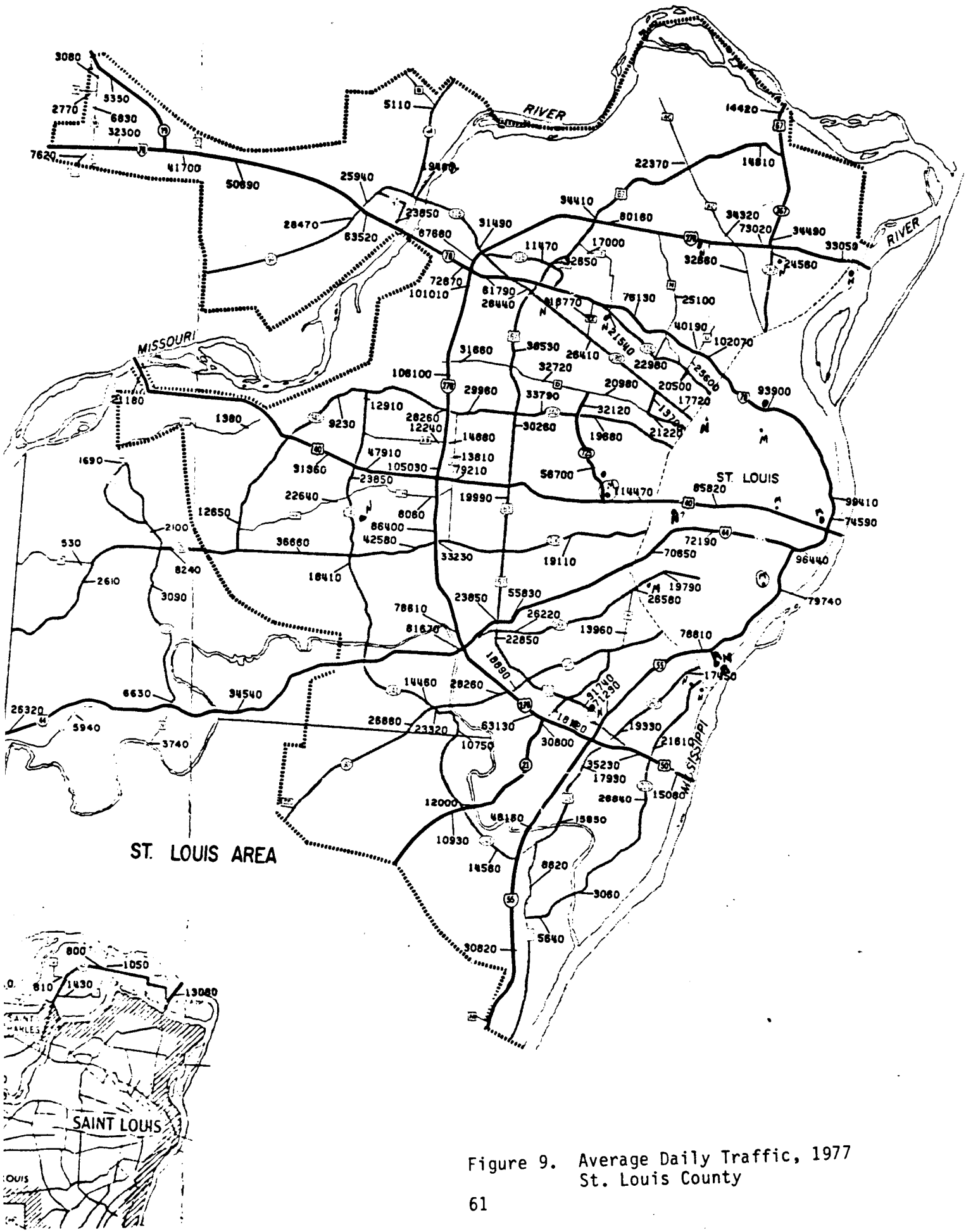


Figure 9. Average Daily Traffic, 1977
St. Louis County

XIII. POPULATION EXPOSURE

Population exposure to elevated pollutant concentrations is difficult to measure accurately. (People spend varying amounts of time in different parts of a city which may have localized areas with high pollutant concentrations. Population estimates within such localized areas are difficult to compute manually because that calculation requires locating and summing the populations of numerous small, detailed geographical areas.) Previous attempts to estimate population exposure have focused on populations of entire counties or metropolitan areas, even though the designated non-attainment areas were only portions of those counties or cities. While such approximations are understandable, given the difficulty of obtaining and using population data with more detailed spatial resolution, they may greatly overestimate the populations exposed to elevated pollutant concentrations. A better approximation of exposed population would be a determination of just that segment of the population living within the designated nonattainment areas. (For O_3, while that number may over-estimate the population actually exposed to high ozone concentrations, it should closely approximate the population affected by pollution control measures.) At our request, Systems Applications, Inc. (SAI) has developed software to estimate the population within any given closed polygon, using the detailed census Block Group/Enumeration District data in their computer data base. The non-attainment areas shown on the maps in Sections IV through VIII of this report were sent to SAI for computation of the enclosed populations. Table 5 summarizes the results of those calculations. The population density maps from which the table was prepared are shown in Appendix C. That Appendix also describes the calculation procedure more fully.

It should be noted that redesignations were recommended which would reduce the size of some non-attainment areas. The populations in the table show that significant numbers of people have benefitted from the recent reductions in pollutant concentrations.

TABLE 5

Population Estimates Within Designated Non-Attainment and Unclassified Areas

TSP	Primary	Secondary	Unclassified
Kansas City	334,000	683,000 (incl. PNA)	
Mexico			10,000
New Madrid		2,000	
St. Joseph	16,000	74,000	
St. Louis	122,000	525,000 (incl. PNA)	

CO	Primary & Secondary	Unclassified
Kansas City		672,000
St. Louis	1,200,000	

O_3	Primary & Secondary
Kansas City	
MO portion	860,000
Bi-state	1,250,000
St. Louis	
MO portion	1,730,000
Bi-state	2,360,000

XIV. SUMMARY AND RECOMMENDATIONS

A. Attainment Status Designations

The evaluation of ambient air quality based on recent monitoring data found attainment status designations to be generally consistent with recent data in most parts of the State. Recommendations were made in the text to consider attainment status changes in some locations for TSP and CO. Those recommendations are summarized in Table 6. In each case, we recommend that the State review all of the data available to them, in order to base their decisions on the most complete information available. The State has recently requested redesignations from primary non-attainment to secondary non-attainment for TSP in Kansas City, St. Joseph and St. Louis; and from primary non-attainment to attainment for O_3 in Kansas City. Those requests are under review by the Air Branch of EPA, Region VII.

B. Air Quality Concern Areas

Relatively few serious air quality problems were found in Missouri, based on the monitoring data available in SAROAD. The areas which have recently posed human health concerns (because the primary NAAQS's were exceeded) are summarized in the following paragraphs.

One site (the CO Monitor in Independence) showed exceedances of the alert level and violation of the eight-hour primary standard in both years covered by the evaluation.

The following sites showed violation of the primary standards in 1982, or in the last year of operation, if 1982 data were not available:

- TSP - St. Joseph (Pump Station South) and St. Louis (4 sites which did not meet siting criteria for neighborhood scale monitors. Sites which meet the neighborhood scale criteria are needed in three of those areas).
- SO_2 - West Alton (ascribed to point source impact from the Alton Box Board Plant).
- O_3 - St. Louis Area (305 Weidman Road, Clayton, Water Department, and 8227 South Broadway).

The following sites showed violation of the primary standards before 1982, but the 1982 data showed no violations:

- SO_2 - Sugar Creek
- CO - St. Ann
- O_3 - Kansas City Area (most sites) and St. Louis Area (Ferguson, Jefferson County, St. Ann and West Alton).

TABLE 6

Recommendations Regarding Attainment Status Changes

TSP	
Kansas City	Remove the primary non-attainment designation. Reduce the size of the secondary non-attainment area.
St. Joseph	Continue efforts to ensure the completeness of data collection. Consider reducing the size of the non-attainment areas.
St. Louis Area	Re-evaluate the size of the designated primary and secondary non-attainment areas when the 1983 data are available.
CO	
Kansas City	Consider designating part of the area as non-attainment.
St. Louis	Consider reducing the size of the designated non-attainment area.

In each of the above areas, we encourage the State to determine whether or not a long-term air quality problem exists and, if so, to identify and address the cause(s) of the problem.

C. Monitor Operation and Siting

In two areas of the State, lack of monitoring data impedes efforts to assess current air quality. First, a downtown CO monitor is needed in Kansas City. Since that site is designated as a NAMS monitor and has been out of service since 1980, it should be given high priority. Second, TSP monitors were discontinued at four locations in St. Louis City because they did not meet the siting criteria of 40 CFR 58, Appendix E. Each of those monitors showed exceedances of the primary standards in 1981. The area around one of those sites is covered by other nearby monitoring. Data are needed from properly sited monitors in the three remaining areas in order to determine whether or not current air quality meets the standards. Recommendations were also made for increasing the number of precision checks and monitor audits conducted by the State and local agencies, for increasing the number of samples collected at the existing collocated monitors, and for including the lead monitoring data collected near the smelters in the SAROAD data bank.

APPENDIX A

Tabular Summaries of Data

Table	Description
A1	Ambient Air Monitoring Data
A2	Precision and Accuracy Estimates for Ambient Air Monitoring Data
A3	Attainment Status Designations

ABBREVIATIONS AND SYMBOLS USED IN TABLE A1

SITE ID	Site identification number
YR	Year
REP ORG	Reporting organization
# OBS	Number of observations
MAX 24-HR 1ST	Highest value recorded in a 24-hour period
MAX 24-HR 2ND	Second highest value recorded in a 24-hour period
OBS >260	Number of observations greater than 260
OBS >150	Number of observations greater than 150
ARIT MEAN	Arithmetic mean
GEO MEAN	Geometric mean
GSD	Geometric standard deviation
METH	Method
QTRLY ARITH MEAN 1ST	First quarter arithmetic mean
QTRLY ARITH MEAN 2ND	Second quarter arithmetic mean
QTRLY ARITH MEAN 3RD	Third quarter arithmetic mean
QTRLY ARITH MEAN 4TH	Fourth quarter arithmetic mean
MEANS >1.5	Number of quarterly means greater than 1.5
MAX VALUES 1ST	Highest value recorded for the year
MAX VALUES 2ND	Second highest value recorded for the year
MAX 1-HR 1ST	Highest value recorded in a one-hour period
MAX 1-HR 2ND	Second highest value recorded in a one-hour period
OBS >40	Number of observations greater than 40
MAX 8-HR 1ST	Highest value recorded in an eight-hour period
MAX 8-HR 2ND	Second highest value recorded in an eight-hour period
OBS >10	Number of observations greater than 10
OBS >365	Number of observations greater than 365
MAX 3-HR 1ST	Highest value recorded in a three-hour period
MAX 3-HR 2ND	Second highest value recorded in a three-hour period
OBS >1300	Number of observations greater than 1300
DAILY MAX 1-HR 1ST	Maximum hourly ozone value for a day
DAILY MAX 1-HR 2ND	Second maximum hourly ozone value for a day
DAILY MAX 1-HR 3RD	Third maximum hourly ozone value for a day

ABBREVIATIONS AND SYMBOLS USED IN TABLE A1 (Continued)

VALS >.125 MEAS	Number of measured values greater than .125
VALS >.125 EST	Number of expected violations
NBR VALID DAILY MAX	Number of valid daily maximum values
MISS DAYS ASS < STD	Number of missing days assumed to be less than the standard
?	The mean does not satisfy summary criteria

QUICK LOOK REPORT

SUSPENDED PARTICULATE MATTER (UG/M3) MISSOURI 81-82

METHOD: GRAVIMETRIC, 24-HOUR HI-VOLUME FILTER SAMPLE-91

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAX 24-HR 1ST	MAX 24-HR 2ND	OBS> 260	OBS> 150	ARIT MEAN	GEO MEAN	GSD
260030001G01	AFFTON	ST LOUIS CO	LIN FERRY & L'BE	81	002	45	98	97			54	51	1.4
260030001G01	AFFTON	ST LOUIS CO	LIN FERRY & L'BE	82	002	55	82	81			48	45	1.4
260200001G01	BELLEFONTAINE NEIGH	ST LOUIS CO	805 CHAMBERS ROA	81	002	53	223	151		2	67	60	1.6
260200001G01	BELLEFONTAINE NEIGH	ST LOUIS CO	805 CHAMBERS ROA	82	002	55	106	101			52	48	1.5
260260001G01	BERKELEY	ST LOUIS CO	8811 HAROLD DRIV	81	002	55	236	153		2	67	61	1.5
260260001G01	BERKELEY	ST LOUIS CO	8811 HAROLD DRIV	82	002	14	84	82			55?	54?	1.3
260640001F01	CAMDEN CO	CAMDEN CO	LAKE OF OZARKS	81	001	47	264	63	1	1	43	38	1.5
260640001F01	CAMDEN CO	CAMDEN CO	LAKE OF OZARKS	82	001	58	86	72			28	24	1.7
260960001F01	CHILLICOTHE	LIVINGSTON CO	CHILLICOTHE HEAL	81	001	18	126	95			65?	59?	1.6
261040002G01	CLAYTON	ST LOUIS CO	801 SOUTH BRENTW	81	002	55	220	130		1	68	63	1.5
261040002G01	CLAYTON	ST LOUIS CO	801 SOUTH BRENTW	82	002	45	109	99			54?	49?	1.5
261120002F01	COLUMBIA	BOONE CO	HIGHWAY B	81	001	47	160	122		1	66	61	1.5
261120002F01	COLUMBIA	BOONE CO	HIGHWAY B	82	001	52	120	94			50	46	1.5
261120006F01	COLUMBIA	BOONE CO	511 E.WALNUT COL	81	001	44	240	114		1	74?	68?	1.5
261120006F01	COLUMBIA	BOONE CO	511 E.WALNUT COL	82	001	30	94	87			52?	50?	1.4
261120007H01	COLUMBIA	BOONE CO	POWELL DRIVE	82		14	115	74			51?	48?	1.4
261120008F01	COLUMBIA	BOONE CO	DOWNTOWN FIRE ST	82		10	52	38			29?	27?	1.4
261600001G01	FERGUSON	ST LOUIS CO	FLORISSANT VALLE	81	002	57	257	191		2	60	53	1.6
261600001G01	FERGUSON	ST LOUIS CO	FLORISSANT VALLE	82	002	58	194	145		1	53	48	1.5
261640001F04	FLAT RIVER	ST FRANCOIS CO	FEDERAL MILL RD	81		28	198	129		1	56?	47?	1.8
261640001F04	FLAT RIVER	ST FRANCOIS CO	FEDERAL MILL RD	82		10	130	129			65?	56?	1.8
261840001F01	GRANDVIEW	JACKSON CO	FIRE DEPT. ROOF	81	001	14	98	88			63?	60?	1.4
261920003F01	HANNIBAL	MARION CO	HANNIBAL POLICE	81	001	51	165	165		3	78	70	1.6
261920003F01	HANNIBAL	MARION CO	HANNIBAL POLICE	82	001	51	330	187	1	3	74	65	1.6
262180001H01	INDEPENDENCE	JACKSON CO	213 S. MAIN ST	81	004	33	131	125			69?	64?	1.5
262180001H01	INDEPENDENCE	JACKSON CO	213 S. MAIN ST	82	004	13	136	95			71?	68?	1.4
262180004H01	INDEPENDENCE	JACKSON CO	2300 N LIBERTY S	81	004	40	93	89			58?	55?	1.4
262180004H01	INDEPENDENCE	JACKSON CO	2300 N LIBERTY S	82	004	11	112	107			61?	56?	1.6
262280005F02	JEFFERSON CO	JEFFERSON CO	DUNKLIN HIGH SCH	81	001	53	326	199	1	2	62	55	1.6
262280005F02	JEFFERSON CO	JEFFERSON CO	DUNKLIN HIGH SCH	82	001	10	108	98			59?	53?	1.6
262380002H01	KANSAS CITY	JACKSON CO	1517 LOCUST ST	81	004	49	160	138		1	74	69	1.5
262380002H01	KANSAS CITY	JACKSON CO	1517 LOCUST ST	82	004	58	112	105			60	56	1.5
262380003H01	KANSAS CITY	JACKSON CO	5100 TROOST AVE	81	004	55	107	94			60	56	1.4
262380003H01	KANSAS CITY	JACKSON CO	5100 TROOST AVE	82	004	54	90	79			48	45	1.4
262380004H01	KANSAS CITY	CLAY CO	101 LOU HOLLAND	81	004	52	157	152		3	75	68	1.6
262380004H01	KANSAS CITY	CLAY CO	101 LOU HOLLAND	82	004	54	143	126			59	54	1.5
262380006H01	KANSAS CITY	JACKSON CO	5130 DURANUS RD	81	004	43	176	135		1	78	71	1.5
262380006H01	KANSAS CITY	JACKSON CO	5130 DURANUS RD	82	004	56	122	113			56	51	1.5
262380010H01	KANSAS CITY	CLAY CO	4836 N BRIGHTON	81	004	49	167	152		2	73	69	1.4

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA

QUICK LOOK REPORT

SUSPENDED PARTICULATE MATTER (UG/M3) MISSOURI 81-82

METHOD: GRAVIMETRIC, 24-HOUR HI-VOLUME FILTER SAMPLE-91

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAX 24-HR 1ST	MAX 24-HR 2ND	OBS> 260	OBS> 150	ARIT MEAN	GEO MEAN	GSD
262380010H01	KANSAS CITY	CLAY CO	4836 N BRIGHTON	82	004	56	96	92			50	47	1.4
262380015H01	KANSAS CITY	JACKSON CO	9445 HOLMES AVE	81	004	55	145	113			71	67	1.4
262380015H01	KANSAS CITY	JACKSON CO	9445 HOLMES AVE	82	004	13	106	101			70?	66?	1.4
262380023H01	KANSAS CITY	PLATTE CO	11500 N 71 HWY	81	004	58	99	89			49	46	1.5
262380023H01	KANSAS CITY	PLATTE CO	11500 N 71 HWY	82	004	54	86	67			35	32	1.5
262380031H01	KANSAS CITY	JACKSON CO	BANNISTER ROAD	82		34	92	91			44?	40?	1.5
262440001F01	KIRKSVILLE	ADAIR CO	SCI BLDG NE STAT	81	001	39	155	134		1	72?	68?	1.4
262630002G01	LEMAY	ST LOUIS CO	9101 SOUTH BROAD	81	002	58	252	228		5	79	70	1.6
262630002G01	LEMAY	ST LOUIS CO	9101 SOUTH BROAD	82	002	57	111	111			54	50	1.5
262630003G01	LEMAY	ST LOUIS CO	8900 SOUTH BROAD	81	002	56	241	194		6	82	73	1.6
262630003G01	LEMAY	ST LOUIS CO	8900 SOUTH BROAD	82	002	49	666	137	1	1	74	58	1.8
263020006F01	MEXICO	AUDRAIN CO	TEAL LAKE - MEXI	82		40	86	79			34?	29?	1.8
263020007F01	MEXICO	AUDRAIN CO	COAL & LOVE STS.	81		6	99	92			56?	48?	1.9
263020007F01	MEXICO	AUDRAIN CO	COAL & LOVE STS.	82		51	265	170	1	2	69	61	1.6
263020008F01	MEXICO	AUDRAIN CO	MCMILLAN SCHOOL	82		14	57	56			34?	32?	1.4
263260001F01	NEVADA	VERNON CO	JEFF ELEM SCHOOL	81	001	52	150	125			64	60	1.5
263260001F01	NEVADA	VERNON CO	JEFF ELEM SCHOOL	82	001	56	112	91			50	46	1.5
263280001F02	NEW MADRID	NEW MADRID CO	MO CONS FOR PROT	81	001	45	161	161		3	80	68	1.8
263280001F02	NEW MADRID	NEW MADRID CO	MO CONS FOR PROT	82	001	39	112	100			45?	39?	1.7
263380004F01	NORTH KANSAS CITY	CLAY CO	2800 HOSPITAL DR	81	001	39	105	102			64?	61?	1.4
263740003F01	PLATTE CO	PLATTE CO	WEATHERBY LAKE,C	81	001	38	121	113			59?	56?	1.4
263800003F01	POPLAR BLUFF	BUTLER CO	POPLAR BLUFF REG	81	001	40	105	103			66	62	1.4
263800003F01	POPLAR BLUFF	BUTLER CO	POPLAR BLUFF REG	82	001	57	116	112			49	44	1.6
264120001G01	ST ANN	ST LOUIS CO	10267 ST CHARLES	81	002	54	253	99		1	63	58	1.5
264120001G01	ST ANN	ST LOUIS CO	10267 ST CHARLES	82	002	54	107	95			50	47	1.5
264160002F01	ST CHARLES CO	ST CHARLES CO	HWY 94 (WEST ALT	81	001	52	232	115		1	66	59	1.6
264160002F01	ST CHARLES CO	ST CHARLES CO	HWY 94 (WEST ALT	82	001	37	123	94			51	45	1.7
264260003F01	ST JOSEPH	BUCHANAN CO	8TH ST & EDMOND	81	001	57	213	136		1	73	67	1.5
264260003F01	ST JOSEPH	BUCHANAN CO	8TH ST & EDMOND	82	001	58	157	145		1	58	53	1.5
264260004F05	ST JOSEPH	BUCHANAN CO	SEWER TREATMENT	81	001	41	266	247	1	4	91?	77?	1.8
264260005F05	ST JOSEPH	BUCHANAN CO	PUMP STA., SOUTH	82		22	206	200		4	100?	86?	1.8
264260007F01	ST JOSEPH	BUCHANAN CO	FIRE STA #6 HIB	81	001	40	173	120		1	69	64	1.4
264260007F01	ST JOSEPH	BUCHANAN CO	FIRE STA #6 HIB	82	001	12	106	70			54?	49?	1.6
264260008F03	ST JOSEPH	BUCHANAN CO	FARON PUMPING ST	81	001	38	159	157		4	66	57	1.7
264260008F03	ST JOSEPH	BUCHANAN CO	FARON PUMPING ST	82	001	6	61	53			35?	31?	1.7
264280006H01	ST LOUIS	INDEPENDENT CTY	14TH & MARKET	81	003	103	274	171	1	3	83	78	1.5
264280006H01	ST LOUIS	INDEPENDENT CTY	14TH & MARKET	82	003	94	150	145			70	65	1.5
264280007H01	ST LOUIS	INDEPENDENT CTY	8227 SOUTH BROAD	81	003	75	211	148		1	72	66	1.6
264280007H01	ST LOUIS	INDEPENDENT CTY	8227 SOUTH BROAD	82	003	57	201	159		2	71?	65?	1.5

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA

QUICK LOOK REPORT

SUSPENDED PARTICULATE MATTER (UG/M3) MISSOURI 81-82

METHOD: GRAVIMETRIC, 24-HOUR HI-VOLUME FILTER SAMPLE-91

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAX 24-HR 1ST	MAX 24-HR 2ND	OBS> 260	OBS> 150	ARIT MEAN	GEO MEAN	GSD
264280010H01	ST LOUIS	INDEPENDENT CTY	4408 DONOVAN	81	003	46	239	169		2	76?	69?	1.5
264280010H01	ST LOUIS	INDEPENDENT CTY	4408 DONOVAN	82	003	54	91	84			49	43	2.1
264280015H01	ST LOUIS	INDEPENDENT CTY	1400 SHAINUT PLA	81	003	39	226	206		2	85?	76?	1.6
264280015H01	ST LOUIS	INDEPENDENT CTY	1400 SHAINUT PLA	82	003	56	117	101			56	52	1.5
264280025H01	ST LOUIS	INDEPENDENT CTY	3500 SOUTH GRAND	81	003	40	250	138		1	83?	77?	1.5
264280025H01	ST LOUIS	INDEPENDENT CTY	3500 SOUTH GRAND	82	003	58	121	108			60	56	1.5
264280032H01	ST LOUIS	INDEPENDENT CTY	GRAND + LAC EDE	81	003	44	192	175		2	87?	80?	1.5
264280032H01	ST LOUIS	INDEPENDENT CTY	GRAND + LACLEDE	82	003	57	143	129			67	62	1.5
264280061H01	ST LOUIS	INDEPENDENT CTY	SHREVE " I-70	81	003	26	259	137		1	102?	95?	1.5
264280062H01	ST LOUIS	INDEPENDENT CTY	RIVER DES PERES	81	003	68	239	182		3	89?	83?	1.4
264280063H01	ST LOUIS	INDEPENDENT CTY	WATER DEPT	81	003	30	283	217	1	5	106?	94?	1.6
264280075H01	ST LOUIS	INDEPENDENT CTY	322 CATALAN ST.	81	003	35	232	213		7	105?	95?	1.5
264280080H01	ST LOUIS	INDEPENDENT CTY	NEWSTEAD & COTEB	82		48	125	103			62?	57?	1.5
264300006G01	ST LOUIS CO	ST LOUIS CO	305 WEIDMAN ROAD	81	002	48	218	96		1	53	48	1.6
264300006G01	ST LOUIS CO	ST LOUIS CO	305 WEIDMAN ROAD	82	002	56	251	201		2	46	38	1.8
264320003F01	STE GENEVIEVE	STE GENEVIEVE C	ACADEMY HILL H.S	81	001	54	114	92			61	56	1.7
264320003F01	STE GENEVIEVE	STE GENEVIEVE C	ACADEMY HILL H.S	82	001	57	100	99			46	42	1.6
264580005H01	SPRINGFIELD	GREENE CO	VENTURA & SUNSHI	81	005	44	247	88		1	52?	46?	1.5
264580007H01	SPRINGFIELD	GREENE CO	900 W CHASE	81		20	242	114		1	75?	67?	1.5
264580012H01	SPRINGFIELD	GREENE CO	GRANDVIEW GOLF C	81	005	38	84	79			49?	47?	1.4
264580015H01	SPRINGFIELD	GREENE CO	900 E MONROE	81		21	220	78		1	59?	52?	1.6
264580016H01	SPRINGFIELD	GREENE CO	KANSAS & MT VERN	81	005	35	244	141		1	68?	62?	1.5
264580018H01	SPRINGFIELD	GREENE CO	FAIRGROUNDS	81	005	57	175	142		1	53	48	1.6
264580018H01	SPRINGFIELD	GREENE CO	FAIRGROUNDS	82	005	15	68	65			44?	42?	1.4
264580019H01	SPRINGFIELD	GREENE CO	SILVER SPRINGS P	81	005	9	116	90			58?	53?	1.5
264580023H01	SPRINGFIELD	GREENE CO	3012 W SEMINOLE	81	005	59	200	81		1	42	39	1.5
264580023H01	SPRINGFIELD	GREENE CO	3012 W SEMINOLE	82	005	42	60	59			34?	33?	1.3
264580026H05	SPRINGFIELD	GREENE CO	5012 S. CHARLEST	81	005	55	305	83	1	1	46	40	1.5
264580026H05	SPRINGFIELD	GREENE CO	5012 S. CHARLEST	82	005	15	70	53			37?	35?	1.4
264580028H01	SPRINGFIELD	GREENE CO	GRANT BEACH PARK	81	005	39	84	78			51?	48?	1.4
264580028H01	SPRINGFIELD	GREENE CO	GRANT BEACH PARK	82	005	61	368	102	1	1	54	47	1.6
264580029H01	SPRINGFIELD	GREENE CO	FAIR GROUNDS	82	005	23	126	74			43?	38?	1.6
264580030H01	SPRINGFIELD	GREENE CO	GRANDVIEW GOLF C	81	005	21	72	71			38?	35?	1.5
264580030H01	SPRINGFIELD	GREENE CO	GRANDVIEW GOLF C	82	005	59	90	70			37	34	1.5
264580031H01	SPRINGFIELD	GREENE CO	ZAGONYI PARK	81	005	24	79	71			42?	39?	1.5
264580031H01	SPRINGFIELD	GREENE CO	ZAGONYI PARK	82	005	61	89	68			39	36	1.5
264580032H01	SPRINGFIELD	GREENE CO	S.W.MISSOURI ST.	81	005	29	73	62			43?	41?	1.4
264580032H01	SPRINGFIELD	GREENE CO	S.W.MISSOURI ST.	82	005	60	91	74			42	39	1.5
264580033H01	SPRINGFIELD	GREENE CO	SILVER SPRINGS P	81	005	32	86	81			48?	45?	1.4

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA

SUSPENDED PARTICULATE MATTER (UG/M3) MISSOURI 81-82

METHOD: GRAVIMETRIC, 24-HOUR HI-VOLUME FILTER SAMPLE-91

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAX 24-HR 1ST	MAX 24-HR 2ND	OBS> 260	OBS> 150	ARIT MEAN	GEO MEAN	GSD
264580033H01	SPRINGFIELD	GREENE CO	SILVER SPRINGS P	82	005	59	95	79			44	41	1.5
264580034H01	SPRINGFIELD	GREENE CO	LAURA INGALLS WI	81	005	11	57	49			37?	35?	1.5
264580034H01	SPRINGFIELD	GREENE CO	LAURA INGALLS WI	82	005	57	93	90			37	33	1.6

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA

SULFUR DIOXIDE (UG/M3) MISSOURI 81-82

METHODS: HOURLY VALUES WEST-GAEKE COLORIMETRIC-11, CONDUCTIMETRIC-13, COULOMETRIC-14, FLAME PHOTOMETRIC-16, HYDROGEN PEROXIDE NAOH TITRATION-18, CATALYST FLAME PHOTOMETRIC-19, PULSED FLUORESCENT-20, SECOND DERIVATIVE SPECTROSCOPY-21, CONDUCTANCE ASARCO-22, ULTRA VIOLET STIMULATED FLUORESCENCE-23,SEQUENTIAL CONDUCTIMETRIC-33, 24-HOUR GAS BUBBLERS PARAROSANILINE-SULFAMIC ACID-91, PARAROSANILINE SULFAMIC ACID TEMPERATURE CONTROLLED-97

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAX 24-HR 1ST	MAX 24-HR 2ND	OBS> 365	MAX 3-HR 1ST	MAX 3-HR 2ND	OBS> 1300	MAX 1-HR 1ST	MAX 1-HR 2ND	ARIT MEAN	MTH
260030001G01	AFFTON	ST LOUIS CO	LIN FERRY & L'BE	81	002	7635	118	105		252	245		555	534	26	16
260030001G01	AFFTON	ST LOUIS CO	LIN FERRY & L'BE	82	002	8246	132	103		334	329		595	569	22	16
261040001G01	CLAYTON	ST LOUIS CO	55 HUNTER AVE	81	002	8053	200	91		610	418		812	590	27	16
261040001G01	CLAYTON	ST LOUIS CO	55 HUNTER AVE	82	002	8216	99	95		286	272		500	461	20	16
261600001G01	FERGUSON	ST LOUIS CO	FLORISSANT VALLE	81	002	8296	121	83		397	235		516	490	27	16
261600001G01	FERGUSON	ST LOUIS CO	FLORISSANT VALLE	82	002	8213	220	166		406	379		757	511	43	16
262200005F02	IRON CO	IRON CO	BIXBY	81	001	7722	365	236		856	831		2358	1258	14	14
262200005F02	IRON CO	IRON CO	BIXBY	82	001	2022	451	169	1	1520	777	1	1886	1677	37?	14
262200005F02	IRON CO	IRON CO	BIXBY	82	001	3477	143	133		884	631		2620	1593	15?	20
262280012F01	JEFFERSON CO	JEFFERSON CO	ARNOLDTENBROOK &	81		3569	119	100		314	254		555	435	37?	20
262280012F01	JEFFERSON CO	JEFFERSON CO	ARNOLDTENBROOK &	82	001	1760	123	119		329	312		760	403	45?	20
262380023H01	KANSAS CITY	PLATTE CO	11500 N 71 HWY	81	004	6689	92	81		365	362		665	429	19	20
262380023H01	KANSAS CITY	PLATTE CO	11500 N 71 HWY	82	004	8444	66	64		227	183		323	303	9	20
262380025H01	KANSAS CITY	CLAY CO	49TH & WINCHESTE	81	004	8378	131	125		282	259		453	376	17	20
262380025H01	KANSAS CITY	CLAY CO	49TH & WINCHESTE	82	004	8080	152	138		304	216		403	342	15	20
263280001F02	NEW MADRID	NEW MADRID CO	MO CONS FOR FROT	82		458	106	98		183	121		396	283	59?	20
263380004F01	NORTH KANSAS CITY	CLAY CO	2800 HOSPITAL DR	81	001	5075	92	72		285	263		613	493	16?	20
263740003F01	PLATTE CO	PLATTE CO	WEATHERBY LAKE,C	81	001	5269	237	166		524	393		786	655	20?	20
264120001G01	ST ANN	ST LOUIS CO	10267 ST CHARLES	81	002	8187	130	85		406	325		645	456	18	16
264120001G01	ST ANN	ST LOUIS CO	10267 ST CHARLES	82	002	7582	125	106		336	333		584	553	23	16
264160002F01	ST CHARLES CO	ST CHARLES CO	HWY 94 (WEST ALT	81	001	7173	140	133		269	211		435	422	28	20
264160002F01	ST CHARLES CO	ST CHARLES CO	HWY 94 (WEST ALT	82	001	7449	1278	1255	6	1320	1314	13	1320	1320	53	20
264160005F03	ST CHARLES CO	ST CHARLES CO	WELDON SPRINGS	81	001	6769	219	177		673	423		1014	962	18	20
264160005F03	ST CHARLES CO	ST CHARLES CO	WELDON SPRINGS	82	001	1465	99	57		277	268		524	369	16?	20
264300006G01	ST LOUIS CO	ST LOUIS CO	305 WEIDMAN ROAD	81	002	7436	119	108		252	238		380	351	22	16
264300006G01	ST LOUIS CO	ST LOUIS CO	305 WEIDMAN ROAD	82	002	8037	132	110		397	294		569	401	20	16
264580026H05	SPRINGFIELD	GREENE CO	5012 S. CHARLEST	81	005	6681	214	147		655	499		1179	812	26	20
264580026H05	SPRINGFIELD	GREENE CO	5012 S. CHARLEST	82	005	2040	344	189		625	552		1085	838	35?	20
264580027H01	SPRINGFIELD	GREENE CO	1227E. CHESTNUT	81	005	8292	95	60		350	297		603	550	8	20
264580027H01	SPRINGFIELD	GREENE CO	1227E. CHESTNUT	82	005	8272	84	68		367	314		524	498	8	20
264640002F02	SUGAR CREEK	JACKSON CO	11424 GILL ST	81	001	8239	580	545	3	1330	1249	1	2096	1493	49	20
264640002F02	SUGAR CREEK	JACKSON CO	11424 GILL ST	82	001	5066	357	335		873	830		1153	1048	39?	20

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA

CARBON MONOXIDE (MG/M3) MISSOURI 81-82

METHOD: NONDISPERSIVE INFRARED (NDIR) CONTINUOUS, HOURLY VALUES-11, FLAME IONIZATION-21

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAX 1-HR 1ST	MAX 1-HR 2ND	OBS> 40	MAX 8-HR 1ST	MAX 8-HR 2ND	OBS> 10	METH
260030001G01	AFFTON	ST LOUIS CO	LIN FERRY & L'BE	81	002	8442	7.4	7.1		5.2	4.9		11
260030001G01	AFFTON	ST LOUIS CO	LIN FERRY & L'BE	82	002	8192	8.5	7.6		5.9	4.8		11
261040001G01	CLAYTON	ST LOUIS CO	55 HUNTER AVE	81	002	8472	10.0	9.3		7.9	7.0		11
261040001G01	CLAYTON	ST LOUIS CO	55 HUNTER AVE	82	002	8233	21.3	14.3		8.7	7.9		11
261600001G01	FERGUSON	ST LOUIS CO	FLORISSANT VALLE	81	002	8515	11.2	9.4		7.2	6.9		11
261600001G01	FERGUSON	ST LOUIS CO	FLORISSANT VALLE	82	002	7864	9.9	9.0		7.9	7.0		11
262180007F01	INDEPENDENCE	JACKSON CO	11301E.35TH ST	81	001	7349	33.4	32.2		25.9	16.7	5	11
262180007F01	INDEPENDENCE	JACKSON CO	11301E.35TH ST	82	001	8068	26.5	24.2		20.8	13.8	4	11
262380009H01	KANSAS CITY	CLAY CO	2600 NE PARVIN R	81	004	8374	18.2	16.4		8.1	7.7		11
262380009H01	KANSAS CITY	CLAY CO	2600 NE PARVIN R	82	004	8435	16.5	14.8		8.9	8.3		11
262380031H01	KANSAS CITY	JACKSON CO	BANNISTER ROAD	82		6334	7.6	7.6		6.0	4.1		11
264120001G01	ST ANN	ST LOUIS CO	10267 ST CHARLES	81	002	8394	23.7	21.0		15.8	12.9	4	11
264120001G01	ST ANN	ST LOUIS CO	10267 ST CHARLES	82	002	1786	19.0	17.6		7.9	7.7		11
264300006G01	ST LOUIS CO	ST LOUIS CO	305 WEIDMAN ROAD	81	002	8481	7.0	6.8		4.5	4.1		11
264300006G01	ST LOUIS CO	ST LOUIS CO	305 WEIDMAN ROAD	82	002	2062	5.3	4.8		3.8	3.0		11

NITROGEN DIOXIDE (UG/M3) MISSOURI 81-82

METHODS: HOURLY VALUES COLORIMETRIC-LYSHKOW-11, COLORIMETRIC-GRIESS-SALTZMAN-12, COULOMETRIC-13, CHEMILUMINESCENCE-14, 24-HOUR GAS BUBBLERS NASN SODIUM ARSENITE ORIFICE-84, NASN SODIUM ARSENITE FRIT-94, TEA METHOD-95, TGS METHOD-96

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAX 1-HR 1ST	MAX 1-HR 2ND	MAX 24-HR 1ST	MAX 24-HR 2ND	ARIT MEAN	METH
260030001G01	AFFTON	ST LOUIS CO	LIN FERRY & L'BE	81	002	8333	192	175			40	14
260030001G01	AFFTON	ST LOUIS CO	LIN FERRY & L'BE	82	002	4213	137	133			42?	14
261020005F01	CLAY CO	CLAY CO	HWY33 & COUNTY H	82	001	5676	370	340			16?	14
261040001G01	CLAYTON	ST LOUIS CO	55 HUNTER AVE	81	002	8537	158	147			38	14
261040001G01	CLAYTON	ST LOUIS CO	55 HUNTER AVE	82	002	7861	314	312			39	14
261600001G01	FERGUSON	ST LOUIS CO	FLORISSANT VALLE	81	002	8363	212	212			41	14
261600001G01	FERGUSON	ST LOUIS CO	FLORISSANT VALLE	82	002	4201	451	438			46?	14
262280012F01	JEFFERSON CO	JEFFERSON CO	ARNOLDTENBROOK &	81	001	2482	588	500			26?	14
262280012F01	JEFFERSON CO	JEFFERSON CO	ARNOLDTENBROOK &	82	001	1069	384	353			23?	14
262380023H01	KANSAS CITY	PLATTE CO	11500 N 71 HWY	81	004	4397	135	130			13?	14
262380023H01	KANSAS CITY	PLATTE CO	11500 N 71 HWY	82	004	8069	181	170			33	14
262380025H01	KANSAS CITY	CLAY CO	49TH & WINCHESTE	81	004	6954	200	191			17	14
262380025H01	KANSAS CITY	CLAY CO	49TH & WINCHESTE	82	004	8361	173	171			23	14
264120001G01	ST ANN	ST LOUIS CO	10267 ST CHARLES	81	002	8447	224	222			48	14
264120001G01	ST ANN	ST LOUIS CO	10267 ST CHARLES	82	002	1690	158	126			31?	14
264160002F01	ST CHARLES CO	ST CHARLES CO	HWY 94 (WEST ALT	82	001	5691	209	188			18?	14
264300006G01	ST LOUIS CO	ST LOUIS CO	305 WEIDMAN ROAD	81	002	8475	152	147			31	14
264300006G01	ST LOUIS CO	ST LOUIS CO	305 WEIDMAN ROAD	82	002	8069	150	141			25	14

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA

QUICK LOOK REPORT

OZONE (PARTS PER MILLION) MISSOURI 80-82

METHODS: HOURLY VALUES CHEMILUMINESCENCE-11, ULTRA VIOLET DASIBI CORPORATION-14, CHEMILUMINESCENCE RHODAMINE B DYE-15

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	DAILY MAX 1-HR 1ST	2ND	3RD	VALS > .125 MEAS	EST	NBR VALID DAILY MAX	MISS DAYS ASS < STD	ME
260030001G01	AFFTON	ST LOUIS CO	LIN FERRY & L'BE	80		8016	.171	.128	.120	2	2.2	337	2	11
260030001G01	AFFTON	ST LOUIS CO	LIN FERRY & L'BE	81	002	6578	.161	.119	.103	1	1.3	274	5	11
260030001G01	AFFTON	ST LOUIS CO	LIN FERRY & L'BE	82	002	4241	.114	.104	.104	0	0.0	176	6	11
261020003F01	CLAY CO	CLAY CO	WATKINS MILL ST	80		7757	.160	.160	.160	7	7.8	323	4	11
261020003F01	CLAY CO	CLAY CO	WATKINS MILL ST	81	001	6729	.120	.110	.108	0	0.0	287	3	11
261020003F01	CLAY CO	CLAY CO	WATKINS MILL ST	82	001	7940	.092	.084	.084	0	0.0	344	7	11
261020004F01	CLAY CO	CLAY CO	ROOSTERVILLE AIR	80		5074	.150	.138	.131	5	8.6	211	2	11
261020005F01	CLAY CO	CLAY CO	HWY33 & COUNTY H	81	001	4863	.125	.121	.121	1	1.8	207	1	11
261020005F01	CLAY CO	CLAY CO	HWY33 & COUNTY H	82	001	7383	.103	.099	.099	0	0.0	315	6	11
261040001G01	CLAYTON	ST LOUIS CO	55 HUNTER AVE	80		8221	.139	.134	.134	4	4.2	345	4	11
261040001G01	CLAYTON	ST LOUIS CO	55 HUNTER AVE	81	002	6752	.171	.153	.127	3	3.8	284	1	11
261040001G01	CLAYTON	ST LOUIS CO	55 HUNTER AVE	82	002	4193	.177	.155	.143	4	8.2	176	5	11
261600001G01	FERGUSON	ST LOUIS CO	FLORISSANT VALLE	80		8287	.199	.177	.162	11	11.5	348	1	11
261600001G01	FERGUSON	ST LOUIS CO	FLORISSANT VALLE	81	002	6660	.132	.123	.117	1	1.3	276	3	11
261600001G01	FERGUSON	ST LOUIS CO	FLORISSANT VALLE	82	002	4199	.163	.121	.121	1	2.1	174	7	11
261860014G01	GREENE CO	GREENE CO	FAIR GROVE HIGH	82		2197	.120	.077	.070	0	0.0	92	0	11
262280012F01	JEFFERSON CO	JEFFERSON CO	ARNOLDTENBROOK &	81	001	4085	.180	.140	.110	2	4.2	173	0	14
262280012F01	JEFFERSON CO	JEFFERSON CO	ARNOLDTENBROOK &	82	001	1466	.100	.085	.085	0	0.0	62	0	14
262380023H01	KANSAS CITY	PLATTE CO	11500 N 71 HWY	80		6846	.135	.132	.114	2	2.5	286	2	11
262380023H01	KANSAS CITY	PLATTE CO	11500 N 71 HWY	81	004	8212	.127	.115	.115	1	1.1	342	0	11
262380023H01	KANSAS CITY	PLATTE CO	11500 N 71 HWY	82	004	8467	.109	.097	.094	0	0.0	355	3	11
262380025H01	KANSAS CITY	CLAY CO	49TH & WINCHESTE	80		7089	.140	.094	.091	1	1.2	292	5	11
262380025H01	KANSAS CITY	CLAY CO	49TH & WINCHESTE	81	004	8622	.073	.068	.068	0	0.0	360	3	11
262380025H01	KANSAS CITY	CLAY CO	49TH & WINCHESTE	82	004	8375	.096	.091	.086	0	0.0	351	5	11
262950001A08	MARK TWAIN NATIONAL	MADISON CO	MARK TWAIN NAT.	80		4722	.155	.150	.105	2	3.7	196	1	11
262950001A08	MARK TWAIN NATIONAL	MADISON CO	MARK TWAIN NAT.	81		7850	.115	.115	.105	0	0.0	327	3	11
262950001A08	MARK TWAIN NATIONAL	MADISON CO	MARK TWAIN NAT.	82		684	.050	.045	.045	0	0.0	29	0	11
263740003F01	PLATTE CO	PLATTE CO	WEATHERBY LAKE,C	81	001	3428	.120	.109	.108	0	0.0	149	2	11
264120001G01	ST ANN	ST LOUIS CO	10267 ST CHARLES	80		8027	.148	.138	.137	3	3.2	335	6	11
264120001G01	ST ANN	ST LOUIS CO	10267 ST CHARLES	81	002	6746	.133	.131	.115	2	2.6	279	2	11
264120001G01	ST ANN	ST LOUIS CO	10267 ST CHARLES	82	002	4212	.170	.124	.115	1	2.0	177	3	11
264160002F01	ST CHARLES CO	ST CHARLES CO	HWY 94 (WEST ALT	80		5405	.199	.162	.142	5	7.9	229	2	11
264160002F01	ST CHARLES CO	ST CHARLES CO	HWY 94 (WEST ALT	81	001	6817	.151	.148	.125	3	3.8	288	5	11
264160002F01	ST CHARLES CO	ST CHARLES CO	HWY 94 (WEST ALT	82	001	7623	.128	.109	.109	1	1.1	329	6	11
264160005F03	ST CHARLES CO	ST CHARLES CO	WELDON SPRINGS	81		2295	.120	.108	.096	0	0.0	100	6	11
264160008J05	ST CHARLES CO	ST CHARLES CO	PROSPECT &FRANES	80		6741	.161	.144	.127	3	3.8	282	5	14
264280007H01	ST LOUIS	INDEPENDENT CTY	8227 SOUTH BROAD	80		5483	.136	.133	.123	2	3.3	219	8	11
264280061H01	ST LOUIS	INDEPENDENT CTY	SHREVE " I-70	80		8220	.084	.073	.072	0	0.0	344	4	11
264280062H01	ST LOUIS	INDEPENDENT CTY	RIVER DES PERES	80		7300	.114	.111	.109	0	0.0	306	6	11

QUICK LOOK REPORT

OZONE (PARTS PER MILLION) MISSOURI 80-82

METHODS: HOURLY VALUES CHEMILUMINESCENCE-11, ULTRA VIOLET DASIBI CORPORATION-14, CHEMILUMINESCENCE RHODAMINE B DYE-15

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	DAILY MAX 1-HR 1ST	2ND	3RD	VALS > .125 MEAS	EST	NBR VALID DAILY MAX	MISS DAYS ASS < STD	ME
264280063H01	ST LOUIS	INDEPENDENT CTY WATER DEPT		80		6406	.143	.138	.131	4	5.5	261	10	11
264280064H01	ST LOUIS	INDEPENDENT CTY	208 S 12TH ST	80		7330	.117	.116	.113	0	0.0	302	12	11
264300006G01	ST LOUIS CO	ST LOUIS CO	305 WEIDMAN ROAD	80		8164	.163	.157	.152	8	8.5	342	3	11
264300006G01	ST LOUIS CO	ST LOUIS CO	305 WEIDMAN ROAD	81	002	6363	.139	.114	.080	1	1.4	268	2	11
264300006G01	ST LOUIS CO	ST LOUIS CO	305 WEIDMAN ROAD	82	002	3707	.138	.131	.121	2	4.6	155	5	11
264580026H05	SPRINGFIELD	GREENE CO	5012 S. CHARLEST	80		4454	.100	.090	.080	0	0.0	185	3	11
264580026H05	SPRINGFIELD	GREENE CO	5012 S. CHARLEST	81	005	6980	.090	.080	.070	0	0.0	303	8	11
264580026H05	SPRINGFIELD	GREENE CO	5012 S. CHARLEST	82	005	2038	.060	.059	.059	0	0.0	88	2	11

QUICK LOOK REPORT

LEAD (UG/M3) MISSOURI 81-82

METHODS: JARRELL-ASH EMISSION SPECTRA ICAP-90, EMISSION SPECT MUFFLE FURNACE-91, ATOMIC ABSORPTION-92, DITHIOZONE METHOD-93
EMISSION SPECT (LOW TEMP ASH)-95, X-RAY FLUORESCENCE-96, FLAMELESS ATOMIC ABSORPTION-97

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	METH	QTRLY ARITH 1ST	2ND	3RD	MEAN 4TH	MEANS> 1.5	MAX VALUES 1ST	2ND
260030001G01	AFFTON	ST LOUIS CO	LIN FERRY & L'BE	82		15	92				.29		.93	.57
261040002G01	CLAYTON	ST LOUIS CO	801 SOUTH BRENTW	82		16	92				.51		1.70	1.05

QUICK LOOK REPORT

SUSPENDED PARTICULATE MATTER (UG/M3) ILLINOIS 81-82

METHOD: GRAVIMETRIC, 24-HOUR HI-VOLUME FILTER SAMPLE-91

SITE ID	LOCATION	COUNTY	ADDRESS	REP YR	REP ORG	#OBS	MAX 24-HR 1ST	MAX 24-HR 2ND	OBS> 260	OBS> 150	ARIT MEAN	GEO MEAN	GSD
140160004F01	ALTON	MADISON CO	103 E 3RD ST	81	001	58	172	157		2	80	73	1.6
140160004F01	ALTON	MADISON CO	103 E 3RD ST	82	001	55	129	118			63	58	1.5
140320001F01	BELLEVILLE	ST CLAIR CO	101 SOUTH ILLINO	81	001	61	180	110		1	69	66	1.4
140320001F01	BELLEVILLE	ST CLAIR CO	101 SOUTH ILLINO	82	001	60	117	115			56	52	1.5
140720001F01	CAHOKIA	ST CLAIR CO	BI-STATE PARKS A	81	001	60	215	122		1	70	65	1.5
140720001F01	CAHOKIA	ST CLAIR CO	BI-STATE PARKS A	82	001	54	117	108			53	49	1.6
141500002F01	COLLINSVILLE	MADISON CO	115A W MAIN	81		58	221	123		1	70	66	1.4
141500002F01	COLLINSVILLE	MADISON CO	115A W MAIN	82		60	121	112			55	50	1.5
141520001F01	COLUMBIA	MONROE CO	208 SOUTH RAPP	81		37	184	149		1	63	58	1.5
142120010F01	EAST ST LOUIS	ST CLAIR CO	RAPS SITE	81	001	60	237	231		10	113	105	1.5
142120010F01	EAST ST LOUIS	ST CLAIR CO	RAPS SITE	82	001	56	174	165		5	92	84	1.5
142960007F01	GRANITE CITY	MADISON CO	23RD AND MADISON	81	001	61	251	215		12	116	108	1.5
142960007F01	GRANITE CITY	MADISON CO	23RD AND MADISON	82	001	52	218	178		8	87	77	1.6
142960008F01	GRANITE CITY	MADISON CO	2301 E 23RD	81		19	161	133		1	84?	79?	1.4
142960009F01	GRANITE CITY	MADISON CO	2001 E 20TH ST	81		60	391	341	13	46	205	190	1.5
142960009F01	GRANITE CITY	MADISON CO	2001 E 20TH ST	82		58	417	365	7	23	157	136	1.7
142960010F01	GRANITE CITY	MADISON CO	15TH & MADISON	81		61	357	298	3	26	150	139	1.5
142960010F01	GRANITE CITY	MADISON CO	15TH & MADISON	82		58	462	332	6	20	145	124	1.8
142960011F01	GRANITE CITY	MADISON CO	ROOSEVELT & ROCK	81	001	58	231	173		9	104	96	1.5
142960011F01	GRANITE CITY	MADISON CO	ROOSEVELT & ROCK	82	001	57	188	169		3	83	75	1.6
142960014F02	GRANITE CITY	MADISON CO	N&W RAILROAD	81		46	889	534	4	17	166	137	1.8
142960014F02	GRANITE CITY	MADISON CO	N&W RAILROAD	82		21	279	221	1	6	123?	110?	1.6
142960015F01	GRANITE CITY	MADISON CO	JOHNSON AVE.	81		59	265	145	1	1	81	76	1.4
142960015F01	GRANITE CITY	MADISON CO	JOHNSON AVE.	82		52	159	118		1	64	60	1.5
142960016F01	GRANITE CITY	MADISON CO	23RD & NAMEOKI	82		41	331	271	2	7	104?	90?	1.7
142960016F02	GRANITE CITY	MADISON CO	23RD & NAMEOKI	81		56	288	219	1	11	114	106	1.5
142960019F01	GRANITE CITY	MADISON CO	20TH AND ADAMS	82		46	223	191		3	83?	74?	1.6
144680007F01	MADISON CO	MADISON CO	POAG ROAD	81		53	137	125			62	58	1.5
144680007F01	MADISON CO	MADISON CO	POAG ROAD	82		50	98	94			46	41	1.6
147960001F03	WATERLOO	MONROE CO	U.S. DEPT. OF AG	81		61	200	108		1	60	56	1.5
147960001F03	WATERLOO	MONROE CO	U.S. DEPT. OF AG	82		60	94	87			46	42	1.6
148520007F01	WOOD RIVER	MADISON CO	WATER TRT PLT 54	81	001	54	314	191	1	3	89	80	1.6
148520007F01	WOOD RIVER	MADISON CO	WATER TRT PLT 54	82	001	51	141	122			61	56	1.5

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA

QUICK LOOK REPORT

SULFUR DIOXIDE (UG/M3) ILLINOIS 81-82

METHODS: HOURLY VALUES WEST-GAEKE COLORIMETRIC-11, CONDUCTIMETRIC-13, COULOMETRIC-14, FLAME PHOTOMETRIC-16, HYDROGEN PEROXIDE NAOH TITRATION-18, CATALYST FLAME PHOTOMETRIC-19, PULSED FLUORESCENT-20, SECOND DERIVATIVE SPECTROSCOPY-21, CONDUCTANCE ASARCO-22, ULTRA VIOLET STIMULATED FLUORESCENCE-23,SEQUENTIAL CONDUCTIMETRIC-33, 24-HOUR GAS BUBBLERS PARAROSANILINE-SULFAMIC ACID-91, PARAROSANILINE SULFAMIC ACID TEMPERATURE CONTROLLED-97

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAX 24-HR 1ST	MAX 24-HR 2ND	OBS> 365	MAX 3-HR 1ST	MAX 3-HR 2ND	OBS> 1300	MAX 1-HR 1ST	MAX 1-HR 2ND	ARIT MEAN	MTH
140160006F01	ALTON	MADISON CO	2708 EDWARDS	81	001	6084	129	124		338	329		459	443	29	14
140160006F01	ALTON	MADISON CO	2708 EDWARDS	81	001	79	154	92		284	276		590	521	83?	20
140160006F01	ALTON	MADISON CO	2708 EDWARDS	82	001	6802	207	166		377	355		673	608	40	20
140720001F01	CAHOKIA	ST CLAIR CO	BI-STATE PARKS A	81	001	7439	154	113		293	286		558	527	24	20
140720001F01	CAHOKIA	ST CLAIR CO	BI-STATE PARKS A	82	001	7094	120	101		361	282		786	681	23	20
142120010F01	EAST ST LOUIS	ST CLAIR CO	RAPS SITE	81	001	8138	366	298	1	934	903		1438	1247	57	20
142120010F01	EAST ST LOUIS	ST CLAIR CO	RAPS SITE	82	001	7733	211	167		624	596		1438	1053	41	20
142960012F01	GRANITE CITY	MADISON CO	2301 ADAMS ST	81		83	89	44		164	103		191	157	50?	20
142960012F01	GRANITE CITY	MADISON CO	2301 ADAMS ST	82		7941	114	95		483	351		584	571	29	20
142960012H01	GRANITE CITY	MADISON CO	GRANITE CITY APC	81	001	7137	101	97		337	206		561	422	33	20
144680007F01	MADISON CO	MADISON CO	POAG ROAD	81	001	8044	114	89		198	193		369	296	23	20
144680007F01	MADISON CO	MADISON CO	POAG ROAD	82	001	8258	104	94		302	232		508	359	24	20
148520007F01	WOOD RIVER	MADISON CO	WATER TRT PLT 54	81	001	1795	160	154		279	271		529	406	40?	14
148520007F01	WOOD RIVER	MADISON CO	WATER TRT PLT 54	81	001	7979	267	158		548	505		749	681	34	20
148520007F01	WOOD RIVER	MADISON CO	WATER TRT PLT 54	82	001	7871	271	169		822	657		1258	1100	36	20

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA

QUICK LOOK REPORT

CARBON MONOXIDE (MG/M3) ILLINOIS 81-82

METHOD: NONDISPERSIVE INFRARED (NDIR) CONTINUOUS, HOURLY VALUES-11, FLAME IONIZATION-21

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAX 1-HR 1ST	MAX 1-HR 2ND	OBS> 40	MAX 8-HR 1ST	MAX 8-HR 2ND	OBS> 10	METH
140160007F01	ALTON	MADISON CO	SCHOOL BOARD ADM	81		5882	12.1	12.1		7.7	7.5		11
140160007F01	ALTON	MADISON CO	SCHOOL BOARD ADM	82		7942	11.5	11.3		6.8	6.3		11
142120010F01	EAST ST LOUIS	ST CLAIR CO	RAPS SITE	81	001	8088	15.1	14.8		9.3	7.5		11
142120010F01	EAST ST LOUIS	ST CLAIR CO	RAPS SITE	82	001	7119	16.7	12.3		5.1	5.0		11
142960017F01	GRANITE CITY	MADISON CO	2001 EDISON	82		5561	13.5	11.6		6.5	6.5		11
142960017H01	GRANITE CITY	MADISON CO	YMCA 2001 EDISON	81	001	7793	22.9	18.9		12.2	9.4	1	11

NITROGEN DIOXIDE (UG/M3) ILLINOIS 81-82

METHODS: HOURLY VALUES COLORIMETRIC-LYSHKOW-11, COLORIMETRIC-GRIESS-SALTZMAN-12, COULOMETRIC-13, CHEMILUMINESCENCE-14, 24-HOUR GAS BUBBLERS NASN SODIUM ARSENITE ORIFICE-84, NASN SODIUM ARSENITE FRIT-94, TEA METHOD-95, TGS METHOD-96

SITE ID	LOCATION	COUNTY	ADDRESS	REP YR	REP ORG	#OBS	MAX 1-HR 1ST	MAX 1-HR 2ND	MAX 24-HR 1ST	MAX 24-HR 2ND	ARIT MEAN	METH
142120010F01	EAST ST LOUIS	ST CLAIR CO	RAPS SITE	81	001	790	197	167			41?	14
142120010F01	EAST ST LOUIS	ST CLAIR CO	RAPS SITE	82	001	6871	207	179			42	14
142960017F01	GRANITE CITY	MADISON CO	2001 EDISON	82		5253	165	158			47?	14

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA

QUICK LOOK REPORT

OZONE (PARTS PER MILLION) ILLINOIS 80-82

METHODS: HOURLY VALUES CHEMILUMINESCENCE-11, ULTRA VIOLET DASIBI CORPORATION-14, CHEMILUMINESCENCE RHODAMINE B DYE-15

SITE ID	LOCATION	COUNTY	ADDRESS	YR	REP ORG	#OBS	DAILY MAX 1-HR 1ST	2ND	3RD	VALS > .125 MEAS	EST	NBR VALID DAILY MAX	MISS DAYS ASS < STD	ME
140160006F01	ALTON	MADISON CO	2708 EDWARDS	80		7541	.205	.141	.134	7	8.1	312	6	14
140160006F01	ALTON	MADISON CO	2708 EDWARDS	81	001	6651	.127	.124	.115	1	1.3	273	10	14
140160006F01	ALTON	MADISON CO	2708 EDWARDS	82	001	7799	.148	.116	.114	1	1.1	321	14	14
142120010F01	EAST ST LOUIS	ST CLAIR CO	RAPS SITE	80		7470	.143	.134	.132	5	5.8	307	8	14
142120010F01	EAST ST LOUIS	ST CLAIR CO	RAPS SITE	81	001	6405	.105	.103	.090	0	0.0	258	16	14
142120010F01	EAST ST LOUIS	ST CLAIR CO	RAPS SITE	82	001	8206	.138	.119	.108	1	1.0	338	11	14
142960012F01	GRANITE CITY	MADISON CO	2301 ADAMS ST	81		83	.021	.020	.019	0	0.0	4	0	14
142960012F01	GRANITE CITY	MADISON CO	2301 ADAMS ST	82		6835	.103	.102	.089	0	0.0	279	10	14
142960012H01	GRANITE CITY	MADISON CO	GRANITE CITY APC	80		2486	.084	.068	.066	0	0.0	102	4	14
142960012H01	GRANITE CITY	MADISON CO	GRANITE CITY APC	81		7796	.115	.094	.094	0	0.0	316	16	14
144680007F01	MADISON CO	MADISON CO	POAG ROAD	80		7494	.170	.153	.148	9	10.4	311	7	14
144680007F01	MADISON CO	MADISON CO	POAG ROAD	81	001	6553	.113	.106	.106	0	0.0	269	6	14
144680007F01	MADISON CO	MADISON CO	POAG ROAD	82	001	8242	.122	.111	.111	0	0.0	338	13	14
144680008F01	MADISON CO	MADISON CO	DIST. 11 POLICE	80		6647	.162	.142	.135	5	6.6	272	9	14
144680008F01	MADISON CO	MADISON CO	DIST. 11 POLICE	81	001	6275	.123	.117	.106	0	0.0	258	10	14
144680008F01	MADISON CO	MADISON CO	DIST. 11 POLICE	82	001	7597	.118	.105	.099	0	0.0	311	8	14
147960001F03	WATERLOO	MONROE CO	U.S. DEPT. OF AG	80		8002	.128	.128	.126	3	3.2	331	11	14
147960001F03	WATERLOO	MONROE CO	U.S. DEPT. OF AG	81		5974	.128	.099	.094	1	1.4	249	7	14
147960001F03	WATERLOO	MONROE CO	U.S. DEPT. OF AG	82		7589	.084	.082	.079	0	0.0	313	10	14
148520007F01	WOOD RIVER	MADISON CO	WATER TRT PLT 54	80		8168	.142	.141	.140	6	6.4	337	6	14
148520007F01	WOOD RIVER	MADISON CO	WATER TRT PLT 54	81	001	8275	.126	.122	.117	1	1.0	340	13	14
148520007F01	WOOD RIVER	MADISON CO	WATER TRT PLT 54	82	001	8037	.118	.112	.105	0	0.0	332	10	14

TABLE A2. PRECISION AND ACCURACY ESTIMATES FOR AMBIENT AIR MONITORING DATA

PRECISION-ACCURACY DATA KEY		PRECISION DATA				ACCURACY DATA											
		# OF	PRECIS	PROB LIM		SOURCE	TRACE	# AUDITS		PROB LIM		PROB LIM		PROB LIM		PROB LIM	
RG ST RO TYP POLL	YR-Q	ANLYZRS	CHECKS	LO	UP	AUD GAS	ABLTY	L1-3	L4	LO-L1-UP		LO-L2-UP		LO-L3-UP		LO-L4-UP	
07 26 001 C 42101	81-1	002	0003	-16	+00	B		002		-01	+29	+03	+19	+02	+08		
** CARBON MONOXIDE **	81-4							000									
	81-5	002	0003	-16	+00			0002	0000	-01	+29	+03	+19	+02	+08		
	82-1					A		001									
	82-2	002	0009	-14	+15	A		002		-13	+07	-09	+06	-07	+08		
	82-3	001	0006	-00	+03	A		001									
	82-5	002	0015	-07	+09			0004	0000	-13	+07	-09	+06	-07	+08		
07 26 001 C 42401	81-1	006	0030	-12	+08												
** SULFUR DIOXIDE ***	81-3	006	0035	-15	+12	F		002	002	-02	+20	-02	-00	-07	+04	-01	-01
	81-4	006	0033	-15	+19			000									
	81-5	006	0098	-14	+13			0002	0002	-02	+20	-02	+00	-07	+04	-01	-01
	82-1	008	0030	-10	+19	A		001									
	82-2	007	0041	-56	+55	A		004		-13	+03	-10	+03	-09	-01		
	82-3	008	0051	-28	+20	A		001									
	82-5	008	0122	-31	+31			0006	0000	-13	+03	-10	+03	-09	-01		
07 26 001 C 42602	81-4	002	0005	-16	+03			000									
** NITROGEN DIOXIDE *	81-5	002	0005	-16	+03			0000	0000								
	82-1	003	0009	-08	+08	A		001									
	82-2	003	0014	-19	+07			002		-06	+09	-03	+02	-11	+06		
	82-3	003	0021	-13	+18	A		001									
	82-5	003	0044	-13	+11			0004	0000	-06	+09	-03	+02	-11	+06		
07 26 001 C 44201	81-1	004	0016	-12	+08												
******* OZONE *******	81-3	007	0036	-09	+04	D		003	000	-07	+05	-09	+08	-10	+08		
	81-4	005	0022	-09	+11			000									
	81-5	005	0074	-10	+08			0003	0000	-07	+05	-09	+08	-10	+08		
	82-1	005	0023	-07	+14	E		002		-00	+05	-07	+06	-11	+07		
	82-2	006	0034	-07	+06	E		001									
	82-3	006	0039	-08	+09	E		002		+03	+07	-05	+07	-03	+05		
	82-5	006	0096	-07	+10			0005	0000	+02	+06	-06	+07	-07	+06		

PRECISION-ACCURACY DATA KEY		PRECISION DATA						ACCURACY DATA			
RG ST RO TYP POLL	YR-Q	# OF SAMPLRS	COLLOC SITES	PROB LIM LO	PROB LIM UP	COLL SAMP BELOW LIM	VAL COLL DATA PRS	# AUDITS LEV 1-3	PROB LIM LO-L1-UP	PROB LIM LO-L2-UP	PROB LIM LO-L3-UP
07 26 001 I 11101	81-2	18	2	-24	-01	0	2	007		-11 +08	
**** PARTICULATE ****	81-3	18	2	-19	+20	0	18	005		-03 +02	
	81-5	18	2	-22	+10	0	20	0012		-07 +05	
	82-1	17	2	-10	+11	0		003		-04 +06	
	82-2	17	2	-12	+06	0		002		-06 +07	
	82-3	22	2	-19	+25	0		004		-04 +01	
	82-5	19	2	-14	+14	0	0	0009		-05 +05	

PRECISION-ACCURACY DATA KEY		PRECISION DATA				ACCURACY DATA									
RG ST RO TYP POLL	YR-Q	# OF ANLYZRS	PRECIS CHECKS	PROB LIM LO	PROB LIM UP	SOURCE AUD	TRACE GAS ABLTY	# AUDITS L1-3	# AUDITS L4	PROB LIM LO-L1-UP		PROB LIM LO-L2-UP		PROB LIM LO-L3-UP	PROB LIM LO-L4-UP
07 26 002 C 42101	81-2	005	0054	-06	+08			000							
** CARBON MONOXIDE **	81-3	005	0039	-15	+09										
	81-4	005	0032	-09	+04			000							
	81-5	005	0125	-10	+07			0000	0000						
	82-1	005	0032	-21	+13	A		001							
	82-2	005	0036	-10	+07	A		001		-00	-00	-00	+06	-00	+03
	82-3	005	0035	-12	+12	A		001							
	82-5	005	0103	-14	+11			0003	0000	+00	+00	+00	+06	+00	+03
07 26 002 C 42401	81-2	005	0038	-51	+85			001							
** SULFUR DIOXIDE ***	81-3	005	0035	-13	+14										
	81-4	005	0030	-11	+08			000							
	81-5	005	0103	-25	+36			0001	0000						
	82-1	005	0032	-17	+07	A		001							
	82-2	005	0033	-11	+08	A		001		-07	+07	-14	+11	-13	+05
	82-3	005	0032	-07	+06	F		001							
	82-5	005	0097	-12	+07			0003	0000	-07	+07	-14	+11	-13	+05
07 26 002 C 42602	81-2	005	0041	-15	+18										
** NITROGEN DIOXIDE *	81-3	005	0029	-13	+11										
	81-4	005	0031	-07	+10			000							
	81-5	005	0101	-12	+13			0000	0000						
	82-1	005	0032	-19	+23	A		001							
	82-2	005	0032	-08	+09	A		001		-23	+14	-16	+03	-07	-07
	82-3	005	0031	-06	+11			000							
	82-5	005	0095	-11	+14			0002	0000	-23	+14	-16	+03	-07	-07
07 26 002 C 44201	81-2	005	0039	-16	+12										
******* OZONE *******	81-3	005	0035	-11	+13										
	81-4	000	0000					000							
	81-5	005	0074	-14	+13			0000	0000						
	82-1	000	0000					000							
	82-2	005	0028	-08	+09	E		002		+02	+08	+01	+06	+02	+04
	82-3	005	0033	-10	+08	E		001							
	82-5	005	0061	-09	+09			0003	0000	+02	+08	+01	+06	+02	+04

PRECISION-ACCURACY DATA KEY		PRECISION DATA						ACCURACY DATA			
RG ST RO TYP POLL	YR-Q	# OF SAMPLRS	COLLOC SITES	PROB LIM LO	PROB LIM UP	COLL SAMP BELOW LIM	VAL COLL DATA PRS	# AUDITS LEV 1-3	PROB LIM LO-L1-UP	PROB LIM LO-L2-UP	PROB LIM LO-L3-UP
07 26 002 I 11101	81-1	10	2	-11	+03	0	27				
**** PARTICULATE ****	81-2	9	2	-31	+26	0	5	003		-10 +06	
	81-3	9	2	-08	+14	0	25	006		-08 +09	
	81-5	9	2	-17	+14	0	57	0009		-09 +08	
	82-1	10	2	-44	+59	0		002		-08 +10	
	82-2	10	2	-15	+15	0		002		-09 +01	
	82-3	11	2	-38	+65	0		003		-01 +03	
	82-5	10	2	-32	+46	0	0	0007		-06 +05	

PRECISION-ACCURACY DATA KEY		PRECISION DATA						ACCURACY DATA			
RG ST RO TYP POLL	YR-Q	# OF SAMPLRS	COLLOC SITES	PROB LIM LO	PROB LIM UP	COLL SAMP BELOW LIM	VAL COLL DATA PRS	# AUDITS LEV 1-3	PROB LIM LO-L1-UP	PROB LIM LO-L2-UP	PROB LIM LO-L3-UP
07 26 003 I 11101	81-2							003		-17 +27	
**** PARTICULATE ****	81-3	9	2	-34	+31	0	23				
	81-4	10	2	-38	+22	0	26	000			
	81-5	10	2	-36	+27	0	49	0003		-17 +27	
	82-1							003		-07 +06	
	82-2	10	2	-26	+29	0		003		-06 +09	
	82-3	11	2	-30	+06	0		007		-09 +06	
	82-5	11	2	-28	+18	0	0	0013		-07 +07	

PRECISION-ACCURACY DATA KEY		PRECISION DATA				ACCURACY DATA									
RG ST RO TYP POLL	YR-Q	# OF ANLYZRS	PRECIS CHECKS	PROB LIM LO	UP	SOURCE AUD	GAS	TRACE ABLTY	# AUDITS L1-3	L4	PROB LIM LO-L1-UP	PROB LIM LO-L2-UP	PROB LIM LO-L3-UP	PROB LIM LO-L4-UP
07 26 003 C 42101	82-1					C			001					
** CARBON MONOXIDE **	82-2					A			002		-44 +12	-21 +01	-13 -00	
	82-3	002	0009	-37	+28	A			002		-18 +15	-08 +03	-04 -03	
	82-4	003	0026	-43	+26	A			002		-26 +08	-09 +08	-08 +10	
	82-5	003	0035	-40	+27				0007	0000	-29 +12	-13 +04	-08 +02	
07 26 003 C 42401	82-1					A			001					
** SULFUR DIOXIDE ***	82-2					F			002		-23 -09	-15 +01	-09 +02	
	82-3	004	0015	-26	+24	A			002		+02 +08	+03 +08	+04 +12	
	82-4	004	0029	-17	+28	A			001					
	82-5	004	0044	-22	+26				0006	0000	-11 -01	-06 +05	-03 +07	
07 26 003 C 42602	82-1					A			001					
** NITROGEN DIOXIDE *	82-2								000					
	82-3	002	0013	-55	+56	A			002		-28 +32	-12 +11	-06 +11	
	82-4	002	0009	-42	+23	A			001					
	82-5	002	0022	-49	+40				0004	0000	-28 +32	-12 +11	-06 +11	
07 26 003 C 44201	82-1								000					
******* OZONE *******	82-2					E			001					
	82-3	003	0019	-31	+17	E			005		-15 +08	-14 +02	-16 +04	
	82-4	003	0015	-28	+27	E			001					
	82-5	003	0034	-30	+22				0007	0000	-15 +08	-14 +02	-16 +04	

PRECISION-ACCURACY DATA KEY		PRECISION DATA						ACCURACY DATA			
RG ST RO TYP POLL	YR-Q	# OF SAMPLRS	COLLOC SITES	PROB LIM LO	PROB LIM UP	COLL SAMP BELOW LIM	VAL COLL DATA PRS	# AUDITS LEV 1-3	PROB LIM LO-L1-UP	PROB LIM LO-L2-UP	PROB LIM LO-L3-UP
07 26 003 I 11101	81-2							003		-17 +27	
**** PARTICULATE ****	81-3	9	2	-34	+31	0	23				
	81-4	10	2	-38	+22	0	26	000			
	81-5	10	2	-36	+27	0	49	0003		-17 +27	
	82-1							003		-07 +06	
	82-2	10	2	-26	+29	0		003		-06 +09	
	82-3	11	2	-30	+06	0		007		-09 +06	
	82-4	9	2	-04	+14	0		002		-44 +21	
	82-5	10	2	-20	+16	0	0	0015		-17 +11	
	83-1	2	2	+01	+11	0		003		-05 +03	
	83-5	2	2	+01	+11	0	0	0003		-05 +03	

PRECISION-ACCURACY DATA KEY		PRECISION DATA				ACCURACY DATA									
RG ST RO TYP POLL	YR-Q	# OF ANLYZRS	PRECIS CHECKS	PROB LIM LO	UP	SOURCE AUD	GAS ABLTY	# AUDITS L1-3	L4	PROB LIM LO-L1-UP		PROB LIM LO-L2-UP		PROB LIM LO-L3-UP	PROB LIM LO-L4-UP
07 26 004 C 42101	81-1	002	0007	-00	-00										
** CARBON MONOXIDE **	81-2	002	0008	-15	+16			000							
	81-3	002	0010	-14	+13										
	81-4	002	0009	-10	+07			000							
	81-5	002	0034	-10	+09			0000	0000						
	82-1	002	0009	-10	+12	A		001							
	82-2	003	0015	-02	+16	A		002		-15	-02	-07	-05	-03	-01
	82-3	003	0018	-08	+12	A		001							
	82-5	003	0042	-07	+13			0004	0000	-15	-02	-07	-05	-03	-01
07 26 004 C 42401	81-1	002	0004	-00	-00										
** SULFUR DIOXIDE ***	81-2							000							
	81-3	002	0011	-26	+20										
	81-4	002	0012	-25	+30			000							
	81-5	002	0027	-17	+17			0000	0000						
	82-1	002	0011	-28	+28	A		001							
	82-2	002	0015	-18	+19	A		002		-15	-07	-15	-00	-12	+04
	82-3	002	0011	-22	+23	A		001							
	82-5	002	0037	-23	+23			0004	0000	-15	-07	-15	+00	-12	+04
07 26 004 C 42602	81-1	002	0002	-06	+06										
** NITROGEN DIOXIDE *	81-2	002	0007	-74	+71			000							
	81-3	002	0007	-13	+19										
	81-4	002	0006	-30	+39			000							
	81-5	002	0022	-31	+34			0000	0000						
	82-1	002	0013	-36	+46	A		001							
	82-2	002	0008	-22	+23	A		002		-45	+02	-51	+18	-33	+12
	82-3	002	0015	-26	+27	A		001							
	82-5	002	0036	-28	+32			0004	0000	-45	+02	-51	+18	-33	+12
07 26 004 C 44201	81-1	002	0009	-03	+01										
******* OZONE *******	81-2	002	0010	-18	+21			000							
	81-3	002	0012	-03	+10										
	81-4	002	0011	-10	+16			000							
	81-5	002	0042	-09	+12			0000	0000						
	82-1	002	0012	-05	+17	E		001							
	82-2	002	0017	-10	+16	E		002		-07	+07	-05	+04	-06	-01
	82-3	002	0015	-09	+13	E		001							
	82-5	002	0044	-08	+15			0004	0000	-07	+07	-05	+04	-06	-01

PRECISION-ACCURACY DATA KEY		PRECISION DATA						ACCURACY DATA			
RG ST RO TYP POLL	YR-Q	# OF SAMPLRS	COLLOC SITES	PROB LIM LO	PROB LIM UP	COLL SAMP BELOW LIM	VAL COLL DATA PRS	# AUDITS LEV 1-3	PROB LIM LO-L1-UP	PROB LIM LO-L2-UP	PROB LIM LO-L3-UP
07 26 004 I 11101	81-2	7	2	-06	+15	0	22	000			
**** PARTICULATE ****	81-3	7	2	-02	+07	0	27	012		-09 +11	
	81-4	7	2	-05	+09	0	27	000			
	81-5	7	2	-04	+10	0	76	0012		-09 +11	
	82-1	7	2	-08	+07	0		002		-02 +06	
	82-2	9	2	-08	+09	0		002		-03 +12	
	82-3	10	2	-17	+23	0		002		-02 +04	
	82-5	9	2	-11	+13	0	0	0006		-02 +07	

PRECISION-ACCURACY DATA KEY		PRECISION DATA				ACCURACY DATA									
RG ST RO TYP POLL	YR-Q	# OF ANLYZRS	PRECIS CHECKS	PROB LIM LO	PROB LIM UP	SOURCE AUD	TRACE GAS	ABLTY	# AUDITS L1-3	# AUDITS L4	PROB LIM LO-L1-UP	PROB LIM LO-L2-UP	PROB LIM LO-L3-UP	PROB LIM LO-L4-UP
07 26 005 C 42401	81-2	001	0007	-21	+04	C			001					
** SULFUR DIOXIDE ***	81-3	001				F			001					
	81-4	002	0012	-21	+12				000					
	81-5	001	0019	-21	+08				0002	0000				
	82-1					F			001					
	82-2	001	0012	-07	+41	A			002		-14 +22	-17 +10	-18 +12	
	82-3	001	0007	-47	+17				000					
	82-5	001	0019	-27	+29				0003	0000	-14 +22	-17 +10	-18 +12	
07 26 005 C 44201	81-2	000							000					
******* OZONE *******	81-4	000	0000						000					
	81-5	000	0000						0000	0000				
	82-3	001	0008	-20	+32				000					
	82-5	001	0008	-20	+32				0000	0000				

PRECISION-ACCURACY DATA KEY						PRECISION DATA						ACCURACY DATA			
RG	ST	RO	TYP	POLL	YR-Q	# OF SAMPLRS	COLLOC SITES	PROB LIM LO	PROB LIM UP	COLL SAMP BELOW LIM	VAL COLL DATA PRS	# AUDITS LEV 1-3	PROB LIM LO-L1-UP	PROB LIM LO-L2-UP	PROB LIM LO-L3-UP
07	26	005	I	11101	81-2							003		-03 +10	
**** PARTICULATE ****					81-3	8	2	+05	+10	0	28				
					81-4	10	2	+01	+11	2	30	000			
					81-5	9	2	+03	+11	2	58	0003		-03 +10	
					82-1	10	2	-08	+01	0		002		-03 -00	
					82-2	11	2	-08	+03	0		003		-04 +03	
					82-3	11	2	-02	+04	0		000			
					82-5	11	2	-06	+03	0	0	0005		-04 +02	

PRECISION-ACCURACY DATA KEY		PRECISION DATA						ACCURACY DATA			
RG ST RO TYP POLL	YR-Q	# OF SAMPLRS	COLLOC SITES	PROB LIM LO	PROB LIM UP	COLL SAMP BELOW LIM	VAL COLL DATA PRS	# AUDITS LEV 1-3	PROB LIM LO-L1-UP	PROB LIM LO-L2-UP	PROB LIM LO-L3-UP
07 26 005 I 11101	81-2							003		-03 +10	
**** PARTICULATE ****	81-3	8	2	+05	+10	0	28				
	81-4	10	2	+01	+11	2	30	000			
	81-5	9	2	+03	+11	2	58	0003		-03 +10	
	82-1	10	2	-08	+01	0		002		-03 -00	
	82-2	11	2	-08	+03	0		003		-04 +03	
	82-3	11	2	-02	+04	0		000			
	82-4	9	2	-06	+04	2		007		-06 +03	
	82-5	10	2	-06	+03	2	0	0012		-04 +02	
	83-1	2	2	-01	+08	1		003		-09 +05	
	83-5	2	2	-01	+08	1	0	0003		-09 +05	

PRECISION-ACCURACY DATA KEY		PRECISION DATA				ACCURACY DATA									
RG ST RO TYP POLL	YR-Q	# OF ANLYZRS	PRECIS CHECKS	PROB LIM LO	PROB LIM UP	SOURCE AUD	TRACE GAS ABLTY	# AUDITS L1-3	# AUDITS L4	PROB LIM LO-L1-UP		PROB LIM LO-L2-UP		PROB LIM LO-L3-UP	PROB LIM LO-L4-UP
07 26 005 C 42401	81-2	001	0007	-21	+04	C		001							
** SULFUR DIOXIDE ***	81-3	001				F		001							
	81-4	002	0012	-21	+12			000							
	81-5	001	0019	-21	+08			0002	0000						
	82-1					F		001							
	82-2	001	0012	-07	+41	A		002		-14	+22	-17	+10	-18	+12
	82-3	001	0007	-47	+17			000							
	82-4	001	0007	-29	+09	A		001							
	82-5	001	0026	-28	+22			0004	0000	-14	+22	-17	+10	-18	+12
07 26 005 C 44201	81-2	000						000							
******* OZONE *******	81-4	000	0000					000							
	81-5	000	0000					0000	0000						

§ 81.326 Missouri.

Missouri—TSP

Designated area	Does not meet primary standards	Does not meet secondary standards	Cannot be classified	Better than national standards
St. Louis AQCR (070):				
St. Louis (an area extending west about 2 miles from the Mississippi River, north to near I-270 and south to about 1 mile beyond the city limits)	X	X		
Remainder of the City of St. Louis		X		
Remainder of AQCR				X
Kansas City AQCR (094):				
Kansas City (an area extending approximately from the Kansas State line east along 55th St. to I-435, then north to I-70, east to Meland Rd., north to I-35, southwest to I-29, northwest to I-635, and southwest to the state line)	X	X		

Missouri—TSP

Designated area	Does not meet primary standards	Does not meet secondary standards	Cannot be classified	Better than national standards
Kansas City (an area extending approximately from the Kansas State line east along Red Bridge Rd. and 115th St. to Missouri Highway 291, then north to I-70, east to Missouri Highway 7, north to U.S. Highway 24 west to Missouri Highway 291, north to Missouri Highway 152, west to Missouri Highway 9, south to U.S. Highway FF, and due south to the State line)		X		
St. Joseph City limits	X	X		
Remainder of AQCR				X
Northern AQCR (137): Mexico (township 51 north, range 9 west)			X	
Columbia City limits		[1]X		
Pike County				X
Ralls County				X
Remainder of AQCR				X
Southeastern AQCR (138): Township 23 north, range 14 east and township 22 north, range 14 east (New Madrid)		[1]X		
Remainder of AQCR				X
Southwestern AQCR (139)				X

[1]EPA designation replaces State designation.

Missouri—SO_2

Designated area	Does not meet primary standards	Does not meet secondary standards	Cannot be classified	Better than national standards
Northern AQCR (137):				
Pike County				X
Ralls County				X
Remainder of AQCR				X
Remainder of State				X

Missouri—O_3

Designated area	Does not meet primary standards	Cannot be classified or better than national standards
St. Louis AQCR (070):		
Entire area	X	
Kansas City AQCR (094):		
Jackson County	X	
Clay County	X	
Platte County	X	
Remainder of AQCR		X
Northern AQCR (137):		
Pike County		X
Ralls County		X
Remainder of AQCR		X
Remainder of State		X

Missouri—CO

Designated area	Does not meet primary standards	Cannot be classified or better than national standards
St. Louis AQCR (070):		
The area encompassed by I-270 and the Mississippi River	X	
Northern AQCR (137):		
Pike County		X
Ralls County		X
Remainder of AQCR		X
Remainder of State		X

Missouri—NO_2

Designated area	Does not meet primary standards	Cannot be classified or better than national standards
Northern AQCR (137):		
Pike County		X
Ralls County		X
Remainder of AQCR		X
Remainder of State		X

[43 FR 8964, Mar. 3, 1978, as amended at 45 FR 22931, Apr. 4, 1980; 45 FR 27781, Apr. 24, 1980; 45 FR 62821, Sept. 22, 1980; 46 FR 899, Jan. 5, 1981; 46 FR 40008, Aug. 6, 1981]

APPENDIX B
Statistical Evaluation of Trends

The trend evaluation procedure used in the air quality evaluation is based on the Sen non-parametric statistic. The procedure was recommended by Vector Research, Incorporated, in a study performed under contract with the U.S. Environmental Protection Agency. It was selected over other candidate methods as the method which gives the highest probability of detecting real trends. Essential advantages of the method include the following:

1. It takes the seasonality of data into account.

2. It deals with autocorrelation effects in data collected at frequent intervals e.g., hourly. (Autocorrelation is the tendency for data measured at nearby times to be more similar than data measured at more distant times).

3. It does not assume that the data are normally distributed.

4. It identifies continuing trends, even if there is some oscillation around the trend line.

The latest draft report of the study, "Methods for Classifying Changes in Environmental Conditions" [VRI-EPA 7.4-FR80-1(R)] describes in more detail the other candidate methods and the advantages of the Sen statistical test.

A step-by-step summary of the trend evaluation procedure is given in the following paragraphs, which were adapted from the above report.

1. Compute one data value for each month of each year. For high-frequency data series in which autocorrelation may be present (e.g., continuous monitor data), a monthly average will correct for that autocorrelation. Alternatively, if trends in high pollutant concentrations at a site are of greater interest, the 90th percentile concentration for each month is used. (The 90th percentile concentration produces a more stable statistical estimate than would the maximum concentration.)

2. Compute the seasonal average of the data for each calendar month, (i.e., compute the average of all January values, the average of all February values, etc.). Subtract the appropriate seasonal average from the value for each month to obtain seasonally adjusted data.

3. Rank the seasonally adjusted data. Replace each adjusted datum with its rank. (This step makes the procedure non-parametric. It eliminates the requirement for different statistical methods for different series of data with different distributional laws governing their random behavior. It also limits the potential error-producing effects of outliers.)

4. Compute the Sen test statistic, S, from the formula

$$S = \sqrt{\frac{12\,T^2}{Y(Y+1)\sum_{y=1}^{Y}\sum_{t=1}^{T}(R_{yt} - R_{.t})^2}} \sum_{y=1}^{Y}\left(y - \frac{Y+1}{2}\right)\left(R_{y.} - \frac{TY+1}{2}\right)$$

where

Y = number of years
y = the index of the year (the index of first year is 1, of the second year, 2, etc.)
T = number of periods per year (12)
t = the index of the month (the index for January is 1, for February 2, etc.)
R_{yt} = the rank of the seasonally adjusted value for month t of year y
$R_{\cdot t}$ = the mean rank for month t over all the years
$R_{y\cdot}$ = the mean rank over all months for year y

The significance of the individual parts of that formula is described as follows.

a) For each year, $R_{y\cdot}$ is computed by averaging the ranks of the seasonally adjusted data for that year. This will be large if the data in that year are higher than that in other years, small if the data are smaller. Thus, an increasing trend in this mean rank indicates an increasing trend in the data through the years. Likewise, a decreasing trend in the mean ranks indicates a decreasing trend in the data.

b) The term

$$\sum_{y=1}^{Y} \left(y - \frac{Y+1}{2}\right)\left(R_{y\cdot} - \frac{TY+1}{2}\right)$$

represents the covariance between the mean rank for a year and the index of that year. When large annual mean ranks ($R_{y\cdot}$ - (TY + 1)/2 positive) occur in late years (y-(Y+1)/2 positive) or small annual mean ranks ($R_{y\cdot}$ - (TY + 1)/2 negative) occur in early years (y-(Y+1)/2 negative) a positive product will result. Thus, an accumulation of positive products, and therefore, a large positive result, is associated with a positive trend. Similarly, an accumulation of negative products, and a large negative result, is associated with a negative trend.

c) The first term of the equation is a scale factor which normalizes the covariance calculated above. It is a data-based estimate of the expected standard deviation of the covariance statistic if there were no trend. The scaling adjusts the covariance statistic so that it may be compared with tabulated percentile values of the normal probability distribution, rather than requiring the generation of special tables uniquely applicable to this statistic.

5. If the statistic exceeds (in either direction) the appropriate percentile values of the tabulated normal probability distribution, a statistically significant trend is present. If it does not exceed those values, no statistically significant trend is present.

Specifically, if the Sen statistic exceeds ± 1.645 (the 90th percentile values of the normal distribution for a two-tailed test), we conclude that the data show a trend. If the statistic does not exceed those limits, but does exceed ±1.28 (the 80th percentile values), we conclude that the data show a probable trend. Otherwise, we conclude that no statistically significant trend is shown by the data.

The following example illustrates the above process. While the trend calculations are usually performed by a computer, and include five years of data, the example shows how the calculations can be done manually. The example uses only three years of data, so that the calculation can be more easily followed.

Monthly geometric mean TSP data provide the starting point for the calculation. The monthly values and the seasonal averages are:

Year	Jan	Feb	Mar	Apr	May	Jun
1	102	126	142	150	92	112
2	136	107	144	68	80	100
3	70	67	84	125	112	83
Monthly (Seasonal) Average	102.67	100.0	123.33	114.33	94.67	98.33

Year	Jul	Aug	Sep	Oct	Nov	Dec
1	124	122	126	117	93	136
2	90	104	125	125	102	63
3	95	105	107	101	68	98
Monthly (Seasonal) Average	103.0	110.33	119.33	114.33	87.67	99.0

The seasonally adjusted data are obtained by subtracting the appropriate seasonal average from each monthly value.

Year	Jan	Feb	Mar	Apr	May	Jun
1	-.67	26	18.67	35.67	-2.67	13.67
2	33.33	7	20.67	-46.33	-14.67	1.67
3	-32.67	-33.0	-39.33	10.67	17.33	-15.33

Year	Jul	Aug	Sep	Oct	Nov	Dec
1	21.0	11.67	6.67	2.67	5.33	37.0
2	-13.0	-6.33	5.67	10.67	14.33	-36.0
3	-8.0	-5.33	-12.33	-13.33	-19.67	-1.0

The seasonally adjusted data are ranked from lowest to highest and replaced by the ranks R_{yt}, as shown in the next table. Ties are handled by assigning the same average rank to each of the tied values. (Ranks 24 and 25 are tied, so both months are ranked as 24.5). The mean rank for each season ($R_{.t}$) and the mean rank for each year ($R_{y.}$) are also shown.

Year	Jan	Feb	Mar	Apr	May	Jun
1	17	33	30	35	15	27
2	34	23	31	1	8	18
3	5	4	2	24.5	29	7
$R_{.t}$	18.67	20	21	20.17	17.33	17.33

Year	Jul	Aug	Sep	Oct	Nov	Dec	$R_{y.}$
1	32	26	22	19	20	36	26.0
2	10	13	21	24.5	28	3	17.875
3	12	14	11	9	6	16	11.625
$R_{.t}$	18	17.67	18	17.5	18	18.33	

The individual terms $(R_{yt}-R_{.t})^2$ in the summation of the scale factor are listed in the following table. The summation over all three years for each individual month, is shown in the last line of the table.

Year	Jan	Feb	Mar	Apr	May	Jun
1	2.8	169	81	219.9	5.4	93.5
2	235.1	9	100	367.5	87.0	0.4
3	186.8	256	361	18.7	136.2	106.7
$\sum_{y=1}^{3}(R_{yt}-R_{.t})^2$	424.7	434	542	606.1	228.7	200.6

Year	Jul	Aug	Sep	Oct	Nov	Dec
1	196	69.4	16	2.25	4	312.2
2	64	21.8	9	49.	100	235.0
3	36	13.5	49	72.25	144	5.4
$\sum_{y=1}^{3}(R_{yt}-R_{.t})^2$	296	104.7	74	123.5	248	552.6

Summing across the last line of the table, we have

$$\sum_{t=1}^{12} \sum_{y=1}^{3} (R_{yt} - R_{.t})^2 = 3834.9$$

Substituting into the formula for the Sen statistic, we have

$$S = \sqrt{\frac{12\ (12)^2}{3(4)\ (3834.9)}} \left[(1 - \tfrac{4}{2})\ (26.0 - \tfrac{37}{2}) + (2 - \tfrac{4}{2})\ (17.875 - \tfrac{37}{2}) + (3 - \tfrac{4}{2})\ (11.65 - \tfrac{37}{2}) \right]$$

$$= .1938\ [\ -7.50 + 0 - 6.85\ ] = -2.78$$

Since the test statistic is below the range $\pm$ 1.645 (the 90th percentile values of the normal distribution), we conclude (with greater than 90% confidence) that the data show a decreasing trend.

APPENDIX C
Population Exposure Estimates

As Section XIII of this report described, previous estimates of population exposure to elevated concentrations have focused on county-level populations in areas where all or portions of a county had been designated as not meeting the NAAQS's for specific pollutants. Those approximations tend to overestimate, and sometimes greatly so, the population exposure. In order to refine those estimates, populations within the designated non-attainment areas were desired. Systems Applications, Inc. (SAI), of San Rafael, California has written the software necessary to compute population estimates within any arbitrary closed polygon at any location in the United States. The procedure used is based in part on the high resolution population gridding program used in the SHEAR model for estimating population exposure to air pollutants (Anderson and Lundberg, 1983). Robert G. Ireson was the SAI project manager for the current study. Funding for the project came through EPA Headquarters. Tim Matzke (Environmental Results Branch, OMSE) provided the necessary coordination. The assistance of both of those individuals is gratefully acknowledged.

This Appendix gives a general description of the software, and provides copies of the program outputs, including population density maps. Since those maps show approximate population densities by square kilometer, they may be useful as a reference for other analyses, in addition to the population exposure estimates. The abbreviations "PNA," "SNA," and "Unclass" in the map titles stand for "Primary Non-Attainment Area," "Secondary Non-Attainment Area," and "Unclassified Area," respectively.

The starting point for the population estimation is a set of points which define a closed polygon (the non-attainment area). These points were initially obtained by digitizing the outline of each non-attainment area from appropriate maps. Those points were used both in constructing the non-attainment area boundaries shown in the body of the report, and as input to the population estimation software.

The SAI software checks each polygon to verify closure, and selects a cell size which is appropriate to the size of the non-attainment area of interest. Map scale is also adjusted according to the size of the area Comparison of the Kansas City O_3 map (2 km x 2 km cells) with the St. Joseph TSP map (1 km x 1 km cells) illustrates both effects. Maps are plotted with Universal Transverse Mercator coordinate axes, and include a border extending four cell widths beyond the boundary of the area of interest.

The program searches the population data file, which contains the locations of the centroids of all census block groups and enumeration districts (BG/ED's), and the population of each BG/ED. It assigns each centroid to the appropriate cell in the final grid, and distributes the population for each BG/ED according to the density of centroids and the size of the cells. It then calculates the population density for each cell. Individual cells are classified as being inside the polygon, outside

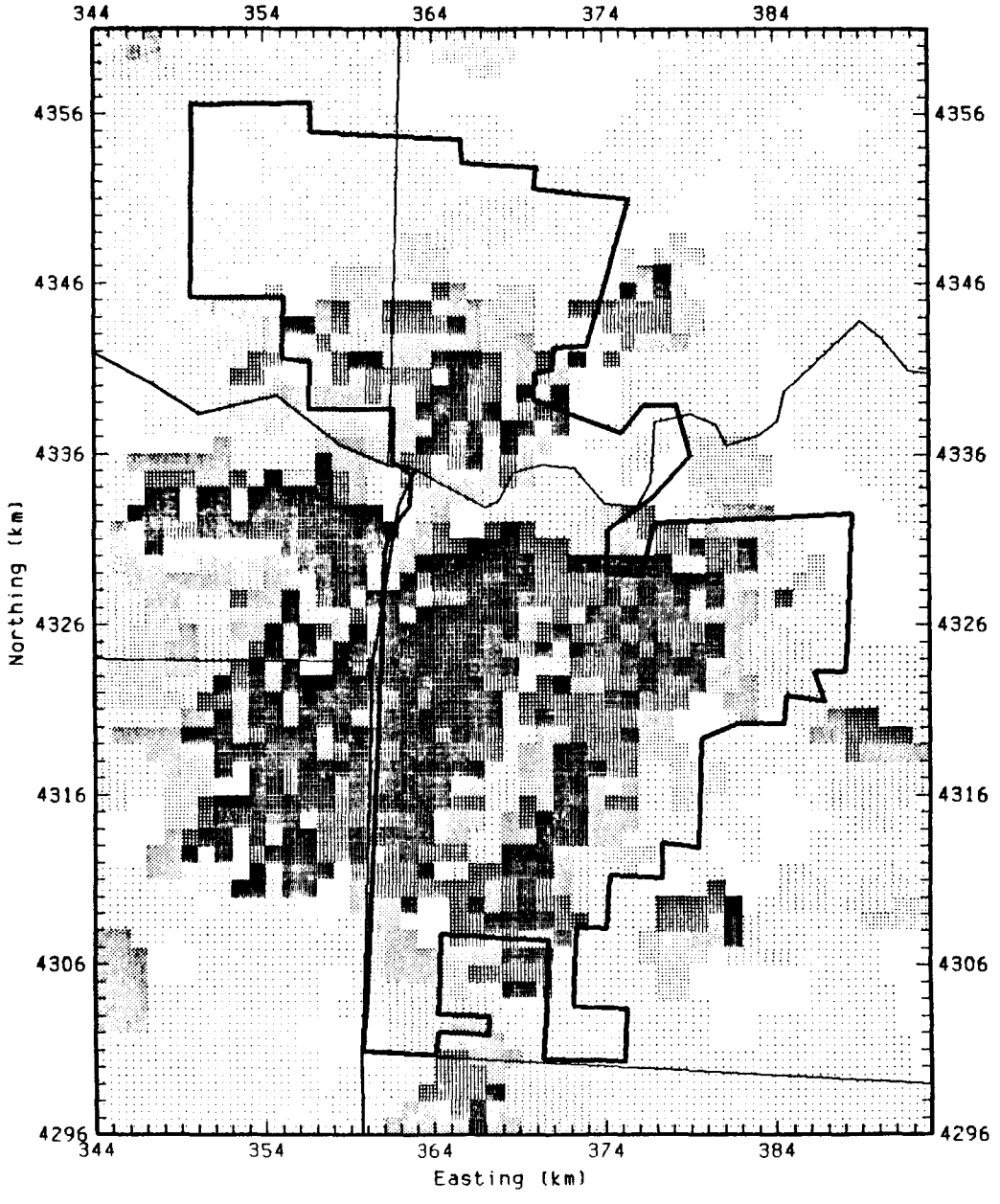
the polygon, or divided by the polygon. The population within the polygon is estimated by adding up the populations of all cells in the polygon. For cells divided by the polygon, the relative areas inside and outside are used to estimate the population inside.

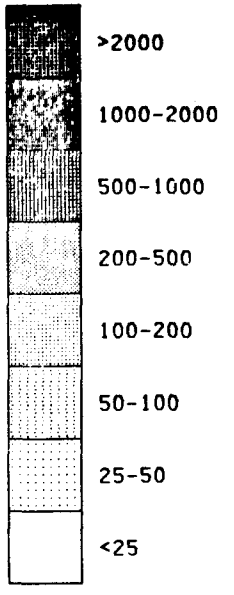
The population extraction and gridding program produces a listing, by county, of the number and total population of the BG/ED's extracted for the grid. For completeness, those listings are also included. Where the geographical density of the BG/ED's centroids is low, the populations may be spread over a large number of cells, especially near the edges of the final grid. In those cases, (which appear on the map as large areas with uniform low density), population density estimates may be shifted into or out of the polygon. If the total population is small, that effect may significantly change the estimate for population within the polygon.

Because of the approximations discussed above, the population estimates in the text were rounded to the nearest 1000. Where total population was low, and the non-attainment area boundary coincides with the city limits, the city population from census tables was used, rather than the estimate from the computer-produced population density map.

Reference

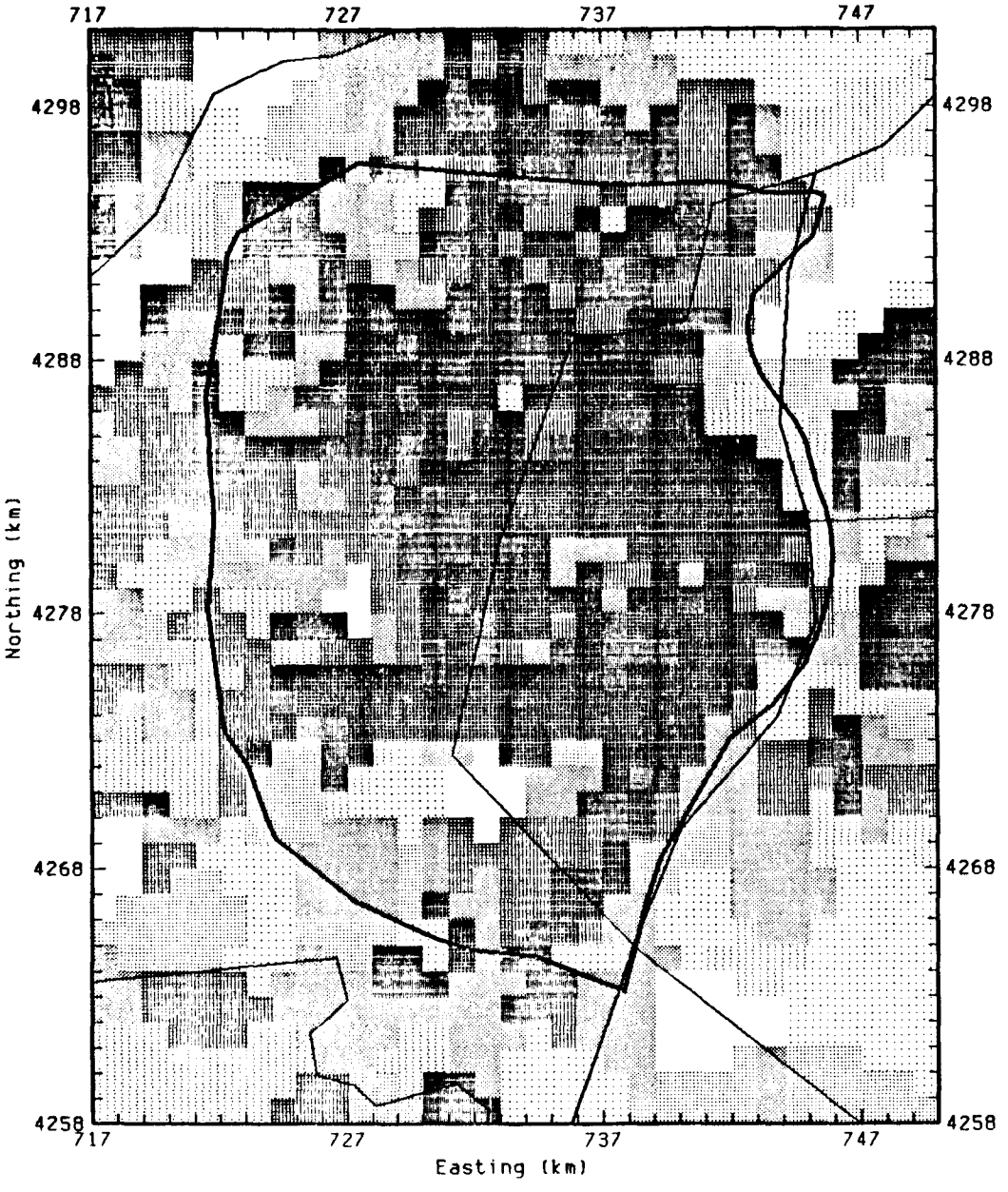
Anderson, Gerald E., and Lundberg, Gary W. 1983. User's Manual for SHEAR. A Computer Code for Modeling Human Exposure and Risk from Multiple Hazardous Air Pollutants in Selected Regions. Report SYSAPP-83/124, Systems Applications, Inc., San Rafael, California.

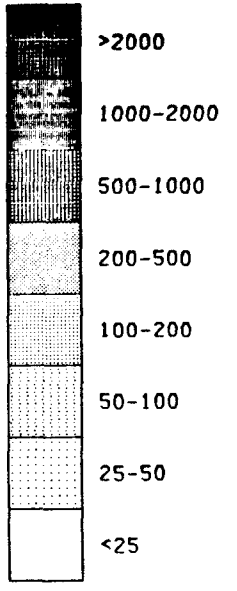




Enclosed Population is 672.000

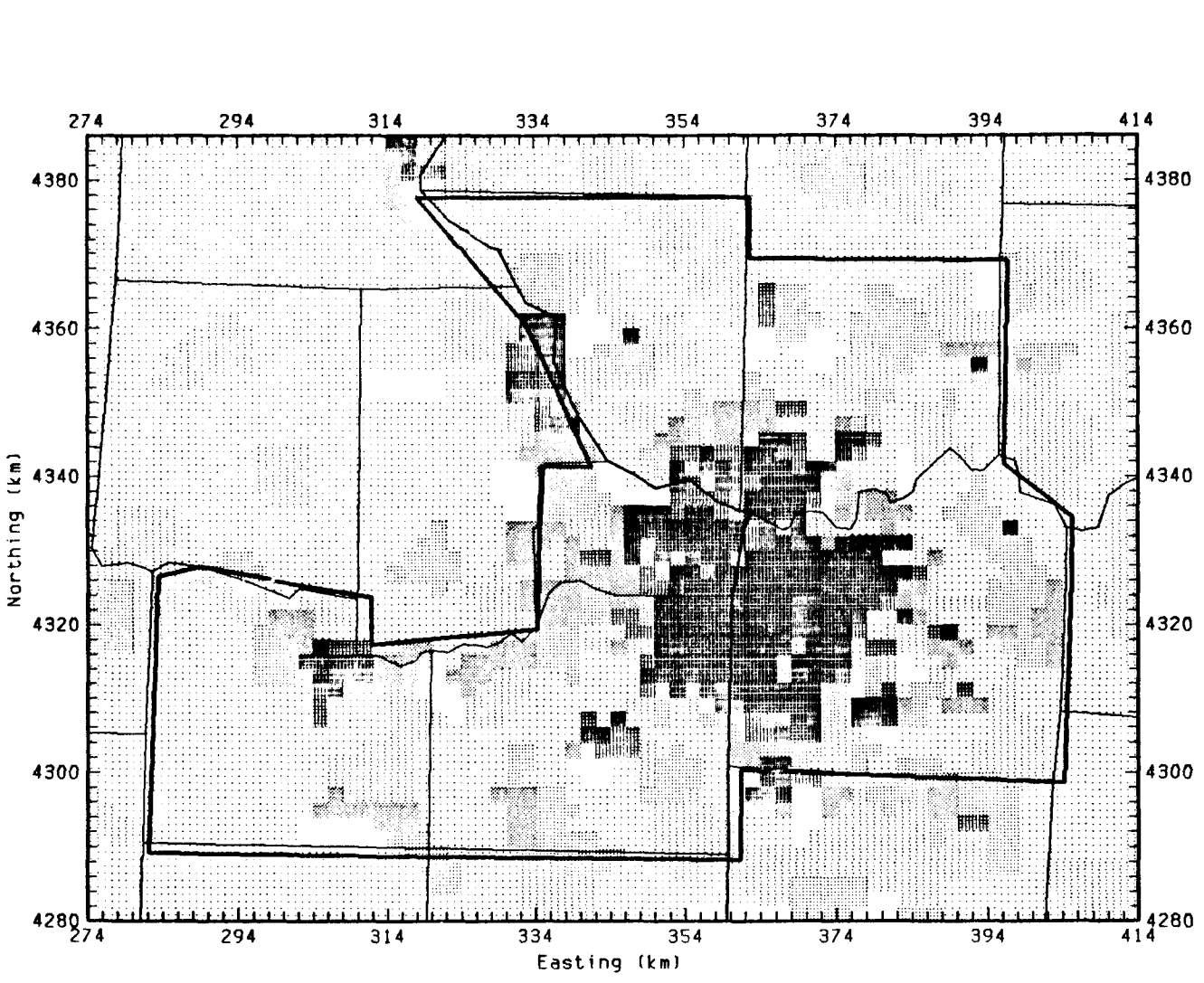
Kansas City CO Unclass
Population Density Map for Polygon 3

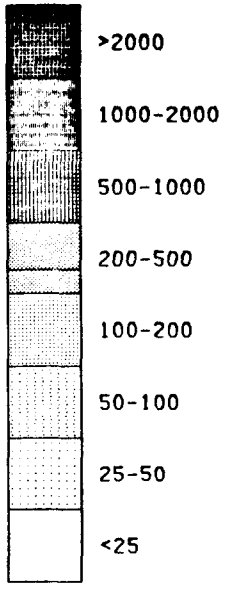




Enclosed Population is ~~1,199,99~~
1,200,000

St. Louis CO PNA
Population Density Map for Polygon 44

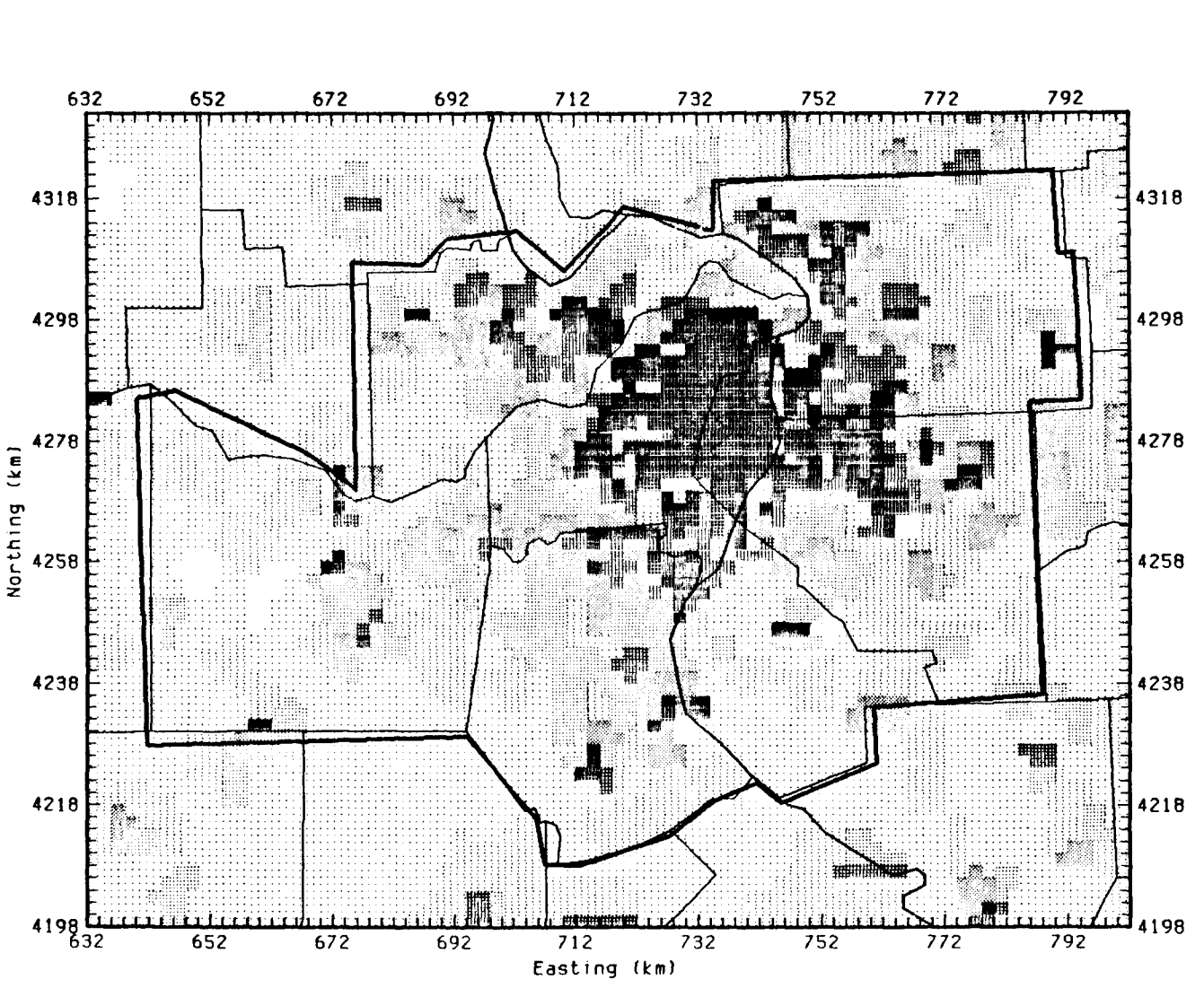


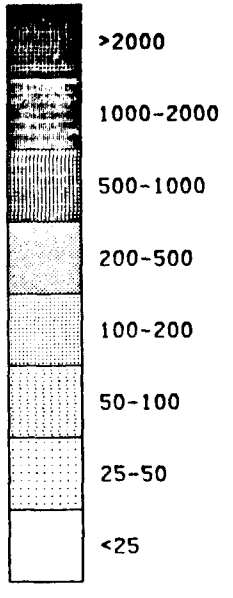


Enclosed Population is ~~1,919,99~~

1,320,000

Kansas City and Lawrence PNA's
Population Density Map for Polygon 47

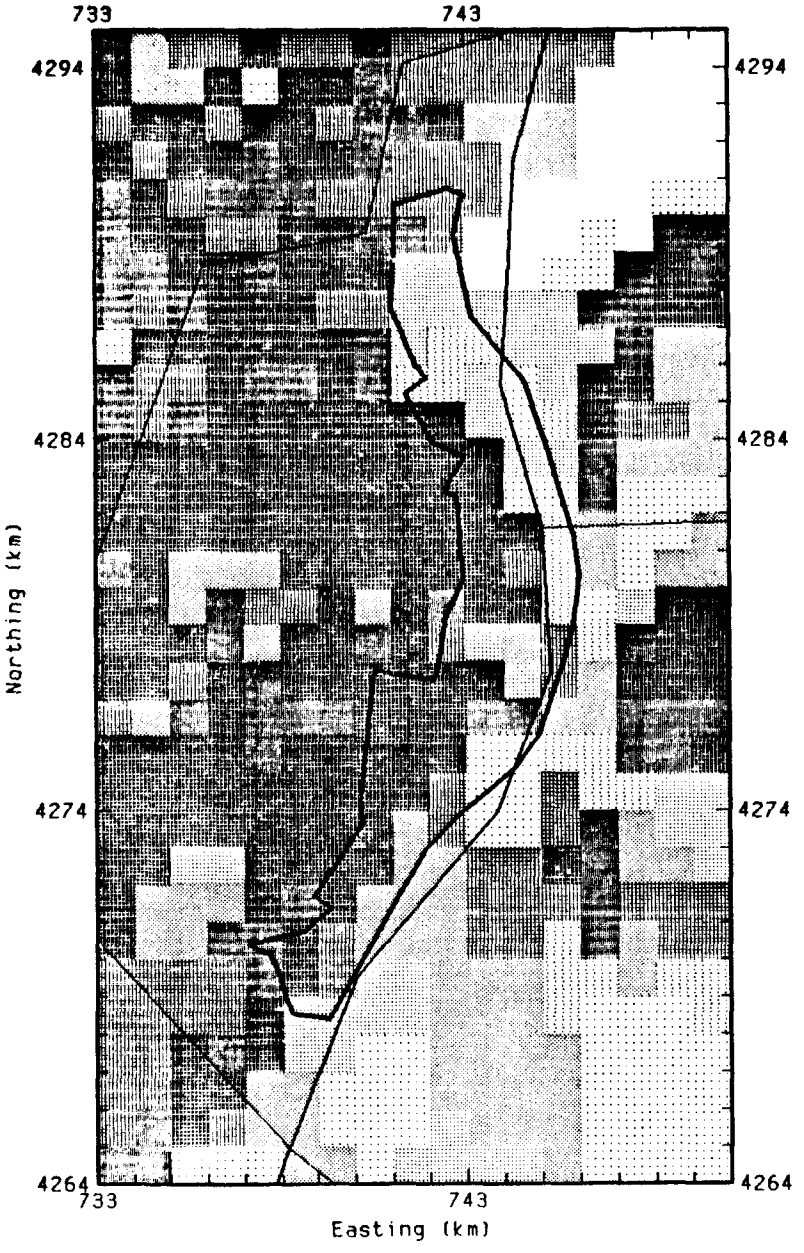


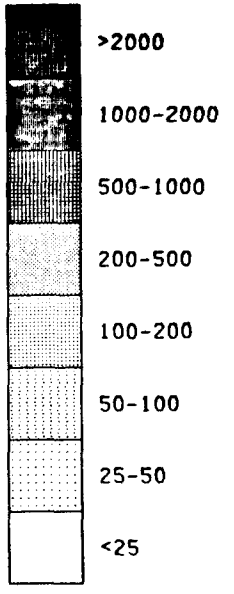


Enclosed Population is ~~2,359,99~~

2,360,000

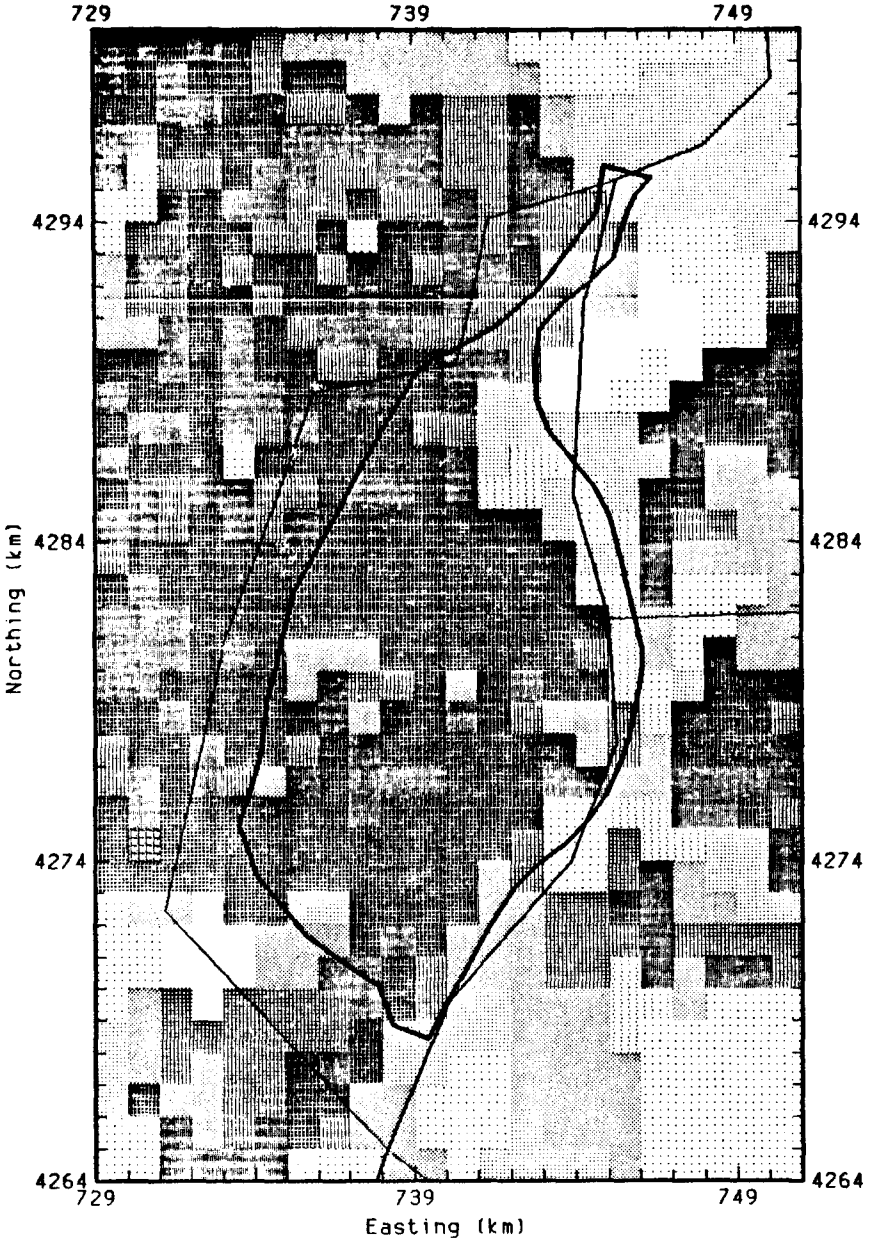
St. Louis O_3 PNA
Population Density Map for Polygon 48

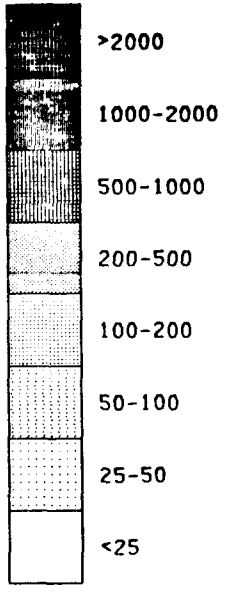




Enclosed Population is 122,000

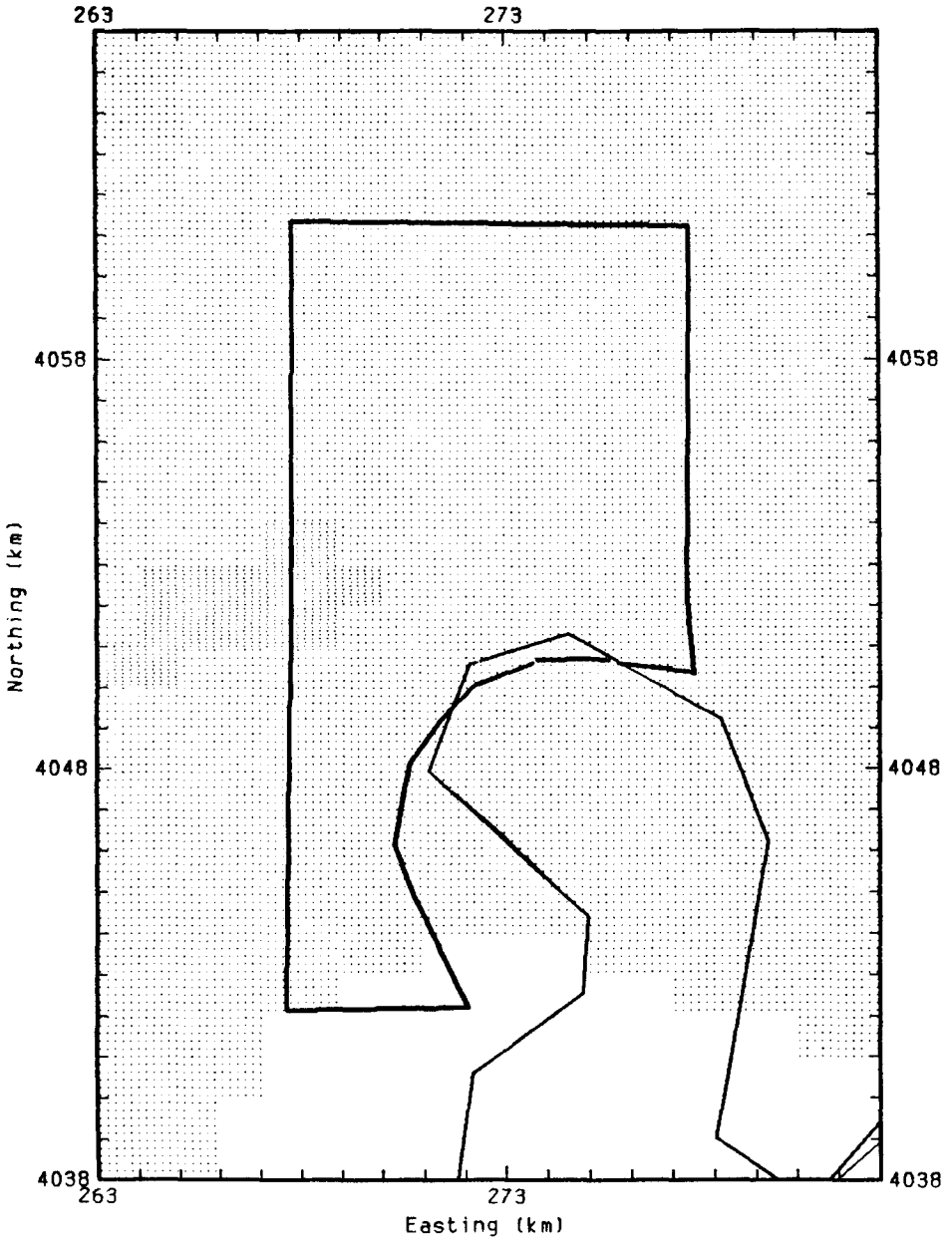
St. Louis TSP PNA
Population Density Map for Polygon 49

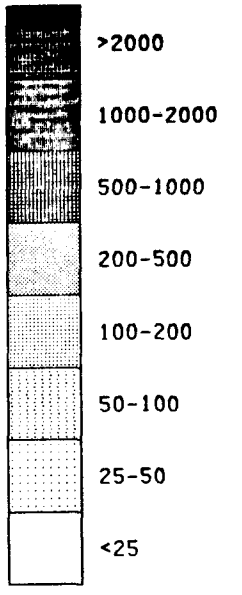




Enclosed Population is 525,000

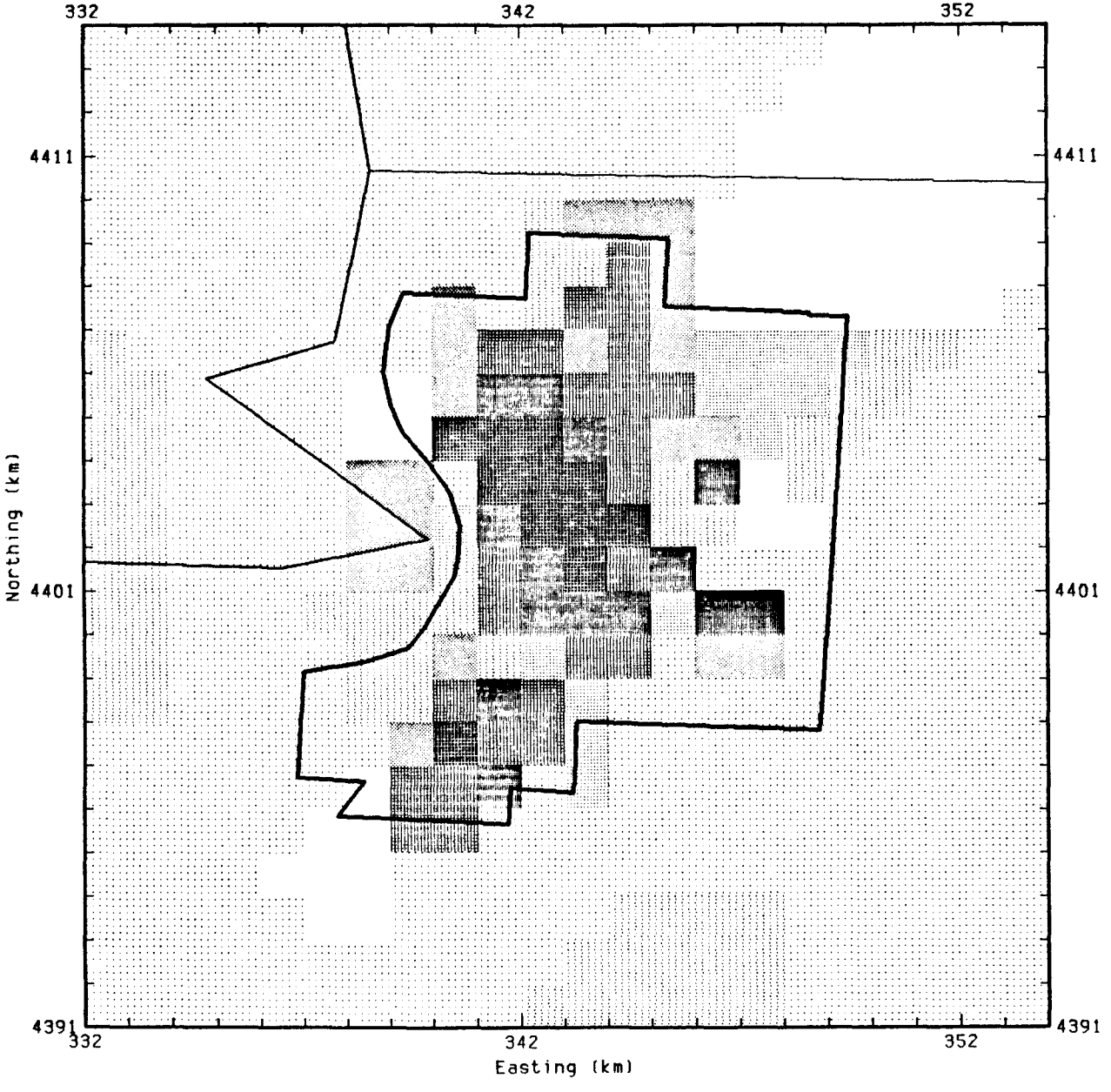
St. Louis TSP SNA
Population Density Map for Polygon 50

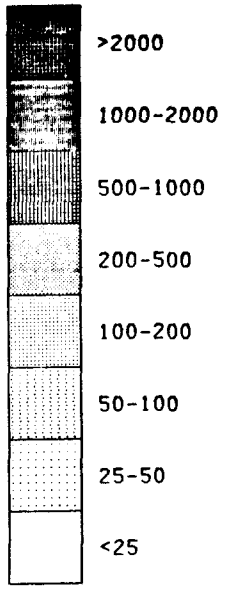




Enclosed Population is 2,260

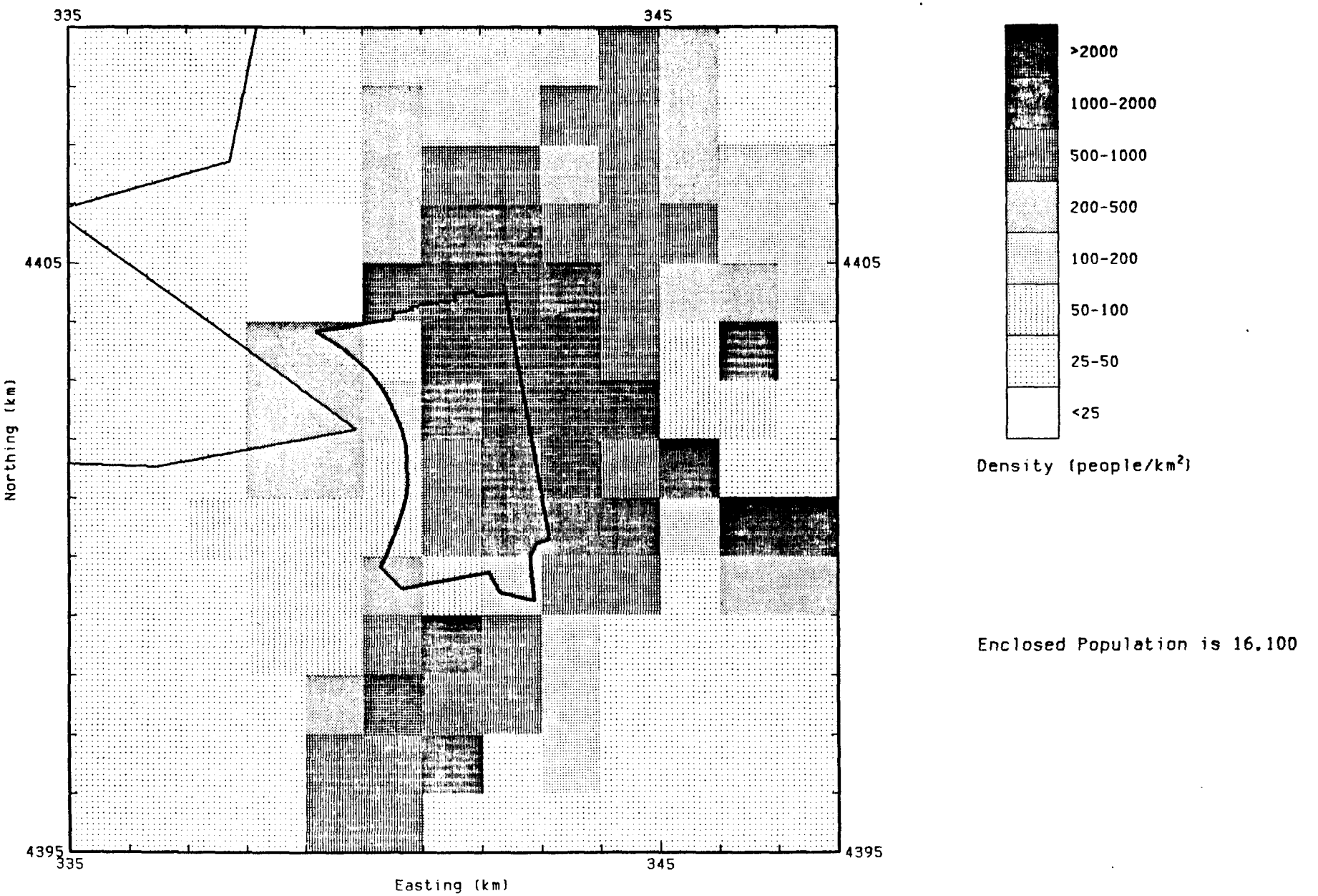
New Madrid TSP SNA
Population Density Map for Polygon 51



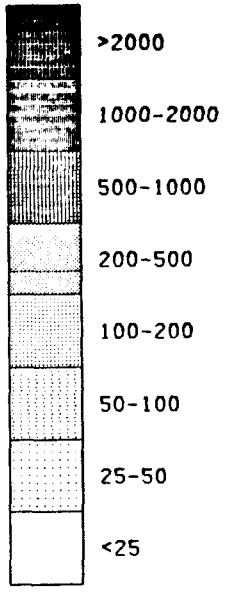


Enclosed Population is 74,200

St. Joseph TSP SNA
Population Density Map for Polygon 52



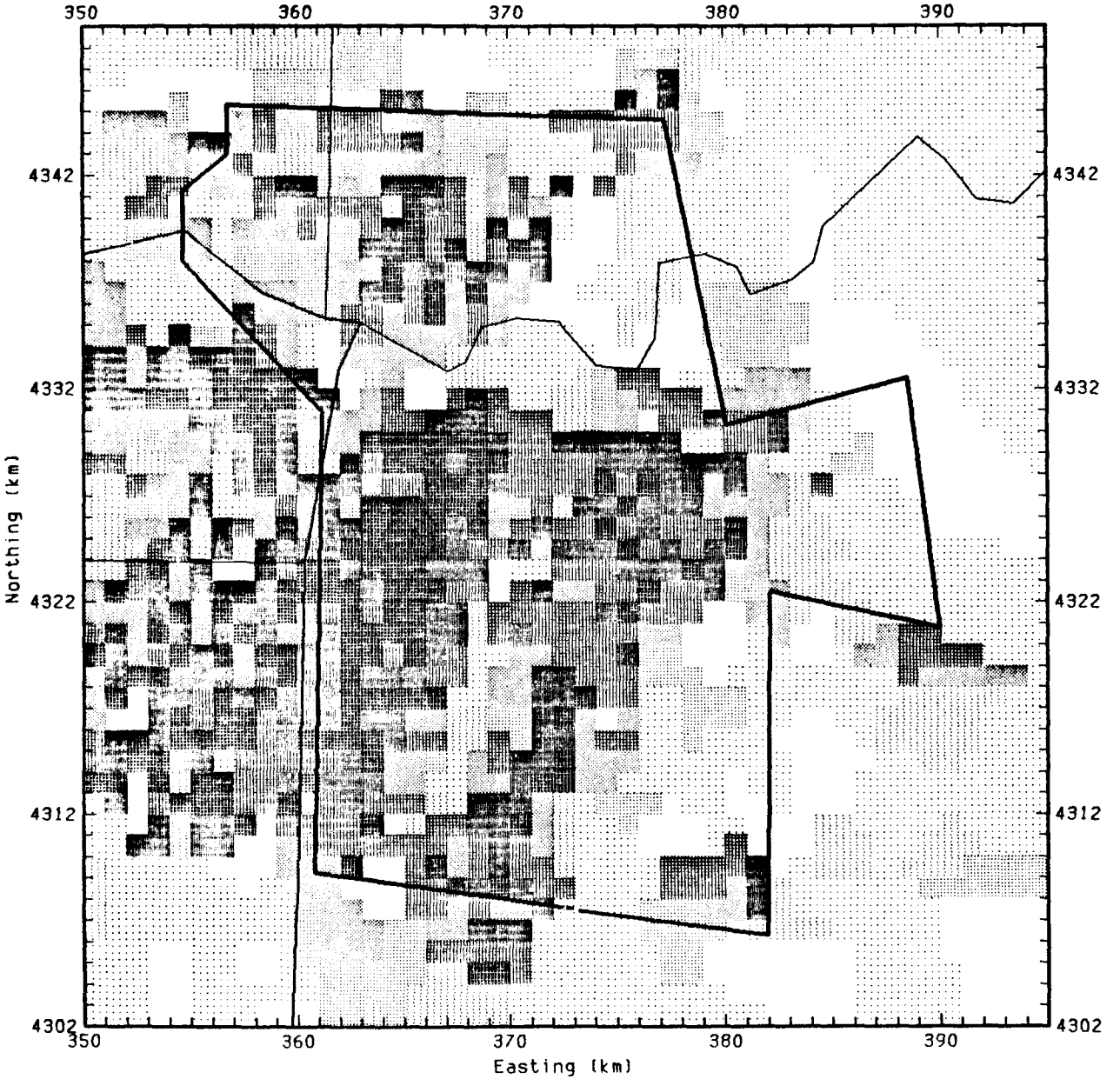
St. Joseph TSP PNA
Population Density Map for Polygon 53

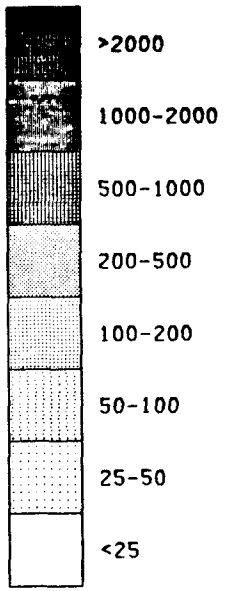


Enclosed Population is 9,890

115

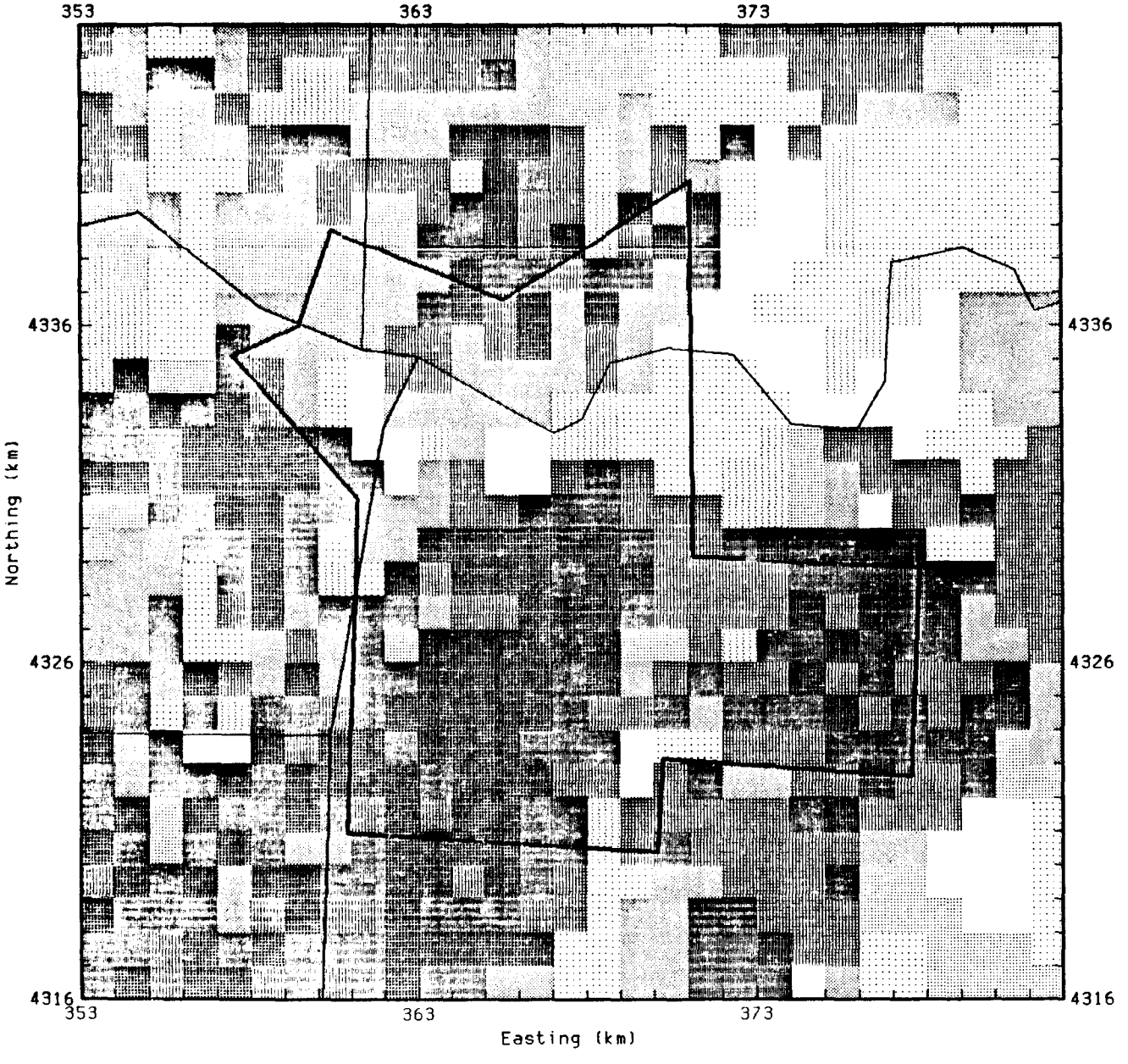
Mexico TSP Unclass
Population Density Map for Polygon 54

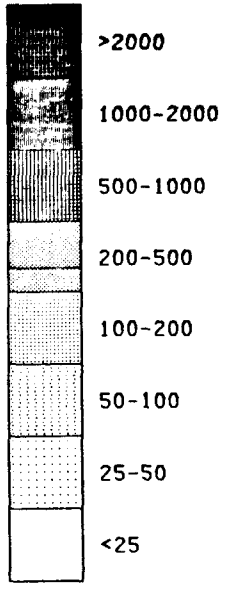




Enclosed Population is 683,000

Kansas City, MO. TSP SNA
Population Density Map for Polygon 69





Enclosed Population is 334,000

Kansas City, MO. TSP PNA
Population Density Map for Polygon 70

```
    55 BG/ED-S WITH A TOTAL POPULATION OF     63786 EXTRACTED
REGION -
REGION ORIGIN (UTM COORDINATES/METERS)
        EASTING -                344000.
        NORTHING -              4296000.
        ZONE -                       15
REGION SIZE (METERS)
        EAST-WEST -                49000.
        NORTH-SOUTH -              65000.

POPULATION YEAR - 1978

    51 STATES FOUND ON POPULATION-FILE INDEX,
  3141 COUNTIES,
232567 BG/ED'S,
  1000 BG/ED'S PER PAGE IN POPFILE.

   245 BG/ED-S WITH A TOTAL POPULATION OF    224063 EXTRACTED FROM COUNTY 20091
   227 BG/ED-S WITH A TOTAL POPULATION OF    167503 EXTRACTED FROM COUNTY 20209
    14 BG/ED-S WITH A TOTAL POPULATION OF     17439 EXTRACTED FROM COUNTY 29037
   178 BG/ED-S WITH A TOTAL POPULATION OF    122531 EXTRACTED FROM COUNTY 29047
   813 BG/ED-S WITH A TOTAL POPULATION OF    614482 EXTRACTED FROM COUNTY 29095
    52 BG/ED-S WITH A TOTAL POPULATION OF     33512 EXTRACTED FROM COUNTY 29165

  1529 BG/ED-S WITH A TOTAL POPULATION OF   1179530 EXTRACTED
```

Polygon 3


```
REGION - 44
REGION ORIGIN (UTM COORDINATES/METERS)
        EASTING -                717000.
        NORTHING -              4258000.
        ZONE -                       15
REGION SIZE (METERS)
        EAST-WEST -                33000.
        NORTH-SOUTH -              43000.

POPULATION YEAR - 1978

    51 STATES FOUND ON POPULATION-FILE INDEX,
  3141 COUNTIES,
232567 BG/ED'S,
  1000 BG/ED'S PER PAGE IN POPFILE.

    53 BG/ED-S WITH A TOTAL POPULATION OF     34738 EXTRACTED FROM COUNTY 17119
     6 BG/ED-S WITH A TOTAL POPULATION OF      5683 EXTRACTED FROM COUNTY 17133
    89 BG/ED-S WITH A TOTAL POPULATION OF     72620 EXTRACTED FROM COUNTY 17163
    10 BG/ED-S WITH A TOTAL POPULATION OF     28191 EXTRACTED FROM COUNTY 29099
    27 BG/ED-S WITH A TOTAL POPULATION OF     31523 EXTRACTED FROM COUNTY 29183
  1112 BG/ED-S WITH A TOTAL POPULATION OF    920385 EXTRACTED FROM COUNTY 29189
```

Polygon 44

1959 BG/ED-S WITH A TOTAL POPULATION OF 1599603 EXTRACTED

REGION - 47

REGION ORIGIN (UTM COORDINATES/METERS)

EASTING -	274000.
NORTHING -	4280000.
ZONE -	15

REGION SIZE (METERS)

EAST-WEST -	140000.
NORTH-SOUTH -	106000.

POPULATION YEAR - 1978

51 STATES FOUND ON POPULATION-FILE INDEX.
3141 COUNTIES.
232567 BG/ED'S.
1000 BG/ED'S PER PAGE IN POPFILE.

26	BG/ED-S WITH A TOTAL POPULATION OF	16124	EXTRACTED FROM COUNTY 20005
51	BG/ED-S WITH A TOTAL POPULATION OF	66790	EXTRACTED FROM COUNTY 20045
5	BG/ED-S WITH A TOTAL POPULATION OF	2886	EXTRACTED FROM COUNTY 20059
2	BG/ED-S WITH A TOTAL POPULATION OF	559	EXTRACTED FROM COUNTY 20085
20	BG/ED-S WITH A TOTAL POPULATION OF	14479	EXTRACTED FROM COUNTY 20087
293	BG/ED-S WITH A TOTAL POPULATION OF	256977	EXTRACTED FROM COUNTY 20091
49	BG/ED-S WITH A TOTAL POPULATION OF	57106	EXTRACTED FROM COUNTY 20103
3	BG/ED-S WITH A TOTAL POPULATION OF	2950	EXTRACTED FROM COUNTY 20121
3	BG/ED-S WITH A TOTAL POPULATION OF	1753	EXTRACTED FROM COUNTY 20139
5	BG/ED-S WITH A TOTAL POPULATION OF	4688	EXTRACTED FROM COUNTY 20177
241	BG/ED-S WITH A TOTAL POPULATION OF	176666	EXTRACTED FROM COUNTY 20209
8	BG/ED-S WITH A TOTAL POPULATION OF	3288	EXTRACTED FROM COUNTY 29021
3	BG/ED-S WITH A TOTAL POPULATION OF	1285	EXTRACTED FROM COUNTY 29025
38	BG/ED-S WITH A TOTAL POPULATION OF	32506	EXTRACTED FROM COUNTY 29037
190	BG/ED-S WITH A TOTAL POPULATION OF	137056	EXTRACTED FROM COUNTY 29047
12	BG/ED-S WITH A TOTAL POPULATION OF	7483	EXTRACTED FROM COUNTY 29049
830	BG/ED-S WITH A TOTAL POPULATION OF	624447	EXTRACTED FROM COUNTY 29095
4	BG/ED-S WITH A TOTAL POPULATION OF	2316	EXTRACTED FROM COUNTY 29101
6	BG/ED-S WITH A TOTAL POPULATION OF	2834	EXTRACTED FROM COUNTY 29107
69	BG/ED-S WITH A TOTAL POPULATION OF	42332	EXTRACTED FROM COUNTY 29165
16	BG/ED-S WITH A TOTAL POPULATION OF	9488	EXTRACTED FROM COUNTY 29177

1874 BG/ED-S WITH A TOTAL POPULATION OF 1464013 EXTRACTED

REGION - 48
REGION ORIGIN (UTM COORDINATES/METERS)
EASTING - 632000.
NORTHING - 4198000.
ZONE - 15
REGION SIZE (METERS)
EAST-WEST - 170000.
NORTH-SOUTH - 134000.

POPULATION YEAR - 1978

51 STATES FOUND ON POPULATION-FILE INDEX.
3141 COUNTIES.
232567 BG/ED'S.
1000 BG/ED'S PER PAGE IN POPFILE.

8	BG/ED-S WITH A TOTAL POPULATION OF	4022	EXTRACTED FROM COUNTY 17005
6	BG/ED-S WITH A TOTAL POPULATION OF	2035	EXTRACTED FROM COUNTY 17013
13	BG/ED-S WITH A TOTAL POPULATION OF	12685	EXTRACTED FROM COUNTY 17027
18	BG/ED-S WITH A TOTAL POPULATION OF	8724	EXTRACTED FROM COUNTY 17083
25	BG/ED-S WITH A TOTAL POPULATION OF	16441	EXTRACTED FROM COUNTY 17117
336	BG/ED-S WITH A TOTAL POPULATION OF	245587	EXTRACTED FROM COUNTY 17119
35	BG/ED-S WITH A TOTAL POPULATION OF	18831	EXTRACTED FROM COUNTY 17133
4	BG/ED-S WITH A TOTAL POPULATION OF	1099	EXTRACTED FROM COUNTY 17135
2	BG/ED-S WITH A TOTAL POPULATION OF	1241	EXTRACTED FROM COUNTY 17145
49	BG/ED-S WITH A TOTAL POPULATION OF	33962	EXTRACTED FROM COUNTY 17157
379	BG/ED-S WITH A TOTAL POPULATION OF	279238	EXTRACTED FROM COUNTY 17163
6	BG/ED-S WITH A TOTAL POPULATION OF	2924	EXTRACTED FROM COUNTY 17189
21	BG/ED-S WITH A TOTAL POPULATION OF	15349	EXTRACTED FROM COUNTY 29055
80	BG/ED-S WITH A TOTAL POPULATION OF	67343	EXTRACTED FROM COUNTY 29071
11	BG/ED-S WITH A TOTAL POPULATION OF	6903	EXTRACTED FROM COUNTY 29073
117	BG/ED-S WITH A TOTAL POPULATION OF	129259	EXTRACTED FROM COUNTY 29099
24	BG/ED-S WITH A TOTAL POPULATION OF	15788	EXTRACTED FROM COUNTY 29113
12	BG/ED-S WITH A TOTAL POPULATION OF	4712	EXTRACTED FROM COUNTY 29139
85	BG/ED-S WITH A TOTAL POPULATION OF	127495	EXTRACTED FROM COUNTY 29183
7	BG/ED-S WITH A TOTAL POPULATION OF	5985	EXTRACTED FROM COUNTY 29187
1164	BG/ED-S WITH A TOTAL POPULATION OF	981534	EXTRACTED FROM COUNTY 29189
11	BG/ED-S WITH A TOTAL POPULATION OF	10777	EXTRACTED FROM COUNTY 29193
14	BG/ED-S WITH A TOTAL POPULATION OF	13032	EXTRACTED FROM COUNTY 29219
13	BG/ED-S WITH A TOTAL POPULATION OF	10756	EXTRACTED FROM COUNTY 29221
662	BG/ED-S WITH A TOTAL POPULATION OF	506463	EXTRACTED FROM COUNTY 29510

3102 BG/ED-S WITH A TOTAL POPULATION OF 2522185 EXTRACTED

REGION - 49
REGION ORIGIN (UTM COORDINATES/METERS)
EASTING - 733000.

```
          NORTHING -              4264000.
          ZONE -                       15
REGION SIZE (METERS)
          EAST-WEST -               17000.
          NORTH-SOUTH -             31000.

POPULATION YEAR - 1978

     51 STATES FOUND ON POPULATION-FILE INDEX,
   3141 COUNTIES,
 232567 BG/ED'S,
   1000 BG/ED'S PER PAGE IN POPFILE.

     53 BG/ED-S WITH A TOTAL POPULATION OF     34738 EXTRACTED FROM COUNTY 17119
     88 BG/ED-S WITH A TOTAL POPULATION OF     71640 EXTRACTED FROM COUNTY 17163
    371 BG/ED-S WITH A TOTAL POPULATION OF    281108 EXTRACTED FROM COUNTY 29189
    662 BG/ED-S WITH A TOTAL POPULATION OF    506463 EXTRACTED FROM COUNTY 29510

   1174 BG/ED-S WITH A TOTAL POPULATION OF    893949 EXTRACTED
REGION - 50
REGION ORIGIN (UTM COORDINATES/METERS)
          EASTING -               729000.
          NORTHING -             4264000.
          ZONE -                       15
REGION SIZE (METERS)
          EAST-WEST -               22000.
          NORTH-SOUTH -             36000.

POPULATION YEAR - 1978

     51 STATES FOUND ON POPULATION-FILE INDEX,
   3141 COUNTIES,
 232567 BG/ED'S,
   1000 BG/ED'S PER PAGE IN POPFILE.

     64 BG/ED-S WITH A TOTAL POPULATION OF     49740 EXTRACTED FROM COUNTY 17119
    105 BG/ED-S WITH A TOTAL POPULATION OF     85565 EXTRACTED FROM COUNTY 17163
    766 BG/ED-S WITH A TOTAL POPULATION OF    625531 EXTRACTED FROM COUNTY 29189
    662 BG/ED-S WITH A TOTAL POPULATION OF    506463 EXTRACTED FROM COUNTY 29510

   1597 BG/ED-S WITH A TOTAL POPULATION OF   1267299 EXTRACTED
REGION - 51
REGION ORIGIN (UTM COORDINATES/METERS)
          EASTING -               263000.
          NORTHING -             4038000.
          ZONE -                       16
REGION SIZE (METERS)
          EAST-WEST -               19000.
          NORTH-SOUTH -             28000.

POPULATION YEAR - 1978
```

```
      51 STATES FOUND ON POPULATION-FILE INDEX.
    3141 COUNTIES.
  232567 BG/ED'S.
    1000 BG/ED'S PER PAGE IN POPFILE.

      13 BG/ED-S WITH A TOTAL POPULATION OF     8554 EXTRACTED FROM COUNTY 29143

      13 BG/ED-S WITH A TOTAL POPULATION OF     8554 EXTRACTED
REGION - 52
REGION ORIGIN (UTM COORDINATES/METERS)
         EASTING -                332000.
         NORTHING -              4391000.
         ZONE -                       15
REGION SIZE (METERS)
         EAST-WEST -              22000.
         NORTH-SOUTH -            23000.

POPULATION YEAR - 1978

      51 STATES FOUND ON POPULATION-FILE INDEX.
    3141 COUNTIES.
  232567 BG/ED'S.
    1000 BG/ED'S PER PAGE IN POPFILE.

       3 BG/ED-S WITH A TOTAL POPULATION OF     2650 EXTRACTED FROM COUNTY 20043
       2 BG/ED-S WITH A TOTAL POPULATION OF     1210 EXTRACTED FROM COUNTY 29003
     137 BG/ED-S WITH A TOTAL POPULATION OF    81904 EXTRACTED FROM COUNTY 29021

     142 BG/ED-S WITH A TOTAL POPULATION OF    85764 EXTRACTED
REGION - 53
REGION ORIGIN (UTM COORDINATES/METERS)
         EASTING -                335000.
         NORTHING -              4395000.
         ZONE -                       15
REGION SIZE (METERS)
         EAST-WEST -              13000.
         NORTH-SOUTH -            14000.

POPULATION YEAR - 1978

      51 STATES FOUND ON POPULATION-FILE INDEX.
    3141 COUNTIES.
  232567 BG/ED'S.
    1000 BG/ED'S PER PAGE IN POPFILE.

       2 BG/ED-S WITH A TOTAL POPULATION OF     1506 EXTRACTED FROM COUNTY 20043
     130 BG/ED-S WITH A TOTAL POPULATION OF    78551 EXTRACTED FROM COUNTY 29021

     132 BG/ED-S WITH A TOTAL POPULATION OF    80057 EXTRACTED
```

REGION - 54
REGION ORIGIN (UTM COORDINATES/METERS)
EASTING - 584000.
NORTHING - 4329000.
ZONE - 15
REGION SIZE (METERS)
EAST-WEST - 19000.
NORTH-SOUTH - 19000.

POPULATION YEAR - 1978

51 STATES FOUND ON POPULATION-FILE INDEX.
3141 COUNTIES.
232567 BG/ED'S.
1000 BG/ED'S PER PAGE IN POPFILE.

22 BG/ED-S WITH A TOTAL POPULATION OF 15486 EXTRACTED FROM COUNTY 29007

22 BG/ED-S WITH A TOTAL POPULATION OF 15486 EXTRACTED

REGION - 69
REGION ORIGIN (UTM COORDINATES/METERS)
EASTING - 350000.
NORTHING - 4302000.
ZONE - 15
REGION SIZE (METERS)
EAST-WEST - 45000.
NORTH-SOUTH - 47000.

POPULATION YEAR - 1978

51 STATES FOUND ON POPULATION-FILE INDEX.
3141 COUNTIES.
232567 BG/ED'S.
1000 BG/ED'S PER PAGE IN POPFILE.

215 BG/ED-S WITH A TOTAL POPULATION OF 208797 EXTRACTED FROM COUNTY 20091
201 BG/ED-S WITH A TOTAL POPULATION OF 142265 EXTRACTED FROM COUNTY 20209
163 BG/ED-S WITH A TOTAL POPULATION OF 115739 EXTRACTED FROM COUNTY 29047
809 BG/ED-S WITH A TOTAL POPULATION OF 610963 EXTRACTED FROM COUNTY 29095
36 BG/ED-S WITH A TOTAL POPULATION OF 28345 EXTRACTED FROM COUNTY 29165

1424 BG/ED-S WITH A TOTAL POPULATION OF 1106109 EXTRACTED

REGION - 70
REGION ORIGIN (UTM COORDINATES/METERS)
EASTING - 353000.
NORTHING - 4316000.
ZONE - 15
REGION SIZE (METERS)
EAST-WEST - 29000.
NORTH-SOUTH - 29000.

POPULATION YEAR - 1978

51 STATES FOUND ON POPULATION-FILE INDEX.
3141 COUNTIES.
232567 BG/ED'S.
1000 BG/ED'S PER PAGE IN POPFILE.

125 BG/ED-S WITH A TOTAL POPULATION OF 99015 EXTRACTED FROM COUNTY 20091
181 BG/ED-S WITH A TOTAL POPULATION OF 124715 EXTRACTED FROM COUNTY 20209
139 BG/ED-S WITH A TOTAL POPULATION OF 105966 EXTRACTED FROM COUNTY 29047
619 BG/ED-S WITH A TOTAL POPULATION OF 457131 EXTRACTED FROM COUNTY 29095
30 BG/ED-S WITH A TOTAL POPULATION OF 26358 EXTRACTED FROM COUNTY 29165

1094 BG/ED-S WITH A TOTAL POPULATION OF 813185 EXTRACTED

3. Geometric Mean = Antilog $\frac{(\Sigma \ln x)}{n}$

4. Geometric Standard Deviation

$$SD_{GEO} = \text{Antilog } (SD_{log}) = \text{antilog } \sqrt{\frac{\Sigma(\ln x)^2 \quad \frac{-(\Sigma \ln x)^2}{n}}{n-1}}$$

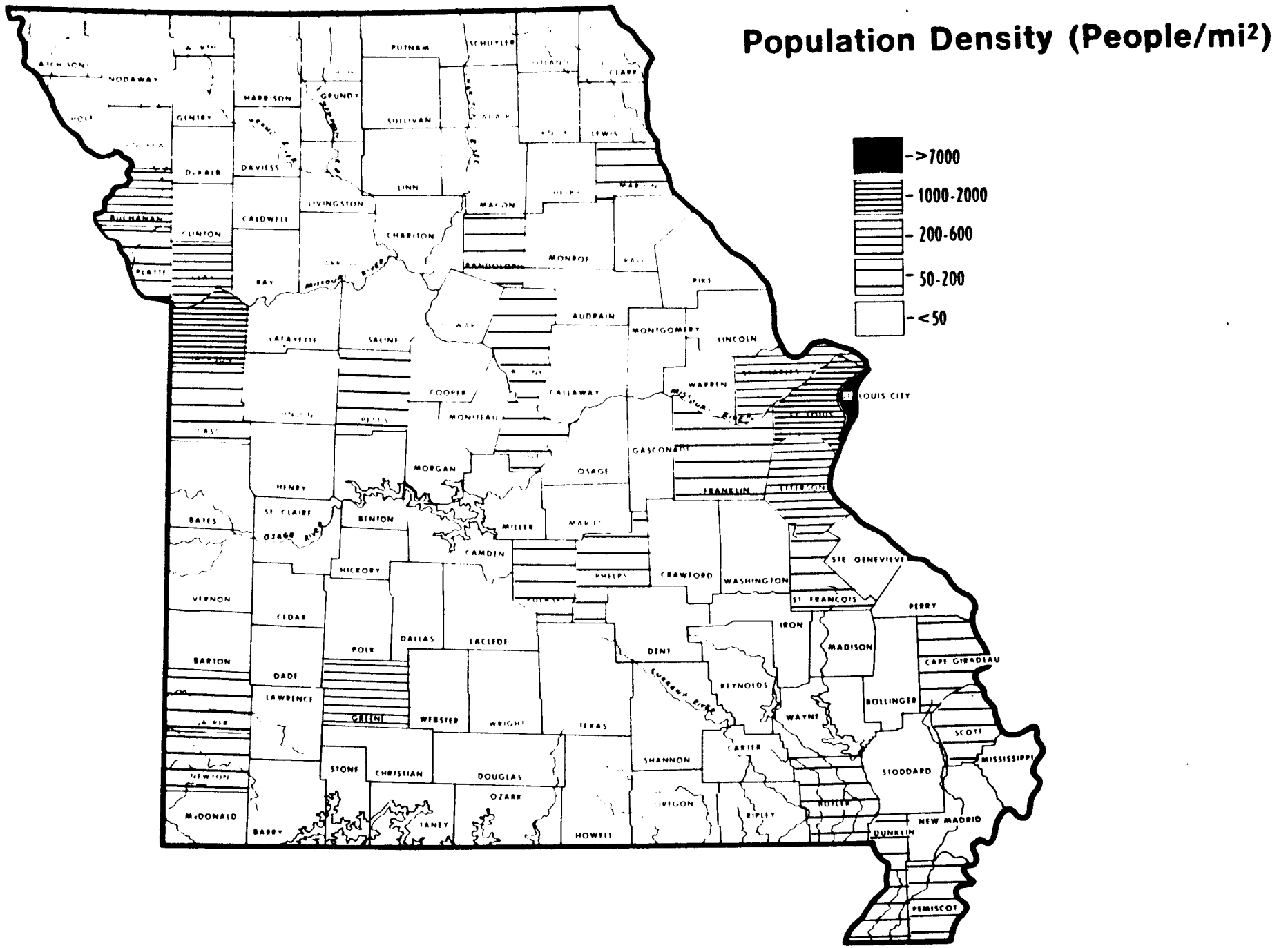
The air quality data criteria are as follows:

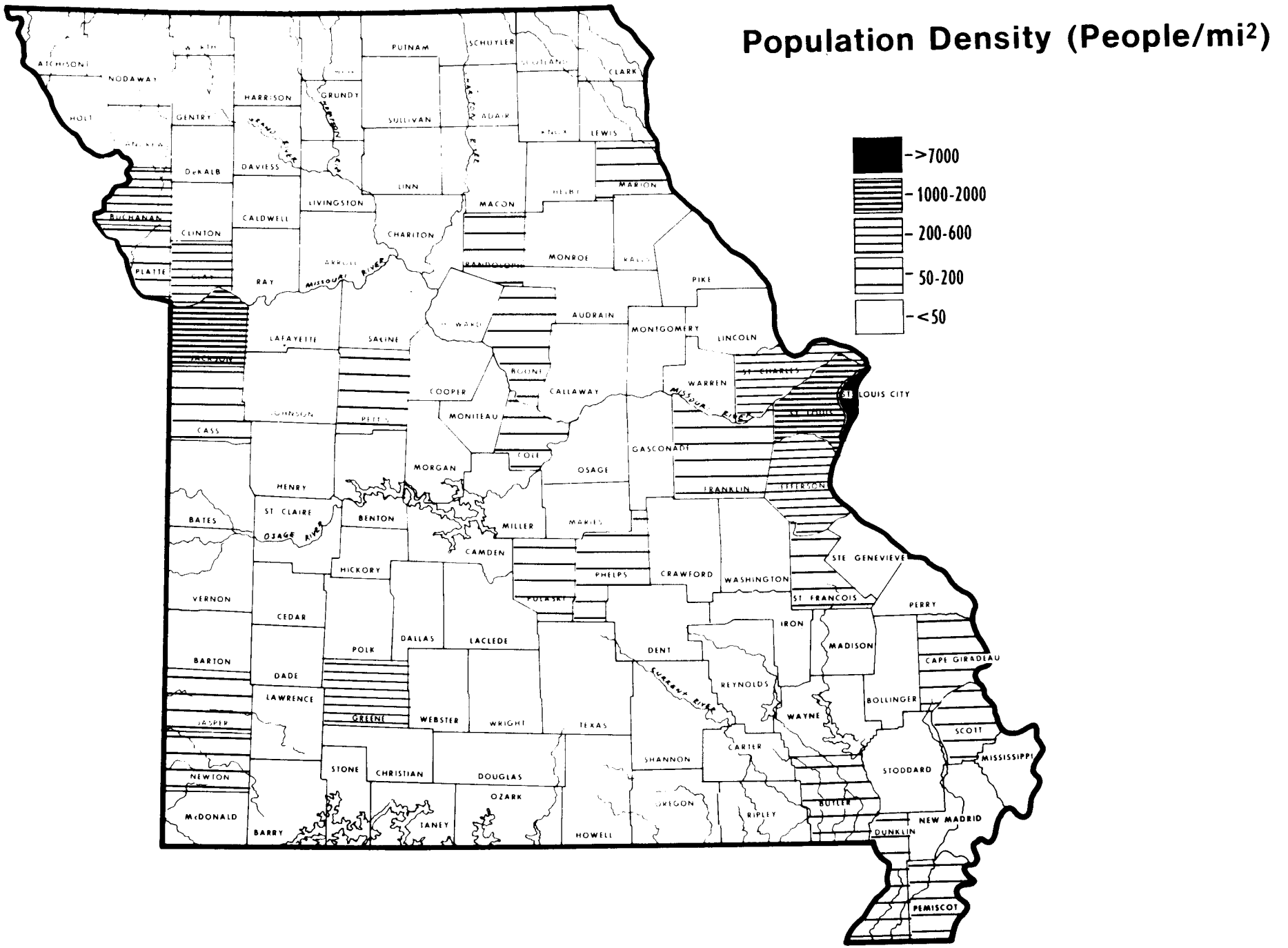
1. Minimum summary criteria for continuous sampling (sampling interval less than 24 hours) are:

   a. Data representing quarterly periods must reflect a minimum of 75 percent of the total number of possible observations for the applicable quarter.
   b. Data representing annual periods must reflect a minimum of 75 percent of the total number of possible observations for the applicable year.

2. Minimum summary criteria for noncontinuous sampling (sampling interval of 24 hours or more) are:

   a. Data representing quarterly periods must reflect a minimum of five observations made during the applicable quarter. If no measurements were made during 1 month of the quarter, each of the two remaining months must have no fewer than two observations reported.
   b. Data representing annual periods must reflect 4 quarters of observational data satisfying the individual quarterly criteria.


Population Density (People/mi²)
->7000
1000-2000
200-600
50-200
<50
PUTNAM
SCHUYLER
CLARK
HARRISON
GRUNDY
SULLIVAN
LEWIS
GENTRY
DAVIESS
LINN
MACON
CALDWELL
LIVINGSTON
CHARITON
MONROE
PIKE
CLINTON
PLATTE
RAY
AUDRAIN
MONTGOMERY
LINCOLN
LAFAYETTE
SALINE
COOPER
CALLAWAY
WARREN
MONITEAU
MORGAN
OSAGE
GASCONADE
FRANKLIN
HENRY
ST. CLAIR
BENTON
MILLER
BATES
CAMDEN
HICKORY
PHELPS
CRAWFORD
WASHINGTON
STE GENEVIEVE
VERNON
CEDAR
ST FRANCOIS
PERRY
IRON
DALLAS
LACLEDE
POLK
DENT
MADISON
CAPE GIRARDEAU
BARTON
DADE
REYNOLDS
BOLLINGER
LAWRENCE
GREENE
WEBSTER
WRIGHT
TEXAS
WAYNE
SCOTT
CARTER
SHANNON
MISSISSIPPI
STONE
CHRISTIAN
DOUGLAS
STODDARD
OZARK
NEWTON
McDONALD
BARRY
TANEY
HOWELL
OREGON
RIPLEY
BUTLER
DUNKLIN
NEW MADRID
PEMISCOT


Population Density (People/mi²)
->7000
1000-2000
200-600
50-200
-<50
ATCHISON
NODAWAY
HOLT
GENTRY
HARRISON
GRUNDY
PUTNAM
SCHUYLER
SULLIVAN
ADAIR
CLARK
LEWIS
DeKALB
DAVIESS
LINN
MARION
BUCHANAN
CALDWELL
LIVINGSTON
MACON
CLINTON
CHARITON
MONROE
PIKE
PLATTE
RAY
AUDRAIN
MONTGOMERY
LINCOLN
LAFAYETTE
SALINE
COOPER
BOONE
CALLAWAY
WARREN
ST CHARLES
ST LOUIS CITY
JOHNSON
MONITEAU
CASS
COLE
GASCONADE
MORGAN
OSAGE
HENRY
FRANKLIN
JEFFERSON
ST CLAIRE
BATES
BENTON
MILLER
OSAGE RIVER
CAMDEN
STE GENEVIEVE
HICKORY
PHELPS
CRAWFORD
WASHINGTON
ST FRANCOIS
VERNON
CEDAR
IRON
PERRY
DALLAS
LACLEDE
POLK
DENT
MADISON
CAPE GIRARDEAU
BARTON
DADE
REYNOLDS
BOLLINGER
LAWRENCE
GREENE
WEBSTER
WRIGHT
TEXAS
WAYNE
SCOTT
JASPER
CARTER
MISSISSIPPI
STONE
CHRISTIAN
DOUGLAS
SHANNON
STODDARD
NEWTON
OZARK
McDONALD
BARRY
TANEY
HOWELL
OREGON
RIPLEY
BUTLER
NEW MADRID
DUNKLIN
PEMISCOT


ATCHISON
NODAWAY
WORTH
PUTNAM
SCHUYLER
SCOTLAND
CLARK
HARRISON
GRUNDY
SULLIVAN
ADAIR
KNOX
LEWIS
HOLT
GENTRY
ANDREW
DeKALB
DAVIESS
LINN
SHELBY
MARION
BUCHANAN
CLINTON
CALDWELL
LIVINGSTON
MACON
CHARITON
RANDOLPH
MONROE
RALLS
PIKE
PLATTE
CLAY
RAY
CARROLL
HOWARD
AUDRAIN
MONTGOMERY
LINCOLN
LAFAYETTE
SALINE
JACKSON
BOONE
WARREN
ST CHARLES
COOPER
CALLAWAY
ST LOUIS CITY
JOHNSON
PETTIS
MONITEAU
ST LOUIS
CASS
COLE
GASCONADE
MORGAN
OSAGE
HENRY
FRANKLIN
JEFFERSON
ST CLAIRE
BATES
BENTON
MILLER
MARIES
CAMDEN
STE GENEVIEVE
HICKORY
PHELPS
CRAWFORD
WASHINGTON
VERNON
PULASKI
ST FRANCOIS
PERRY
CEDAR
IRON
DALLAS
LACLEDE
MADISON
BARTON
POLK
DENT
CAPE GIRADEAU
DADE
REYNOLDS
LAWRENCE
BOLLINGER
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GREENE
WEBSTER
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TEXAS
WAYNE
SCOTT
CARTER
SHANNON
NEWTON
STONE
CHRISTIAN
DOUGLAS
STODDARD
MISSISSIPPI
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OREGON
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McDONALD
BARRY
TANEY
HOWELL
RIPLEY
NEW MADRID
DUNKLIN
PEMISCOT

TABLE 2

LEGEND FOR AMBIENT MONITORING DATA MAPS

Boundaries

- Primary Nonattainment Area
- Secondary Nonattainment Area
- Unclassified Area

Monitor Symbol Colors and Flag

- No Violation of Standard
- Violation of Secondary Standard
- Violation of Primary Standard
- Exceedance of Alert Level

Annotation for Standards Violated

- A — Annual Primary Standard
- Q — Quarterly Primary Standard
- 24 — 24-hour Primary Standard
- 24 — 24-hour Secondary Standard
- 8 — 8-hour Primary Standard
- 3 — 3-hour Secondary Standard
- 1 — 1-hour Primary Standard

Annotation for Trends

- ↑ Increasing Trend
- ∧ Probable Increasing Trend
- – No Trend
- ∨ Probable Decreasing Trend
- ↓ Decreasing Trend

(Where two trend symbols are shown, the first is for long-term averages, the second for 24-hour observations.)

Monitor Symbol Sizes

- Microscale
- Middle Scale
- Neighborhood Scale
- Urban Scale
- Regional Scale

Data Completeness

- Data met completeness criteria each year.
- () Data did not meet completeness criteria one or more years.